THE UNIVERSITY OF HULL

# Student experiences of online group work and peer assessment

being a Thesis submitted for the Degree of PhD

in the University of Hull

by

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July 2019

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# ABSTRACT

Peer learning and peer assessment are well established pedagogies which can support learning and provide a range of benefits, such as improved self-reflection, team working, and communication skills. In recent decades the embedding of peer learning and assessment in online environments has been investigated, often with conflicting findings. However, there are commonly cited factors that must be addressed if students are to engage with the process and have confidence in peer learning and assessment. These factors include considering how peer groups are created, facilitated and assessed in an online environment. This study set out to explore student experiences of online group work and peer assessment through engagement with a structured blended learning model. A longitudinal study of bioscience and forensic science students was undertaken to investigate their experiences of this blended learning approach. The results demonstrated that with the appropriate environment students did develop confidence in online peer learning and assessment. This was achieved by investigating the factors which would actively engage students in the process. In addition to demonstrating student confidence in online peer learning and assessment, other benefits are also reported. This includes reports of skills development and evidence that online collaborations could provide indicators to student academic performance. This thesis considers how the findings add to the literature by demonstrating how students can have confidence in online peer learning and assessment by creating an appropriate environment for them to interact with each other.

# 1 INTRODUCTION

Peer learning and assessment is a commonly used pedagogical approach that helps students develop, both academically and socially, as well as providing skills development opportunities. Research on peer learning and peer assessment is well established and this chapter introduces some of the early literature in these fields to set the context of this study. With the advent of technology in recent decades, and particularly the more modern 'digital world' students now study in; the effectiveness of peer learning and assessment has to be considered in a blended learning environment.

Blended learning is the combination of online and face-to-face learning activities and has significant implications for peer learning and assessment, where the historical research was based purely on face-to-face interactions. This study considered peer learning in a blended learning environment, and the impact on students, such as their perceptions of online peer learning and assessment (OPLA), skills development and potential educational gains. This chapter sets the historical context of peer learning and assessment and how it led into the purpose of this study to explore student experiences of group work in a blended learning environment.

## 1.1 EARLY RESEARCH INTO PEER LEARNING

There has been over one hundred years of research into peer learning and its effectiveness in the classroom. Burnham (1910) asked '*What is the effect on mental activity of the presence of a group of other persons*' (p761) and referred to earlier work by a Dr Mayer in his paper (Burnham, 1910) who studied this in relation to the ability to do school work. Burnham reported that Mayer found '*In general the result of the work of the pupils in groups was superior to their work as individuals*' (Burnham, 1910:762).

Allport (1924) discussed this further, firstly by considering a person's personality traits and how they operate in social situations. Allport also described in some detail facial and bodily expressions and how they influence social interaction. This includes body gestures and paralinguistics (nonverbal communications), which is mentioned in section 2.5.5.

In relation to stimulation through group interactions, Allport (1924) identified two social factors. The first was social facilitation and the second was rivalry, which Allport demonstrated as having an influence on student performance. Allport argued that social facilitation combined with rivalry '*produces a distinct increase in the quantity and quality of the product of the individuals*' (Allport, 1924:264). This early work showed that researchers found evidence that social interaction and peer work had a positive effect on learning.

The premise of the environment and social interaction having an effect on group learning were also championed by other key researchers in the field of child development. Piaget (2006) is one of the more noted researchers in this field to discuss how we develop our knowledge and understanding through experience and interaction with our surroundings. Vygotsky (1978) is another such researcher who suggested that learning can result from social interactions with others. Vygotsky developed the phrase 'zone of proximal development' relating to the positive learning effects of group interaction. Therefore, it has long been recognised that learning can be positively influenced by external factors, through which the learner builds up a picture of the outside world in order to make sense of it.

Charters and Newcomb (1952) discussed how the attitudes of an individual may be influenced by that of the group. This issue was further discussed by Kelley (1952) who reflected on how a person could be motivated to be accepted in a group by what is called a ‘positive reference group’. Riecken (1958) also showed that levels of communication by individuals in a group could influence group solutions to problems. Such interactions have implications for how peer learning can operate successfully. According to Shaw (1970) there were two basic contexts in which learning takes place; the physical and the social context. The physical context related to learning from the world around us and the individual interacting with it. The social context involved others in the learning process.

Topping (2005) reviewed the forms of peer learning, revisiting some terminology and definitions. It was noted that despite years of research, some educators who believed they were engaging students in peer or cooperative learning did not realise that their approaches were not conducive to peer learning and any positive outcomes may be by accident. Topping noted that the research had shown that peer learning worked but it needed to be organised well and proposed a theoretical model. This model was based around five categories covering organisational features, cognitive, scaffolding, communication and affect. Topping cited examples of gains in academic achievement, transferable social and communication skills and self-esteem as examples of how peer learning worked. Topping even suggested that peer learning was a cost effective way of learning, with ‘high effect size at low delivery cost’ i.e. cost investment being worth the educational benefits it delivers. Topping went on to discuss the use of peer learning in wider contexts, such as with the use of technology.

Based on the decades of research into peer learning this thesis looked at peer learning and assessment in a modern setting of increasing student numbers and technological developments. There are plenty of documented methods of promoting peer learning and assessment (Elshami & Abdalla, 2017; Ertmer et al., 2010; Li, 2001; Weaver & Esposto, 2012) but the challenge is how large student cohorts, combined with the use of technology can promote effective peer interaction. To be effective, students must have confidence in peer learning and assessment in order to fully engage and benefit from it.

The background to the research in this thesis stems from the author's early teaching practice, aiming to integrate peer learning into the curriculum in the late 1990s. At the time, class sizes were approximately 60 so creating peer learning groups was manageable and group interactions were feasible in the classroom. There were some benefits to this but also some challenges, such as student engagement in the process and the administrative burden of the tutor led approach to managing the group interactions. As Topping (2005) noted, if the process of promoting and administering peer learning and assessment is not fully considered, then there is a potential hindrance to the academic process. Alongside this, the author considered peer assessment for summative assessment purposes.

## 1.2 Origins of peer assessment

Research relating to peer assessment emerged around the 1950s. In the early literature on peer assessment and peer review, the terminology referred to 'peer nomination' and the nature of discussion showed that the concept of peer assessment was still developing. Much of this early work related to military studies such as Wherry (1949), McClure (1951) and Hollander (1954a) and explored peer assessment in relation to predictors of performance and leadership. For example, Hollander (1954b) and Gleason (1957) discussed the validity and ability of peers as a predictor of leadership ability and the potential of peers to predict pass/fail in training.

Rowntree's (1977) work on assessment contained one of the early references to peer assessment within an educational context. Rowntree discussed how teachers seem to be more accepting of peer assessment as '*a means of involving students more actively in the learning process*' (Rowntree, 1977:146-7). However, Rowntree suggested that some teachers would argue that, whilst peer assessment provides valuable information about student knowledge, they felt it could not be used for summative assessment. Although Rowntree disagreed with this, he felt peer assessment could not be used to provide a summative grade, but rather a ‘profile’ of the student.

Mowl (1996) reported that following peer assessment, students had a higher level of reflection, a more analytical approach to professional practice, and engaged in a deeper level of learning. Topping (1998) also reviewed peer assessment literature and suggested that simple approaches to peer assessment could bring benefits such as *‘improved grades/scores and the subjective perceptions of participants*’ (towards peer assessment) (Topping, 1998:267).

Boud et al. (1999) reviewed the relative merits of peer learning and assessment in an educational setting and believed it was important to link peer learning to appropriate peer assessment practices and argued that some existing assessment practices undermined the benefits of peer learning. A range of issues relating to the importance of designing good peer assessment practices were discussed and how they could effectively support peer learning, such as focusing on key outcomes, contributing to lifelong learning and promoting a self-reflexive view of assessment. It was also stated that assessment needed to be considered carefully for peer learning for three main reasons: addressing important educational outcomes; recognising the value of peer learning; and recognising commitment to peer learning.

Peer learning is a skill that develops from working in a group by engaging in the social and interactive activities that underpin the learning process. Like any skill, it must be practiced in order to develop, with students immersing themselves in the experience. Since group work in a modern setting will often happen outside of the classroom it cannot be fully and reasonably assessed by the tutor. This is because the social interactions that contribute to group work are developmental and any kind of external assessment or partial observation would lack authenticity. Therefore students are best placed to self and peer assess contributions to group work, though only if students take ownership of the process, as this cannot be managed by the externally placed tutor.

## 1.3 Peer learning and assessment in a digital environment

Based on the literature about peer learning and assessment, the author started to investigate ways in which peer learning and assessment could be integrated in a digital educational setting. A successful measure of this work would be the ability to demonstrate that students would develop confidence in engaging with peer learning and assessment. In order for students to take ownership of peer learning and assessment they would need to understand the process and benefits, as well as find the process helpful and not a hindrance to their work. This involved considering how students can be supported to engage with peer learning and be able to consider peer assessment as a valid and authentic form of assessment.

The author started promoting group work in the mid-1990s first publishing an article (Chin & Woolston, 1995) that mentioned their early investigations of group work. This work focussed on biology students working in groups investigating simulated ecological scenarios using computer software. The author’s use of group work continued in the late 1990s and early 2000s with other biology students (Chin & Overton, 2005; Pennie et al., 2001). After initially engaging students in group work, peer assessment was introduced and it was recognition for this work which resulted in the award of a University Teaching Fellowship for 2005-2007.

During this time, student numbers were increasing in classes and the administration of the peer assessment process was becoming an issue, being administratively difficult and time consuming to manage. Using the bursary gained from the University Teaching

Fellowship it was possible to commission some technical support to develop a rudimentary electronic peer assessment tool. Whilst this helped automate the peer assessment process the functionality of the tool was limited. It was at this time the author became aware of a similar system that had been developed at Loughborough. Contact was made with the developers and a joint consortium bid to JISC was submitted for funding to develop their software further and turn it into an open source tool.

The consortium was successful in gaining funding from JISC in 2006 and was successful in creating an open source version of the tool, called WebPA. The WebPA tool won an international award (IMS Global Learning award) and is now used by institutions worldwide. Having now developed an electronic peer assessment tool with the functionality needed to deal with large cohorts of students, it was now possible to fully engage students in online peer assessment. The next challenge however, was convincing students that electronic peer assessment is a valid form of assessment that they can have confidence in.

With increasing numbers and the advances in technology making online interaction tools more available, particularly through Virtual Learning Environments (VLEs), it was possible to integrate the use of technology for peer learning and assessment. The use of a VLE for online collaboration and communication, coupled with electronic peer assessment now presented new opportunities for peer learning and assessment, but this also brings new challenges. Will students engage with a blended learning approach or will they see it as a hindrance or barrier to engagement?

## 1.4 STUDENT PERCEPTIONS OF PEER LEARNING AND ASSESSMENT

There are a number of challenges tutors face when attempting to engage students in peer learning, such as social presence (Chen & Wang, 2009) or academic performance (Wamser, 2006).  However, students are not always convinced that group work is effective since they complain about freeloaders (students who do not do their share of the work), they don’t fully understand or appreciate the benefits of peer learning and don’t recognise the skills they develop when engaging in group work. Developing a suitable approach to peer learning therefore needs to take into account the various factors that affect it, so that students appreciate the benefits of peer learning.

As well as peer learning students can also be very wary of peer assessment, especially for high stakes assessment, because they can sometimes feel their grades are not fully dependent on their own efforts (Maiden & Perry, 2011; Orr, 2010; Patton, 2011). Students need to be convinced that peer assessment gives full recognition for their efforts, is seen as fair, and is actually a valid form of assessment. There are other concerns such as peer pressure (McLaughlin & Simpson, 2004; Qiu et al., 2014) and confidentiality (Freeman & McKenzie, 2002; Neus, 2011) that students cite as problems with peer assessment and so any approach to a successful peer assessment model must mitigate for these factors.

A challenge in considering student perceptions of peer learning and assessment is whether student perceptions match with how they interact and assess each other’s contribution to their group work (Sluijsmans et al., 2004). How students form groups can influence their perceptions of individual contributions. For example, peers may be more forgiving of friends who are freeloaders, or perceptions may be positively or negatively influenced by personalities when it comes to peer assessment (Aggarwal & O'Brien, 2008). As part of this study therefore, evidence of student confidence in peer learning and assessment was measured not only from the students themselves, but by triangulation of peer assessment scores and online collaborations.

Chapter 2 reviews the literature on peer learning and assessment and discusses its early developments, outlining the key factors in promoting good peer learning and assessment. It then reviews the literature on how peer learning and assessment has developed in recent years to address student engagement in a number of different contexts. The literature is then used to outline the challenges for the research in this study to developing a technology-supported approach to peer learning and assessment which promotes student confidence and which demonstrates a number of benefits such as skills development and improved attitudes to group work.

# 2 BLENDED LEARNING APPROACHES TO PEER LEARNING AND ASSESSMENT

Peer learning and assessment is a commonly used pedagogical approach to supporting students in helping them learn and develop, both academically, socially and through general skills development opportunities such as critical thinking and team work. However, the use of peer learning and assessment in a modern, digital educational world introduces new perspectives on how students engage with peer learning and assessment. This study explored how 'traditional' i.e. classroom-based face-to-face approaches to peer learning and assessment could be adapted in a blended learning environment, where students work in groups partly face-to-face and partly online. The previous literature on peer learning and assessment must therefore be revisited to consider how it might still hold true, or need to be developed for a blended learning environment.

One of the challenges of reviewing the literature on peer learning and assessment is that it uses a range of different terminologies which can sometimes mean slightly different things in different contexts. It is first worth expanding on the terminology therefore to discuss how it is used in the context of this study.

## 2.1 KEY TERMINOLOGIES FOR PEER LEARNING AND ASSESSMENT

The literature uses a wide range of overlapping terminologies which often reference the same definition. The following sections describe some of the key terminologies used in the context of this study.

### 2.1.1 Peer learning

When describing peer learning it is first important to define what we mean by the term. Falchikov (2001:1) defined a peer as '*someone of the same social standing*'. At its fundamental level, peer learning can arise from the interaction of two peers i.e. two students engaging with each other to promote learning. At another level, peer learning can involve small groups of students, usually up to about five or six peers, who engage in similar learning activities. A peer group consisting of three or more peers, however, tends to be defined more simply as a group, and so the phrase 'group work' is often used interchangeably for a peer group of three or more peers.

A range of definitions has arisen over the years to describe peer interactions, such as peer learning; peer assisted learning (PAL), collaborative learning and cooperative learning. Boud et al. (2001) referred to peer learning as a reciprocal two-way learning activity that moves from independent to interdependent mutual learning. Topping and Ehly (1998:1) referred to peer assisted learning as *'the acquisition of knowledge and skill through active helping and supporting among status equals or matched companions* [peers]'.

Other authors referred to peer interactions as collaborative or cooperative learning and mostly use the same definition; peers collaborating or cooperating to support learning. For example, Johnson et al. (1991) referred to cooperative learning whilst Bruffee (1981) referred to collaborative learning. As with any terminology, interpretations can differ and Barkley et al. (2005) suggested that collaborative learning involves true interaction whereas cooperative learning may be seen as being directed in an activity. Topping and Ely (1998:9) also highlighted this issue identifying how students 'do cooperative learning' when students in peer groups are simply working individually.

This issue was debated by Lumpe (1995) who pointed out that cooperative learning may involve students working separately and bringing their results back to the group. Peers simply cooperate to do work independently to achieve a goal or learning outcome without really interacting with each other. To avoid confusion therefore, this study shall use the term ‘peer learning’ to describe students working collaboratively together, and not just working individually and ‘cooperating’ as a group. This point is also important when considering what is actually being peer assessed.

### 2.1.2 Peer assessment

As Lumpe (1995) discusses, cooperative learning to achieve a goal without working together is not really peer learning so this study defines peer learning as the process of how students worked together, rather than the actual assignment product they produce. These two aspects of peer assessment are therefore the *product* of the assessment i.e. what work the students actually produce or the *process*, how the students actually work together to achieve their assignment goals. MacDonald (2003) argued that it is important to develop a good process for peer assessment and Carlson and Berry (2005) developed a tool for assessing the process rather than the product. Sridharan and Boud (2019) also discuss the importance of peer feedback and judgement through the process of peer feedback.

### 2.1.3 Peer review

The phrase ‘peer review’ is sometimes associated with peer assessment but can be used in different contexts. Some literature (Bostock, 2000; Carlson & Berry, 2003; Hamnett & McKie, 2019; Zou et al., 2018) has referred to peer review as the activity of students reviewing other students’ work and providing feedback, either formatively or summatively. Others (Pond et al., 2007; Sakulwichitsintu et al., 2014; Wanner & Palmer, 2018) relate to peer review more in the sense of peers supporting each other’s learning through group work activities, rather than formative or summative assessment of each other's individual work.

Peer review can be used in different contexts depending on the nature of the activity and intended outcomes. For example, students commenting on each other's work and providing feedback might be referred to as 'peer review' and students providing feedback on how they contributed to the group activity might be referred to as 'peer assessment'. Both phrases are equally valid and are used interchangeably in the literature. For the purpose of this study the term 'peer assessment' is used in the context assessing students' contributions to group work activities, rather than the context of peer review as assessing an individual student's work.

#### 2.1.4 Online and blended learning

Gilbert and Green (1986) talked about how improvements in computer technology and cheaper prices were allowing more people to access personal computing. As technology advanced and access to the Internet grew in the late 1980s (and not just the development of the World Wide Web in 1993) people were able to communicate with other 'online'. Salmon (2000) described how the term 'online' came to be used to describe a range of technologies which, amongst others, allows computer based communication to support learning. Moore et al. (2011) also described the challenges of defining what different terminologies mean, demonstrating that different people will use different terms whilst meaning the same thing.

More recently this terminology has been developed further, to include the term 'blended learning'. Graham (2006b) discussed the increasing use of the term blended learning and defined it as "*Blended learning systems combine face-to-face instruction with computer-mediated instruction*" (p 5). For this study, students worked face-to-face and with the support of technology to communicate and interact online. Therefore, the term ‘blended learning’ describes how students used technology in this study to complement their face-to-face group work. The term ‘online’ however is also sometimes used simply to describe when students are working with the use of technology and not necessarily face-to-face. That is, students worked online during this study and overall, they took a blended learning approach to their group work.

Given the ranging definitions relating to peer learning, peer assessment, peer review, online learning and blended learning in the literature across the years, the terms can often be used interchangeably and in different contexts. During this study, students worked face-to-face and also with the support of technology to continue their interactions outside of the classroom setting. They engaged with peer assessment of how each other contributed to the group activities and not actually marking each other’s personal assignments. Therefore, the terms that best describe the activities in this study is peer learning primarily to support each other’s skills development, peer assessment of each other’s contribution to the group work and in a blended learning environment where they collaborated online with the support of technology to supplement their face-to-face interactions.

### 2.1.5 Online peer learning and peer assessment

This study investigated student experiences of a blended learning approach to peer learning and assessment. That is, students worked in groups both face-to-face and online. The students therefore engaged in an ‘online peer learning and assessment activity’ so for convenience, this is shortened to ‘OPLA’ activity. The use of the term ‘OPLA activity’ throughout this thesis therefore refers to the online, or blended learning work that students engaged in as the focus of this thesis.

## 2.2 FACTORS AFFECTING PEER LEARNING AND ASSESSMENT

Peer learning and assessment is not something students can necessarily engage in successfully without academic support and so requires an awareness of the factors that help foster peer learning. This includes providing appropriate ground rules for engaging with peer learning, and consideration for factors that support peer assessment. Students must also be clear about the benefits in order to fully engage with the process, such as improved learning, communication skills and IT skills. Students must therefore be introduced to and supported with peer learning and assessment in order for them to develop confidence in the process. To understand how peer learning and assessment might work in a blended learning environment it is important to first review the current literature on the factors that influence peer learning and assessment.

The literature reviewed in this chapter directly relates to the factors linked to the implementation of peer learning and assessment in this study. These factors include the creation of student groups, such as how groups are formed, the makeup of groups (e.g. gender, ability) and guidance given to promote effective communication and collaboration. The research on the potential benefits of peer learning and assessment are also reviewed to draw comparisons with the outcomes of this study. This included skills development, student engagement with peer learning and assessment and general student satisfaction.

Established research for peer learning shows that how groups of peers are created is one such factor (Kim, 2013; Kyprianidou et al., 2012; Oakley et al., 2004), defining the goals and outcomes of peer learning is another consideration (Matheson et al., 2012; van den Berg et al., 2006b) and other factors such as group size (AbuSeileek, 2012; Piezon, 2005) and ability (Ireson & Hallam, 1999) also need consideration. The planning, design and implementation of peer learning activities needs to address such factors if peers are to actively engage in the peer learning process.

### 2.2.1 Mixed ability groups

Research has reported that the abilities of different peers in a group can influence how well a group works together. For example, Jones and Carter (1994) showed that dyads (groups of two students) could work differently depending on their social interactions. Jones and Carter's study focussed on students working together on laboratory equipment using verbal and nonverbal behaviour. Different ability dyads responded to tasks differently but 'low-achieving' students (students with low reading scores on the California Achievement Reading Test) were supported by 'high-achieving' students (high reading scores). Jones and Carter argued that the results of the study could be used to more effectively support students and that mixed ability students could benefit from group work.

King et al. (1998) also suggested that student dyads could support each other's learning. They argued that by developing 'scaffolding' skills to promote peer tutoring, students could promote learning without either peer being more knowledgeable to start with. Scaffolding of knowledge building was also described by Lai and Law (2006) with two groups of students engaging in online collaboration. They suggested that scaffolding of knowledge between two groups of students led to an increased ability to knowledge build for less experienced students.

Ireson and Hallam (1999) undertook a review of the literature on mixed ability group formation and highlighted the effect of group collaboration on school learning outcomes (such as reading ability). Ireson and Hallam (1999) showed the outcomes for ability grouping for school pupils were mixed, with some studies showing no significant effects and others having a positive effect. They also found evidence of undesirable social consequences in the long term such as an adverse effect on self-esteem. The evidence from their review showed that grouping students based on ability could influence the academic attainment of pupils.

In addition to school pupils, Lejk et al. (1999) explored mixed ability groups in a university setting. They found that lower achieving students performed better but higher achieving students didn't, when placed in mixed ability groups. Ability was based on streaming from the results of previous tests. Other work by Webb (1982) found '*medium ability*' students did better in uniform ability groups than mixed ability groups, suggesting group formation based on ability can affect the learning potential of students. Lejk et al. (1999) didn't dispute the value of group work and wondered if the issue (of mixed outcomes for the different ability students) was more to do with assessment than the group work itself. They considered whether group work with an element of individual assessment would resolve these problems.

### 2.2.2 Group formation and size

In relation to group formation, one concern that has often been voiced is the risk of bias brought about by collusion or personal interactions between peers. Magin (2001) drew on literature relating to interactionist theory and small group behaviour research that suggested that judgements '*are influenced by relational effects which extend beyond those which can be attributed simply to friendships*.' (p55) This would suggest that the assessment of peer interactions by peers may be influenced by their relationships with each other and thus incur bias in the marking process.

In an attempt to evaluate this Magin (2001) undertook a study to consider any potential biases in peer assessment between students. Magin analysed data from peer assessment marks for students on a Community Medicine course. The data showed that rater-ratee interaction effects accounted for only 1% of variance in peer scores. Magin concluded that despite the expectations that peer interactions or reciprocity may add bias to peer assessment, no evidence was found for this. Magin argued therefore, that peer assessment was a useful tool for summative assessment.

Kyprianidou et al. (2012) considered group formation by deliberately creating groups based on learning styles. It should be noted however that learning styles have since been criticised (Garner, 2000). Kyprianidou et al. (2012) put students into groups of 3-5 based on learning styles analysis, using a learning styles inventory questionnaire that was undertaken and discussed by the students prior to starting their group work. By making this process explicit to the students they found that students worked more collaboratively together.

Paus et al. (2012) used randomised groups of two but focussed on learning outcomes rather than effects of group interactions resulting from group size. Moreno et al. (2012) took an alternative approach by assigning groups of five students based on an algorithm, which took into account estimates of three student characteristics (knowledge levels, communicative skills, leadership skills). Their statistical measurement of success (grades) was limited and not always statistically better than the control group. For Kyprianidou et al. (2012) no conclusive evidence was provided either as to whether managed group selection improved learning over more randomised group formation.

How group size affects student participation in online discussions forums was raised by Kim (2013) who considered large, class-wide discussions of 138 students and smaller groups of 25-30. Kim found that class size did affect interactivity on an online course but quantitative evaluation of participation alone may not confirm whether there was an influence on learning. In a similar study, Shaw (2013) did provide evidence that "*different group sizes did not significantly influence learning scores directly but that group size significantly influenced participation and participation positively influenced* *learning scores*" (p196). Shaw split 120 students into two groups, one of 60 who were assigned to one forum and the other 60 were randomly split into groups of 2-6. Shaw cited Jacobs and Ball (1996) who suggested that social loafing (freeloading) increased as the group size increased and suggested the optimum is 3-4 students. van den Berg et al. (2006a) also argued groups of 3-4 were best. Similarly, AbuSeileek (2012) who explored groups of 2-7 found that groups of 5 were most effective. It would appear, therefore, that smaller groups can positively influence online discussions and learning more than larger groups.

### 2.2.3 Freeloading

Lack of engagement or contribution to group activities is commonly referred to as social loafing, free riding or freeloading, and affects both online (Kao, 2013; Piezon, 2005) and face-to-face (Aggarwal & O'Brien, 2008; Brooks & Ammons, 2003) groups. Piezon and Donaldson (2005) discussed the potential increased risks of freeloading of distance online students due to physical separation, social isolation and temporal distance. To address this they made a number of recommendations including clarifying roles and responsibilities for assigned tasks, emphasise the importance of teamwork and alternate group roles.

Freeloading was also found to be a factor by Pieterse and Thompson (2010) when they had mixed ability groups in a face-to-face setting, and they found two key issues. When mixed ability groups were created there were instances of 'social loafing' where some group members did not do their share of the work. This occurred more often in mixed ability groups where more 'weaker' students were excluded from the task by 'stronger' students and so simply gave up on the task. They only found one instance of deliberate social loafing to avoid work and this came in a group of six. Citing other research in this area, Pieterse and Thompson concluded that team size should not exceed five since social loafing corresponds with group size. There are a number of potential issues therefore that can give rise to freeloading, which tutors need to be aware of to minimise the problem.

### 2.2.4 Maturity

Houston and Lazenbatt (1996) discussed the use of peer groups in a mathematical modelling course. Students were drawn from a first year BSc and second year HND course. The peer tutoring was designed by putting students into groups (initially by the lecturer then self-selecting) and supported by a more senior student acting as peer tutor. Some group sessions (for all groups) were held with the lecturer present, and some were by '*independent learning*'. Feedback showed that students recognised the need to work in groups and support each other, though they did not readily accept the ideas associated with peer learning and assessment. A key outcome of this study is that Houston and Lazenbatt claimed that '*The evaluation illustrates that these students were just not mature enough to take so much responsibility for their own learning*' (p259).

Pope (2001) also discussed peer assessment and the issue of maturity. The research focused on postgraduate students who argued that peer assessment should count towards summative assessment due to the time and effort involved. They did remark that they felt this type of activity would only be suitable for postgraduates with work experience and not undergraduates. Pope reported that '*Reasons given* [for not being suitable for undergraduates] *related to maturity, work experience and group size.*' (p242). The students reported high anxiety during the activity but appreciated the process afterwards.

Warren and Rada (1999) undertook a study with undergraduate and postgraduate students and found only a weak correlation between intellectual ability in relation to peer rating and level of study (undergraduate and postgraduate level). Their results suggested that level did not pre-determine their ability to engage (or not) with peer evaluation, in contrast with the findings of Houston and Lazenbatt's (1996). Research overall therefore shows a mixed view of whether maturity plays a part in students being able to engage in peer learning activities.

### 2.2.5 Gender differences

Caspi et al. (2008) considered gender differences in face-to-face and online environments. They found that men spoke more in face-to-face settings than women but that women contributed more to online discussions. However, given the relatively low contribution rates of the online discussions, Caspi et al. implied that the online environment was "*attractive enough for either gender*" (p718) though no evidence was provided for this claim. Richardson (2012) also explored preferences between white and ethnic minority students. Whilst differences in pass rates for courses were noted between ethnic groups for face-to-face and online tuition, they were no different to previous discrepancies between the two groups and concluded that online tuition is an appropriate mode of support for both white and ethnic minority students.

## 2.3 Benefits of peer learning and assessment

When considering the use of technology for peer learning and assessment students need to understand the purpose of using the technology, otherwise the technology can be seen as a distraction. Research into face-to-face peer learning and assessment is well established but in an online environment these benefits risk being lost due to the different environments involved. As with face-to-face settings, effective online peer learning and assessment must be planned with clear goals and outcomes in order to realise the intended learning benefits. Being aware of how technology can affect student perceptions of peer learning and assessment helps to focus on the benefits and not just the risks.

Mitigating for these risks, there are new opportunities to promote effective peer learning and assessment online. Understanding how technology can be used effectively to promote peer interactions and engage with peer assessment helps support student engagement in the learning process. As with face-to-face engagement, the potential benefits of online peer learning and assessment range from skills related opportunities such as communication and IT skills development to improved self-esteem. As well as skills related benefits there are also a range of academic benefits and some of these academic and skills development benefits are now discussed.

## 2.4 Academic benefits of online peer learning and assessment

There has been significant research into the benefits of online peer learning and assessment (Bhalerao & Ward, 2001; Davies, 2003; Keppell et al., 2006). Reported benefits include improved critical thinking skills, increased confidence and self-reflection and even grade improvements. Depending on how the peer learning is planned and delivered, a range of benefits can be promoted to students. These benefits are now discussed in more detail.

### 2.4.1 Critical thinking

The idea that peer learning can promote critical thinking was explored by Matheson et al. (2012). They used the idea that patchwork text (where short sections of text are built up over time) combined with online discussion boards could facilitate critical thinking and collaborative working. They argued that the use of the discussion boards diminished competition and promoted collaboration, citing examples from student feedback where students communicated on the patchwork text assignments. They concluded that using the patchwork text method encouraged '*vital higher level skills that students require in order to achieve and flourish in their education and beyond*' (p265).

Kim and Ryu (2013) reported enhanced metacognitive awareness and performance, using a web-based formative peer assessment system. They found students achieved higher scores for metacognitive awareness and performance in ill-structured tasks than a '*traditional peer assessment group*' (p549) and that the traditional peer assessment group scored higher than a self-assessment group. Lu and Zhang (2012) also looked at the cognitive effects of peer assessment from the perspective of knowledge and skills and attitude changes. Their study considered how rubric-based assessment and peer feedback affected learning performance of assessors and assessees. They found that students benefited more as an assessor than as an assessee. The authors argued that cognitive feedback (feedback provided by peers) should be encouraged and to be aware that rubric-based assessment could have different effects on students as it would '*set in motion different learning processes in assessors and assessees*' (p329). An assessment rubric is a criteria and standards based model that is linked to the learning outcomes.

In addition to promoting knowledge sharing Lee (2013) investigated students' approaches to online learning to explore how academic performance may be enhanced. Students were found to take different approaches to their learning (deep or surface learning) depending on their perceptions of learning and Lee concluded that students were more likely to contribute and take a deeper approach to learning if they have a better understanding of how "*online discussions can help their cognitive activities and skills"* (p350).

### 2.4.2 Improved writing skills

Pope (2001) found evidence of improved writing skills and van den Berg et al. (2006b) also explored various aspects of peer assessment for improving undergraduates' writing skills. More recent work by Ciftci and Zeynep (2012) supported improved writing skills from peer feedback, in particular from working online. Another example of improved writing skills in an online environment was provided by Guasch et al. (2013) who explored different types of peer feedback and found epistemic feedback (e.g. Do you think that this idea reflects what the author really highlights in his/her study?) was better than 'corrective' feedback about the adequacy of the content.

### 2.4.3 Measuring academic performance

Romero et al. (2013) took a quantitative approach to online analysis of student communications and developed an algorithm to predict student marks for a course. They explored a variety of criteria that may contribute to predicting success or failure based on student communications. Tayebinik and Puteh (2013) also took a quantitative approach to linking online communication to their passing grade. Romero et al.'s (2013) approach to the analysis was quite detailed, outlining a number of criteria whereas Tayebinik and Puteh considered only three variables, based on the type and volume of online interactions (student-teacher, student-student, student-group). One criterion Romero et al. (2013) used in developing the algorithm for identifying students at risk of failing, however, was an instructor-allocated score based on individual message contributions by students.

Romero et al. (2013) discussed using a scoring rubric developed by Kleinman (2005) where a message is graded from 0-3 depending on the relevance of the message to the content. Romero et al. (2013) awarded a zero score to "*invalid messages that are off-topic or irrelevant to the content of the course"* (p461). This was counter to work by Pozzi (2010), Chen and Wang (2009) and Kim et al. (2011) who argued that social interaction (which is classed as off-topic) was important for online learning. The statistical results for this study were only moderate (positive correlations of with r values ranging between 0.1 and upwards). So this algorithmic approach to predicting student performance appeared to have some grounds for further investigation.

## 2.5 Skills-related benefits of online peer learning and assessment

A number of skills related benefits have been identified in the literature and the following sections discuss some of these in more detail.

### 2.5.1 Student satisfaction

Pena-Shaff et al. (2005) explored student attitudes to online communication and found a mixed response, with some valuing the experience and others disliking it. Pena-Shaff et al. discussed various reasons for this (such as resentment due to 'forced' involvement, time and lack of ownership) and suggested better understanding of social processes of knowledge construction will help future developments. Further work by Hostetter and Busch (2006) and Shen et al. (2006) added more evidence to support the case that an online class can be designed to facilitate students' perceptions of social presence similar to a face-to-face setting. So and Brush (2008) also found statistically significant positive links between perceived levels of collaborative online learning, social presence and student satisfaction.

Gomez et al. (2010) reported that student enjoyment was affected by motivation and perceptions of team interactions and perceived learning. This is supported by Biasutti (2011) who reported students claiming "*we shared knowledge and skills to support each other*" (p1872) and that the online activities in their study helped develop several skills including "*the attitude to collaborate*" (p1874). Joo et al. (2011) also reported that learner satisfaction was linked to "*higher levels of learner persistence*" (p1663). These studies suggest, therefore, that students who more actively engage with team interactions that are contributing to learning will enjoy the experience more.

Although there is evidence to support the notion that students may find online peer learning and assessment enjoyable or satisfying, Jung et al. (2012) also discussed stress amongst Japanese students studying English in an online setting. They identified four key factors affecting stress in online collaboration, including ‘self-efficacy’ and ‘technology use’.  Self-efficacy was about learners’ beliefs in their abilities and students’ ability to use technology and students’ readiness for online learning. Jung et al. (2012) suggested that this can be ameliorated by appropriate support early on. Conversely, Pope (2005) found evidence of stress during peer assessment but reported that whilst stressful, this could lead to improved student performance.

### 2.5.2 Social engagement

By its very nature, peer learning is a social activity and Piaget (2006) is one of the more commonly cited researchers in this field, alongside Vygotsky (1978). Piaget discussed the social role of others in a group and the influence it has on intellectual development, helping promote collaboration and exchange of ideas (Piaget, 2006:178). Vygotsky also introduced the ‘zone of proximal development’ to refer to someone’s ability to problem solve if they are ‘*in collaboration with more capable peers*’ (Vygotsky et al., 1978:86). Damon (1984) also summarised some social benefits of peers, including:

- Peers motivate each other to ‘search for better solutions’
- Helps peers develop socially (such as participation and argumentation)
- Can foster interpersonal relationships through mutual respect

More recent research (Cheung et al., 2008; Hornby, 2009; Yi & LuXi, 2012) also demonstrated that group work though peer interactions promoted social engagement and a sense of community, particularly when online (Biasutti, 2011; Deng & Tavares, 2013). Francescato et al. (2007) even demonstrated the persistence of social ties among online students after collaborative online learning.

### 2.5.3 IT skills development

Early research into technology supporting peer learning and assessment, including general online collaboration, had the potential challenge of the technology itself being a barrier to access and therefore interaction (Kuh & Vesper, 2001; Muilenburg & Berge, 2005; Russell, 1995). Prensky (2001) wrote about digital natives and digital immigrants, referring to how younger people were apparently more used to dealing with technology in all aspects of their lives, though later revised this approach (Prensky, 2009) talking about digital wisdom that could transcend the digital native/immigrant divide. Selwyn (2009) also challenged the view of the digital native, arguing that the use of technology is no different between generations. So, attention as to whether modern technology and its users is a barrier to learning must still be a consideration.

MacDonald (2003) made reference to the development of IT skills for online collaboration, arguing that online collaborative learning needs to consider if skills are to be developed during the process or whether students should start with the necessary skills. Ge et al. (2000) addressed this through pre-class planning that helped develop student confidence in using technology. With the new generation of students having full access to the world of social media and smartphones (Deloitte, 2016) students now have a ready access to technology anywhere and at any time. Even with ready access to technology, students can still develop IT skills when engaging in online learning (Altınay, 2017; Arabi, 2016; Hampel & de los Arcos, 2013; Jeffrey et al., 2011; Mac Callum et al., 2014).

### 2.5.4 Self-efficacy, self-esteem and reflective skills

Self-efficacy is how someone views themselves and is described as "*an individual's judgments of his or her capabilities to perform given actions*" (Schunk, 1991:207). Self-efficacy is also commonly known by other descriptions such as self-esteem and Slavin (1995) discussed how students engaging in cooperative learning can increase their self-esteem (Slavin, 1995:60). Self-efficacy or self-esteem comes from personal reflection and is a skill that students can develop, by reflecting on their experiences. Puzziferro

(2008) and Hsia et al. (2016) discussed how self-efficacy has been shown to have a positive influence on achievement and therefore engaging students in collaborative learning can promote self-efficacy or self-esteem by encouraging them to reflect on their collaborative activities.

McMahon (2010) described how they created a peer assessment process to help promote conditions for developing critical reflection and discussed how students reported an increase in their self-confidence. Panadero et al. (2014) also described how the use of a rubric for self-assessment increased self-efficacy. Jeffrey et al. (2011) demonstrated an increase in self-efficacy using digital tools (e.g. blogs, video editing software) for peer and Altinay (2017) also demonstrated peer assessment in an online environment helped develop reflection skills.

### 2.5.5 Communication skills

With the development and broader use of electronic communications in education, initially through email (McCaslin & Torres, 1992; Russell, 1995) and subsequently through CMC (computer mediated conferencing, including discussion boards) (Hammond, 2000; Veerman et al., 2000), new modes of student interaction presented themselves. Walther (1992) predicted that as CMC developed it would have a positive impact on communication but would not totally replace face-to-face benefits, partly due to the asynchronous nature of CMC. Walther (1996) later discussed CMC in more detail, and how the lack of nonverbal clues may limit the personal interaction of communication, but still brings new benefits. Warren and Rada (1999) subsequently considered how CMC might be used as an electronic medium to support peer assessment.

Whilst early research into CMC addressed the cultural and nonverbal (including paralinguistic) shifts to communicating online (Sixl-Daniell & Williams, 2005;

Veerman et al., 2000; Zafeiriou, 2001) modern use of technology focusses more on the skills CMC can bring rather than just communication (Downing et al., 2007; Ellis et al., 2004; Salmon, 2002). Once research had addressed the factors necessary for effective online communication such as role of instructors (An et al., 2009; Shea et al., 2005) emphasis switched to actual skills afforded through CMC such as critical thinking and problem solving skills (Lai, 2012; Lin et al., 2012; Liu & Tsai, 2008; Merrill & Gilbert, 2008), flexibility of communication (Horspool & Lange, 2010; Wuensch et al., 2008; Young & Norgard, 2006) and reflective skills (Bliuc et al., 2011; Chen et al., 2011; Lin et al., 2014; Qiu & McDougall, 2013).

## 2.6 THE INFLUENCE OF TECHNOLOGY ON PEER LEARNING AND ASSESSMENT

Research on peer learning has been well documented, stretching back over 100 years (Allport, 1924; Burnham, 1910; Shaw, 1932) so it is important to note that this early research was very much focussed on face-to-face interactions ‘in the classroom’. The application of peer learning and assessment with the support of technology, particularly in a modern online environment, is therefore relatively new. This is based on the fact that the ubiquitous access to technology only really took off in the mid-1980s to early 1990s, when computing costs started to become realistic for whole classroom teaching (Gilbert & Green, 1986; McCaslin & Torres, 1992). How students interact with technology and with each other therefore introduces new dimensions to how students engage with peer learning and assessment.

Early attempts at promoting peer learning with the support of technology involved the use of computer conferencing and chat tools (Veerman et al., 2000; Warren & Rada, 1999). This approach, in many ways was the transference of face-to-face communication to an electronic setting but the nature of the interaction was new. This involved factors such as the loss of nonverbal communication (including paralinguistics) (Jones & Carter, 1994; Walther, 1996) and asynchronous communication (Kear, 2004; Mabrito, 2006). Early research on peer learning discussed how face-to-face factors played an important role in the social and pedagogical influence on effective peer interactions (Bruffee, 1981; Gebhardt, 1980). Therefore, if the use of technology was to be effective in supporting peer learning, previous face-to-face interactions would need adaptation to promote comparable outcomes.

Although factors such as paralinguistics and asynchronous communication posed new challenges in promoting peer learning, it also provided new opportunities. With the development of the Internet (e.g. listserv lists) and the subsequent World Wide Web (e.g. discussion boards), more sophisticated communication and information sharing tools became more common, allowing for more complex peer to peer interactions, such as content sharing (Davies & Lewis, 2004) and more elaborate communication tools (Aghaee & Keller, 2016). Unlike face-to-face interactions, asynchronous communication allowed students to reflect and this could be beneficial (Chen et al., 2011; Lin et al., 2014). Technology was further enhanced by the now commonplace use of Virtual Learning Environments and Web 2.0, or social media tools. As with face-to-face peer learning therefore, students need to be orientated into how to interact effectively online for the benefits of peer learning to be realised.

There has been a lot of research exploring and differences between face-to-face interactions and online communication to promote group work (Bliuc et al., 2010; Castaño-Muñoz et al., 2014; Suthers et al., 2002; Wang & Woo, 2007). Such studies have demonstrated differences in how students interact face-to-face and online, such as whether students would converse more or less (Suthers et al., 2002) or levels of collaboration (Tutty & Klein, 2008). There are some reported differences between face-to-face collaboration compared to online, such as communication being quicker for face-to-face (Meyer, 2003) or promoting social presence online (Chen & Wang, 2009). This research demonstrates that whilst differences exist between face-to-face and online communication and collaborations, there are also benefits of using technology to support online peer learning.

Alongside peer learning, technological developments have also provided more opportunities to promote the use of peer assessment. Early attempts at electronic peer assessment included online peer review of students' work through computer mediated conferencing systems (Warren & Rada, 1999), moving on to more web based systems that allowed online scoring (Ma & Ng, 2002; Tsai et al., 2001). More sophisticated tools developed (Chin et al., 2006; Davies & Lewis, 2004) and now there are a range of tools available which can help provide a number of benefits for peer assessment (Park, 2017) such as iPeer (iPeer) and PeerMark by Turnitin (Turnitin).

### 2.6.1 Blended learning approaches to group work

In higher education when computer technology was becoming more ubiquitous and accessible to students, the possibility of promoting online group collaboration started to be explored. Rada (1998) explored the efficiency of different approaches to fostering online collaboration with teacher and student led activities. Rada found that teacher directed collaboration was effective but time consuming and said that "*Managing such teams is not easy for a teacher to do but the computer could help.*" (p145). This was echoed by Stacey (1999) who argued that 'computer mediated communication" (CMC) could help foster collaborative learning. This was also echoed by other researchers (An & Kim, 2006; Dixon et al., 2006; Durán & Amandi, 2011; Ng, 2002; Postmes et al., 2001; Wentzell, 2002), demonstrating the real potential of technology to support learning.

As technology developed further and collaborative learning became more common, investigators moved more from a core objective of fostering online communication for collaborative learning, to broader learning goals. This included promoting social interaction (Morgan et al., 2009; Pozzi, 2010; Remesal & Colomina, 2013; Tirado-Morueta et al., 2017), skills development (Hsia et al., 2016; Issa, 2012; Mao & Peck, 2013) and peer assessment (Haddadi et al., 2018; Kim & Ryu, 2013; Watts et al., 2015). Some of this research addressed purely online activities (Ma & Ng, 2002; Sansone et al., 2018; Thomas & MacGregor, 2005; Watts et al., 2015), but there was also another focus on blended learning approaches – where students worked together both online and face-to-face.

The idea of blended learning has been around for some years now (Ginns & Ellis, 2009; Graham, 2006a; Loncar et al., 2013) and there are a number of considerations as to whether this approach is effective or not (Barak & Usher, 2019; Bliuc et al., 2011; Ginns & Ellis, 2009; Yuen et al., 2009; Ziegler et al., 2006). Even the terms used can be contentious (Moore et al., 2011), potentially causing confusion about which terms mean what to allow researchers to build on previous research. However, a generic definition can be accepted whereby blended learning means students working online and face-to-face in parallel. The focus of this study therefore, related to the effectiveness of peer learning and assessment in such a blended learning environment.

This study employed the use of blended learning to consider how students would experience peer learning and assessment. As noted already (section 2.2) there are a number of factors that can affect online group collaboration. Some similar factors were noted by Aghaee and Keller (2016) for peer review (of students' work), such as having clear guidelines and understanding of the process for peer interactions, but they were only able to make recommendations based on their findings, which they had not actually demonstrated in their study. That is, they had identified factors which could promote peer review but had not tested their effectiveness. This is echoed by Chang and Kang (2016) who argued that "*If done correctly, however, online group work can help optimize student learning*" (p74) and cited similar factors required to promote online learning – though this study was from an entirely online course.

For context of identifying contributory factors for effective online peer learning, Kleinsasser and Hong (2016) undertook a similar study, though these factors were explored for a fully online course. They found the need for tutor input and a challenge around developing learner autonomy. Madland and Richards (2016) discussed the use of online study buddies and instead of tutor engagement they provided student incentives of additional marks to participate, similar to that of Huang and Law (2018). Tuomainen (2017) showed that a blended learning environment can promote student interaction, allowing students to interact in the classroom and the asynchronous nature of the online tools gave students time to reflect on their learning. These studies demonstrate therefore, that online and blended learning approaches can support student learning.

Nortvig et al. (2018) undertook a review of the factors that influence student engagement with blended learning, focussing on professional education and teacher training. These factors included tutor presence in the online environment, student interactions and the connections between online and offline activities as well as campus and practice based activities. Although highlighting some of the key factors that influence blended learning more broadly, Nortvig et al. concluded that more research was needed to better understand what influences students' learning experiences for professional bachelor programmes.

Opdecam and Everaert (2018) highlighted ‘seven disagreements’ with cooperative learning which highlight key factors involved in creating a good cooperative environment. These include challenges of teamwork, free riding and peer assessment but also offer potential solutions. Such considerations equally apply to a blended learning approach but the recommendations made were generic and provided no detail on how such issues could be resolved. For example, they argued for ‘positive interdependence’ of group members but provided no information on how to achieve this goal. Peacock and Cowan (2018) addressed this more directly for a blended learning environment and offered new thoughts to address these challenges.

Peacock and Cowan (2018) discussed the importance of student-directed communities of enquiry, arguing that student-directed Communities of Inquiry can promote ‘*higher level cognitive and interpersonal skills*’ (p678). They went on to describe nine features which will promote student directed learning such as tutors negotiating the learning, learners deciding the detailed learning outcomes and learners planning and managing their own learning activity. In addition to addressing issues relating to successful implementation of blended learning, Peacock and Cowan also provided pertinent questions to challenge other researchers to provide additional evidence for the success of student directed learning.

The potential for promoting Communities of Inquiry is also discussed by Law et al. (2019) along with social, cognitive and teaching presence to enable learning performance. They also outlined how motivation is vital for students’ learning performance, explaining how intrinsic motivation is the dominant type in students’ learning in blended learning who also aim to finish tasks and show better performance than extrinsically motivated students. They go on to explore how enrolment on blended learning courses may be positively related to learning motivation and cognitive, teaching and social presence. This suggests that a student's motivation to enrol on a blended learning course may be positively related to these themes. However, the study disclosed that the subject studied were part of the students' course and they were government-funded for their degrees. A potential flaw in this research therefore is that the student motivation was more extrinsic than intrinsic – i.e. they were required to enrol because it was part of their course and they had to pass the course to have their degree funded.

As well as exploring the factors that promote effective blended learning experiences, the exploration of student population differences was a factor explored by Money and Dean (2019). They reviewed the literature to focus on how student populations and their differences might be '*leveraged into more successful learning outcomes*' (p58). They argued that the design of online instruction needed to take account of such differences to develop student-centred approaches that help to motivate learning. One of the problems with this literature review was that the methodology was not fully rigorous and incomplete, finding only a small pool of articles. However, they do identify seven key population descriptors which they suggest are relevant to promoting learning in a blended learning environment.

The seven population descriptors identified by Money and Dean (2019) covered cognitive differences, knowledge, personal traits, motivation, technology self-efficacy and preferences, demographic attributes and learning styles. Cognitive differences related to different abilities of students which has previously been discussed (Ireson & Hallam, 1999; Lai & Law, 2006), or knowledge, based on previous experience. Money and Dean related personal traits to the likes of personality, self-directedness and motivation has already been discussed (Law et al., 2019).

Demographic attributes included items such as gender, age, ethnicity, generation and even financial and marital status. Technology preferences related to familiarity with technology and learning styles was acknowledged as contentious, given that research on learning styles (Kolb, 1984; Kyprianidou et al., 2012; Sadler-Smith, 1996; Sharp, 2001) has been challenged (Coffield et al., 2004; Garner, 2000; LeBlanc, 2018). Whilst it may be difficult to relate all these descriptors to the design of a blended learning experience, it is important to be aware that they may have a direct or indirect influence on the student experience.

The themes of technology and motivation were explored by Dunn and Kennedy (2019). They argued that the literature has not always differentiated between technology use and engagement and assessed the impact of emotional, cognitive and behavioural engagement with technology on student grades, as well as how motivation predicts engagement with technology. They employed a psychometric questionnaire to measure motivation and asked students to keep a diary of their use of technology. They argued that engagement with technology (comprising emotional, cognitive and behavioural components) conferred a direct benefit to educational attainment, but that simple use of technology does not.

The broader use of technology to support student learning has been discussed by Serrano et al. (2019), who discussed the potential benefits of different technologies to support a blended learning approach. However, this focussed more on classroom related technologies which students could access online, such as ‘audience response systems’ (in class voting tools), peer assessment tools and recorded lectures. The use of discussion boards as an additional blended learning approach is discussed by Martinez-Izaguirre et al. (2019). Both of these appear to run counter to the identified benefits highlighted by Dunn and Kennedy (2019) where engagement appears more beneficial than just usage.

The research discussed so far explored how technology has developed over the years to provide the platform for students to engage on online learning, whether fully online or through blended learning. This technology orientated medium of engaging students and attempting to promote a positive learning environment has introduced a number of design factors which must be taken into account. Development of a constructive blended learning environment therefore involves researching the effectiveness of these factors and this study considers several of them, such as communication and skills development. This study also investigated the use of peer assessment and whether it was a valid form of assessment.

### 2.6.2 Validity of peer assessment

There has long been a challenge of devising marking schemes for peer assessment which students deem is 'fair' (McConlogue, 2010; Pitt & Winstone, 2018) and this is discussed in section 1.4. However, the 'fairness' or validity of peer assessment involves several factors. Student perception of peer assessment as being a valid form of assessment is a major factor, but also whether the actual marking schemes, assessment rubrics or peer assessment moderating algorithms do not introduce or miss potential marking bias. Another factor is whether these components of peer assessment can be reconciled so that students not only feel the process is fair but that this is reflected in the actual scores they give each other. That is, do the peer assessment marks students give each other reflect the actual contributions group members make to provide a genuinely valid form of assessment?

Previous research on the validity of peer assessment (Falchikov & Goldfinch, 2000; López-Pastor et al., 2011; Magin & Helmore, 2001; Mostert & Snowball, 2012; Stefani,

1994) has often tended to focus on peer assessment scores and the comparison between peer scoring and tutor scores. Topping (1998) reviewed the literature on validity of peer assessment and concluded that it is '*of adequate reliability and validity in a wide variety of applications.*' (p249) Other studies (English et al., 2006; Evans et al., 2007; Lew et al., 2010) still argue whether peer assessment is valid however and even within one recent study (Chang et al., 2011) it was reported that peer assessment was not valid yet self-assessment was (Chang et al., 2013).

Online collaborative learning is discussed by Lock and Johnson (2015), who mention learning can be designed to promote formative and summative self and peer assessment. They argued that online learning is a complex space involving dynamic interactions between students (peer assessment), instructors (instructor assessment) and themselves (self assessment). They put forward the need therefore, for an assessment model that covers assessment design, assessment transactions and assessment for knowledge construction. Whilst these are valid aspects of peer assessment, they make no reference to the additional challenges of demonstrating the validity of a peer assessment process.

Validity of peer assessment was investigated by Strang (2015) using a combination of peer, tutor and online peer assessment comparisons. The assessment was based on the submitted work of students in a face-to-face environment. A positive outcome of validity of the peer assessment was considered given that the mean peer ratings were statistically in agreement with each other, consistent with the marks of the tutor, and the online peer assessment grading tool (Moodle Workshop) was also 'valid and reliable'. However, these results are open to interpretation and counter to other published literature (Usher & Barak, 2018:756).

Strang (2015) showed that 'interrater' marking between each student demonstrated reliability and that validity could be measured with the help of a carefully designed assessment rubric. However, the validity was measured against agreement between student raters and this will only measure reliability, not validity. Students may simply fall into ‘compliance’ with marking each other similarly, potentially due to peer pressure or bias (McLaughlin & Simpson, 2004; Qiu et al., 2014; Thondhlana & Belluigi, 2017). Comparison of tutor mark may be a valid reference point for peer assessment (Jung, 2016) if it relates to the product of the assessment but cannot be used if the peer assessment is assessing the process, i.e. student engagement with the work, rather than the assignment product they produce. Finally, Strang notes that the Moodle Workshop is valid because it takes the average of the student scores and the accuracy of the Moodle Workshop was calculated to be correct. This simply confirms Moodle Workshop calculated the averages correctly but does not account for potential marking bias (Lejk & Wyvill, 2001; Pond et al., 2007) as simple averages have flaws when calculating peer assessment scores.

Ashenafi (2017) reviewed peer assessment practices and also addressed the issue of peer assessment validity. Validity was “*measured in terms of agreement between scores assigned by the teacher and those assigned by students*” (p233). Amongst the challenges cited to measure validity was a common statistical approach to compare scores and comparing related disciplines. However, this review still only addressed validity of scoring comparisons (between peers and tutors) and not the validity of the process as related to student perceptions. This issue is addressed by Izgar and Akturk (2018) who found differences between tutor and peer scores, with peer scores being higher than those given by the tutor. Conversely, peer feedback showed that, even though they had scored each other higher than the tutor, they felt a fair assessment had not been made.

An online peer feedback system, ITPmetrics.com was introduced by O'Neill et al (2019) to explore peer feedback and evaluate inter-rater correlations. They used a model for assessing team members' effectiveness, CATME (Comprehensive Assessment for Team Member Effectiveness) based on five themes, including teamwork (commitment), knowledge skills and abilities (KSAs) and communication. They found their results were favourable with other studies and so were considered acceptable for inter-rater reliability and offered predictive validity evidence.

Current research on the validity of peer assessment has explored different aspects and contexts of peer assessment. Some literature reviews validity in relation to the comparison of peer versus tutor marks, or peer to peer inter-rater comparisons. Yet more studies consider the validity of peer assessment tools. Most of these studies are also predicated on the peer assessment of work and/or peer review. This study however investigated the validity of peer assessment as a measure of how students worked together, not what work they produced.

Furthermore, results were triangulated not only for inter-rater validity but also to validate the actual marks against student views, based on their marks. This aspect of peer assessment – where students can evaluate their performance having known what their peers scored them individually, is missing from the current literature and is therefore addressed in this study. A key benefit of peer assessment is to support student learning so the next section reviews the literature on whether peer assessment can lead improvements in academic performance.

### 2.6.3 Improvement in performance

Collaborative peer learning and assessment has been cited as having a range of benefits, ranging from skills development such as improved writing skills (Pope, 2001; van den Berg et al., 2006b), improved communication (Horspool & Lange, 2010), critical thinking skills (Matheson et al., 2012) and better self-reflection (Sridharan & Boud, 2019). The literature on whether peer learning and assessment can improve grades is more mixed however. A main driver of this study as outlined in section 1.3 was to improve the teaching and learning experience for students but any improvement in grades could also be investigated, given that a key output of the blended learning activity was a summative assessment.

Early research has suggested peer assessment can help improve student grades (Moreno et al., 2012; Tayebinik & Puteh, 2013) and Castaño-Muñoz et al. (2014) discussed the potential benefits of a blended learning approach to improving academic achievement. They explored Internet use (for accessing and using learning resources) for interactive and individual learning. It is important to note that they acknowledged the research difficulty that it is impossible to actually know if there was a causal effect due to so many other potential variables between the target and control group. Based on average means for academic achievement (grades) however, they found that use of the Internet for interactive learning (with other students) led to a significantly greater improvement than use of the Internet for individual learning – where the student used the Internet for personal study.

In another study (Usher & Barak, 2018), peer assessment was compared between an on campus course (traditional face-to-face course), a Small Private Online Course (SPOC) and a MOOC (Massive Open Online Course). The SPOC involved students from the same institution but working online and the MOOC was open to anyone across the world, so the MOOC had a mixed group of demographic and academic backgrounds. Usher and Barak (Usher & Barak, 2018) found that the peer assessment gradings in the courses were mixed.

They found that on campus students graded work lower than SPOC or MOOC students, with a statistical significance. When compared to tutor marks for ‘accuracy’ on campus students marked slightly lower, but not statistically so, than the tutor, but SPOC students did. MOOC students were not marked due to the open nature of the course. However, the quality of on campus grading more closely correlated to the tutor, suggesting marking was more ‘accurate’ than the SPOC students. The authors postulated that this might be due to their ‘strong academic background’ and are more likely to be committed to grading process compared to their online counterparts. They also suggested the association between peer and tutor is dependent on many factors. This raises the issue of whether tutor linked peer assessments differ from peer to peer dependent assessments, where the tutor has no influence.

A recent study supports this notion of peer dependent review to improve academic performance (Gharehbagh et al., 2019). Students were tested initially on their writing skills so that a pre and post-test analysis could be completed to measure any subsequent improvements in writing performance.  Whilst not strictly peer assessment, Gharehbagh et al. (2019) found that students improved their writing performance in the assessment of essays when they used a wiki to peer review their initial essays before final submissions. They concluded that that approach freed up staff time for other support activities and students were able to learn from each other, implying a socio-constructive educational benefit.

Whilst not strictly peer assessment another recent study looked at co-assessment, which reflects good practice used for promoting constructive peer assessment. Quesada et al. (2019) investigated co-assessment, where the assessment was negotiated with the students. This chimes with research on peer assessment (Peacock & Cowan, 2018; van Hattum-Janssen & Lourenço, 2008) whereby students have an input into the development of the assessment criteria by which they are assessed. Quesada et al. found that students felt it led to a better grade and that the grade was fairer. They did mention that there was a limitation on the degree of consensus with grades, with some over and underestimation of grade expectations by students. This echoes peer assessment literature that suggests objectivity of grading can be an issue (Kun-Hung & Chin-Chung, 2012; Naber et al., 2018).

## 2.7 Adopting a blended learning approach to support peer learning and assessment

As discussed in chapter one, this study evolved from a desire to promote peer learning and assessment in a blended learning environment. There were several main drivers for this, including to:

- engage students more actively in the learning process in a blended learning environment
- promote skills development in relation to graduate attributes and general employability skills
- promote the use of technology to support group work
- Use electronic peer assessment as a valid assessment tool
- Adopt a general blended learning approach to improve efficiency, such as quicker student feedback, improved student communication and reduced administration overheads for assessment – whilst maintaining academic quality through active student engagement with the peer assessment process

In addition, there were possible benefits from a blended learning approach, such as increased student confidence and even improved academic performance. Whilst the literature for promoting peer learning and assessment was already established in a face-to-face setting, the literature on a blended learning approach to peer learning and assessment was less well established at the time of this study.

Although the use of technology to support peer learning and/or peer assessment has grown in recent years, much of it focussed on individual aspects of peer learning and assessment. For example, the literature discusses online peer learning (Carter et al., 2018; Serrano et al., 2019) and online peer assessment (Seifert & Feliks, 2019a; Siow, 2015) but not always together as an holistic approach to supporting online group work i.e. a blended learning approach to peer learning and assessment. Furthermore, there is the challenge to explore how students engage with a blended approach overall.

The premise for this study was therefore to explore the various factors that promote good peer learning and assessment in a blended learning environment and explore the general student experiences of online group work and peer assessment. There were therefore two key aspects to this study, focussing on the student experiences of group work in a blended learning environment and what students thought of electronic peer assessment and whether it was a valid form of assessment.

The students involved in this study came from two different subject disciplines and levels of study. It was not only possible to explore the student experiences of OPLA but also to compare students' experiences between two separate cohorts. The student groups involved were bioscience students and forensic science students and sections 3.2 and 3.3 describe their background in more detail.

## 2.8 RESEARCH QUESTIONS

The driver for this research was to develop a positive learning experience for students. Peer learning and assessment have been shown to provide the conditions to support learning, along with a range of other benefits such as improved critical self-reflection, communication skills and even, arguably improved grades. Combined with the support of technology, a blended learning approach to peer learning and assessment has the potential to provide a positive experience for online group work and peer assessment.

This study therefore, considered a blended learning approach to peer learning and assessment to promote a positive experience for the students involved.

The literature on peer learning and assessment are well established fields in a face-to-face environment (see section 1.2), identifying a range of factors that are key to promoting learning and student engagement. This is also true for a blended learning environment as discussed in section 2.1.4 above; and additional factors that relate to the use of technology also emerge, such as social presence and engagement with the technology (or not). However, research on blended learning and their overall positive impact on students is still developing. Rather than just explore the impact specific factors may have on a blended learning approach to peer learning and assessment, this study explored the broader impact, based on students' overall experiences. The outcome would then be to provide key guidance on how to design a blended learning approach to promote a positive experience of online group work and peer assessment.

The research aim of this study was to explore the student experiences of online group work and peer assessment, with the goal of improving the teaching and learning experience for students. A review of the literature on student experiences of online group work and peer assessment rarely focus on both components together and those that have explored these components (Ashenafi, 2017; Bayat & Naicker, 2012; Gikandi & Morrow, 2016; Koh & Lim, 2012; Molina-Carmona et al., 2018; Nguyen, 2017; Nortvig et al., 2018; Seifert & Feliks, 2019a; Serrano et al., 2019; Widjaja & Chen, 2017), did not consider the overall student experience, the validity of the peer assessment, and/or positive outcomes.

Whilst some of these studies discussed the relevant factors involved or the conditions needed to promote a good learning experience, few, if any explored the whole approach to the blended learning environment in any great detail. This study adds to the literature by not only considering the key factors that contribute to blended learning, but also exploring student experiences based on their demographics and previous experiences, and the validity of online peer assessment to produce an overall view of their experiences of online group work and peer assessment.

By considering the student experiences in this study, it sought to answer two key questions, which themselves present several additional questions.

- Do students have a positive experience of online peer learning and assessment based on a structured blended learning model?
- Is online peer assessment a valid form of assessment?

Since one of the aims of the work was to promote skills development there is an additional question around whether there was any evidence of skills development as a result of the peer learning activities. Alongside this, a number of additional questions are raised about peer assessment and student performance (below) and which investigated fully in the results chapters.

The literature explores validity of peer assessment from different perspectives, such as validity against tutor marks, validity against assessment criteria (sometimes referred to as rubrics), or against scores given between peer reviewers. There is very little research however, exploring the validity based on triangulation of actual marks and student perceptions – in other words, do students see peer assessment as ‘fair’? Finally, a key aim is that any approach to teaching and assessment actually produce quantifiable improvements in grades so does the OPLA help improve student performance?

This study set out to investigate such research questions and explore how this work added to the overall literature. The aim was to demonstrate how a blended learning approach to peer learning and assessment might give a more complete framework or model for providing a positive student experience of online groupwork and peer assessment. This study sought therefore, to consider how the components of OPLA could be considered together to deliver a positive learning experience for students.

# 3 RESEARCH DESIGN

In the previous chapter the literature on the development of peer learning and assessment was introduced. This was followed by a current review of the literature covering blended learning approaches and how the recent research fed into this study. As a result, key research questions were developed to address current gaps in the literature looking at broader student experiences of blended peer learning and assessment. This chapter will now outline the research design for the study and introduce the pedagogic principles on which the study was implemented.

## 3.1 THE STUDY AND PARTICIPANTS

This study evolved from early work by the author to promote group work in two discipline cohorts. In the mid-1990s opportunities to promote the group work and support learning online arose through adopting technology to support a blended learning approach, as well as introducing summative peer assessment. This blended learning approach had a number of academic, skills and even administrative benefits as class sizes began to rise.

By exploring the benefits that blended learning might offer for students, several objectives were identified to investigate how students engaged with the OPLA activities and how this related to the known literature. The specific research questions relating to the blended learning approach have already been outlined (section 2.8) but the broad objectives covered:

- An examination of the factors that promote a positive student experience of blended peer learning and assessment
- The validity of peer assessment, triangulated against student perceptions
- Identification of any skills development from online group work

- The possibility that student engagement with blended learning might improve academic performance

Participants in this study came from two courses, a level 4 (first year undergraduate) biology module and a level 6 and 7 (final year/ postgraduate) forensic science module. To investigate the objectives, both discipline cohorts undertook similarly designed blended learning activities.

The research approach taken for this study was predominantly action research, though with a quasi-experimental focus. The action research focus was based on the fact that each year, two cohorts of students were investigated and changes made in response to the results in a cyclic process. The quasi-experimental aspect was the fact that the student cohorts each year were treated as one group and pre and post tests were undertaken for each group. Each year, one class of bioscience students and forensic science students were investigated separately and are discussed below.

## 3.2 Bioscience students

The first discipline group involved in this study were level 4 (first year) bioscience students who were undertaking a core module called 'Skills for biologists'. Although all students were biologists, they were studying different variants (e.g. microbiology, environmental biology, biomedical sciences) so there was a mix of background sub-disciplines within the core module. This module had different components relating to IT skills, statistics and fundamentals of chemistry. The activities and assessment relating to the IT skills component of the module were the focus for this study. The aim was to help students develop foundation IT skills they would need for other parts of their course and so the work had a biological focus – that is, the assignment involved applying IT skills to biological topics.

The bioscience students across academic years 2008/09 to 2010/11 involved in this study averaged 55.2% females and 44.8% males. Since this was a level 4 module it was made up of 80.6% of students aged between 18-21 years of age, 14.8% aged between 22-35 and 4.6% over 35 years old. Students who reported English as their first language was 78.1% and 10.1% not being their first language. Student numbers for the module ranged from 171 (08/09), 218 (09/10) to 224 (10/11). The method for creating the student groups is now described, partly based on the known research literature at the time and partly within the scope of the study investigation to explore how students engaged with the way the blended learning approach was supported.

The students were given a group task based around a biological topic which involved researching a topic and then producing a MS Word report and associated PowerPoint presentation on their work. The students were divided into random groups of five. Groups were chosen by the tutor on the basis of timetable logistics and as a means to promote group interaction with fellow students who may not have known or interacted with each other prior to this activity. The literature (Ireson & Hallam, 1999; Oakley et al., 2004; Qiu et al., 2014) discusses how group selection can influence peer learning but since no prior knowledge of the students was available, since they were new students; the main reason for random group selection was to promote cross course interaction and encourage social interaction.

Each group was then required to produce a one page summary report of a biological topic and a PowerPoint presentation over 5-6 weeks. There were two timetabled classes and the groups were split approximately evenly between the two classes. There were five topics used for the assignment, one of which was assigned at random to each group. Each group was given access to their own discussion board (and file exchange area) on eBridge (introduced during class) and were expected to use eBridge to collaborate for the duration of the activity.

Given the number of groups of five produced (44 groups for 224 students), the fact that they were split between classes meant there were about 22 groups in each class. These figures changed slightly due to student drop outs. So, four groups in each class were given the same topic to research. The topic allocated to each group was known since the information was made available on Blackboard/eBridge, but students would not necessarily have known who was in which group – i.e. they didn't necessarily know which students were studying the same topic as themselves. The activity started with an introduction on how to work as a group, background to the assignment and the sorts of scientific and team working skills the activity was designed to support.

The topics themselves had been chosen deliberately for their content. They consisted of 'The Peppered Moth', 'Biofuels', 'Smoking and lung cancer', 'Ageing' and 'Climate change'. Each of these topics had potentially two very contrasting aspects/arguments and part of the assignment was to research both sides of the topic and present a balanced overview. This was intended to promote knowledge development in a biological topic and balanced scientific argumentation. For example, with ageing, students had to present information about ageing, what causes it and information about how to reduce the signs, or slow the process of ageing. This presented students with the opportunity to research the biological nature of ageing, research into slowing its effects and claims made by the cosmetics industry about the effectiveness of their products.

## 3.3 Forensic science students

The second discipline group in this study were level 6 and 7 students from different backgrounds on a core forensic science module. This activity was delivered to a mixed set of level 6 (BSc), level 7 (MChem and MSc) students and level 6 criminology students, collectively referred to as forensic science students for the purpose of this study. Students from each course did not know each other beforehand, similar to the bioscience students. Given the nature of the topic, there was no prior knowledge expectations so regardless of background, all students were starting the module equally in terms of background knowledge and skills in forensic science.

The forensic science students across 08/09 to 10/11 averaged 57.5% females and 42.5% males. The age profile of the students consisted of 50% 18-21 years old, 46.7% aged between 22-35 and 3.3% aged over 35. Students who reported English as their first language was 74.2% and 14.2% not being their first language. Student numbers for the module ranged from 28 (08/09), 34 (09/10) to 56 (10/11). The module itself was split between two key topics, a forensic investigation, and Bayesian statistics. The forensic investigation formed the basis of the OPLA activity.

The students undertook this activity for 4-6 weeks. The students were split into groups of three to four, with group members deliberately selected at random from each of the different courses. This was aimed at getting a random mix of students from different backgrounds to share experiences during the activity and to mix students who may not have known or interacted with each other previously. The activity started with a lecture on how to work as a group, background to the assignment and the sorts of investigative and team working skills the activity was designed to support. Students were expected to collaborate on the activity in-between teaching sessions with the support of eBridge.

The chemistry department provided a forensic-related component of a module based around the forensic investigation of a murder. Students were provided with details of a real murder case previously investigated by Dutch police which they had to attempt to solve. The case was provided by a former forensic scientist involved in the investigation and who was acting as a visiting professor to the Chemistry department. This activity was co-taught with the author in this study and was supported by lecture and workshop activities.

The following two weeks the visiting professor (a former forensic scientist) provided two double lectures about forensic investigations and the groups were also provided with details about the murder case. In the fourth week there was an interactive workshop where students worked in groups to investigate the case and request forensic reports during the session. In the subsequent weeks they then had to submit a group report summarising their findings of the case and who they think committed the murder. In addition, each student produced a personal two-part report, consisting of a personal account of the investigation they undertook in their group, and a personal reflection on how they felt they worked as a group.

## 3.4 PROCEDURE FOR BLENDED LEARNING

There were typical differences between the two discipline groups used in this study – based on the fact that they were two distinct disciplines and one was level 4 and the other was a level 6/7 course. However, the nature of the groups and the assignment format provided a number of similarities between both disciplines which could be considered for this study. For example, both disciplines were made of up of students from different courses that didn't know each other. The nature of the assignments was also the same, with both disciplines having to work together on a group assignment which was peer assessed for the process and not the product i.e. how well they worked together. The group work was also designed to promote skills development so comparisons could be made in the analysis of results. Both discipline groups were therefore set up in similar ways, as described in the following sections.

### 3.4.1 Group formation

Section 2.2.2 describes how group formation is a key factor in promoting peer learning. Group size for both discipline groups were chosen based on optimal conditions for promoting peer learning, engagement with the actual assignment and number of students in the class. For the biology students, given the large cohorts and assignment brief, students were put into groups of 5-6. This ensured that the assignment brief provided enough workload for a group of that size and the number of groups created provided manageable sets of groups due to the cohorts reaching over 200 students. The same approach was taken for the forensic science students where groups of three were appropriate for the assignment brief and smaller cohort sizes.

In relation to how students were assigned to groups, both disciplines were assigned part randomly and not on any ability criteria. For the biology students, since they were all level 4 students, there was no prior ability scoring available so students were allocated to groups randomly but based on course. Students were deliberately mixed up between courses to promote social interaction between students. The same process was followed for the forensic science students. The process of group formation was explained to all students to make the process transparent, as part of their ‘orientation training’ for working in groups.

### 3.4.2 Orientation training

The literature on peer learning (Boud & Lee, 2005; Falchikov & Blythman, 2001; Topping, 2005) and assessment (Bostock, 2000; Davies, 2006; Gielen et al., 2011) suggests that better engagement and more reliable marking can be achieved (Nash, 2014; Swaray, 2011; Xu, 2012) if students are prepared for the activity and have a chance to be orientated or trained in the activity. Therefore, for both cohorts were introduced to the OPLA at the very start of the activity. This introduction was almost identical for both disciplines (but allowing for assessment information differences) and covered key points such as how to work effectively as a team by agreeing communication channels early on, organising their work effectively, nominating a rotating group chairperson each week and proactively taking steps to engage each other. Students were also given an example of the type of work they would have to produce and an opportunity to practice group work in class. Students were then given an opportunity to contribute to the assessment criteria.

### 3.4.3 Developing the assessment criteria

For any form of summative assessment, there is evidence (Orsmond et al., 2000; van Hattum-Janssen et al., 2006) that students will engage more in the work and take ownership of assignment if they are involved in the development of the assessment criteria, or at the very least are given the opportunity to discuss and reflect on the criteria at the start. The students in this study therefore were given the opportunity to discuss the nature of the assignment and what was required in terms of module outcomes. They were then given the opportunity to negotiate how the exact criteria were defined. E.g. students were advised that the module outcomes had to assess… (something) but the students were given the opportunity to define exactly how this 'something' was to be met, using a form of words co-created with the students. This is key according to the literature (Meer & Chapman, 2015; Rust et al., 2003) as students can take ownership of the criteria, knowing what they will be assessed against, using a form of words they understand and can relate to.

### 3.4.4 Introduction to peer assessment

In addition to co-creating the assessment criteria definitions with the students they were also briefed on how the peer assessment process would work. Students were given ground rules on how to work effectively as a group and how to deal with various challenges of group work such as communication tips, managing the work itself such file sharing tips and how to manage conflict amongst group members. A key issue that crops up in the literature with peer assessment is concern over fairness and freeloaders (see section 2.2.3) so another key aspect of describing the peer assessment process was to make the marking process clear and provide worked examples of how peer assessment marks were distributed.

Students were given worked examples of how the peer assessment calculations would be used to create moderated marking. Moderated marking was based on an established algorithm (Lejk & Wyvill, 2001; Willmot & Crawford, 2007) to balance out and mitigate for potential marking bias. Peer assessment was managed through an online tool called WebPA (see section 3.8.4) and the process around this was also explained, including anonymous marking. Students therefore had a clear understanding of how peer assessment was moderated and how marks were calculated to give final individual peer assessment marks.

## 3.5 RESEARCH PRINCIPLES – KNOWLEDGE GENERATION

The educational driver leading to the genesis of this study was a desire to improve teaching practice by promoting group work. Group work and associated peer assessment offer a number of educational benefits, so in the lead up to this study the principles of good practice were considered. The approach to group work with the support of technology and combined with peer assessment was also considered but literature covering this holistic approach was less well established in this area. At the start of this study therefore, a number of principles around the approach to this study had to be considered, such as the philosophical approach to the research, the research methods employed and how the data would be analysed to provide the contextual answers in response to the research methods i.e. being fit for purpose. The following sections describe the pedagogical approaches taken and associated methods to collect data for this study.

### 3.5.1 Action Research

Elliot (1991) discusses teaching practice and how it needs to be reflective, arguing that reflective practice can actually be termed action research (p50). Kemmis (1980) mentions how the term 'action research' was first used by Kurt Lewin in around 1944. Indeed Lewin (1946) discussed how action research is '*research which will help the practitioner*' (p34). Lewin also talked about how action research can investigate group work (Swanson et al., 1952:459). Opie (2004) talked about reflection as a reflective cycle and referred to work by Kemmis and McTaggart (p79) who described how the act of action research is to plan, act, observe and reflect on the process. This definition chimes with that of Carr and Kemmis (2003) who said that action research is about planned action which is implemented, observed, reflected on and changed (p165). This is further defined in the context of this study where Elliott (1991) defined action research as "*the study of a social situation with a view to improving the quality of action within it*".

Altrichter et al. (2005) describe a key purpose of action research was to "*improve the quality of teaching and learning as well as the conditions under which teachers and students work in schools*" (p4). This view is supported by that of Stringer (2013:36) who said that action research needs to understand *how* things are happening rather than just *why* to understand how people respond to events related to the investigation. Given the longitudinal nature of the teaching context in this study, an action research approach was considered suitable to enact improvements from year to year. Stringer also went on to say that by understanding *why*, it was possible to consider the social aspect, "*that all social events are subject to ongoing construction and negotiation*" (p36). Taking account of this social dimension this study also needed to consider another lens by which to view the research and this approach was taken through social constructivism.

### 3.5.2 Social constructivism

There are two main theories of teaching and learning on student activity according to Biggs (2003:12-13) , phenomenology and constructivism. Their common link is the idea that what the learner has to *do* to create knowledge is the important thing (p12). Biggs argued for constructivism as a theory of learning that can translate into practice, whilst acknowledging phenomenology in its own domain. Biggs suggested that constructivism emphasises what students have to do, rather than how they represent knowledge, so the student constructs knowledge and is created by the student's learning activities (p13).

The idea of social constructivism to support educational research is explored by the likes of Bostock (1998), Price et al. (2007) and Stewart et al. (2019). This was echoed by Creswell (2012) who said that for "*social constructivism, individuals seek understanding of the world in which they live and work*" (p24). Creswell went on to say that "*the goal of research, then, is to rely as much as possible on the participants' views of the situation*" (p25). Since part of this study related to student experiences of OPLA the application of social constructivism to measure students' interpretation of peer learning was deemed appropriate. Students had to make sense of the group learning and the peer assessment process so part of the study focussed on their qualitative views. Consideration of student views from different cohorts was potentially problematic, but it was possible to adopt a quasi-experimental approach to compare the results from the two discipline groups.

### 3.5.3 Quasi-experiments

In a more scientifically orientated approach to research, experiments would have clearly defined controls, with randomised subject selection and control groups. This is what

Creswell (2018) describes as 'true experiments' (p12). Davies (2007) argued that randomised controlled trials are the "gold standard" (p32) of experimental research but that quasi-experiments are more common in social sciences research. Davies went on to argue that a quasi-experiment can work as long as the measurements used to evaluate outcomes "*will work equally well with all groups you are comparing*" (p115). Quasi-experiments are therefore a valid form of research in the social sciences.

One of the reasons quasi-experiments are popular in social science research is because 'true experiments' are not actually possible due to the potentially large number of variables at play, for example teaching conditions, make up of student participants and even ethical considerations of splitting student groups in the same cohort. Quasi-experiments are well reported in the literature (Gao et al., 2018; Gharehbagh et al., 2019; Vanderhoven et al., 2015) and even The Joanna Briggs Institute provides a manual to help plan a quasi-experiment (Tufanaru C et al., 2017). Quasi-experiments are therefore a commonly used methodology when random groups and control groups are not possible.

White and Sabarwal (2014) also explained that a quasi-experimental design by definition lacks random assignment but can test causal hypotheses and can "*identify a comparison group that is as similar to the treatment group in terms of baseline (pre-intervention) characteristics*" (p1). Davies (2007) said that since comparison groups are not strictly equivalent, researchers can take steps to increase the level of equivalence by matching pairs by criteria such as age, gender, or experience (p33). Davies also said that pre and post tests can be measured in both groups to improve the level of internal validity (p33). Gribbons and Herman (1997) also stated that non-equivalent 'pretest-posttest' design partially elimininates a major limitation of the non-equivalent group. Based on the nature of this study exploring two similar student groups, a quasi-experimental approach was therefore taken as part of this study to compare the bioscience and forensic groups.

### 3.5.4 Data collection

Based on the premise of taking a quasi-experimental approach for part of this study it was decided to undertake pre and post-test questionnaires. This approach would allow benchmarking of both groups before the study intervention and afterwards to evaluate any possible causal effects. Since the study actually involved teaching students across several years there was also an action research consideration whereby some minor elements were changed as a result of feedback and reflection as a goal to improve teaching year on year. Part of action research also involves reflection so in addition to the questionnaires, student feedback was obtained with focus groups and an attempt was made at observation by videoing students in class. This action research approach using quasi-experiments only provided part of the picture however, as student peer to peer interaction was key, and this prompted a social constructivist viewpoint as well.

Whilst part of the learning activity for the student was teacher directed, the fact that it focussed on peer learning and assessment deemed that students would socially construct part of their learning themselves. The research methodologies chosen to explore this student generated learning involved discourse analysis of their blended learning communications and a triangulation of data from different sources, including student interviews, to build up a picture of how students constructed their own learning. Discourse analysis involved the analysis of student online discussions using qualitative analysis software called NVIVO. Given that some of the research data was also quantitative, statistical software called SPSS was also used. Collectively therefore, a range of research instruments were used to obtain data during this study. The principles and validation of the research tools used in this study are explained in more detail in section 5.1.3.2 and 7.1.3.1.

## 3.6 Research scope

There are a number of factors concerned with the implementation of blended learning and the literature focusses on different aspects depending on the context of the investigation. These factors may range from the likes of development of writing skills, communities of practice based on online group interactions, to peer review of student work and the role of the tutor in promoting learning opportunities. This study addressed some of the factors relating to blended learning so it is worth outlining the scope of this study to clarify what it did, and did not cover.

### 3.6.1 Tutor involvement

Tutor contributions to blended learning activities can involve active tutor intervention in assignment tasks (Parks-Stamm et al., 2017) or contributing to online discussions. The tutor can therefore have a positive contribution to the development of learning if they actively contribution to knowledge development. However, tutor intervention by definition will influence the social and educational dynamics of the activity. There is also the time commitment involved, especially if student numbers are large and online communication is voluminous.

Student collaboration in this study was part of the blended learning activity and the associated peer assessment involved the group collaborations, not the actual work they produced. Therefore, students were best placed to review this peer input, not the tutor. Tutor involvement during this study therefore was primarily restricted to the classroom interactions, not the online collaboration. Since this study focussed on peer interactions rather than direct tutor involvement, the role of the tutor in the online interactions was not a consideration for the research.

### 3.6.2 Social presence

A key theme for this study was how the OPLA facilitated group communications so there was no tutor involvement in online communications and this was explained as part of the orientation training (see section 3.4.2). Some studies explore the development of social presence online (Chen & Chiu, 2008; Tirado-Morueta et al., 2017) but given the nature of the blended approach i.e. students could also meet in person, social presence was not a focus of attention. However, although it was not a primary focus of this study it was possible to observe any potential social development by analysing the group discussion boards.

Part of the procedure for the blended learning was to create private discussion boards for each peer group. The groups could then use the discussion boards to communicate and share work. The tutor had access to the discussion boards and this was made known to the students from the start, for example if the tutor had to intervene in any potential dispute, this option was open to review evidence of communication. After the activities, it was also possible to analyse the discussion boards through discourse analysis (section 7.4) and this was able to measure any 'natural' development of social presence i.e. group community engagement not deliberately designed as part of the blended learning activity.

### 3.6.3 IT literacy and skills development

One factor which was investigated was the potential for the computer technology itself to be a barrier to the online peer learning and assessment. Students were being expected to engage with blended learning but could prior experience and IT confidence be a barrier to engagement? Student prior knowledge, skills and experience were therefore reviewed and compared afterwards in the post tests to address this theme. It was possible therefore to measure student confidence with their IT skills and explore any perceived improvements afterwards. Another skill which was explored was student prior experience of peer assessment, as this was a key skill which could be promoted in the scope of this study.

### 3.6.4 Peer assessment and peer review

Students were asked about their prior experiences of peer assessment to gauge how confident they felt assessing the performance of their peers. This is different to the literature on peer review (Carlson & Berry, 2005; Kao, 2013; Lee, 2017), where students are asked to actually review the work output of other students. Students were not asked to peer review each other's work in this study and so this fell outside the scope of the investigation.

## 3.7 RESEARCH INSTRUMENTATION

As outlined in section 3.5 different pedagogical approaches were adopted for this study, based on the mixed qualitative and quantitative data available for investigation. Several different research instruments were therefore employed to collect and analyse these data and the following sections discuss the validation of these instruments in the context of this study.

### 3.7.1 Literature review strategy

Research for this study was undertaken using a systematic academic search strategy methodology. This involved using academic literature databases such as the EBSCO*host* and Scopus research databases. Using advanced research searches, key words commonly used in the field, along with standard Boolean search techniques, the literature was investigated to find current literature. In addition to this, other sources were used such as Zetoc email alerts, which is another research database that sent regular email alerts about new abstracts for research journals in this field. This approach is a standard research methodology advocated by academic librarians and the main search query employed – in line with health sciences related systematic reviews, yielded over 600 articles, which is within expected parameters for an academic search strategy.

### 3.7.2 Questionnaires

As part of the comparative study between the two discipline cohorts web-based pre-test and post-test questionnaires were delivered. A questionnaire is a common research method commonly used to gather data from people and can be defined as "a type of research strategy" (Aldridge & Levine, 2001 p5). A questionnaire allows the researcher to study causal relationships by retrospectively reconstructing outcomes from the data gathered (Scott & Usher, 1999). One key benefit of a questionnaire is that it allows the researcher to collect data from a large number of respondents (Scott & Usher, 1999) with the aim of getting a representative sample of the community. A questionnaire has to be standardised in such a way that all respondents are expected to understand each question in the same way (Scott & Usher, 1999).

There are two basic types of questions, open and closed. Open questions allow the respondent to provide a free response where the answer is unstructured and has to be recorded in full (Neuman, 2006; Oppenheim, 1992). Closed questions elicit a direct response, often 'yes or no' or factual information which requires no discursive response, such as age or height information. Open and closed questions have a number of associated advantages and disadvantages (Neuman, 2006) so consideration needs to be given as to which type of question will give the researcher the best data for the question being asked. Questionnaires also have the advantage of being able to collect both quantitative and qualitative data.

#### *3.7.2.1 Development of questions for a questionnaire*

Wiersma and Jurs (2000) suggested that information about the questionnaire and instructions should be '*concise and clear*' (Wiersma & Jurs, 2000:174) and should follow a logical format so that there is no 'jumping around' to avoid confusing the train of thought for the respondent. They also suggested that the length of the questionnaire may vary as it should not be too long as to make it tedious to respond to. This was supported by Neuman (2006) who said that whilst researchers would often prefer longer questionnaires to gather more data this has to be balanced against putting people off responding in order to gain a reasonable response rate.

In terms of question order Converse and Presser (1986) claimed that the meaning of many questions could be altered by the preceding question. Therefore, question order is important so as to avoid inadvertently skewing the response, or unintentionally asking leading questions. Converse and Presser (1986:40) emphasised that this is only a possibility; so as long as the questions are appropriately phrased and ordered, respondents should not be misled. Oppenheim (1992) and Wiersma and Jurs (2000) both argued, however, that certain questions such as demographic questions should be placed at the end of the survey. Oppenheim (1992) argued that having been given information about the questionnaire respondents then expect some '*interesting questions dealing with the topic of the study*' (Oppenheim, 1992:109) and not a series of personal questions.

The questionnaires for the pre and post-tests were designed based on the established literature and included a combination of open and closed questions which had been tested and refined with previous student cohorts prior the start of this study. They had also been independently peer reviewed by academic staff who were not connected with the study, thus providing independent verification on the validity of the questions. The delivery format of the questionnaire, web or paper based involved further thought as the literature demonstrated this could impact on data collection.

#### 3.7.2.2 *Paper versus web-based questionnaires*

Questionnaires are commonly administered in paper format but the increase in technology in recent years has opened up more opportunities for their use. One approach was the use of 'readers' to scan paper forms, known as 'optical mark recognition' or OMR. This approach is not so common now due to accuracy of scanning, cost of equipment and time taken so web-based questionnaires have increased greatly in recent years.

Neuman (2006) pointed out that web-based questionnaires would not have been possible until the late 1990s across the '*advanced world*' (Neuman, 2006:301) due to the limited number of web-based users. Neuman did caution that there are a number of potential disadvantages such as coverage and privacy issues, where not everyone may use the Internet to access web-based questionnaires. Access to web-based questionnaires is not a technological or social barrier now however, given the common use of smartphones where 'four out of five adults now have one' and higher in 18-44 year olds is higher at 91% (Deloitte, 2016).

Carini et al. (2003) explored potential differences between responses to web-based and paper-based questionnaires and found no major differences between both formats. They found that response biases were minimal between both modes (40% web responses vs 43% paper responses) but that web feedback responses tended to be slightly more positive – especially when asking about computing and information technology. The authors cited several possibilities for this but which were difficult to qualify due to various factors involved. These factors, such as access to email (to notify students about the web survey) were discussed by Porter (2004:9).

The literature showed mixed results for response rates between paper and web-based questionnaires. For example, Sax et al. (2003) and Cole (2005) found a lower response rate for web-based questionnaires but Cobanoglu et al. (2001) and Schaefer and Dillman (1998) showed better results for web surveys. Wiersma and Jurs (2000:185) also reported contrasting findings with some studies favouring web surveys and vice versa. Related to this is student preference for online or paper-based surveys and Donavan et al. (2007) reported that students prefer web-based surveys. Irrespective of format of questionnaire delivery, there are arguments for and against the use of either and there are no major disadvantages of using paper or web-based questionnaires.

#### *3.7.2.3 Likert scales and ordinal data analysis*

Whilst there are two key question types used for questionnaires, open and closed, a common format for asking such questions involve the use of Likert scales. Likert scales were developed by Rensis Likert in 1932, as reported by Matell and Jacoby (1972) and Allen and Seaman (2007) as a way of rating attitudes. However, there is often much confusion about the description of a Likert scale, as opposed to a Likert item. Clason and Dormody (1994) discussed the difference between them and Carifio and Perla (2007) discussed the common misconceptions of Likert scales and tried to dispel common myths around the terminology. A Likert item (commonly called but actually confused as a Likert 'scale') may look like:

Please indicate your preference for the following statement:

I am confident working with computers

| **1** | **2** | **3** | **4** | **5** |
|---|---|---|---|---|
| Strongly disagree | Disagree | Neutral | Agree | Strongly agree |

A Likert item is really what most people commonly refer to as a Likert 'scale' yet a Likert scale is actually the range of responses produced by respondents to the Likert item. Knowing this it is perhaps confusing that the phrase ‘Likert scale’ has entered common vocabulary in recent years, as mentioned by Jamieson (2004) and subsequently clarified and lamented by Carifio and Perla (2007).

There are contrasting findings in the literature about how many scale items should be used for a Likert item. For example, Jacoby and Matell (1971) argued that as few as three points are valid and reliable, whilst others such as Dawes (2008) argued that five items or more are better. Preston and Coleman (2000) suggested seven items probably provides the optimal reliability. There is also the issue of whether or not to include an odd number of items, allowing for a respondent to give a middle, neutral response (Converse & Presser, 1986). Regardless of number of response options, the main issue of contention is whether a researcher considers a middle, neutral point or not.

Another major issue with the use of Likert scale data is the way it is analysed. Jamieson (2004) discussed the ways in which many researchers misuse and misinterpret this data yet is admonished by Carifio and Perla (2007) for making some generalisations about likert scales. The issue is the type of data collected from Likert type questions and how it is statistically analysed. Allen and Seaman (2007) provided a simple explanation of how statisticians define types of data and McKillup (2006) also described the types of data as nominal, ordinal, interval and ratio data. A Likert item will generate ordinal data and the statistical method of analysis of this data is often wrongly applied, leading to incorrect interpretations. Ordinal data relates to data where the values are ranked and which indicates relative order. Ordinal data can be ranked and counted but not measured. Examples include 1st, 2nd… or strongly dislike, dislike, like...

Allen and Seaman (2007) suggested Likert scale data is often treated as interval data because parametric statistical tests are seen as more powerful than nonparametric alternatives. Jamieson (2004) argued that people often wrongly treat ordinal data as nominal and use parametric tests whereas ordinal data is best analysed using nonparametric methods. Tastle et al. (2005) provided a good example of the difficulty of statistically analysing ordinal data as interval data with a question about testing the temperature of a cup of tea. Using words such as “cold, tepid, lukewarm, warm, moderately hot, hot, and very hot” to describe the tea as a uniform (interval) scale is not possible. They argued that “*cold + lukewarm = moderately hot, or the average of hot and very hot is hot and a half, is both impractical and illogical*” (p4). So when analysing Likert data it is important to treat it as ordinal data.

### 3.7.3 Interviews

As part of the investigation into student perceptions of peer assessments, interviews were conducted. An interview is a means of obtaining qualitative data by having a dialogue with an individual or individuals. Gubrium and Holstein (2002) described an interview as a conversation, with the researcher asking questions and listening and respondents answering. Gubrium and Holstein (2002) described a range of interview methods which may be used to elicit feedback and information from respondents:

- Survey interviewing
- Qualitative interviewing
- In-depth interviewing
- The life story interview
- Focus group interviewing

Survey interviewing is a typical survey method which may be administered by paper, electronically or face-to-face; a common example of the latter being a market research survey conducted in public with passing pedestrians. For this study, face-to-face interviews were used

In-depth interviews may take various forms, with Seidman (2006) describing a range of interviews from tightly structured to open ended interviews with no apparent structure.

Drever (1995) articulated a third aspect, that of the semi-structured interview. The format for a structured interview should be thought out carefully and Opie and Sikes (2004) listed several factors for conducting an interview such as choosing an appropriate venue, seating arrangements and negotiating the method of recording (e.g. written notes, video or audio). Seidman (2006) suggested allowing 90 minutes for an interview claiming that an hour might have interviewees '*watching the clock*' (Seidman, 2006:20) as it is a common standard of time. Seidman argued that two hours might be too long but for younger participants, a shorter period might be more appropriate. For this study, structured interviews were undertaken to ask specific questions around student perceptions of the peer assessment process (Appendix C).

### 3.7.4 World café

One research instrument used to collect student feedback for this study was the use of a 'world café'. The concept of the world café was developed in 1995 by Brown and Isaacs (2005) and now has a global world café web community. The basic method of a world café is that participants break into small groups around a series of tables. On each table participants discuss a specific question (common to all tables) and make notes and after set times, say 20 minutes or so, people will randomly move to another table. At the end of the discussions, each table will feedback to the whole group and any comments recorded at the table can be kept as a record of the discussions.

A world café embraces the concept of diversity of the group and enables all views to be aired equally. This is a departure from the concept of more formal interviews (be they structured, semi structured, focus groups etc.) in that there is a feeling of invitation (for all). At its core, is the idea that questions of interest for the participants around a single, given theme are raised and anyone with an interest in those questions break off into separate discussions. People are free to participate at will and change groups if they like.

### 3.7.5 Liquid café

Arising from the concept of the world café is the liquid café. Whereas a world café deals with a single question, a liquid café can address several questions or themes. The concept of the liquid café was developed by Seel (2006) who developed the idea of having several questions on different tables where participants discuss the question placed on that table. Seel proposed some simple rules:

- Move to a new table
- There should be no more than six people at any table
- There should be no fewer than four people at any table
- As far as possible, work with people you haven't worked with before

(Seel, 2006)

As part of this process, Seel's webpage cited Owen's (1997) "*law of two feet*" whereby you move if you're not learning anything (Seel, 2006). Seel also cited Owen's (1997) description of people as bumblebees of butterflies. Bumblebees move from table to table cross pollinating and butterflies flit around, perhaps seemingly not contributing, but may strike up valuable conversations along the way. By utilising a liquid café it was able to benefit from the advantages of a world café and elicit broader feedback on several themes.

### 3.7.6 Focus groups

A final student forum used in this study to collect qualitative data was the use of a focus group. Focus groups, as their name suggests are interviews with groups of people. A focus group is a way of collecting qualitative data by interviewing a small group of people, usually between about 6-12, according to Neuman (2006). Flick (1998) said that focus groups may be used on their own or in combination with other methods such as questionnaires. Neuman (2006) cited a number of advantages and limitations of focus groups:

Advantages

- The natural setting allows people to express opinions/ideas freely
- Open expression among members of marginalized social groups is encouraged
- People tend to feel empowered, especially in action-oriented research projects
- Survey researchers are provided a window into how people talk about survey topics
- The interpretation of quantitative survey results is facilitated
- Participants may query one another and explain their answers to each other

Limitations

- A 'polarization effect' exists (attitudes become more extreme after group discussion)
- Only one or a few topics can be discussed in a focus group discussion)
- A moderator may unknowingly limit open, free expression of group members
- Focus group participants produce fewer ideas than in individual interviews
- Focus group studies rarely report all the details of study design/procedure
- Researchers cannot reconcile the differences that arise between individual–only and focus group-context responses

Morgan (1993) cited a number of reasons for using focus groups as a research tool, such as when investigating complex behaviour and motivations or exploring the degree of consensus on a topic. Greenbaum (1998) also cited similar purposes of a focus group, including attitude studies and ideas generation. Morgan and Greenbaum both highlighted a number of caveats with focus groups and highlighted myths (Morgan, 1993) or common mistakes (Greenbaum, 1998) relating to the use of focus groups.

These included avoiding the use of focus groups to collect quantitative data as the data collected is qualitative; and not needing a trained moderator, since this is not particularly necessary. Langford and McDonagh (2003) listed several activities, including planning the research, recruiting participants, specifying the contents of the sessions (including preparing the questions) and moderating the session. These issues are also highlighted by Greenbaum (1998) who discussed fine detail such as venue, time of the session and developing a moderator guide. By combining the use of questionnaires, interviews and focus groups (including the café formats) it was possible to elicit rich qualitative data from the students. Different tools were used for quantitative data and these are discussed next.

## 3.8 DATA ANALYSIS TOOLS

The data collected during this study was a mix of qualitative and quantitative data from several sources as shown in Table 1.

*Table 1 List of data sources and data types recorded for study*

| Data source | Type |
|---|---|
| Survey | Quantitative, qualitative |
| Focus group | Qualitative |
| Liquid café | Qualitative |
| Interviews | Qualitative |
| Workshop video | Qualitative |
| Discussion boards | Quantitative, qualitative |

As discussed above, the questionnaires, focus groups, and discussion boards provided qualitative data and the questionnaires and discussion boards also provided quantitative data. Several data analysis tools were employed to evaluate the data from these different sources.  Two commonly used research instruments used to analyse these data, NVIVO and SPSS, along with a commercial questionnaire tool called JISC Online Surveys (formally called Bristol Online Surveys).

### 3.8.1 JISC Online Surveys

The web-based survey tool used in this study was a commercially licenced tool called 'Bristol Online Surveys' (BOS) but has since been bought by JISC, who rebranded the tool as JISC Online Surveys. Once students completed an online survey the results could be exported as a CSV file which could be imported into NVIVO or SPSS for later analysis.

### 3.8.2 SPSS

SPSS (IBM) is a commonly used statistical analysis software package that allows a wide range of sophisticated statistical tests to be undertaken such as ANOVA, t-tests and Spearman correlation tests. Quantitative data generated during this study was imported into SPSS, which could then be analysed in different ways, based on the data and appropriate test applied to the data. Outputs from SPSS included data tables and visual graphs of the analyses. With continuous updates of the software during this study SPSS versions 20-25 were used, with version 25 being the most recent version at time of this publication.

### 3.8.3 NVIVO

As well as quantitative data analysis, data analysis tools are available to evaluate qualitative data and NVIVO was the tool used in this study. NVIVO allows for detailed qualitative analysis of content from different media formats (e.g. text, video, images) and so was the tool used for the text-based qualitative data from this study.

### 3.8.4 WebPA

The online peer assessment tool used for this study was an open source software tool called WebPA. Students use this web-based tool to anonymously record their peer assessment scores for their fellow group members. The WebPA software then calculates individual student scores based on a moderated algorithm to mitigate for potential marking bias. Once all the scores are recorded, the tutor can then export various reports, such as scores by individual question and overall scores for each student.

WebPA calculates a student's score by accounting for the marks they gave to other group members and what other group members gave them. Allowance is made for the number of students in the group and for students who may not submit. A student's final mark is calculated by taking the WebPA factor and multiplying it by the group mark for the assignment. For example:

John awards 14 marks in total to all his group, of which he awards himself 4 out of the 14 marks. John's score is normalised (4/14 = 0.29). This is combined with the same scores that the other students scored John e.g. 0.29 + 0.23 + 0.20 + 0.19 = 0.91. If the group was awarded 80% for their group assignment, John's final peer assessed mark is 0.91 x 80% = 73%. A more detailed explanation of the WebPA scoring algorithm is given on the WebPA website (WebPA). The use of WebPA for this study is detailed in chapter 5.

# 4 EXPLORING STUDENTS' EXPERIENCES OF ONLINE GROUP WORK

The literature review in Chapter 2 discussed the various factors which can encourage student engagement, knowledge and skills development in a blended learning environment. The OPLA activity for this study was designed to explore whether the factors involved in promoting effective peer learning and assessment face-to-face would be comparable in an online environment resulting in a positive learning experience for students. It set out to address one of the primary research questions for this study, namely *do students have a positive experience of online peer learning and assessment*?

Factors involved with facilitating online group work include setting up groups, enabling good communication, providing guidance on managing and sharing workloads within the group. Collectively these factors aimed at developing a positive experience could be investigated to explore students' experiences of online group work. This chapter explores the setting up of the blended learning environment and an analysis of the student experiences of the online group work and peer assessment.

## 4.1 METHOD

Students from two undergraduate based modules were used for this three-year longitudinal study between the 2008-09 and 2010-11 academic years. The students involved were level 4 bioscience students and a mixed, level 6/7 forensic science module (see section 3.2 and 3.3). Prior to starting the OPLA activity all students were asked to complete a pre-test questionnaire to gauge their prior engagement with, and experience of both face-to-face and online group work and peer assessment. This was followed up with a post-test questionnaire after the OPLA activity. Taking a mixed methods approach based on the research principles discussed in section 3.5, the questionnaire was anonymous, which had various research implications.

Choosing to deliver an anonymous questionnaire meant that individual student comparisons would not be possible for the study but acknowledging the quasi-experimental approach taken (see section 3.5.3), this is an acceptable form a social research. Since the questionnaires were identical for both discipline cohorts, this meant that whole group comparisons could be made, whereas administering named questionnaires would make comparisons more difficult. This is because data would be incomplete and have to be excluded if the same, named student did not complete the pre and post-test questionnaires. After the OPLA activity students were asked to complete a post-test questionnaire which was administered prior to students receiving their grades. The ethical considerations for the questionnaire were carefully considered.

### 4.1.1 Ethical considerations

At the start of this study there were no formal ethics committees or expectations required as part of the research investigations. Regardless, it was important to be aware of the importance of what data was collected to ensure confidentiality and security of data. Ethical considerations focussed primarily on the collection of student data through anonymous questionnaires, individual student interviews, and focus groups.

When collecting survey data it was important to be aware that even if direct personal data was not requested (e.g. name date of birth etc.), there were no risks of indirect identification, such as identifying a student if they were female, studying a particular course and was of a particular age, for example. For this study, general information about students was gathered covering gender, age brackets (18-21, 22-35, over 35) and first language as English (or not). All data was stored on a secure University server with restricted access.

An additional level of anonymity provided for students was the fact that the questionnaires were conducted online, which meant that responses were typed and therefore not handwritten. The survey tool used also meant that information about the respondent was not recorded, such as IP address or user login details of the computer so it was not possible to trace the source of survey to any particular computer. An added layer on anonymity was that the questionnaires were often completed on open access computers so any student had access to the computer, making potential tracing more difficult still.

### 4.1.2 Questionnaires

For the pre-test questionnaire students were asked about their previous experiences of working in groups; both face-to-face and online. This information was used to benchmark student attitudes beforehand in order to compare with student attitudes after undertaking the OPLA activity. Bioscience students and forensic science students undertook different OPLA activities but the format of the blended learning was the same for each discipline cohort. Afterwards, forensic science and bioscience students completed the same post-test questionnaires about their experiences of the group work.

The questionnaires were designed based on known approaches developed from established literature (see section 3.7.1) and administered using the web-based tool called Bristol Online Surveys (BOS) (see section 3.8.1). At the time of this study the author was involved in a funded peer assessment project with Loughborough University and in 2008-09 the project made an attempt to undertake some cross-institutional analysis of student engagement with peer assessment. Therefore the 2008-09 pre and post-test questionnaires had some questions that did not relate directly to this study.

The pre and post-test questionnaire question sets explored various student attitudes to face-to-face and online group work, attitudes and experience of peer assessment and also skills development. As part of the study, some anonymous demographic data was collected in an attempt to consider any impact or consequence of demographic differences on student experiences. Due to the one-off intervention of the Loughborough joint project however, some questions were not collectively asked in 2008-09. The following results therefore sometimes were not able to show the same data across all three years, mainly focussing on comparative data across 2009-10 and 2010-11. The pre and post-questionnaires are shown in Appendix A and B respectively.

### 4.1.3 Data collection

During the first class the bioscience students were simply advised they would be undertaking group work during the module and were asked to complete the pre-test questionnaire. The students were based in a computer suite for their module classes so were directed to the web-based questionnaire at the start of their first class. The forensic science students were based in a lecture theatre so they were contacted by email prior to their first class and asked to complete the pre-test questionnaire. The questionnaire was closed after the first class, when students were introduced to the group work activity. This would prevent some potential bias if students completed the questionnaire after being told about how the activity would operate.

### 4.1.4 Data analysis

The pre-test surveys provided a mix of quantitative and qualitative data in CSV format. This was exported from BOS, with the qualitative data being analysed in NVIVO and the quantitative data being analysed in SPSS. As previously discussed (section 3.5.3) it was possible to do comparative analysis of the data from both discipline cohorts so the following results present data from the bioscience and forensic science students alongside each other.

## 4.2 RESULTS

To investigate the student experiences of a blended learning approach to peer learning and assessment, a quasi-experimental approach was taken. This approach involved asking students about their prior experiences on group work and peer assessment to benchmark their initial views. This could then be compared with the results from the post-test questionnaire to consider the research question, asking if students had a positive experience of the blended learning approach to peer learning and assessment. The results are now presented.

## 4.3 STUDENT ATTITUDES TO GROUP WORK PRIOR TO OPLA ACTIVITY

Students were asked if they had undertaken face-to-face group work prior to commencing the OPLA activity, with the majority of both bioscience students and forensic science students stating they had (Figure 1).

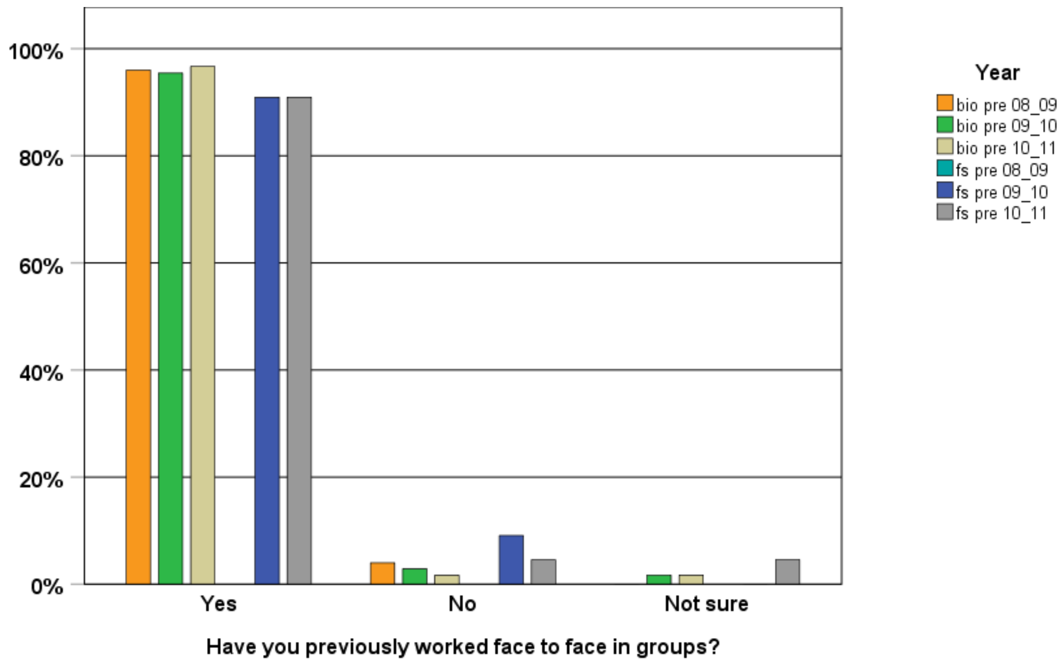


*Figure 1 Bioscience and forensic science students' prior experience of working face-to-face in groups*

Students were also asked if they had enjoyed working face-to-face in groups. Most students enjoyed working face-to-face in groups at least sometimes (Figure 2).

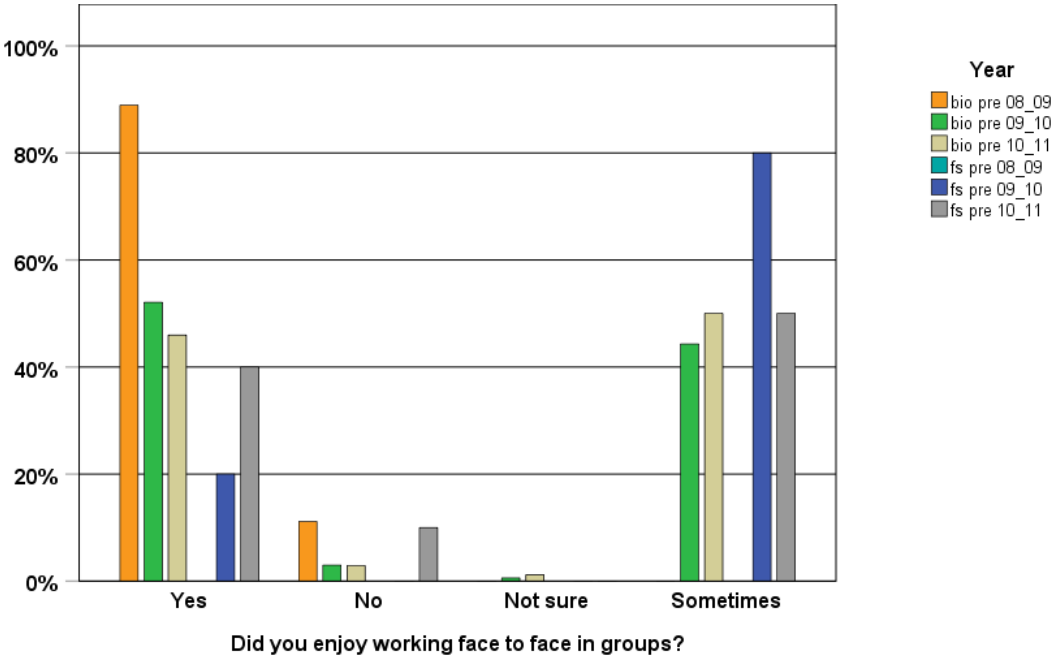


*Figure 2 Bioscience and forensic science students' prior enjoyment of working face-to-face in groups*

Prior to the OPLA activity students were asked whether they had previously worked online in groups. About two thirds of bioscience students had not worked online in groups previously, with roughly one third claiming to have worked online in groups (Figure 3). Forensic science student experiences were more mixed.

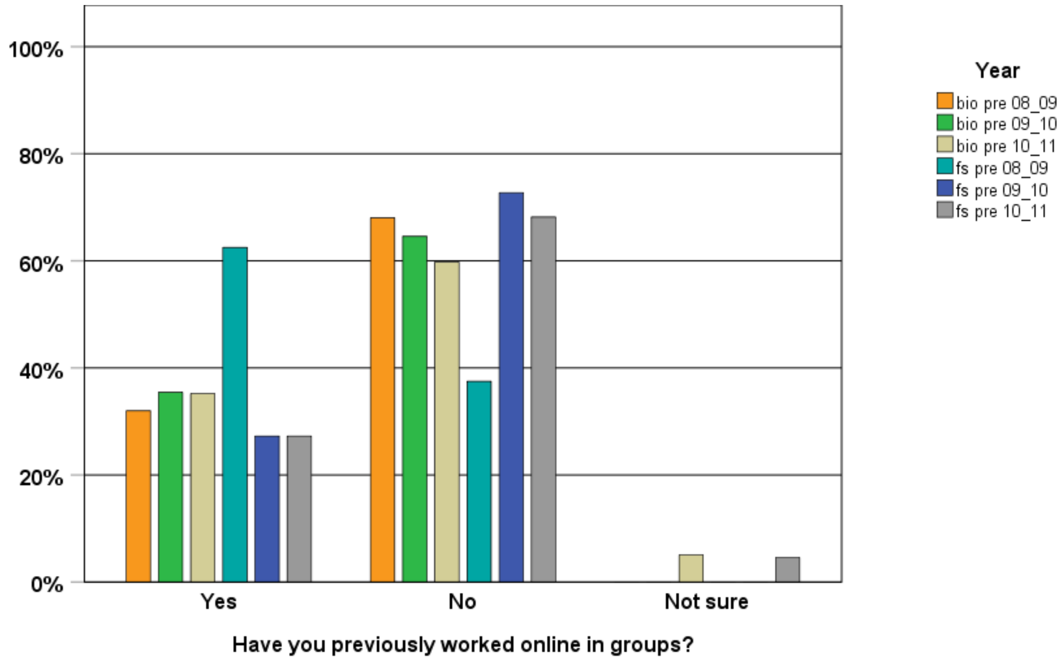


*Figure 3 Bioscience and forensic science students' experience of working online in groups*

The type of online group work undertaken by students was not investigated further so it was not possible to ascertain the nature of the online activity they engaged in.

Of those who said they've previously worked online, when asked if they enjoyed working online in groups the majority of bioscience students did (Figure 4). Approximately one third of bioscience students had previously worked online in groups in 08/09 and reported that they liked it (Figure 4). In 09/10 and 10/11 most students liked it, or liked it 'sometimes'. The results were more mixed for forensic science students across the different years.

When comparing enjoyment of working face-to-face and online, the results were mostly similar. Most students liked working face-to-face at least sometimes (Figure 2), similar to face-to-face preferences (Figure 4), though forensic science students in 10/11 reported not liking working face-to-face previously.

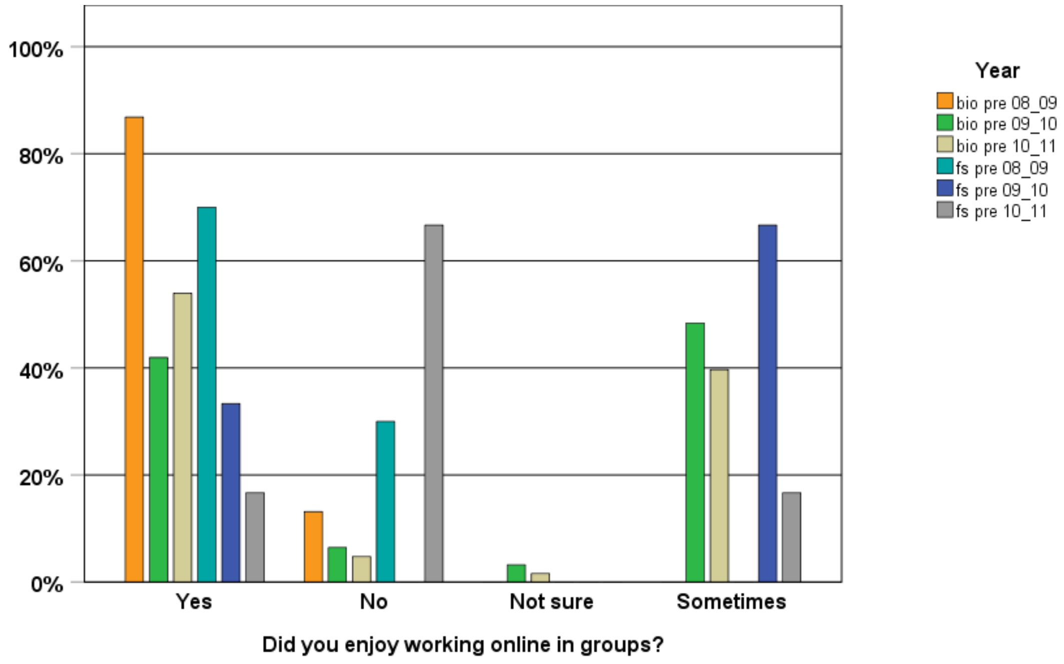


*Figure 4 Bioscience and forensic science students' previous enjoyment of working online in groups*

## 4.4 PRE-SURVEY VIEWS OF WORKING IN GROUPS

The aim of the open text questions in the pre-survey was to explore students' attitudes to, and experiences of, group work and peer assessment. The following two questions were asked in order to gauge students' view of group work.

1. Regardless of whether or not you've worked face-to-face in groups; in general what do you feel about working face-to-face in groups?
2. Regardless of whether or not you've worked online in groups; in general what do you feel about working online in groups?

When the open text responses were qualitatively analysed, as described in section 3.7.2, a number of themes emerged. The same themes emerged for both subject cohorts and these are discussed next.

The number of survey responses for each subject cohort for each year are shown in Table 2 and 3.

### 4.4.1 Student views on face-to-face group work

From the qualitative analysis and coding of the pre-test survey, key themes were identified from the responses. Since bioscience students sometimes identified different themes to those of the forensic science students, or each group attached different emphasis to similar themes. As such these themes have been reported separately in different summary tables.

Pre-survey responses from students about working face-to-face in groups showed that the majority of student comments stated that they felt it was a good way to share ideas and was enjoyable. The third most common theme to emerge was that students were concerned about freeloaders, which echoes that of other researchers (Piezon, 2005; Shiue et al., 2010). Freeloading however, was the biggest concern for forensic science students, possibly due to the higher stakes nature of their assignment. Table 2 and 3 provide examples of responses which were representative of the themes emerging from the data. The number of responses cited for each theme did not necessarily relate to number of students, since some students would often make a single comment that addressed several different themes.

*Table 2 Bioscience students' pre-survey views on face-to-face group work*

| Working face-to-face theme | No. of responses for each theme (08/09 to 10/11) | Response [survey year] |
|---|---|---|
| Share ideas | 93 | *"good experience to share ideas with group members" [bio 08/09]*<br>*"It's useful to work in groups with other students so that you can share ideas." [bio 10/11]* |
| Enjoyable | 57 | *"Its an alternative learning style that is enjoyable and helps develop interpersonal and teamwork skills." [bio 08/09]*<br>*"I enjoy working in face-to-face groups, as I think it enhances team building skills, and is enjoyable." [bio 10/11]* |
| Risk of freeloaders | 45 | *"Problems with students not doing there part of the work." [bio 08/09]*<br>*"Working in groups can be an enjoyable experience although this would depend on the group. For example one bad perfomer (or rude, lazy etc.) could sour a good group project." [bio 09/10]*<br>*"As long as each person in the group pulls their weight, face-to-face groups are a good way of learning." [bio 10/11]* |
| Don't mind working face-to-face | 32 | *"It is ok!" [bio 08/09]*<br>*"I feel comfortable working in face-to-face groups." [bio 09/10]*<br>*"I don't mind it." [bio 10/11]* |
| Improves learning | 42 | *"I feel it gives me and the ones I am working with better a quality of learning, as I allows people who don't understand certain aspects to get help from those who do." [bio 08/09]* |

| **Working face-to-face theme** | **No. of responses for each theme (08/09 to 10/11)** | **Response [survey year]** |
|---|---|---|
| | | *"I feel working face-to-face in a group situation allows you to learn from your peers" [bio 09/10]* |
| Skills development | 26 | *"Its an alternative learning style that is enjoyable and helps develop interpersonal and teamwork skills." [bio 08/09]*<br>*"its a perfect chance for me to improve my skills and learning the subject fully with its positive and negative ways" [bio 10/11]* |
| Interpersonal clashes | 15 | *"working with people one does not get along with can lead to poor quality work and stressful situations" [bio 08/09]*<br>*"when paired with people of conflicting personalities, it's not very efficient." [bio 09/10]*<br>*"It can be difficult tob work with other people as this can lead to disagreements." [bio 10/11]* |
| Prefer working alone | 13 | *"i prefer working alone." [bio 08/09]*<br>*"I prefer working by myself"* [bio 09/10] |
| Develops confidence | 14 | *"I felt it helped me become more confidant around my peers." [bio 08/09]*<br>*"I am more confident and feel more involved and it is easier to learn in groups" [bio 09/10]* |
| Nervous | 13 | *"I get quite nervouse." [bio 10/11]*<br>*"working face-to-face made me quite nervous and uncomfortable." [bio 10/11]* |

### 4.4.2 Forensic science students' views of working face-to-face

The forensic science cohorts were much smaller than the bioscience cohorts and therefore fewer responses were provided, but similar themes still emerged. The most common theme was the risk of freeloading, and others citing the sharing of ideas, being enjoyable and developing confidence (Table 3).

*Table 3 Forensic science students' pre-survey views on face-to-face group work*

| Working face-to-face theme | No. of responses for each theme (08/09 to 10/11) | Response [survey year] |
|---|---|---|
| Share ideas | 4 | *"can be very useful as you can often see things from many different points of view" [FS 09/10]*<br>*"its great to be able to have in depth discussions i find it alot easier to be abe to have discussions this way." [FS 10/11]* |
| Enjoyable | 2 | *"If in a group where everyone inputs the same effort then it is usually a good and enjoyable experience." [FS 09/10]*<br>*"Its a useful experience, and can be good fun. It makes a change from normal lectures." [FS 10/11]* |
| Risk of freeloaders | 10 | *"sometimes it can be difficult as people often put different levels of effort in and it can be frustrating if you are working with someone lazy." [FS 09/10]*<br>*"i do like it however there is always a risk not everyone will pull their weight" [FS 10/11]* |
| Don't mind working face-to-face | 1 | *"I think it would be agood idea." [FS 10/11]* |
| Skills development | 1 | *"It is a good oportunity to display communication and team builidng skills" [FS 09/10]* |
| Interpersonal clashes | 1 | *"I'm not a fan of being forced to work with random people. I prefer to head up a group of people that I'm able to hand pick, knowing that they're all good at what they do (and will all contribute) but that they are all conflicting personalities." [FS 10/11]* |

| **Working face-to-face theme** | **No. of responses for each theme (08/09 to 10/11)** | **Response [survey year]** |
|---|---|---|
| Prefer working alone | 3 | *"Hate it. Don't like to rely on other people when it comes to a mark for my degree." [FS 10/11]*<br>*"I do not enjoy working in groups. I would rather take responsibility for my own learning and marks and know that I did it myself as there is always someone in the group who doesnt contribute as much as others." [FS 10/11]* |
| Develops confidence | 2 | *"think it may be helpful for people who are not confident" [FS 10/11]*<br>*"gice me a little more conifdence im myself, i find it a little awkward at first as i am a litle shy but once i'v meet everyone im fine." [FS 10/11]* |

### 4.4.3 Bioscience students' views of working online

When bioscience students were asked about working online the most common theme that emerged was that students were happy to work online (Table 4). Students also felt it would be a convenient communication tool and a good way to work. Another major theme was that students would prefer to work face-to-face and that it would be difficult to communicate online. Other themes emerging included being able to share ideas and information.

### 4.4.4 Forensic science students' views of working online

The majority of forensic science students' comments referred to working online as a convenient communication tool or not being aware of what it involved (Table 5). Several comments were made about preferring to work face-to-face or difficulties in communicating, whilst other comments related to it being a good way to work and share ideas online.

Although the number of comments varied due to the different size cohorts, similar themes arose for both groups. Both cohorts of students suggested working online could be convenient for communication, others not knowing what it involved and some preferring to work face-to-face.

*Table 4 Bioscience students' pre-survey views of working online*

| **Working online theme** | **No. of responses for each theme (08/09 to 10/11)** | **Response [survey year]** |
|---|---|---|
| Convenient communication tool | *48* | *"Because you are not able to 24/7 work outside, being able to work online means you're able to communicate with other people like face-to-face even at home." [Bio 08/09]*<br>*"i dont mind working in online groups as this can be an easier way to communicate" [bio 10/11]* |
| Happy to work online | 60 | *"would be happy to work online in groups" [08/09] "Could be very fun and interesting." [bio 09/10]*<br>*"I am happy to work with others online." [bio 10/11]* |
| Prefer working face-to-face | 52 | *"It would be great but i'd rather speak face-to-face" [bio 08/09] "i prefer face-to-face, as you can not tell emotions, also confusion can occur" [bio 10/11] "It does not seem as good as working in groups 'face-to-face" [bio 10/11]* |
| Good way to work (online) | 58 | *"It may be very useful to be able to work online in groups as easier and everyone may be able to voice their views better." [bio 08/09] "You can be more anonymous and to an extent this increases your confidence in asking "silly" questions or throwing out "challenging" ideas. It helps to boost thinking/imagination/creativity but its less physically involved." [bio 089/09] "Online groups can be useful as most people are online a lot of the time" [bio 10/11]* |
| Don't know what it involves | 39 | *"Never done it so don't no what it entails." [bio 08/09] "i don't have an idea how this would work and this would be like" [bio 10/11]* |

| **Working online theme** | **No. of responses for each theme (08/09 to 10/11)** | **Response [survey year]** |
|---|---|---|
| Can be difficult to communicate | 31 | *"It is a little harder to communicate some ideas online compared to having face-to-face groups." [bio 09/10]*<br>*"Its more difficult to portray opinons and easier to misregard opinions" [bio 10/11]* |
| Good for sharing information | 33 | *"I think this would be an easy way to pass work between a group of people, allowing everyone to have an involvment, I would quite like to be involved in something like this." [bio 09/10]*<br>*"I like the idea a lot, it makes it a lot easier to share files and allows people who may be shy in groups to put their full ideas forward." [bio 10/11]* |
| Share ideas online | 15 | *"it may be useful when working on your own to be able to discuss the groups work online." [bio 08/09]*<br>*"Working online in groups allows access to more information and ideas from other students and so is a more educational experience than working alone." [bio 10/11]* |
| OK if given the skills to work online | 7 | *"i would be happy doing this as long as i feel confident i have the necessary skills to do this type of work." [bio 08/09]*<br>*"fine as long as i know how" [bio 10/11]* |
| Not as good as face-to-face | 7 | *"Definatly not as efficent as face-to-face group" [bio 08/09]*<br>*"I think it wont be as beneficial as working face-to-face." [bio 08/09]* |
| Easier than working face-to-face | 7 | *"can be easyer then working face-to-face" [bio 08/09]*<br>*"i think that working online in groups is preferable to working face-to-face in groups." [bio 10/11]* |

*Table 5 Forensic science students' pre-survey views of working online*

| Working online theme | No. of responses for each theme (08/09 to 10/11) | Response [survey year] |
|---|---|---|
| Convenient communication tool | 7 | *"I think it may be easier to work online as you can do this at any time of the day" [FS 09/10]*<br>*"Good way of communicating basic information to other people." [FS 09/10]*<br>*"Its easier because people can access the discussions in their own time if they don't have the time to meet up" [FS 01/11]* |
| Happy to work online | 3 | *"I think it will be interesting." [FS 10/11]*<br>*"very good and i recommended" [FS 08/09]*<br>*"I feel that working groups is a very good idea, both  and with the help of computers." [FS 08/09]* |
| Prefer working face-to-face | 6 | *"I prefer working face-to-face because I can discuss in more detail" [FS 08/09]*<br>*"It lacks the personalisation of face-to-face discussion, debate and argument that leads to creative problem solving." [FS 10/11]* |
| Don't know what it involves | 7 | *"Dont have much of an opinion yet as haven't tried it." [FS 09/10]*<br>*"never have worked in an online group so am unsure how well it will work." [fs 10/11]* |
| Can be difficult to communicate | 3 | *"I think the use of computers to comunicate and share work presents a range of communication problems" [FS 08/09]*<br>*"i feel that interprtations of a person point of view can be taken in the wrong way" [FS 10/11]* |

| **Working online theme** | **No. of responses for each theme (08/09 to 10/11)** | **Response [survey year]** |
|---|---|---|
| Share ideas online | 4 | *"Allows discussions to raise points which may not have been covered otherwise i.e. on your own" [FS 08/09]*<br><br>*"its nice to bounce ideas off other people, and get their imput on the work rather that just your own ideas." [FS 08/09]* |

## 4.5 POST-SURVEY VIEWS OF ENGAGING IN GROUP WORK

Students were asked how positive they felt about group work after undertaking the OPLA activity. For both bioscience and forensic science students the majority felt positive or very positive (Figure 5).

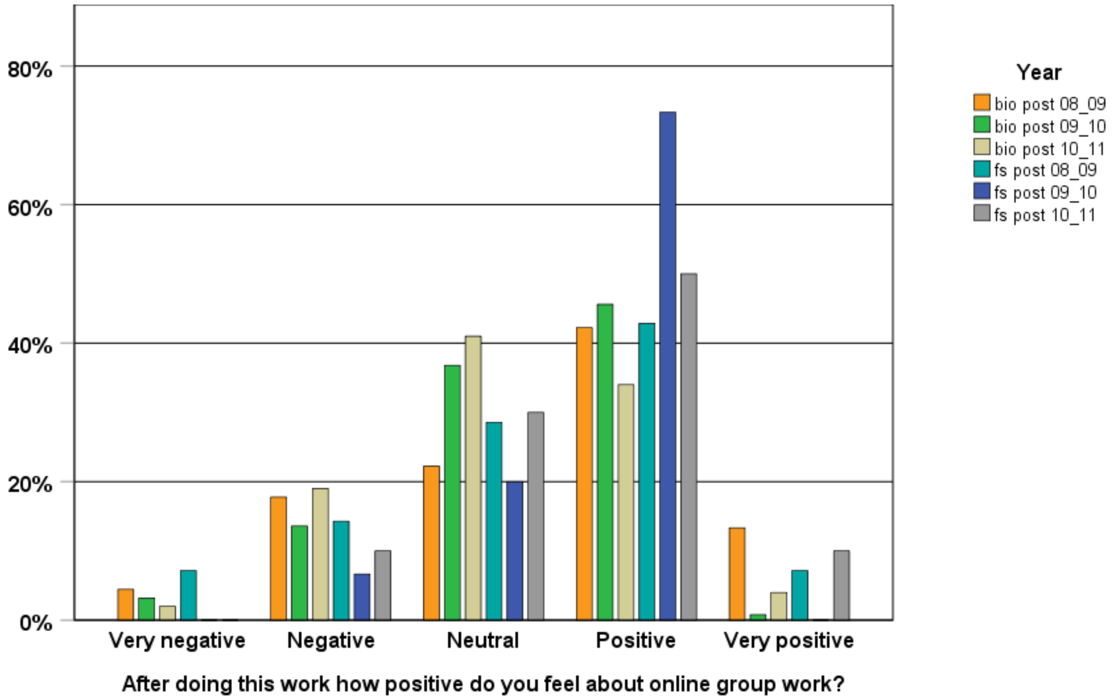


*Figure 5 Bioscience and forensic students' post-activity attitudes to online group work*

The majority of forensic science students ($p<.05$) across all years felt positive about the group work after the OPLA activity (Figure 5). Across the years the majority of bioscience students ($p<.05$) felt that they were able to work effectively online as a group (Figure 6). Responses from the forensic science students in 09/10 and 10/11 also showed that the majority of them ($p<.05$) felt they were able to work effectively online as a group (Figure 6).

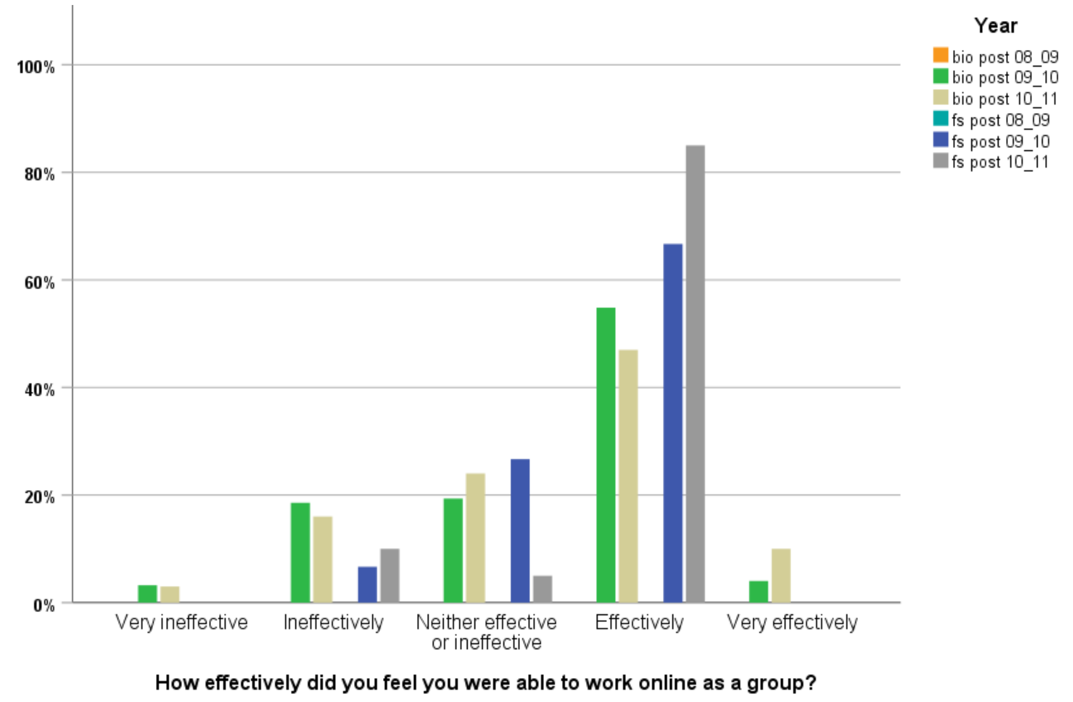


*Figure 6 Bioscience and forensic students' views about how effective they worked online as a group*

It is worth noting that in 10/11, the majority of forensic science students who had previously engaged in online group work had not liked it (Figure 4). However, after undertaking the OPLA activity the majority of these students had subsequently reported that they were able to work effectively as a group with 85% saying they had done so (Figure 6).

In 09/10 and 10/11 students were asked if they felt they could have worked more effectively face-to-face rather than working together online. The majority of bioscience students felt that they could have worked more effectively face-to-face (Figure 7). Similar results were found for the forensic science students, where most students felt they could have worked more effectively face-to-face (Figure 7). It is worth noting that the bioscience students all had similar course timetables and this meant that, if they wished, it would have been easy to arrange to work together face-to-face. Since the forensic science cohort comprised of students from different courses and with contrasting timetables, it was more difficult for them to arrange to meet face-to-face outside of the formal timetabled classes.

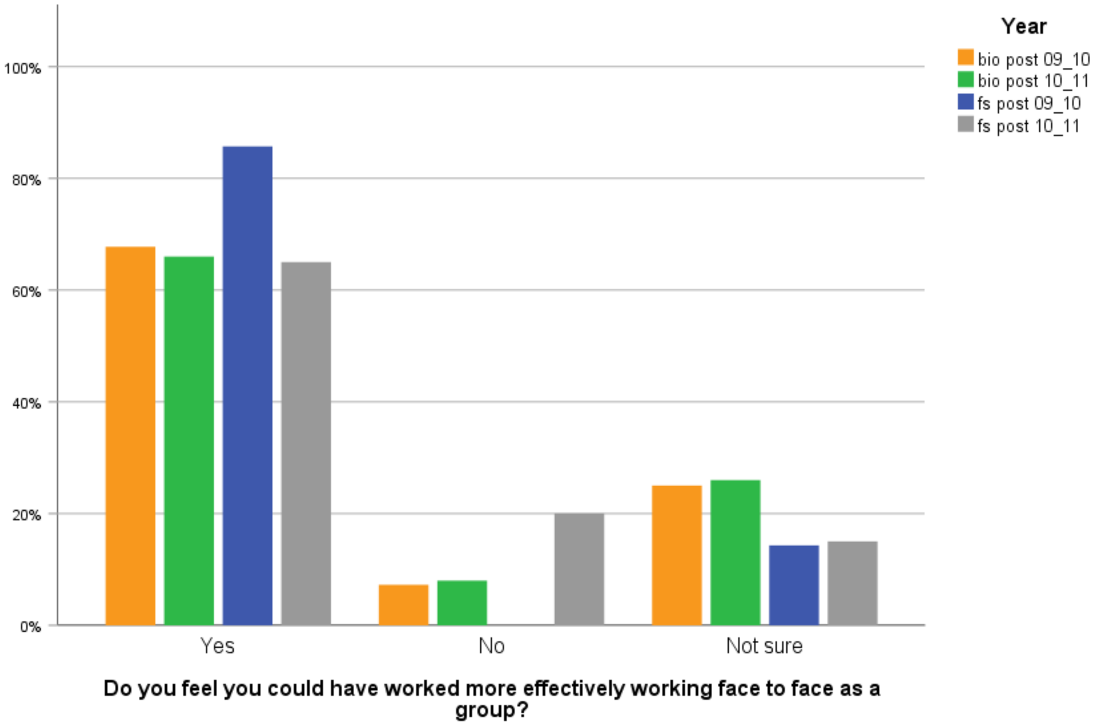


*Figure 7 Bioscience and forensic science students' views of working face-t-face or online as a group*

Students were asked how willing they would be to undertake online group work in the future and the majority of both bioscience students ($p<.05$) and forensic science students ($p<.05$) were willing (Figure 8).

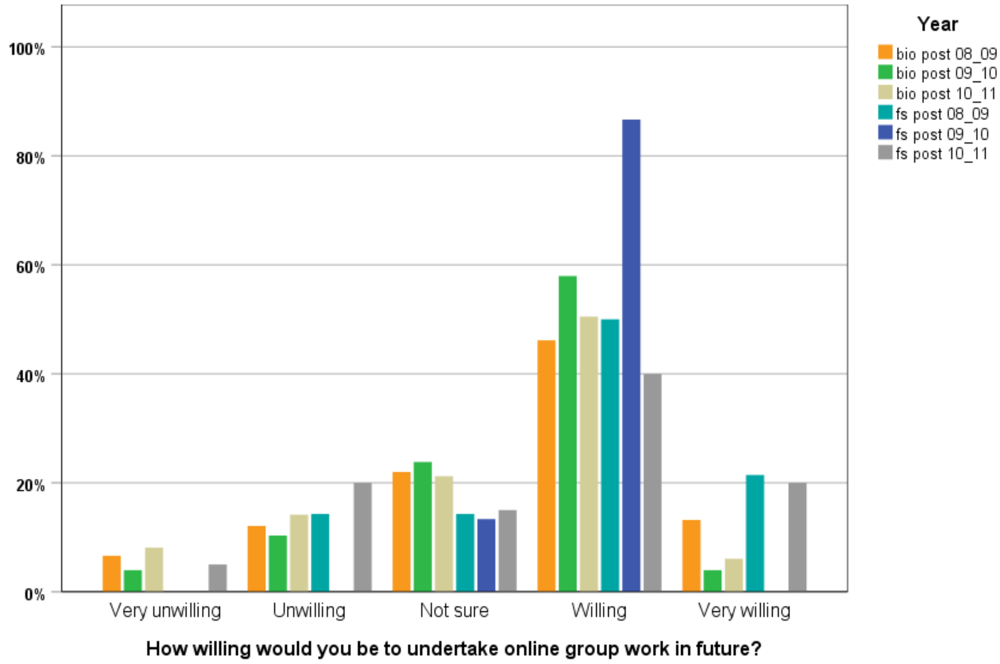


*Figure 8 Bioscience and forensic science students' willingness to undertake online group work again*

In the 09/10 and 10/11 post-surveys, students were asked to give a preference as to whether they would prefer working face-to-face, online or a mix of both. The majority of bioscience and forensic science students preferred a mix of both methods (Figure 9).

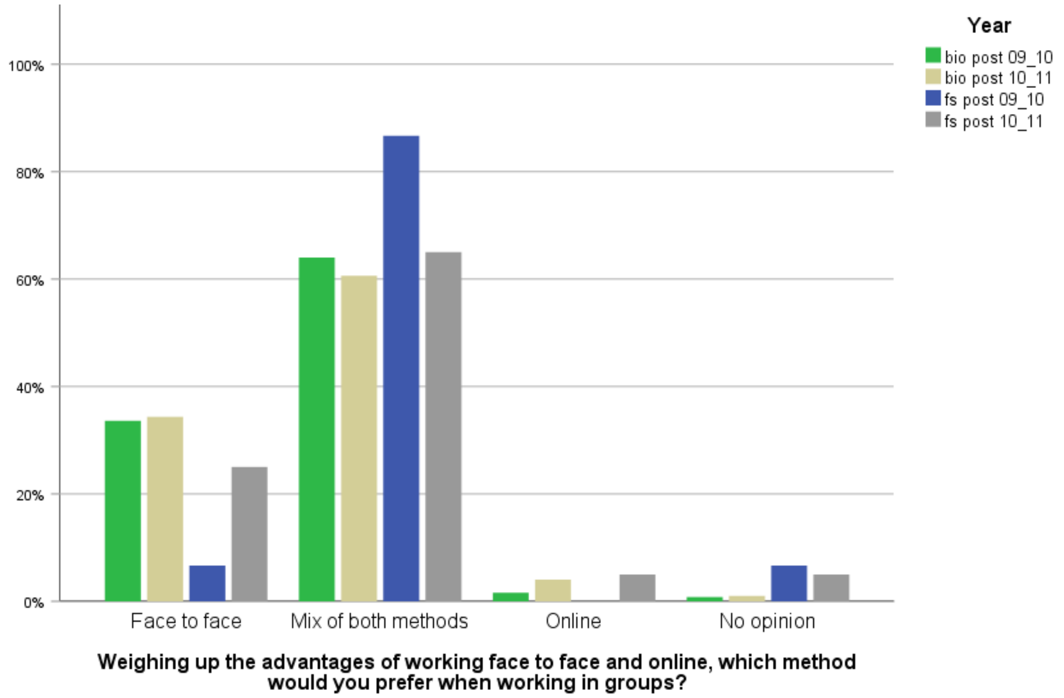


*Figure 9 Bioscience and forensic students' preferences for working in groups*

### 4.5.1 Post-survey views of working online

For the OPLA activity students used a VLE as the platform for the online group work. Early in this study the VLE used was Blackboard but was changed to SAKAI after the university changed platforms. SAKAI was branded locally as 'eBridge' and therefore student comments referred to both Blackboard and eBridge, but both platforms provided similar functionality for the online group work. Students were asked what they had liked or disliked about using the VLE and if they would change anything. A number of themes were commonly mentioned and these are discussed below.

The number of survey responses for each subject cohort are shown in Table 6.

*Table 6 Number of post-survey responses*

| Subject/survey year | Number of survey responses |
|---|---|
| Bioscience post 08_09 | 91 |
| Bioscience post 09_10 | 127 |
| Bioscience post 10_11 | 100 |
| Total | 318 |
| Forensic science post 08_09 | 14 |
| Forensic science post 09_10 | 15 |
| Forensic science post 10_11 | 20 |
| Total | 49 |

### 4.5.2 Bioscience students' positive views of working with the VLE

When bioscience students were asked to comment about what they liked when working online using the VLE, the most common themes focussed around it being a good communication tool, being able to share work and ideas and meeting new people. Table 7 provides some sample comments reflecting the themes raised.

*Table 7 Bioscience students' comments about liking the VLE*

| Working online theme | No. of responses for each theme (08/09 to 10/11) | Response [survey year] |
|---|---|---|
| Good communication tool | 106 | *"Blackboard made it easy to exchange work, and get in contact with the whole group. It mean that even if it was impractical for the whole group to physically meet, we could still make contact and document progress of our work." [bio 08/09]*<br><br>*"It was very easy to have communication with everyone" [bio 10/11]* |
| Flexibility of communication | 35 | *"Allowed for people to always be up to date with what needed to be done as blackboard can be accessed by all of us from anywhere so theres no excuse really." [bio 08/09]*<br><br>*"it meant we didnt have to meet up all the time and work could be done from home" [bio 09/10]*<br><br>*"I live in Chesterfield so it suited me better working across a forum as I didn't have to make an effort to turn up for meetings on days I didn't need to be here." [bio 10/11]* |
| Share work | 47 | *"We were able to send and share files with eachother to keep up with the progress of the group and avoid having to copy the same documents repeatedly." [bio 08/09]*<br><br>*"it was easier to share information while working online in groups and the response was fast." [bio 09/10]*<br><br>*"It was a lot easier to get the necessary information and work to the people who needed it." [bio 10/11]* |

| **Working online theme** | **No. of responses for each theme (08/09 to 10/11)** | **Response [survey year]** |
|---|---|---|
| Meet new people | 40 | *"I also enjoyed making new friends who I speak to on a regular basis." [bio 08/09]*<br><br>*"Nice social exercise, enjoyed getting to know new people and being a little out of my comfort zone." [bio 08/09]*<br><br>*"I got to work with people that I didn't know so got to make new friends." [bio 10/11]* |
| Share ideas | 24 | *"What I liked about working in groups was the fact that there were more broader ideas from different people." [bio 08/09]*<br><br>*"Enjoyed the team work and the variety of input that you get from different people's perspectives." [bio 09/10]*<br><br>*"What I enjoyed was putting ideas together, with the idea that two heads are better than one." [bio 10/11]* |
| Record of work | 16 | *"It was easy to get in touch with members of group and keep track of the work" [bio 08/09]*<br><br>*"All the messages were saved, and we could see each other's posts. It allowed for a full record to be viewed quickly." [bio 09/10]*<br><br>*"It enables to keep a track of all the contributions that each person made." [bio 10/11]* |
| Access to content | 8 | *"All the information that was needed to complete the assignment was available on blackboard or was linked to the information on blackboard." [bio 08/09]*<br><br>*"Information needed was there, and how to submit the work was nice and clear." [bio 09/10]*<br><br>*"All the information was in one place." [bio 10/11]* |

### 4.5.3 Forensic science students' positive views of working with the VLE

Forensic science students provided comments that could be categorised under the same themes raised by bioscience students. The main themes were good and flexible communication and sharing work and ideas. Sample comments from forensic science students are provided in Table 8.

*Table 8 Forensic science students' comments about liking the VLE*

| Themes around liking VLE | No. of responses for each theme (08/09 to 10/11) | Response [survey year] |
|---|---|---|
| Good commun - ication tool | 15 | *"it was much easier to communicate through the forums and discuss ideas without having to constantly meet up." [FS 09/10]*<br>*"It was a lot easier than having to meet up to discuss simple things or using phones as that can get quite tricky. Especially between four people." [FS 10/11]*<br>*"Iam confident working,speaking and writting on computer because Iam international student" [FS 10/11]* |
| Flexibility of commun - ication | 10 | *"Blackboard did make it easier to communicate within the group and pass on information and files. Allowed me to work easily from home, which is really good as I have a tight schedule to adhere to." [FS 08/09]*<br>*"post info when it suited me, easy to check and keep up to date and recall info from earlier convosations." [FS 10/11]* |
| Share work | 3 | *"Easy to share opinions and very easy to share the files we needed" [FS 08/09]*<br>*"Blackboard did make it easier to communicate within the group and pass on information and files. Allowed me to work easily from home, which is really good as I have a tight schedule to adhere to." [FS 08/09]* |
| Share ideas | 2 | *"Easy to share opinions and very easy to share the files we needed" [FS 08/09]*<br>*"able to ask questions and get a response quickly" [FS 10/11]* |

| **Themes around liking VLE** | **No. of responses for each theme (08/09 to 10/11)** | **Response [survey year]** |
|---|---|---|
| Record of work | 1 | *"it was also easy to follow up with work and check that group member were doing assigned pieces of work" [FS 09/10]* |

### 4.5.4 Bioscience students' concerns around the use of the VLE

Bioscience students made fewer comments about what they disliked about working with the VLE and the comments provided could be categorised under five main themes. The most common theme was a lack of contact from student members, followed by online communication being an excuse not to work and freeloading. Some of the comments received are presented in Table 9.

*Table 9 Bioscience students' comments about disliking the VLE*

| **Themes around dislike of VLE** | **No. of responses for each theme (08/09 to 10/11)** | **Response [survey year]** |
|---|---|---|
| Lack of contact | 55 | *"Not being able to reach all my members sometimes - hard to get in contact with all of them at one time" [bio 08/09]*<br><br>*"Some people did not check the forum often enough" [bio 09/10]*<br><br>*""you can lead a horse to water..." some people will not respond even when requested to do so." [bio 10/11]* |
| Excuse not to work | 26 | *"Gave other group members an excuse not to contact you." [bio 08/09]*<br><br>*"There was some members of the group that seemed to put little effort in and when asked to improve their work expected myself to improve it for them." [bio 09/10]*<br><br>*"You couldnt see people face-to-face so you didnt know if they were actually puling their own weight and doing the work load as they said." [bio 10/11]* |
| Freeloaders | 23 | *"having to do other peoples work for fear of loosing marks constantly chasing up the children of the group" [bio 08/09]*<br><br>*"Not everyone pulls their weight in, and you have people who put all the effort in and others who do very little." [bio 09/10]*<br><br>*"I didn't like the fact that some people didn't get involved, this made the work load for others who were willing bigger which was unfair." [bio 10/11]* |

| **Themes around dislike of VLE** | **No. of responses for each theme (08/09 to 10/11)** | **Response [survey year]** |
|---|---|---|
| Difficult to arrange meetings | 20 | *"It can sometimes be hard to organise meeting times. The use of blackboard is a good idea but to really keep in touch with your group, it would require the checking on blackboard every hour or so for new messages on the internal discussion board." [bio 08/09]*<br><br>*"very hard to organise meeting up as not everyone is online at the same time, so in some respects it better to see people face-to-face rather than online." [bio 09/10]* |
| Not able to meet face-to-face | 6 | *"no face-to-face communication" [bio 09/10]*<br><br>*"sometimes difficult not being able to talk to the person. often easier to express yourself." [bio 09/10]*<br><br>*"There was no face-to-face interaction." [bio 09/10]* |

### 4.5.5 Forensic science students' concerns around the use of the VLE

Very few comments were made by forensic science students about disliking working with the VLE (Table 10). Most comments focussed on a lack of contact from other students.

*Table 10 Forensic science students' comments about disliking the VLE*

| Themes around dislike of VLE | No. of responses for each theme (08/09 to 10/11) | Response [survey year] |
|---|---|---|
| Lack of contact | 6 | *"you can't make the other members of the group check the online discussion board" [FS 09/10]*<br><br>*"Some members did not access the online forum and it could take days for other members to reply if they did not check it very often." [FS 10/11]* |
| Excuse not to work | 1 | *"There were problems with the unreliability of people in the groups, some that did not contribute at all, and some very unhelpful. It was difficult sometimes to get replies off people straight away." [FS 09/10]* |
| Not able to meet face-to-face | 1 | *"Often hard to fully communicate in the same way you do face-to-face." [FS 10/11]* |

### 4.5.6 Biosciences views on changing online group work

Students were asked if they would make any changes to the online group work. Five themes arose which the comments could be grouped under and are shown in Table 11, along with example comments. By far the most common response from bioscience students was that they would not change anything. A number of comments across each of the years indicated that some students would prefer to choose their own group members or have more tutor input.

*Table 11 Bioscience students' views about changing the online group work*

| Would students make any changes to the group work | No. of responses for each theme (08/09 to 10/11) | Response [survey year] |
|---|---|---|
| No changes | 89 | *"No, I think the fact that we had to work in groups that we didn't choose was a good method and at first uncomfortable but ws generally really effective." [bio 08/09]*<br><br>*"It worked well for me, but that's my opinion. Therefore, no changes really needed" [bio 09/10]*<br><br>*"No. I don't think it could have been mad eany easier. The only way I would improve the whole group work is the way my group approached the task." [bio 10/11]* |
| Improve VLE functionality | 11 | *"Make it easier to access, without it taking a while (relatively speaking) to load. Alerts on the home page to say when there are new messages." [bio 09/10]*<br><br>*"maybe have some kind of instant messaging." [bio 09/10]*<br><br>*"I would suggest that some king of email notification system be implemented for specific forum topics/groups this would mean that people would check the forum more frequently" [bio 10/11]* |
| Choose own group | 33 | *"should be allowed to pick our own groups" [bio 08/09]*<br><br>*"Choose group members, that way you know the people you are working with" [bio 09/10]*<br><br>*"Allow people to choose their own group." [bio 10/11]* |
| More tutor input | 15 | *"Possibly draw up an action plan for the group to meet up with the lecturer a couple of times throughout the assignment to make sure everyone pulls their wight and is happy with what they are doing." [bio 08/09]*<br><br>*"the groups should meet 1st before, this should be compulsory" [bio 09/10]*<br><br>*"have a higher level of moderation maybe" [bio 10/11]* |

| Would students make any changes to the group work | No. of responses for each theme (08/09 to 10/11) | Response [survey year] |
|---|---|---|
| Require online engagement | 8 | *"I would try to get people to use the discussion board and email more, but I don't know how you could do this." [bio 08/09]*<br><br>*"I would make in mandatory that everyone went onto the forum every so ofen, i.e. 2 or 3 times a week." [bio 10/11]* |

### 4.5.7 Forensic science views on changing online group work

Most comments received from forensic science students indicated that they would not make any changes to the online group work (Table 12). As with the bioscience students, several comments were made about improving the functionality of the VLE. This related to being notified when new messages were posted, instead of having to manually check the VLE each time.

*Table 12 Forensic science students' views about changing the online group work*

| Would students make any changes to the group work | No. of responses for each theme (08/09 to 10/11) | Response [survey year] |
|---|---|---|
| No changes | 12 | *"No" [FS 09/10]*<br><br>*"none that i can think of" [FS 10/11]*<br><br>*"No, it was well organised." [FS 10/11]* |
| Improve VLE functionality | 3 | *"A version with instant messaging when group members are online would be good as its much easier to "chat" in real time as apposed to contantly writing replies and hoping everyone stays online long enough." [FS 09/10]*<br><br>*"notification what a post has been made" [FS 10/11]* |
| More tutor input | 2 | *"if it was moderated or something to encourage everyone to use it" [FS 09/10]*<br><br>*"Yes, not enough regulation to make sure all members are working effectively. For example,* |

| Would students make any changes to the group work | No. of responses for each theme (08/09 to 10/11) | Response [survey year] |
|---|---|---|
| | | *checking group forums to see who has put work in and who hasn't." [FS 10/11]* |

### 4.5.8 Bioscience student general thoughts about working online in groups

Students were asked for any general thoughts about working online in groups. Responses were grouped according to a number of key themes that emerged. By far the most common theme for the bioscience students was that they liked working online in groups. A number of other positive themes were cited too, including it being flexible or convenient and being able to make friends. Some concerns were also raised, mostly around uncooperative members. Examples of student comments around these themes are provided in Table 13.

*Table 13 Bioscience students' general comments about working online in groups*

| **Working online theme** | **No. of responses for each theme (08/09 to 10/11)** | **Response [survey year]** |
|---|---|---|
| Like it | 121 | *"I feel the group i was assigned to this time make me feel optimistic about working online in groups however next time i could be dealt with a very different group and my opinion could sway easily." [bio 08/09]*<br>*"Better than i thought i would, i enjoyed the process." [bio 08/09]*<br>*"i enjoyed it found it easy and would do it again." [bio 10/11]* |
| Uncooperative group members | 43 | *"It would have been a good activity if everone in the group pulled their weight and did not rely on one person to complete the work (i.e. me)." [bio 08/09]*<br>*"I think it's a good idea just some people are unwilling to use it within the group making it awkward for the others" [bio 10/11]* |
| Flexible/ convenient | 43 | *"Working online in groups is a really quick and efficient way of communication for me. Everyone can get in touch with each other since they use the Internet very often in daily life." [bio 08/09]*<br>*"i think it isa easier way to communicate from the comfort of your home and it means you do not ahve to go outside in the horrible weather!" [bio 10/11]* |
| Prefer face-to-face | 35 | *"It's nicer to work face-to-face, then you know where you stand abit more." [bio 08/09]*<br>*"It is an ok method of working in groups, however I prefer to work with people face-to-face." [bio 09/10]* |
| Dislike | 21 | *"I hated this group work, but I would work onlikne in a group in the future." [bio 08/09]* |

| Working online theme | No. of responses for each theme (08/09 to 10/11) | Response [survey year] |
|---|---|---|
| | | *"I don't feel it is very effective and I personally wouldn't want to do it again" [bio 10/11]* |
| Lack of contact | 27 | *"I suppose this is good as sharing work etc can easily be exchanged, although is really frustrating when messages are not getting answered." [bio 08/09]*<br><br>*"It is hard work as not everybody checks and/or responds to posts on ebridge" [bio 10/11]* |
| Blended approach preferable | 17 | *"Good, it is an easy and efficiant way to communicate and collaborate all the individual pieces of work, however I think meeting face-to-face is needed at least a couple of times so proper discussion can take place" [bio 08/09]*<br><br>*"Needs a mixture of both online and face-to-face as ideas etc can't be expressed as efficiently online as they can otherwise." [bio 10/11]* |
| Make friends | 5 | *"I felt very satisfied working in groups, not only did it introduce me to some very nice people and help me settle in further, but i have a group of people im not afraid to ask/give advice to on other areas of knowledge. Furthermore, working in a group allowed a relaxing way to be assessed, as work could be delegated and the pressure of a load of work seemed reduced." [bio 08/09]*<br><br>*"I feel it helped me get through the work, allowed me to meet new people and get a new perspective on the work. All in all it was very enjoyable" [bio 08/09]*<br><br>*"I have now made some more mates which will stay." [bio 09/10]* |

### 4.5.9 Forensic science student general thoughts about working online in groups

Similar to the bioscience students, most forensic science students' responses about online group work were positive, saying they liked it. The second most common response was about uncooperative group members, with several other comments made under the different themes. Examples of the student feedback are provided in Table 14.

*Table 14 Forensic science students' general comments about working online in groups*

| Working online theme | No. of responses for each theme (08/09 to 10/11) | Response [survey year] |
|---|---|---|
| Like it | 13 | *"It is fantastic because i can post any question and my groups really cooperate" [FS 08/09]*<br>*"Group work is an important skill, and working online for most people is a very useful tool." [FS 09/10]*<br>*"I believe its a very good idea with many advantages. It should be something all modules try to incorporate." [FS 10/11]* |
| Uncooperative group members | 8 | *"It's annoying. You don't know what to do if they're not helping and every contact method you have has failed. If you have good froup members it would be a great idea." [FS 08/09]*<br>*"It is a lot easier than having to meet up constantly or texting however, its a shame when there is one or two people that do not put as much work into the online part as the others." [FS 10/11]* |
| Flexible/ convenient | 3 | *"Its easier as different people have different schedules" [FS 09/10]*<br>*"It's good for group members that don't have the same timetable. This is the easiest way to communicate between them." [FS 10/11]* |
| Prefer face-to-face | 2 | *"The work takes a lot longer online than talking in person" [FS 08/09]*<br>*"would prefer to work face-to-face as gives the opportunity to express opinions easier" [FS 09/10]* |
| Dislike | 3 | *"Don't like it. It takes a long time." [FS 10/11]*<br>*"dislike" [FS 10/11]* |

| **Working online theme** | **No. of responses for each theme (08/09 to 10/11)** | **Response [survey year]** |
|---|---|---|
| Lack of contact | 2 | *"Working online within a group is a really good idea aslong as all the members of the group know how blackboard works and regularly check emails and posts etc.  Often to make sure everyone read things posted it involved chasing up members of the group via text, which just required more time." [FS 08/09]*<br><br>*"It's fine unless a member of the group isn't prepared to attempt communication." [FS 09/10]* |
| Blended approach preferable | 4 | *"i think it can work but its always nicer to talk face-to-face when you can, you can bounce ideas around in person, not as easy when working online" [FS 09/10]*<br><br>*"in some ways yes it is good but in others it's not, face-to-face is better but arranging online when to meet is also a good way" [FS 10/11]* |

## 4.6 DISCUSSION

The results in this chapter showed how the students felt about working online in groups. Their previous group work experiences and initial attitudes to group work were recorded to benchmark their views before undertaking the OPLA activity. The results collected after the online group work enabled any change in attitudes to be recorded. By interrogating the pre and post-questionnaire data it was possible to investigate the student experiences of online peer learning and assessment and whether this experience was positive or not.

Students discussed how they felt about group work, highlighting what they had previously experienced and what they liked or disliked about working in groups. By comparing these results with the results after the OPLA activity it was possible to consider if students felt they had had a positive experience of online group work or not. The following sections now discuss the findings in more detail.

## 4.7 STUDENTS' INITIAL ATTITUDES TO GROUP WORK

The results overall for both discipline cohorts showed that most students had undertaken and enjoyed face-to-face group work. Both bioscience and forensic science students reported positive benefits of working face-to-face in groups, stating that it was enjoyable and a way of sharing ideas. Their biggest concern was the risk of freeloaders, which was raised by both subject cohorts. Some students expressed an initial preference for working face-to-face and felt it would be difficult to communicate online. The benefits of working face-to-face were clearly cited in the results but comments about online group work were more mixed.

Joyner (2015) discussed potential frustrations students can have with online group work, such as incompatibility of groups, freeloaders, lack of leadership, communication and sense of fairness. Joyner also claimed however (without citing supporting evidence), that many students dislike online group work. The connection between student preference for online or face-to-face work was noted by O'Bannon et al (2013) who found that students would still want to meet face-to-face and suggested it was about realising the potential of the technology and providing guidance for students on how to work online. This argument would therefore support the results, suggesting students are bound to be initially cautious about working online, and which is echoed by Serrano et al. (2019).

Some students reported uncertainty about the prospect of working online and this could simply be due to the fact that fewer had experienced this type of working, a response that would be expected. For example, Wang and Woo (2007) found students mostly preferred face-to-face communication, although this was only a post-intervention outcome. The positive views of working online could be due to students being able to apply their positive experiences of working face-to-face to the online setting, or simply being comfortable with technology and being willing to experience online group work.

This compares with Ellis et al. (2004) who found that both face-to-face and online discussions offered benefits, such as reflection on their learning from the asynchronous online discussions and a deeper approach to learning in the face-to-face discussions. Mixed views about online learning were therefore possibly down to their prior experience of group work or familiarity with technology.

Of those who had previously undertaken online group work in this study, most were positive about it with the exception of forensic science students in 10/11 (Figure 4). Madland and Griffiths (2016) claimed that past experience was a barrier to engagement in new activities but with the exception of the forensic science 10/11 cohort, the results do not reflect this. Further evidence for this also came from student comments (Tables

4, 5) which were considerably positive about the prospect of working online. Working online was therefore viewed positively overall, though one key concern was the risk of freeloading.

Forensic science students showed proportionately more concern for freeloaders than bioscience students. Given that the bioscience students were level 4 (first year) students, the assessment of the group work was relatively low stakes; i.e. the assessment was not a major part of the overall assessment and the module did not count towards their overall degree. For the forensic science students, consisting of a mix of level 6 and 7 students, their work involved high stakes assessment, with the assessment being a significant part of the module that counted towards the overall degree. Forensic science students might, therefore, have been more concerned about the effect freeloaders would have on their assignment marks if they felt part of their mark relied on the efforts of fellow group members.

This concern about freeloading is well documented in the literature, where students often see freeloading as one of the biggest challenges of group projects (Aggarwal & O'Brien, 2008; Brooks & Ammons, 2003; Kao, 2013; Teng & Luo, 2015). Opdecam and Everaert (2018) discuss how the risk of freeloading can result in other students committing less time to the work. They mention that peer assessment can be used to mitigate for this but argue that students should be given more choice to encourage autonomy (see section 4.8.4) Peer assessment was the method used to tackle freeloading in this study and is discussed in section 2.2.3 and 4.8.9.

The findings from the pre-survey results demonstrated that students of both disciplines had plenty of prior experience of group work irrespective of level of study. The results also showed that students were generally aware of the key challenges and benefits of engaging in group work. Given that similar themes were mentioned in the feedback from both discipline groups, this also suggests that students develop a common understanding of group work, regardless of their background. This would include challenges such as personality clashes and opportunities to share ideas. The overall results clearly showed that therefore that students were familiar with group work and generally liked engaging with it.

## 4.8 Students' views of working online in groups

The results after the OPLA activity provided a good comparison with students' attitudes beforehand. When planning for effective group work there are a number of factors which can influence how well group members work and interact with each other. These factors include how groups are formed (Drake et al., 2006), how they are guided in their activities (Piezon, 2005) and the technologies used to support their work and communication (Yang et al., 2011). Student awareness of these factors (either directly or indirectly) were noted beforehand and they also discussed them afterwards. It was therefore possible to review how student views of working online in groups changed before and after the blended learning activity.

### 4.8.1 Online communication

The use of technology specifically to support online learning must take account of various factors. These factors include: consideration of instructor involvement (Hammond, 2005; Ngoyi & Malapile, 2018; Rada, 1998; Veerman et al., 2000), creating defined online structures (Pozzi, 2010; Skinner, 2009), and social interaction (Chen & Wang, 2009; Kim et al., 2011; Zilka et al., 2018). This study did not set out to explicitly promote learning in the online environment but to foster online communication as part of the overall OPLA activity, so the online communication did not involve tutor intervention for example (see section 3.6.1). A primary driver for engaging students in online group work during this study was therefore focussed more on communication rather than promoting online communities or knowledge generation *per se*, though it created the platform for this to happen.

When considering communication in a purely online setting there are various features to promote knowledge generation, including commitment (Chang & Kang, 2016), communities of enquiry (Zydney et al., 2012), social presence (Kim et al., 2011; Zilka et al., 2018), or tutor presence (Stephens & Roberts, 2017; Tsai, 2010). For this study the VLE was used as the communication platform, which supported a range of functionalities to support online collaboration including file transfer and online discussion boards. With each group having access to their own area on the VLE they were able to manage their own online group interactions. Creating a private online communication environment was therefore a key initial consideration for any online interactions and to provide the opportunity to promote knowledge generation.

Given that a primary goal of the online group work was to facilitate content sharing and promote communication the results clearly supported this intended outcome (Table 7 and 8). Both bioscience and forensic science students reported the main benefits of the VLE as being a good communication tool and providing flexibility of communication. Bioscience students also strongly reported how the VLE was good at enabling the sharing of work and ideas. Although students had no instructor intervention during their online discussions and collaborations, formal advice and guidance was provided initially, to ensure students had a scaffold on which to begin their online group work. This aligned with other research on creating the conditions for online communication (Schertler & Bodendorf, 2002; Skinner, 2009; Thomas, 2013).

### 4.8.2 Social presence

Given that both bioscience and forensic science students reported positive views of working online with the VLE, they also reported that they felt they could have worked more effectively face-to-face. Furthermore, both cohorts reported they would prefer a mix of both face-to-face and online methods. This would suggest that whilst they appreciated working online, a balance between the two approaches would be optimal for them. This is supported by other research (Chang & Kang, 2016; Drouin & Vartanian, 2010; O'Bannon et al., 2013; Pritchard & Morrow, 2017; Wang & Woo, 2007), that found students also found benefits in both face-to-face and online environments.

To promote learning and social presence in an online environment Pozzi (2010) proposed a structured approach to encourage students to engage with each other, whereby students were given two different formats (a jigsaw approach to piecing information together, and a case study) to direct their activities. The results from Pozzi's study found that the student-led online group work (i.e. unstructured, not instructor directed) developed good social cohesion. Students initiated contact online to introduce themselves and then continued to communicate about the assignment tasks as time progressed. However, Pozzi found a more structured approach, through the use of a jigsaw approach produced higher mean marks for the work.

Other studies (Chen et al., 2009; Kim et al., 2011; Ngoyi & Malapile, 2018) also provided evidence that social conversation is integral to online group learning. The importance of social interaction is overlooked, however, by Romero (2013) who did not consider social interaction important when exploring indicators of student performance in online discussions.

Zhao et al. (2014) reported that online collaboration does not occur automatically but required participation and that social presence helps to realise collaboration. They found that an '*optimal level of social presence encouraged participation and positively shaped the dynamics of interaction, and thereby promoted collaboration*' (p817). Other studies (Chen & Wang, 2009; Kim et al., 2011; Zhao et al., 2014) also supported the benefit of social presence. There was little evidence of online social presence recorded directly through the discussion boards' results of this study however, which is discussed in section 3.6.2.

Although there was little evidence of social presence displayed in the discussion boards, there was evidence of it occurring in other places. Opportunities for developing social presence occurred face-to-face, particularly during timetabled sessions and when students met in their own time too. Students also reported interacting via other electronic means such as social media (namely Facebook), via email, text messages and even through phone calls (see section 4.8.6). Therefore, students did report in the results that they developed a social presence through their group work, commenting that it provided opportunities to meet new people and make friends (Table 7). The format for this online group work therefore provided the environment for the development of social presence through a combination of online communication and face-to-face interaction, and the discussions boards were a component of this blended learning approach.

It is worth exploring the fact that the bioscience students made more reference to the social benefits of working with the VLE than forensic science students. The bioscience students were level four (first year), new to university and so may not yet have formed established course friendships. The OPLA activity was run in semester one and, by engaging the students at this early stage and deliberately mixing groups, the OPLA provided more opportunities to meet other students. Remesal and Colomina (2013) discussed another development of social presence by new students, from a social constructivist stance, supporting the hypothesis that new students may better placed to form course friendships.

The forensic science students did not comment on the social aspects of group work as much as the bioscience students. The forensic science module was made up of students from three different courses and social interaction might have been inhibited by pre-existing relationships within the separate courses. This might also be explained by the stage of their studies (level 6 and 7) when they already had well established course friendships. Additional social benefits could be gained from the OPLA activity therefore, but depending on the status and motivation of the students. Student perceptions of social presence is also mentioned by Cameron et al. (Cameron et al., 2009) who suggested some students may lack the importance of social tasks to complete a project.

For entirely online courses, the literature is clear about what it takes to promote online social presence (Kim et al., 2011; Kreijns et al., 2003; Laffey et al., 2006; Tirado-Morueta et al., 2017). Whilst social presence was not a key driver for this study, the results provided some evidence that by creating an appropriate model for blended learning, social presence could still evolve naturally, as Pozzi (2010) suggested.

Tirado-Morueta et al (2017) found that for entirely online courses, social connections increased with the complexity of the task. Based on the analysis of the student discussion boards (see section 7.4), there is some evidence to support this argument, with the forensic science students collaborating on a more complex assignment. Opportunities to develop social presence was also possible since this was a blended learning approach. Ngoyi and Malapile (2018) argued that social presence is perhaps the most important factor in the success of online learning, echoed by Zilka et al. (2018). Therefore a combination of group planning and setup by the tutor initially, the complexity of the task and the opportunity to meet face-to-face provide support for enabling social presence to develop in a blended environment.

### 4.8.3 Motivation

Student motivation to engage in online group work has long been identified as a contributing factor to student engagement (Hsia et al., 2016; Liu, 2009; Sluijsmans et al., 1998; Somervell, 1993; Xie & Ke, 2011). This may involve student rewards (Slavin, 1991), peer assessment (Hannaford, 2017) or tutor involvement (Zilka et al., 2018). Motivation can be described as intrinsic or extrinsic (Law et al., 2019) and student engagement can depend more on intrinsic motivation than extrinsic motivation. Motivation to engage in the online group work in this study was primarily extrinsic, with a requirement to complete an assignment, but results showed some evidence that this extrinsic motivation supported intrinsic motivation too.

Students were asked if the self and peer assessment had increased their motivation to carry out the group task and the majority of students agreed (Figure 24). Students were also asked where any pressure they felt under to complete the assignment, came from. Most students reported being only under some or no pressure, with any pressure coming from the whole experience, rather than pressure just to complete the assignment. This suggests that the extrinsic motivation of the assignment was not necessarily a major influence on student motivation, with most students saying they would undertake online group work again (Figure 8).

As well as the assignment itself, cooperative group work can also promote student motivation (Madland & Richards, 2016) so the combination of group work and a group assignment can arguably help intrinsically motivate students. The potential for peer assessment can also have an impact on motivation and this is discussed further in section 5.11.4. Money and Dean (2019) also discussed student motivation and say '*learners generally hold a mix of intrinsic, external (extrinsic) and task-orientated motivations*' (p68). Li (2019) also discussed the use of game-based training to increase intrinsic motivation. Such motivators therefore seem to be reflected in this study, with no single factor being the primary driver to motivation.

### 4.8.4 Learner autonomy (Self-efficacy)

Linked to motivation is the concept of learner autonomy, the ability of students to take responsibility for, and manage their own learning. Fotiadou et al. (2017) discussed how defining learner autonomy can result in '*inter-related definitions*' (p97) but in essence, is the '*learner's ability to assume control of their own learning*' (p97). Henri et al. (2018) echo this view and suggest it involves a number of themes, including self-efficacy, the learner's '*confidence in skills or ability to achieve*' (p508). Schunk (1991) discussed self-efficacy theory and discussed how students measure their self-efficacy from their performance accomplishments. Learner autonomy in this study could therefore be considered, based on student perceptions of their experiences of the OPLA before and after the study.

Schunk (1991) discussed how success raises self-efficacy and failure lowers it, and Henri et al. (2018) discussed research that increased self-efficacy is linked to learner autonomy. Henri et al. (2018) also argued that students need to be provided with opportunities to be autonomous but also to recognise their autonomy, something supported by Gu (2016). Self-efficacy in this study was shown to increase, suggesting students experienced 'success' as defined by Schunk, but whether this was linked to any change in learner autonomy, would require further investigation.

### 4.8.5 Mixed mode delivery

The open comments from the post-surveys provided some explanation for a mixed mode preference. Students worked together in class but still needed to work outside of class on their projects, whether face-to-face or online. Students complained that other group members did not turn up for face-to-face meetings, or did not make regular contact online. Students therefore, had difficulty contacting some group members regardless of whether it was face-to-face or online. Based on student comments lamenting the frustration of a lack of contact, a mixed mode approach would give students more opportunity to engage students and hold them accountable for their work. These results echo comments by Joyner (2015) who also mentioned lack of communication.

There is supporting evidence from the student feedback to explain why they reported enjoying working online but also had a preference for working face-to-face. A typical student comment in the post survey feedback was:

> *"it was easy to communicate with each other if we couldnt actually meet in person."* [Bioscience student 09/10]

The VLEs used during this study (Blackboard and eBridge) provided limited functionality for students to receive notifications of new messages being posted. Students were advised to use the discussion boards to introduce each other and use it as the main communication tool provided as part of the teaching and group work. Students reported that they found themselves logging in every several hours hoping or expecting responses to their messages.  A typical response would be:

> *"The use of blackboard is a good idea but to really keep in touch with your group, it would require the checking on blackboard every hour or so for new messages on the internal discussion board."* [Bioscience student 08/09]

After a while, with no responses some reported just giving up checking. In this sense therefore, the VLEs were restrictive in their capacity to enable the discussion boards to provide a seamless flow of information between group members, hence the preference for face-to-face contact.

The results clearly showed that students would be willing to undertake online group work again. Bliuc et al. (2011) and Saltan (2016) suggested that face-to-face and online discussions have complementary strengths and that students should be helped to understand the role of technology in learning. The results echoed Bliuc et al.'s findings, showing that, whilst students preferred to work face-to-face, they valued the online group work and felt a mix of face-to-face and online was preferable.

### 4.8.6 Social media as an enabling technology

Since discussion board technology has been around for decades it can be considered a 'stable' technology in the sense that users understand the concepts of discussion boards and know how to use them. This must be put in the context of the time the peer learning and assessment activities were undertaken, when mobile Internet use was only starting to become the norm, with 24% of users having access to the Internet on a mobile device (Office for National Statistics, 2012). Social media was starting to take off but common access through smartphones (i.e. mobile technology) was still in its relative infancy due to the cost of technology and typically only 26% of the population reported owning a smartphone in 2010 (OFCOM, 2010). Between 2008 and 2011 therefore, familiarity with discussion board technology was deemed appropriate and accessible for all the students as a baseline enabler to online communication for this study.

Despite some mixed responses to the benefits of the discussion boards in this study, students still engaged with them and saw the benefit of online communications overall. Students also reported use of several other electronic tools for communication, including email, text and even phone calls. The main example cited was the use of Facebook, which could be argued had two main benefits. The first is that since Facebook was starting to become a popular social media tool at the time of this study, students would be checking Facebook more regularly than the discussion board so would be more likely to pick messages up. The second benefit is the much more flexible functionality of Facebook and its ability to alert users to new messages. So students developed their own way of communicating online, with or without discussion boards. However, given the surge in use of social media tools in recent years and with more flexible access and connectivity; discussion board technology may now seem a bit restrictive. If discussion boards are to remain a valid communication tool they must ensure easy accessibility (e.g. single sign on to a VLE) and the ability to notify users when new messages are posted.

An alternative, or complement to using discussion boards as a communication tool today would appear to be the use of social media tools such as Facebook or WhatsApp. The ready use of mobile technology can no longer be considered a barrier to engagement by students. There are hundreds, if not thousands of social media tools which could act as a platform for student online communications. Facebook would appear to be an appropriate tool of choice, given its ubiquitous use though studies have shown Facebook may not be suitable for academic purposes (Wise et al., 2011) whilst more recent research counters this argument (Pai et al., 2017). The solution therefore may be to create the structure as Pozzi (2010) suggested, but then allow online communication and social presence to evolve naturally.

### 4.8.7 Group formation

The overwhelming majority of student respondents said they would not make any changes to the online group work, though a minority of bioscience students argued that they should be able to choose their own groups. This finding supports that of Bacon et al. (1999) who argued that randomised group selection, rather than self-selecting groups can be as unfair as '*randomly assigning grades*' (p469). However, Bacon et al. did acknowledge other problems of self-selecting groups such as being overly homogenous or having a limited range of skills sets. This is contrary to findings by Drake et al. (2006) however, where feedback from students was more positive about being selected by the tutor than random selection. Oakley et al. (2004) also argued strongly in favour of tutor selected groups, arguing that "*stronger students in the class will tend to seek one another out, leaving the weaker ones to shift for themselves, which works to no one's benefit*" (p11).

Other research in both face-to-face and online environments has argued that preference over group selection based on characteristic traits can have an impact on groups, such as learning styles (Kyprianidou et al., 2012; Moreno et al., 2012; Oakley et al., 2004), ability (Ireson & Hallam, 1999; Lejk et al., 1999) and motivation (Du et al., 2013; Gomez et al., 2010; Xie & Ke, 2011). Whilst the findings of Bacon et al. (1999) supported the view of some bioscience students about group self-selection this is counter to other research that suggested randomised groups can reduce freeloading (Swaray, 2011).

Pieterse and Thompson (2010) supported self-selection of groups to ensure more homogeneity in terms of academic abilities, skills and goals; which supports the view held by Bacon et al. (1999). However, Pieterse and Thompson claimed that team success was not so much about group selection (who selected the groups) but since they found most students were good at conflict resolution, they should be given training in management skills. This argument suggests group work is more about managing the process than deciding who selects the groups.

The results from this study showed that only a minority of student comments were made about self-selecting groups. Several bioscience students also commented that students should be required to communicate online, with some suggestions that this might be facilitated by the tutor to monitor communication or force students to engage. This finding supports that of Pozzi (2010) who argued for tutor intervention to support group work. This echoes claims by Pieterse and Thompson (2010) that group selection in itself is not a defining factor in team success, but the way in which teams are supported to promote collaboration, with or without tutor intervention.

### 4.8.8 Group size

A related issue to group formation is the size of groups and how many might be most appropriate for optimal group collaboration. The research is mixed about the most appropriate number of students for a group, with some suggesting group size is a factor (Kim, 2013) and groups should be no greater than five (Pieterse & Thompson, 2010) since groups of six or more can encourage freeloading. This is supported by Abuseileek (2012) who also suggested five is optimal. However, Qiu et al. (2014) referred to the principle of '*small groups*' that were between 5-14 and van den Berg et al. (2006b) suggested groups of 3-4. Bacon et al. (1999) however found that group size did not have an effect on group experiences and this was mirrored by Shaw (2013). Small group size was also mentioned as important for online groups (Money & Dean, 2019) and groups of three or four have been recommended (Chang & Kang, 2016).

Bacon et al. (1999) and Shaw (2013) argued that the size of a group should be decided based on the pedagogical goals of the project. This argument is supported by Aggarwal and O'Brien (Aggarwal & O'Brien, 2008) but on the basis that as group size increases, so does the incidence of freeloading. However, they do not define what makes a larger or small group or, indeed an optimal group size. In this study bioscience students were placed in groups of five or six at most and forensic science students were mostly placed in groups of three, or occasionally four based primarily on the scope of the assignment.

The bioscience project was based around a PowerPoint presentation which allowed students to share workloads and the product (the PowerPoint presentation file). The forensic science project was more reliant on critical thinking skills that relied closely on group collaboration and problem solving. In both cases, no evidence was found from student feedback to suggest group size had any effect on how the groups collaborated with each other. This would support Bacon et al. (Bacon et al., 1999) and Shaw (Shaw, 2013) that the nature of the group project was more important than group size.

### 4.8.9 Freeloading

Freeloading (see section 2.2.3) was a concern for both student cohorts in this study. The results showed that student concerns focussed around other group members not communicating online and general freeloading. Technology gives students another excuse not to get in touch as reported in the results (Table 9) but this is true irrespective of online or face-to-face (Vonderwell, 2003). The additional concern about freeloaders in relation to peer assessment are discussed separately in chapter 5. Vonderwell (2003) found that when students did not see each other, they avoided answering other students' online questions, and suggested the students may not feel morally obligated or pressured to participate in online communication. Student complaints about freeloading in this study were therefore a consequence of student non-contact irrespective of whether it was online or not.

Thompson and Ku (2006) highlighted this problem and suggested that '*more interventions from instructors was needed to eliminate the social loafing phenomenon in online collaborative learning*' (p373). They suggested that instructors should provide reminders offering help to detect early signs of freeloading. Koh et al. (2010) also suggested instructor strategies to promote online group work. They suggested instructor strategies including providing plans for the group work and building virtual teams, course strategies for multiple communication methods and detailed guidelines for the group work projects, which could increase online group work i.e. reduce freeloading.

Such strategies were implemented as part of the OPLA activity yet freeloading still persisted. These studies (Koh et al., 2010; Thompson & Ku, 2006) echoed what was undertaken in this OPLA activity and highlighted similar issues, but the results showed that despite such interventions, freeloading is a persistent problem with group work, whether face-to-face or online. The results showed that the concern of freeloading existed before and after the OPLA activity, whether real or perceived.

A study by Du et al. (2013) explored student interest in online group work and considered what interventions might be undertaken to maintain student interest. Their study found that group work interest was positively associated with learning-oriented reasons but negatively associated with peer-oriented reasons. Their findings suggested that instructors need to better help students see the value of doing online group work and warn students about the risk of focussing too much on socialising '*on topics that may have little relevance to their groupwork'* (p495). This was not reflected in the results however, since online social presence was not evidenced as a major influence (or distraction) on the assignment.

Whilst this point about socialising contradicts other work on the value of social presence for promoting group work, the suggestion might help address the issue of freeloading. If student interest in online group work is monitored through student surveys, the instructor may intervene with strategies to promote engagement and potentially reduce freeloading. Shiue et al. (2010) also argued that increasing 'social ties' online can help minimise freeloading.

Student 'satisfaction' that freeloading was addressed through peer assessment is discussed in chapter 5, however it does not tackle the underlying causes of freeloading. As discussed already (section 2.2.3) the literature proposed strategies to avoid or reduce freeloading (Brooks & Ammons, 2003; Pieterse & Thompson, 2010) and this was addressed in this study through the orientation training (section 3.4.2). This included providing initial guidance and instructions to students about how to communicate online, how to manage discussions (e.g. rotating chairperson for group) and keeping records of meetings and agreed group actions. Perhaps more regular instructor intervention might ameliorate this further, though Warren and Rada (1999) warned about the instructor time commitment for this approach. Further refinement of student support and instructor intervention may minimise freeloading slightly more, but it is unlikely to totally eliminate it.

The decision to create tutor selected groups in this study compared favourably with other research espousing the benefits of tutor selected groups (Oakley et al., 2004; Qiu & McDougall, 2015). Limiting group size to no more than five and engaging students in peer assessment were also factors echoed by the literature that can help minimise freeloading. The phenomenon of freeloading is unlikely ever to be eliminated but introducing more orientation training early on to support existing advice on working in groups, may further ameliorate the risks or perception of freeloading as a problem.

Interestingly, students cited freeloading as a potential risk in the pre-survey but when asked about online group work, it wasn’t mentioned as a concern. Did students not equate working online with a risk of freeloading or might they have thought freeloading would not be a problem online? This argument did not bear out in the results however, since students highlighted freeloading again, though it was cited as a lesser problem compared with the positives students reported (Table 7). The results therefore demonstrated a positive experience of working online that could be applied across different disciplines but the challenge of freeloading is still prevalent.

### 4.8.10 Student satisfaction with online group work

After undertaking the OPLA activity the majority of both subject cohorts reported being satisfied and positive about online group work and most reported liking the online group work. The majority of both cohorts also felt they worked effectively online as a group.

Prior to engaging with the OPLA most bioscience and forensic science students reported having undertaken and liked working face-to-face. Fewer of both cohorts had previously worked online in groups, and the majority of respondents had also enjoyed working online in groups. Both cohorts also documented the key benefits (e.g. share ideas, skills development) and challenges (e.g. freeloading, interpersonal clashes). The results showed that student comments after the OPLA activity were predominantly positive and students listed a range of reasons why they liked working online, such as being able to share work, meet new people and that it enabled group communications.

Since students reported concerns about working online in their open comments prior to the OPLA activity, the results indicated a general shift in attitude afterwards and it had been a positive experience. These positive attitudes support previous research claiming that students value working online (Ng, 2002). Ellis et al. (2004) for example, discussed how online discussions supported reflection, as shown in the results that are discussed in section 5.3. Masters and Oberprieler (2004) also found creating conditions to encourage online participation included ensuring students were IT literate and allowing unhindered debate; both of which were conditions considered in this study.

As well as reporting feeling positive about online group work, students stated they were satisfied with the group work process in a 2008/09 survey question. Combined with the positive results showing that bioscience and forensic science students worked effectively online and that they would be willing to undertake online group work again; this clearly demonstrated that they were confident working online in groups. Student comments made about the key factors that contributed to a positive experience of online group work also confirm this. Since students highlighted similar factors relating to group work before and after the OPLA activity, it was possible therefore to compare changes in attitude.

Students demonstrated their increased satisfaction with the online group work by listing a range of benefits that they felt they had gained after the OPLA experience (Table 7, 8 Figure 29). Both bioscience and forensic science students reported how working online enabled good communication, were able to share work, meet new people and share ideas. Students did report some problems such as lack of contact and freeloading from some members, but these were minority concerns in relation to the majority of positive experiences reported by students. Overall the most common response from students was that they liked working online so taking all these results together, it was clear students had confidence in the online group work (Table 7, 8).

## SUMMARY

This chapter set out to examine whether an Online Peer Learning and Assessment (OPLA) activity would promote a positive experience of online group work. Student views about peer assessment are discussed in chapter 5. This OPLA activity involved various factors involved in setting up and supporting an online group activity. Factors involved group formation, advice on working in groups, motivation, and working in an online environment. The results provided a greater insight into these, and also a broader range of factors which can impact on the student experience of online group work.

In order for students to have confidence in online group work they must appreciate the benefits it can offer (motivation) and the results supported this. Positive attitudes (self-efficacy) to online group work increased after the OPLA activity and students were would undertake future online group work. Students appreciated the value of working online, citing the benefits of working in groups and that the online communication channels facilitated sharing of ideas, work and flexibility of communication. The mix of online collaboration through the VLE and face-to-face work also provided the platform for social interaction (social presence), even though this was not an intended outcome.

The literature highlights a number of factors, sometimes contradictory, that can impact on student experiences of working online in groups. They include consideration for how groups are selected and how many members should be selected for the volume of work planned. How is social presence supported, particularly online and what technologies are used, are also key considerations. This study considered these factors and created the OPLA activity to give students confidence in the peer learning process which was able to foster a genuinely positive experience for the students.

By undertaking a quasi-experimental approach to exploring ‘student experiences of online group work and peer assessment’ it was possible to benchmark any changes in attitudes to the online peer learning. It is important to note that these changes are based on student perceptions and reflect the student sense of self-efficacy for learner autonomy. Accepting that perspectives of learner autonomy can differ, this study still clearly demonstrated that students had a positive experience of the online group work and that the considerations and planning the blended learning approach helped foster this positive experience.

As well as the positive outcomes of the student experience, one challenge that was noted in line with the literature, was the risk of freeloading. Freeloading was one of the reasons for undertaking peer assessment as part of this study and the next chapter discusses these results in detail. For this chapter however, the results have added to the literature in relation to online group work, exploring broader issues about planning online group work, group formation, motivation and general student satisfaction.

# 5 VALIDATING STUDENT PERCEPTIONS OF PEER ASSESSMENT

As part of the OPLA activity, students were required to undertake summative peer assessment. Previous literature has investigated whether students considered peer assessment to be valid based on their perceptions (Falchikov & Goldfinch, 2000; Jones & Wheadon, 2015; Stefani, 1994) whilst other literature had investigated whether the peer assessment process itself was deemed valid (English et al., 2006; Lew et al., 2010). However, current literature has not considered the full validity of peer assessment. That is, whether peer assessment is not only considered a valid assessment tool, but is this supported by students views and how they actually assessed their fellow peers? This study asked 'is online peer assessment a valid form of assessment' and this chapter explores validity from the perspective of both the student and the actual assessment process.

There is a risk that students may perceive peer assessment to be a fair form of assessment but their actual behaviours and marking tendencies may be different (Sluijsmans et al., 2004; Wen & Tsai, 2006). This chapter explores student attitudes to peer assessment and triangulates their views against related data on how students behaved and marked each other during the peer assessment process. By comparing student attitudes with actual assessment scores and behaviour it was possible to consider if peer assessment is a valid (and accurate) form of assessment, and not just one which is subjectively perceived as fair.

## 5.1 METHOD

As part of the pre and post-test questionnaires that were issued (see chapter 4) students were asked about their prior experience of, and views relating to peer assessment. The questions produced a number of quantitative and qualitative data that was analysed with

SPSS and NVIVO respectively. As well as this data stream, three other key sources of data were collected; from focus groups and video observation, student interviews, and analysis of the peer assessment scores. Prior written consent was obtained were necessary for the video observation and student interviews with other appropriate ethical considerations being taken into account.

### 5.1.1 Ethical considerations

For the focus group interviews, attendance was voluntary and students were informed beforehand the purpose of the focus group and the reasons for collecting the data. The liquid café focus group interview (see section 3.7.5) was conducted without the principle researcher present and all data from the interview was provided anonymously without knowing which students had attended. The second focus group was conducted by the principle researcher who did not keep a record of student names and transcribed the notes anonymously i.e. no individuals were identified in the notes.

For the individual interviews where student permission was sought to divulge individual peer assessment grades, written student consent was obtained. The form used to seek consent was based on a standard form template created by JISC Legal. Students were forewarned about the implications of divulging grades, noting that the sharing of grades only pertained to part of the overall assignment, so students would not find out each other's final assignment grade. After being forewarned and reminded again at interview, grades were not shared until all students in the group had signed the written permission form.

### 5.1.2 Data collection

The pre and post-test questionnaire data were collected as described in chapter 3 and the focus groups were run as described in section 3.7.6. The student interviews were conducted individually and given the nature of interviews discussions, written consent was obtained beforehand. Liquid café and world café focus groups were also conducted to obtain additional student feedback.

#### *5.1.2.1 Liquid café interview*

In 09/10 a liquid café was trialled for the 2009/10 cohort of bioscience students. The format of a liquid café is discussed in chapter 2 (section 3.7.5). In the case of a liquid café, potential research bias due to the researcher being present was avoided by having someone else facilitate the liquid café. An independent moderator facilitated the session, who had little direct contact with the study, thus avoiding bias or influence from the principle investigator. An open invitation to all bioscience students was made that drew 14 acceptances, with nine actually attending the interview. The questions posed during the liquid café are provided in Appendix E and guidance for the moderator was provided in Appendix F.

To conduct the liquid café interview a room was booked and a buffet lunch was offered as an incentive for students to attend. Tables were set up with a question on each for the students to discuss. Students wrote notes on the table covers provided, which were then transcribed for analysis.

#### *5.1.2.2 Focus group interview*

Whilst acknowledging the potential biases of conducting focus groups under certain conditions it was decided that a focus group would provide additional data for this study. A focus group was chosen from the 10/11 bioscience cohort of students to elicit a broad range of student experiences and attitudes. The focus group attendees were selected by open invitation to all students in the cohort. This ensured that when the focus group interview was conducted after the study, there was no bias in selecting groups based on how they performed during the activity, or based on familiarity with students which may have developed during the teaching.

The focus group was arranged by booking a room for an hour with a lunch provided and students were asked a series of semi-structured questions by the principle researcher. The session itself was audio recorded for detailed analysis afterwards. Recording the session allowed the conversation to flow freely, negating the need for continual pauses and interruptions whilst the principle researcher made notes. The questions used were the same as for the liquid café interview in the previous year (Appendix C) but given the opportunity for face-to-face discussion (unlike the liquid café) the conversation was not limited to the initial questions.

Unfortunately, due to logistical reasons it was not possible to conduct any focus groups with the forensic science students. The reasons for this involved the timing of completion of the module and student availability. The bioscience students completed their assignment prior to the Christmas break so it was possible to organise the focus groups with them after completing their assignment. The forensic science students however, finished their assignments later and after the Christmas period when into the examinations period. Given that the forensics class was made up of students from four different courses it was also too difficult to arrange a focus group when most were available. However, an attempt was made to elicit additional information from the forensic science students by videoing their workshop (section 5.1.2.3).

#### *5.1.2.3 Videotaped session*

Each year the forensic science students undertook a class-based workshop as part of their group work assignment. One workshop for the 10/11 cohort was videoed and the group interactions were analysed and the data compared with the group interactions through the online discussions. A University video technician was booked to record the workshop. The technician provided two cameras, placed at different locations to record the workshop interactions from different angles in the room. Recordings from both cameras were provided on CD afterwards.

### 5.1.3 Data analysis

Once the data had been collected it was analysed using different methods depending on whether the data is qualitative or quantitative. How the data was analysed depended on the theoretical framework used, what hypothesis is being tested and so on. Data was available from different sources so it was important to consider how data were managed to give a direct measure of what was being investigated. The following sections discuss aspects of data analysis that were considered for validating the peer assessment process.

#### *5.1.3.1 Triangulation of data*

When collecting data for research the ability to compare different sources of data is helpful for building up a broader view of what is being researched and for validating findings. The benefits of one source of data, such as focus groups, were listed by Morgan (Morgan, 1993) who said that focus groups were a "*friendly research method that is respectful and not condescending to your target audience*" (Morgan, 1993:18). Morgan also mentioned that focus groups did not need to be used in conjunction with other research methods i.e. they do not need to be validated by other methods. However, used in combination with other methods, such as surveys they can help offer a greater insight into student behaviours and attitudes. This was referred to by Morgan (1993) as triangulation where the data gathering would complement other research methods.

The advantages of triangulating data were also discussed by Hammond and Wiriyapinit (2005) where triangulation of data i.e. comparing the findings of data from different research methods could be categorised in three ways. The first category was consistency, where there is a match between findings; contrast, where findings differ; and complementarity, which offers a different perspective that would not have been possible with just one approach. Another benefit, cited by Gubrium and Holstein (2002:461) was that focus groups (as one example of data collection) could involve greater numbers of respondents than might be possible with serial individual interviews. So triangulation also offered the opportunity to collect larger sample sizes from different sources.

#### *5.1.3.2 Validity and Reliability*

When undertaking research, it is important to ensure that what is being measured tests hypotheses or theories directly related to what is studied. Wiersma and Jurs stated that "*Research is a process, and in order to enhance conducting research, it would seem reasonable to make it as systematic as possible.*" (Wiersma & Jurs, 2000:3). There are problems of measurement however, and Hammersley (1987) discussed how the concepts of validity and reliability address Wiersma and Jurs' (2000) approach to systematic research.

Hammersley (1987) discussed problems with defining what validity and reliability mean and attempted to clarify the meanings and purpose as a distinction between goals and means. The goal is what the researcher is trying to achieve and the means is the strategy used to assess it. If reliability is concerned with the way the measurements are undertaken – and not the measurements (or scores) themselves then this is another goal.

Hammersley (1987) also listed precision as another goal – the level to which we measure something in order to obtain the level of validity we can hope to achieve. The means may simply be the methods employed to test validity and reliability. This was supported by Opie who argued that reliability is a "*property of the whole process of data gathering, rather than a property solely of the results*" (Opie, 2004:66).

Opie (2004:65) addressed the variation in the definition of reliability but noted that two features commonly arise, that of repetition and consistency. Wellington (2000) echoed

Hammersley (1987) by saying reliability is contentious and it is considered "*a judgement of the extent to which a test, a method or a tool gives consistent results across a range of settings, and if used by a range of researchers.*" (Wellington, 2000:31). Wellington went on to discuss reliability as "*the extent to which a piece of research can be copied or replicated in order to give the same results in a different context with different researchers"* (Wellington, 2000:31).

Wiersma and Jurs (2000) said that "*reliability refers to the consistency of the research and the extent to which studies can be replicated*" (Wiersma & Jurs, 2000:8). This issue was addressed by Opie (2004) who discussed a simple exercise to measure reliability. Opie raised the issue of repeating the same research with the same group of people at different times. If the same approach was taken by a different researcher, with different people at different times; would the findings be the same? If not, does this mean the research was unreliable? As Opie argued, this is not necessarily the case since research can often be small scale case studies which will inevitably differ and internal reliability checks can be undertaken to measure robustness. Le Compte and Preissle (1984:332) added to this, in Wellington (2000:31) by saying no researcher in the social sciences can achieve total reliability.

Validity of peer assessment in the literature has not always been reported in the context of being 'valid' against what is being measured. As already discussed (section 2.6.2) the literature relating to 'valid' peer assessment often relates to interpretation of what is considered valid, but may not be reliable. For example, the consideration that peer assessment is considered valid if peer marks are in line with those of the tutor, when research already shows that even tutor marks are not always consistent. By exploring different data streams in this study, it was possible to investigate different aspects of peer assessment which has not yet been fully addressed in the literature.

## 5.2 RESULTS

In a similar quasi-experimental approach as that taken for investigating student experiences of online group work, student perceptions of peer assessment were investigated using the pre and post-test questionnaire tool. Student focus groups were also conducted, along with forensic science interviews and a quantitative analysis of the students' peer assessment scores. Results from the student feedback and comparison with actual peer assessment scores are presented below.

## 5.3 STUDENT PRIOR EXPERIENCE OF SELF-ASSESSMENT

Prior to commencing the OPLA activities, bioscience and forensic science students were surveyed about their previous engagement with self and peer assessment.

Bioscience and forensic science students were asked if they had previously undertaken self-assessment with the majority of both cohorts reporting they had (Figure 10).

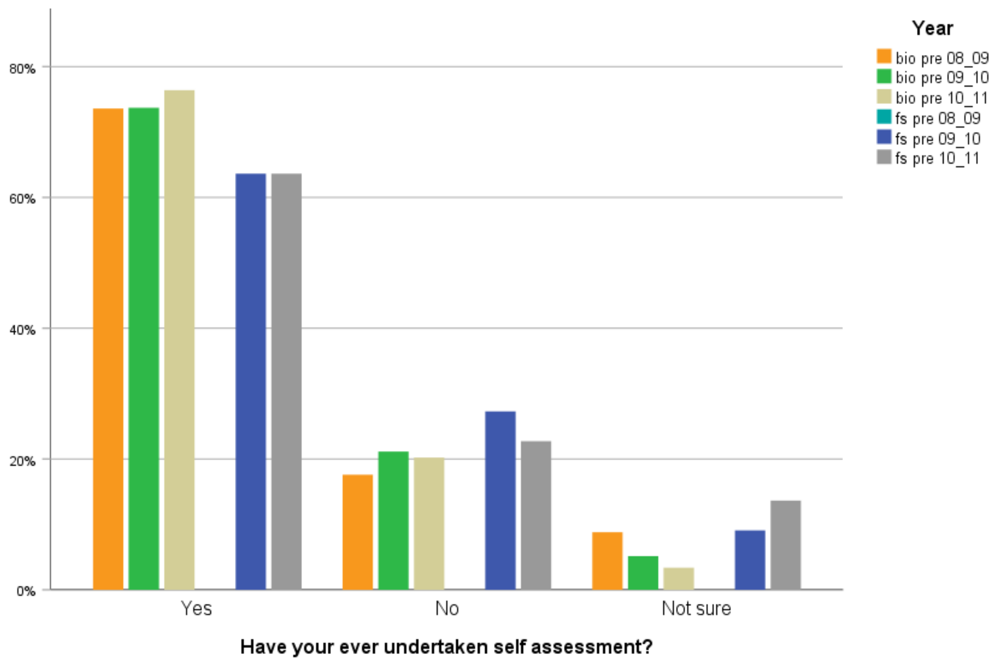


*Figure 10 Bioscience and forensic students' experience of self-assessment*

Students were asked if they like self-assessment and students gave a mixed response (Figure 11). No data was obtained for the forensic science students in 08/09.

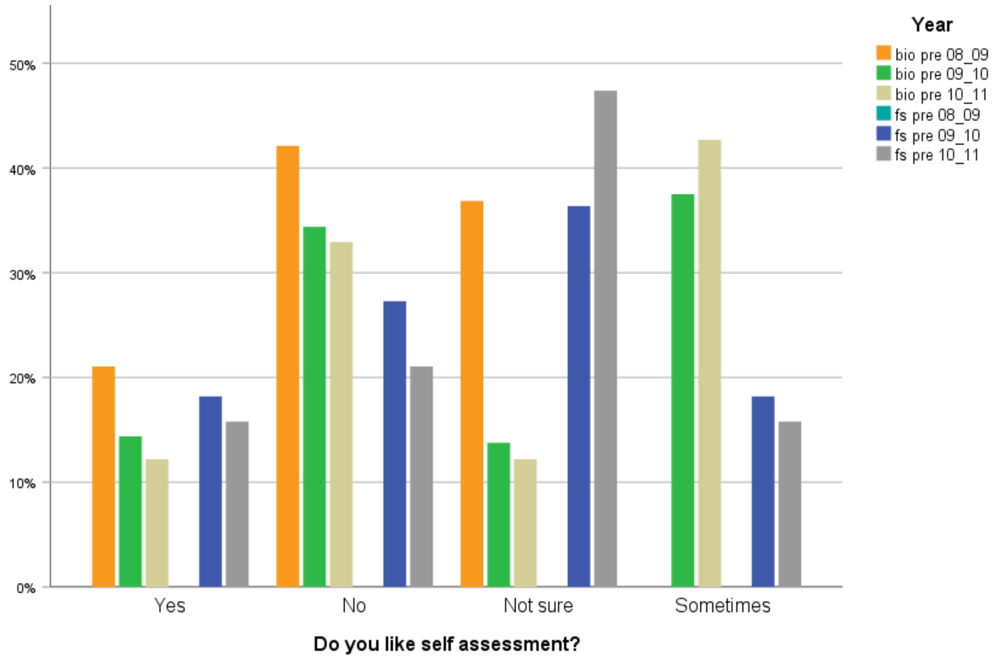


*Figure 11 Bioscience and forensic science students' views of self-assessment*

Prior to engaging in the OPLA students were asked about initial views of self-assessment. The aim of the open text questions in the pre-survey was to gauge students' attitudes and experiences of self and peer assessment. The following question asked students about their views of self-assessment.

1. Regardless of whether or not you have undertaken self-assessment do you like the idea of this form of assessment? Please comment and add anything you might like or dislike about the idea of self-assessment.

When the open text responses were qualitatively analysed, as described in section 4.1.4, a number of themes emerged. The same themes emerged for both subject cohorts and these are discussed next.

The number of survey responses for each subject cohort for each year are shown in Table 15.

*Table 15 Number of pre-survey responses*

| Subject/survey year | Number of survey responses |
|---|---|
| Bioscience pre 08_09 | 125 |
| Bioscience pre 09_10 | 177 |
| Bioscience pre 10_11 | 180 |
| Total | 482 |
| Forensic science pre 08_09 | 16 |
| Forensic science pre 09_10 | 11 |
| Forensic science pre 10_11 | 44 |
| Total | 71 |

### 5.3.1 Bioscience students' views on self-assessment

The most common theme to emerge for bioscience students was that they were concerned about a risk of bias in the marking and there was a mix of responses between those liking or not liking self-assessment. Some students felt that tutor assessment was better or were generally unsure about self-assessment. Table 16 provides examples of responses which were representative of the themes emerging from the data.

*Table 16 Bioscience students' pre-survey comments about self-assessment*

| **Self-assessment theme** | **No. of responses for each theme (08/09 to 10/11)** | **Response [survey year]** |
|---|---|---|
| Risk of bias | 99 | *"I think that its a very subjective method of marking assessments and therefore presents the problem of whether work has been marked fairly. It also depends heavily on the kind of person you are, it also could create bias in the marks." [bio 08/09]*<br><br>*"Fairer markers would appear to get lower marks than people who marked themselves unfairly generously which does not rock" [bio 09/10]*<br><br>*"I don't particularly like self-assement, I find that it is easy to be biased and one tends to over-estimate or under-estimate their performance." [bio 09/10]*<br><br>*"I generally think it's a bad idea as a person will be biased about their own work. So they will either be too favourable, and fail to see the flaws of their work or too negative and feel depressed about what could b a very fine piece of work. Also a problem with self-assessment is that you will know what you mean in your work and it may not be clear to others." [bio 10/11]* |
| No – don't like self-assessment | 63 | *"Not really as I may be unsure of how to futher improve my work, if I have completed the assessment to the best of my ability." [bio 08/09]*<br><br>*"No, I feel it is important to review your work but with self-assessment I feel you will not receive any benefits." [bio 09/10]*<br><br>*"I do not like it as a form of self assesment as in general people are often to hard on them themselves" [bio 10/11]*<br><br>*"I dislike this method because i want to learn what I am doing wrong and how i can improve rather than maybe giving myself extra credit just because it is my own work, when really it isnt deserved." [bio 10/11]* |

| **Self-assessment theme** | **No. of responses for each theme (08/09 to 10/11)** | **Response [survey year]** |
|---|---|---|
| Can promote self reflection | 63 | *"it is a good idea to force yourself to think about you and your actions and sometimes self assesments can be a real eye opener" [bio08/09]*<br>*"Self-assessment is better once a group discussion or feedback (from a leader) has taken place. That way you can reflect your own work against others and mark it accordingly." [bio 09/10]*<br>*"Self-assessment is an excellent way to make students reflect on their own work and the work of their group" [bio 09/10]*<br>*"yes because i can see where i have made mistakes and learn from them." [bio 10/11]* |
| Yes – like self-assessment | 48 | *"Like. It will allow myself to be more critical and obsevant of my strengths and weaknesses and give me the chance to do something about them." [bio 08/09]*<br>*"Self assesment is useful to the student as it makes you think of how you work would be marked by your tutor." [bio 09/10]*<br>*"I have studied self-assessment but never been asked to self assess my own work. I do believe that self-assessment is a good learning tool." [bio 10/11]*<br>"*Yes, I feel that assessing your own work is another way of learning.*" [bio 10/11] |
| Tutor assessment is better | 37 | *"like it but often feel an assessment from someone outside or with superior knowledge would be better." [bio 08/09]*<br>*"I am not really keen on the method of self-assessment, I prefer to be assessed by a tutor or lecturer." [bio 09/10]*<br>*"I do not like self-assessment because i like to have the critique from the teachers and know exactly where i have gone wrong." [bio 09/10]* |

| **Self-assessment theme** | **No. of responses for each theme (08/09 to 10/11)** | **Response [survey year]** |
|---|---|---|
| | | *"I prefer to get feedback from lecturers, as they know what they are looking for and can give professional feedback." [bio 10/11]* |
| Unsure | 22 | *"Not sure. I can be a bit hard on myself!" [bio 08/09]*<br>*"I have uncertainty of self-assessment because I don't know the answers may be right or wrong" [bio 09/10]*<br>*"i think it is a good idea but personally i am not sure if it is that helpful." [bio 10/11]* |
| Feel peer assessment is better | 16 | *"find it difficult to mark my own work because it is difficult to notice flaws in your own work. I find it easier to mark someone elses work." [bio 08/09]*<br>*"I think peer assesment is more effective." [bio 09/10]*<br>*"I wouldn't trust my own judgement very well, I;d rather somebody else assessed my work" [bio 10/11]* |
| It promotes self-motivation | 15 | *"gives you a chance to think about the quality of wotk you have produced and would help in producing further work." [bio 08/09]*<br>*"Yes I do like the idea, it shows me where I have gone wrong and motivates myself on how to solve the problem." [bio 09/10]*<br>*"I think that it is a good idea because it forces you to think what you could have done better and so that next time you have an assessment you will think the same way while doing the assessment and therefore do better." [bio 10/11]* |

### 5.3.2 Forensic science students' views on self-assessment

The two main themes to arise from forensic science students were a concern over the risk of bias and that students liked self-assessment. Table 17 provides examples of responses which were representative of the themes emerging from the data.

*Table 17 Forensic science students' pre-survey comments about self-assessment*

| **Self-assessment theme** | **No. of responses for theme** | **Response [survey year]** |
|---|---|---|
| Risk of bias | 7 | *"I don't like the fact that people could lie to better themselves" [FS 08/09]*<br>*"self-assessment can be a good form of marking, however i feel many people will be dishonest" [FS 09/10]*<br>*"No one likes to admit if they have done wrong so, when filling out a self-assessment, its easy to pretend that you did more work/ had more input than you actually did" [FS 10/11]*<br>*"could be too generous for your own marking." [FS 10/11]* |
| No – don't like self-assessment | 3 | *"No. The idea of marking each other is pretty redundant as everyone marks themselves high er than they deserve." [FS 10/11]*<br>*"it does not give much room for improvement" [FS 10/11]* |
| Can promote self reflection | 1 | *"I think it may help me to evaluate myself as I find it very difficult to highlight my own strengths and weaknesses, so I believe the practice will be good." [FS 10/11]* |

| Self-assessment theme | No. of responses for theme | Response [survey year] |
|---|---|---|
| Yes – like self-assessment | 6 | *"Yes i like it, it gices you a chance to see the other group members' opinions of your effort and input" [FS 08/09]*<br>*"its good as it gives students the chance to have an imput on the marks, as it takes into account the amount of work that was put in by individuals of the group." [FS 08/09]*<br>*"Yes as it reflects how much effort I feel I have put in." [FS 09/10]*<br>*"I think it is a good idea." [FS 10/11]* |
| Tutor assessment is better | 1 | *"Seems a good idea, but probably should be doen in conjunction with peer assessment or assessment by staff as some may just give them selves full marks!" [FS 09/10]* |
| Unsure | 2 | *"I find the idea quite confusing as I wouldn't know whether I had got the work right or not." [FS 09/10]*<br>*"not sure how it would work" [FS 10/11]* |
| Feel peer assessment is better | 1 | *"Seems a good idea, but probably should be doen in conjunction with peer assessment or assessment by staff as some may just give them selves full marks!" [FS 09/10]* |

## 5.4 STUDENT PRIOR EXPERIENCE OF PEER ASSESSMENT

Most students reported that they had previously undertaken peer assessment (Figure 12) but the nature of this assessment was not investigated further.

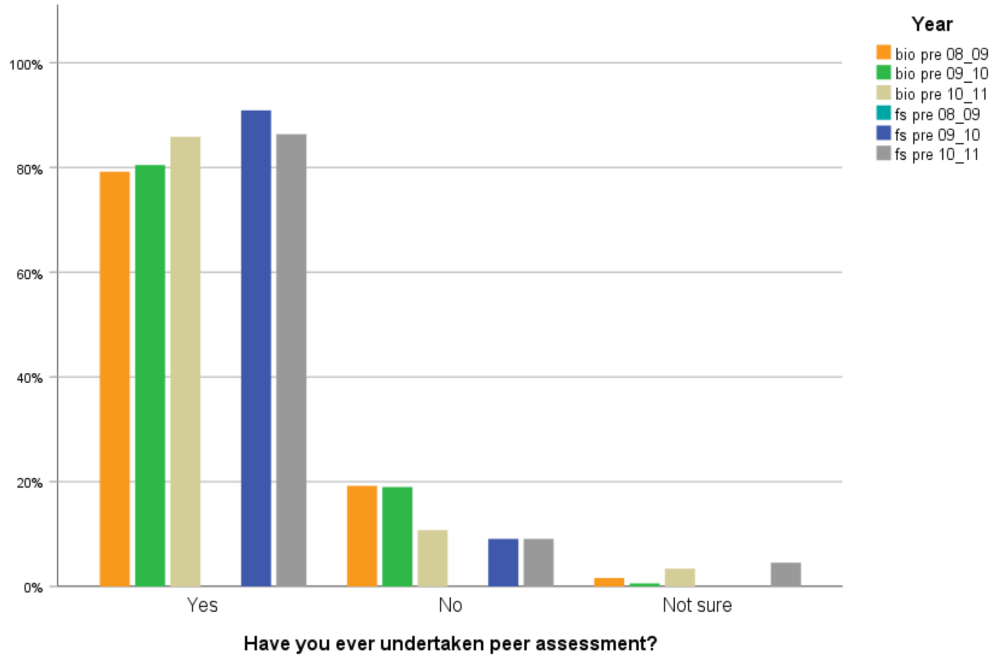


*Figure 12 Bioscience and forensic science students' experience of peer assessment*

When asked if they liked peer assessment the bioscience students reported mixed responses (Figure 13). The forensic science students' responses contrasted with the bioscience students, with the majority reporting they liked peer assessment (Figure 13).

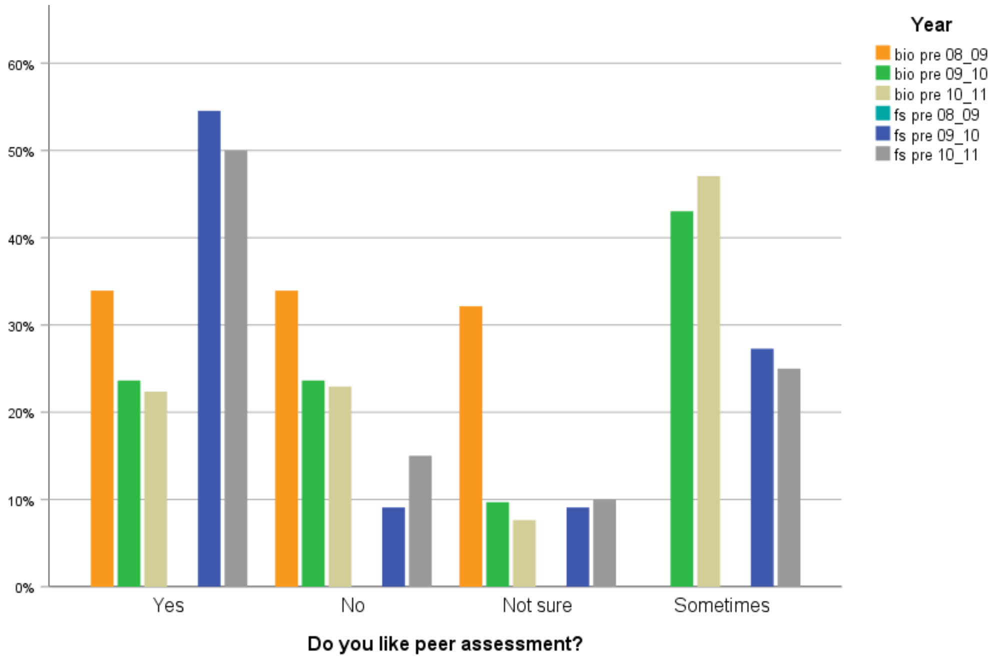


*Figure 13 Bioscience and forensic science students' views of peer assessment*

Students were asked how positive they felt about the idea of carrying out peer assessment as part of the OPLA activity. Bioscience students gave a predominantly neutral response. The response from the forensic science students was more positive by contrast, with higher percentages reporting a positive attitude to peer assessment (Figure 14).

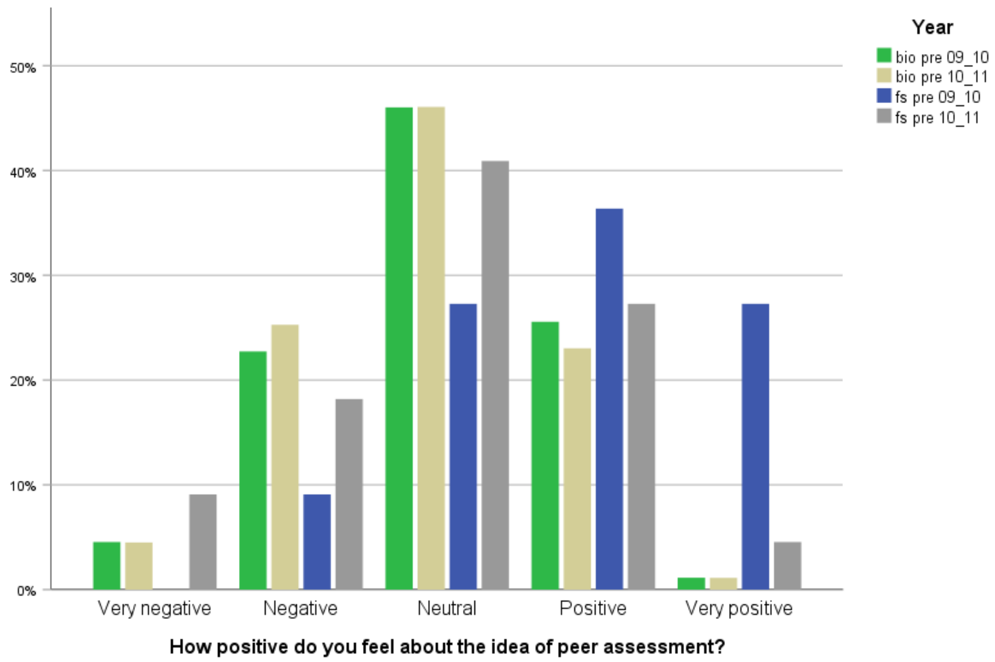


*Figure 14 Bioscience and forensic science students' initial views of peer assessment*

In 09/10 and 10/11 both bioscience and forensic science students were asked about their attitude towards students undertaking peer assessment and assessing fellow students. For the bioscience students the cohorts across both years provided similar responses (Figure 15). The majority of bioscience students felt that students should peer assess each other but this could not be investigated directly as it was asked as a closed question. Students also felt that they would be able to peer assess other students in a reliable and consistent way, but felt others would not be able to assess in a reliable and consistent way. Other views about peer assessment were mixed and so gave no strong overall view as to whether students should or shouldn't assess their peers.

Responses from the forensic science students about peer assessment contrasted with those of the bioscience students (Figure 15) in being more comfortable about being able to peer assessment and being able to mark each other in a reliable and consistent way. The majority of forensic science students agreed that students should engage with peer assessment and felt that peer assessment would be reliable and give an accurate reflection of group work.

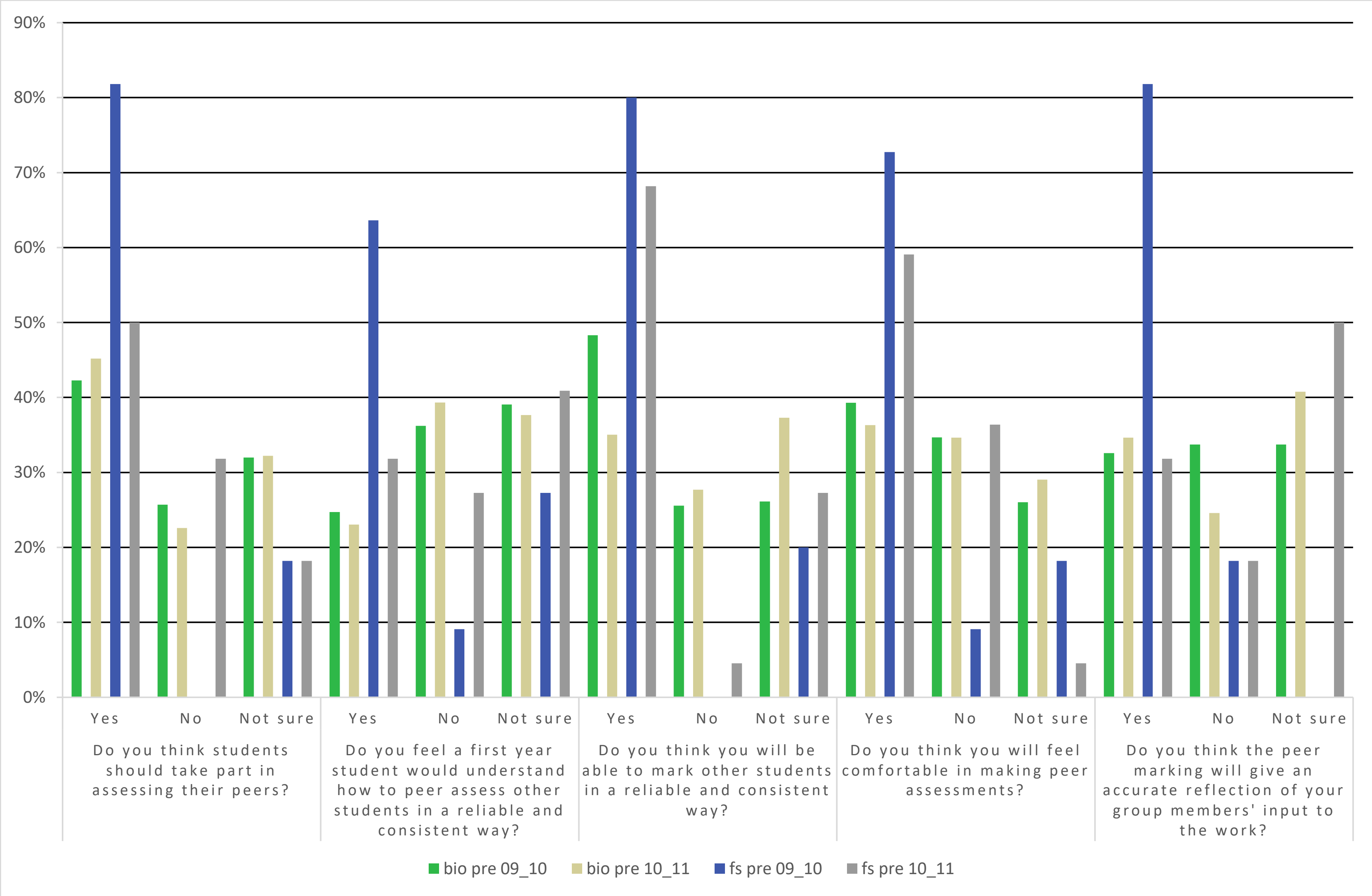


*Figure 15 Bioscience students' pre-survey views about peer assessment 09/10 to 10/11*

The open text questions in the pre-survey gauged students' responses to their attitudes and experience of peer assessment. The following question asked students about their views of peer assessment.

1. Regardless of whether or not you have undertaken peer assessment do you like the idea of this form of assessment? Please comment and add anything you might like or dislike about the idea of peer assessment.

### 5.4.1 Bioscience students' views on peer assessment

There were a number of key themes to arise from the bioscience students in their pre-survey responses about peer assessment. The most common theme to emerge was that they viewed peer assessment as developmental but that they were also concerned about marking bias. Other strong themes to arise were the fact that the students liked peer assessment but that it can cause anxiety or marking pressure. Examples of the main themes raised are shown in Table 18.

*Table 18 Bioscience students' pre-survey comments about peer assessment*

| Peer assessment theme | No. of responses for theme | Response [survey year] |
|---|---|---|
| Marking Bias | 64 (2) | *"Wouldn't like someone to mark me. Give you bad mark if they don't like you maybe. Might not agree with them. They may underestimate your abilities." [bio 08/09]*<br>*"i feel like i could be bias and not be completley honest" [bio 08/09]*<br>*"not always an accurate assessment, may be biased" [bio 09/10]*<br>*"Dont feel like im qualified to be critically marking someone elses work but would give it a go. Marks could be bias if you know whos work your marking." [bio 10/11]* |
| Like peer assessment | 50 (8) | *"i think peer assessment is a great idea to be judged by peers people at the same level as you." [bio 08/09]*<br>*"It's a great form of assessment because the peers are the audience and what they thought is equally important to what the Lecturer or whoever assessing the work thinks" [bio 08/09]*<br>*"Peer assesment is good because it gives two perspectives on your work, from a lecturers point of view and from a fellow students." [bio 09/10]*<br>*"Yes - I like knowing how I should be writing or working and peer assessment allows me to see the level of the work that is done by others" [bio 10/11]*<br>*"I like the idea, as then its not just a teacher looking at your work, other opinions are included." [bio 10/11]* |
| It is development al | 75 (0) | *"Peer assessment allows me to see exactly what I got wrong immediately and if I'm unsure why it's wrong, I have the opportunity to ask my peer or the lecturer while the piece of work is still fresh in my mind." [bio 08/09]* |

| Peer assessment theme | No. of responses for theme | Response [survey year] |
|---|---|---|
| | | *"Peer assesment plays an important role in critical thinking and gaining skills for the future career. It is a good way of guiding people for self improvement." [bio 08/09]*<br>*"When your marking you can easiy see how to improve your work as well as marking other peoples" [bio 09/10]*<br>*"Sometimes, getting feedback from your fellow students can be better than getting feedback from your lecturer, as the other students are in the same situation as you. Because of this they may be able to add valuable pieces of advice." [bio 09/10]*<br>*"i think it is a good way of learning" [bio 10/11]* |
| Can cause anxiety or marking pressure | 57 (0) | *"Wouldn't like someone to mark me. Give you bad mark if they don't like you maybe. Might not agree with them. They may underestimate your abilities. Under pressure to give good marks to people to not hurt their feelings." [bio 08/09]*<br>*"No i don't like this. i have worked in a school and it is rather stressful when your peers mark your work." [bio 08/09]*<br>*"I would feel pressured to give peers a higher mark even if it is undeserved so as not to upset them." [bio 09/10]*<br>*"It puts too much pressure on you, and it can cause arguments" [bio 10/11]* |
| Tutor assessment is better | 25 | "*Peer assessment can be inaccurate compared to staff since the student will not hav the same standard of marking and may make more mistakes." [bio 08/09]*<br>*"Students not marking as good as a lecturer would mark." [bio 08/09]*<br>*"i prefer it when the teacher assesses me as they understand the principle better than the students." [bio 09/10]*<br>*"I would feel more confident about getting feed back from the teacher." [bio 10/11]* |

| Peer assessment theme | No. of responses for theme | Response [survey year] |
|---|---|---|
| | | *"students are not qualified enough." [bio 10/11]* |
| Peer assessment is not affective | 18 | *"I don't really believe peer assesment is that useful as I personally don't feel confortable with judging my peers work." [bio 08/09]*<br>*"It is not very good because if you are marking one of your friends work and they get something wrong they may sometimes try and change it while you are marking it to make them look better." [bio 09/10]*<br>*"No. I dont think it would provide a a useful source of feedback" [bio 10/11]* |
| Allows for shared experiences | 11 | *"great technique, you can bounce ideas off each other." [bio 08/09]*<br>*"I think it can be a good way of assessing others, as it will give an idea bout how other students are approaching the work given" [bio 09/10]*<br>*"Peer assessment can be very useful in getting to know someone and make friends with them." [bio 09/10]* |
| Unsure | 13 (0) | *"Undecided. It would depend on the person assessing your work, it would be important that this person was of higher ability than you. [bio 08/09]*<br>*"dunno" [bio 08/09] "Not entirely sure" [bio 09/10]* |
| Gives an honest/fair mark | 9 (1) | *"Good because you get an honest mark." [bio 08/09]*<br>*"like this form of assessment because you are given an honest mark for the work and you learn from others peoples work." [bio 08/09]*<br>*"It can be fair - and can be a good chance to see someone elses perspective on work and broaden your own knowledge of a topic" [bio 09/10]* |

### 5.4.2 Forensic science students' views on peer assessment

The most common view of forensic science students was that they liked the idea of peer assessment. Other comments provided are shown in Table 19.

*Table 19 Forensic science students' pre-survey comments about peer assessment*

| Peer assessment theme | No. of responses for theme | Response [survey year] |
|---|---|---|
| Marking Bias | 2 | *"I don't like it because may be I won't give him a fair grade." [FS 09/10]*<br>*"It can sometimes be unfair" [FS 10/11]* |
| Like peer assessment | 8 | *"I do like this form of assessment as it gives you the opportunity to assess how much everyone has contributed which may not be clear to an outside assessor who has not seen how the group has worked as clearly." [FS 09/10]*<br>*"It gives a chance for other members of the group to comment on how they think the others have performed. Gives an incentive to work well within the group." [FS 09/10]*<br>*"i think this is a good idea as it reflects the amount of effort put in by each member of your group." [FS 10/11]* |
| Other themes | 0 | *No direct comments made in this theme* |
| Gives an honest/fair mark | 2 | *"Yes, no problems with it. Completely fair." [FS 09/10]*<br>*"Its easier to write down what you think about the group rather than telling them. Peer assessments allows the group to analyse each others input without offending the other people in the group." [FS 10/11]* |

## 5.5 STUDENT POST-STUDY VIEWS OF PEER ASSESSMENT

After undertaking the OPA activity, students were asked several questions about how satisfied they were with various aspects of peer assessment. These questions were:

1. How satisfied were you with the peer assessment process?
2. After doing this, I feel more positive about peer assessment
3. Was the marking scheme easy to understand?
4. Was the marking scheme fair?

### 5.5.1 Students views of the peer assessment process

Bioscience students were satisfied with the peer assessment process, with the majority ($p<.05$) being satisfied or extremely satisfied across all three years (Figure 16). Forensic science students were also satisfied or extremely satisfied with the peer assessment process ($p<.05$) (Figure 16).

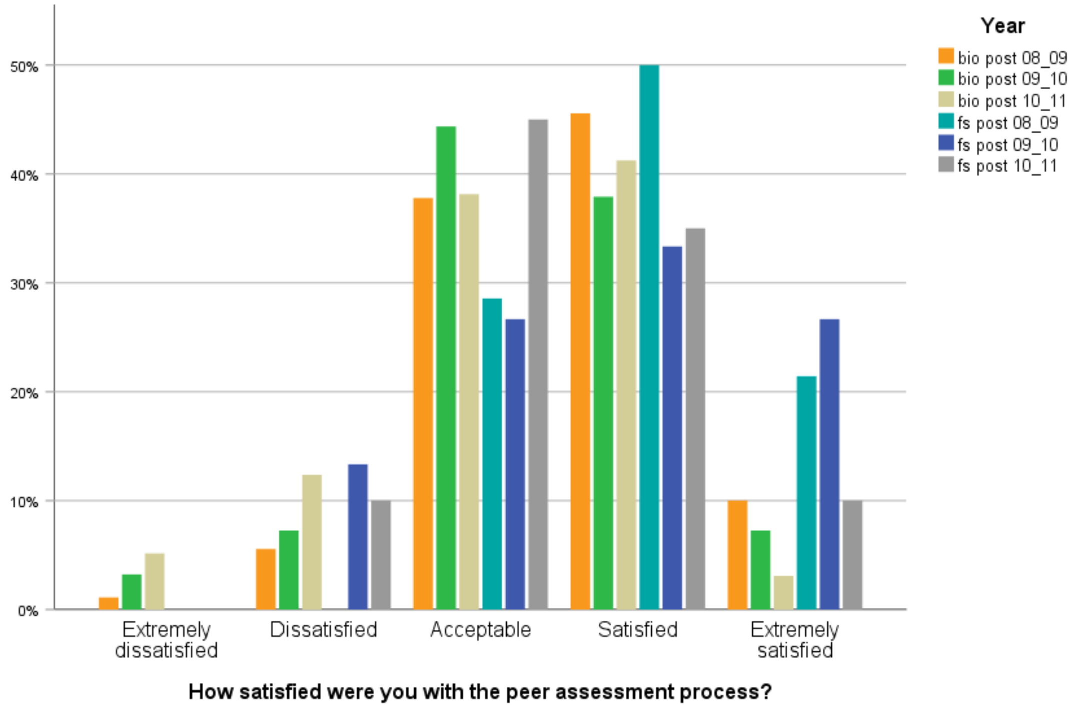


*Figure 16 Bioscience and forensic science students' satisfaction with the peer assessment process*

In the 08/09 post survey, bioscience and forensic science students were asked the question in the form of 'I feel more positive about peer assessment'. Students reported feeling more positive about peer assessment than negative (Figure 17).

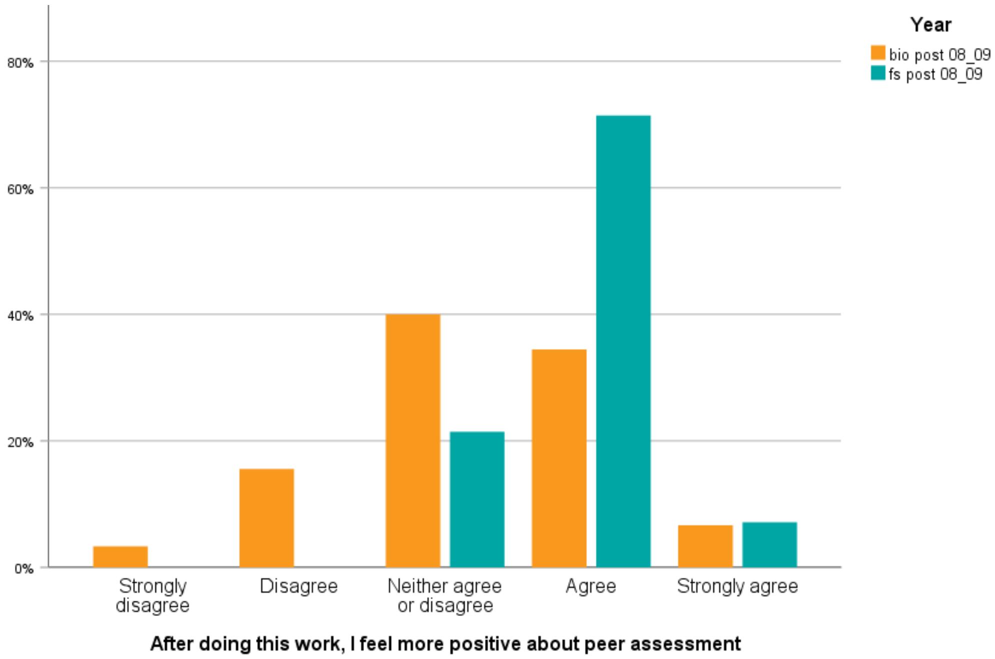


*Figure 17 Bioscience and forensic science students' post-activity attitudes to peer assessment in 08/09*

In 09/10 and 10/11 the question was presented slightly differently to make the question match that of a complementary survey of a partner institution and students were asked 'how positive do you feel about the idea of peer assessment'. Both bioscience students ($p<.05$) and forensic science students ($p<.05$) felt positive about peer assessment than those who felt negative about peer assessment (Figure 18).

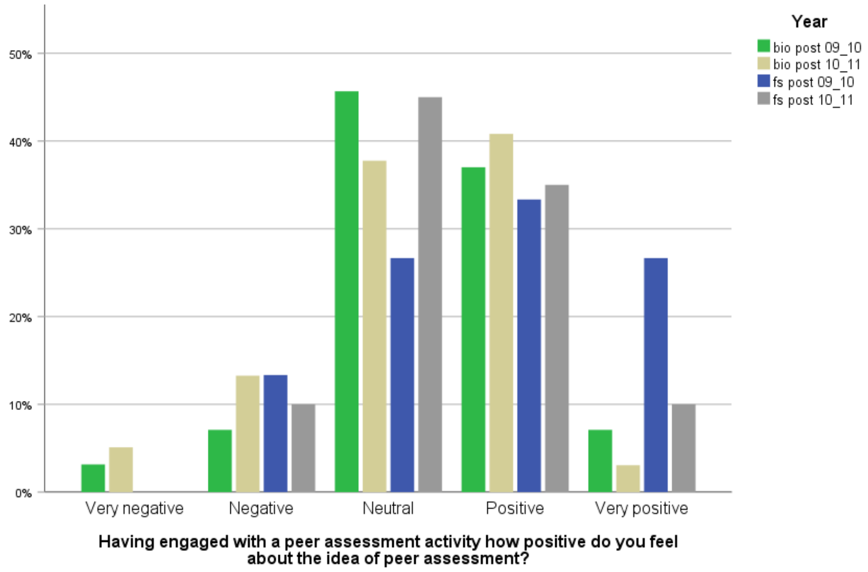


*Figure 18 Bioscience and forensic science students' post-activity attitudes to peer assessment in 09/10 and 10/11*

### 5.5.2 Students views of the peer assessment marking scheme

The peer assessment process for both discipline cohorts was almost identical (see section 3.5.3) and overwhelmingly both bioscience and forensic science students felt that the (peer assessment) marking scheme was easy to understand (Figure 19).

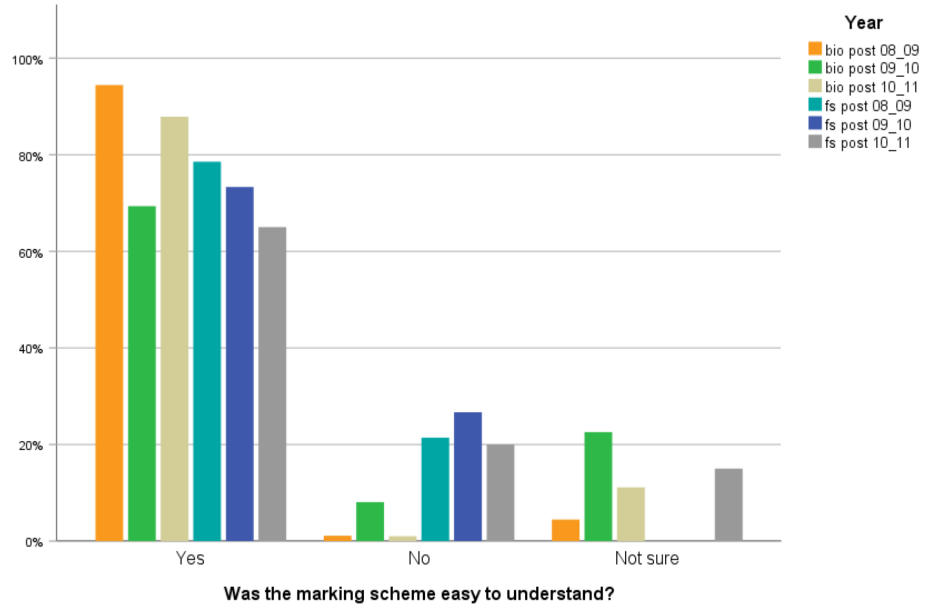


*Figure 19 Bioscience and forensic science students' views of whether the marking scheme was easy to understand*

The majority of students also felt the marking scheme was fair (Figure 20).

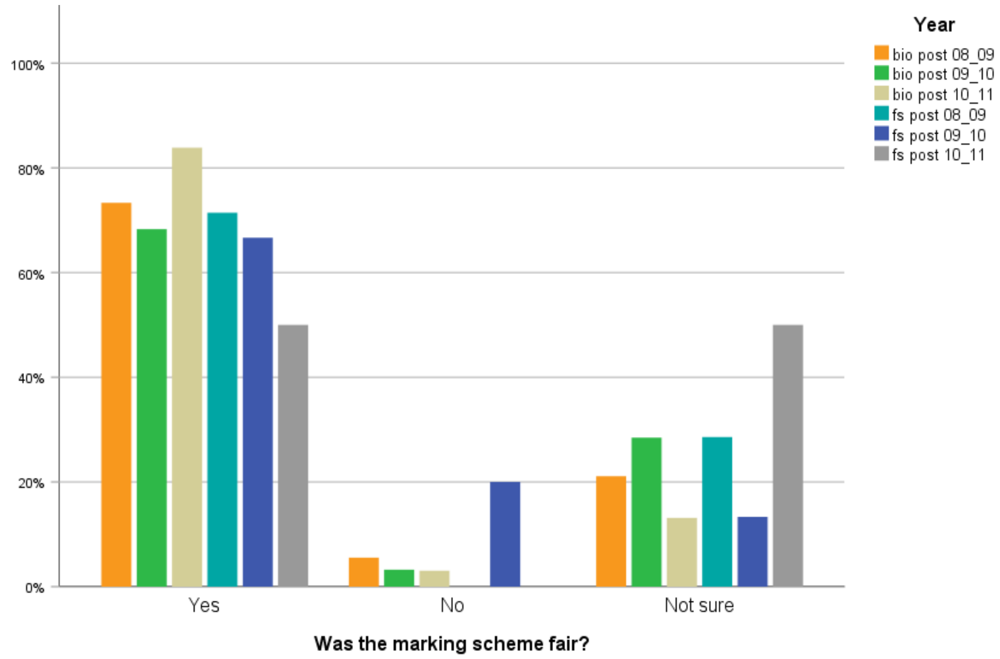


*Figure 20 Bioscience and forensic science students' views of whether the marking scheme was fair*

### 5.5.3 Student engagement with peer assessment

After the OPLA activity students were asked about their attitudes to peer assessment and whether peers should assess each other. In 08/09 bioscience and forensics science students were asked several questions about whether they felt peer assessment was appropriate and if they were comfortable with marking their peers. Figure 21 shows that the majority of students felt that peer assessment was appropriate and that they felt comfortable marking their peers. The majority of bioscience students however, felt that peer assessment was not a fair way to allocate marks which was in contrast to the forensic science students who did feel peer assessment was a fair way to allocate marks.

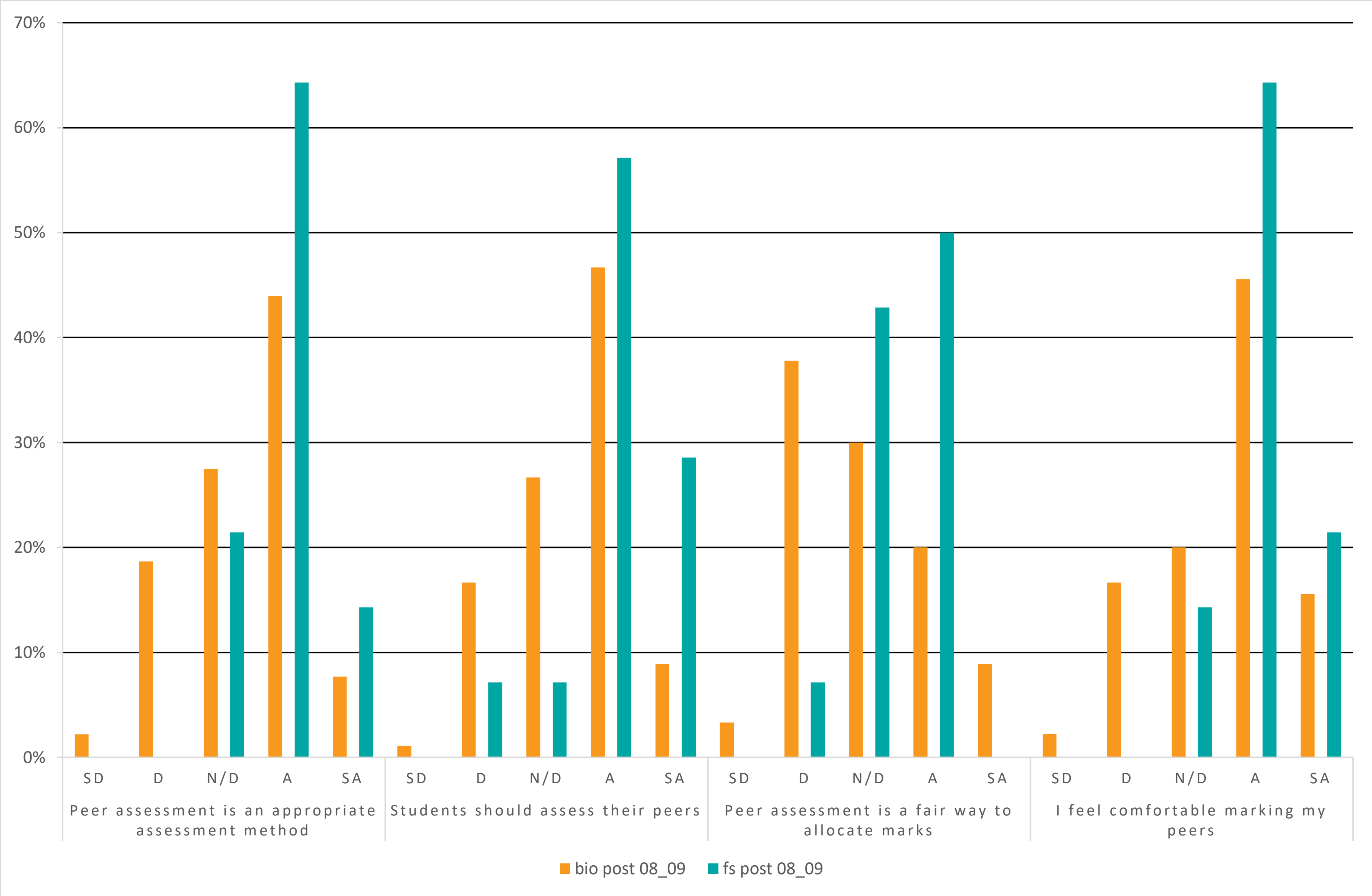


*Figure 21 Bioscience students' post-survey views about peer assessment in 08/09*

In 09/10 and 10/11students were asked a slightly different set of questions about peer assessment to complement questions being asked by a collaborative partner in another institution. Students were still asked if students should assess their peers and the majority of bioscience students agreed (Figure 22). They gave mixed response when asked if they felt students could peer assess each other in a reliable and consistent way. Students still felt comfortable assessing their peers and they felt they made a fair and responsible assessment of their peers.

When forensic science students were asked the same questions in 09/10 and 10/11 the majority also agreed that students should assess their peers and that they felt comfortable doing so (Figure 22). The results were slightly more mixed when asked if students would understand how to peer assess each other in a reliable and consistent way but the majority did feel that they assessed their peers in a fair and responsible way.

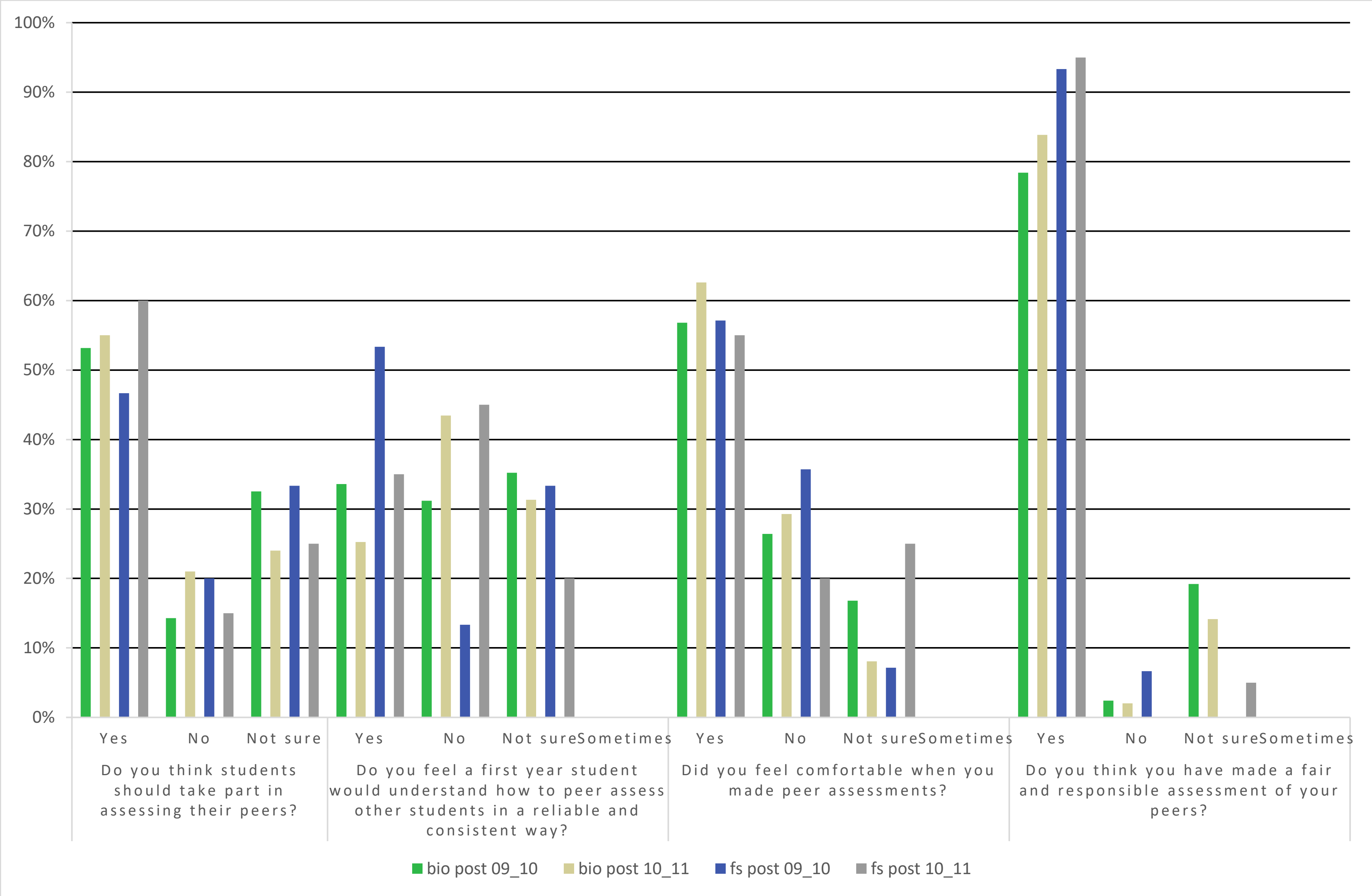


*Figure 22 Bioscience students' post-survey attitudes to making their peers 09/10 to 10/11*

The majority of bioscience students did feel that the peer marking did give an accurate reflection of group members' input to the work and felt under some pressure during the peer assessment. This pressure came mostly from getting the work completed rather than any other influences (Figure 23).

The majority of forensic science students also felt that the peer marking gave an accurate reflection of their group members' input to the work but felt under less pressure from the experience than bioscience students. This pressure came from getting the work completed or the whole experience (Figure 23).

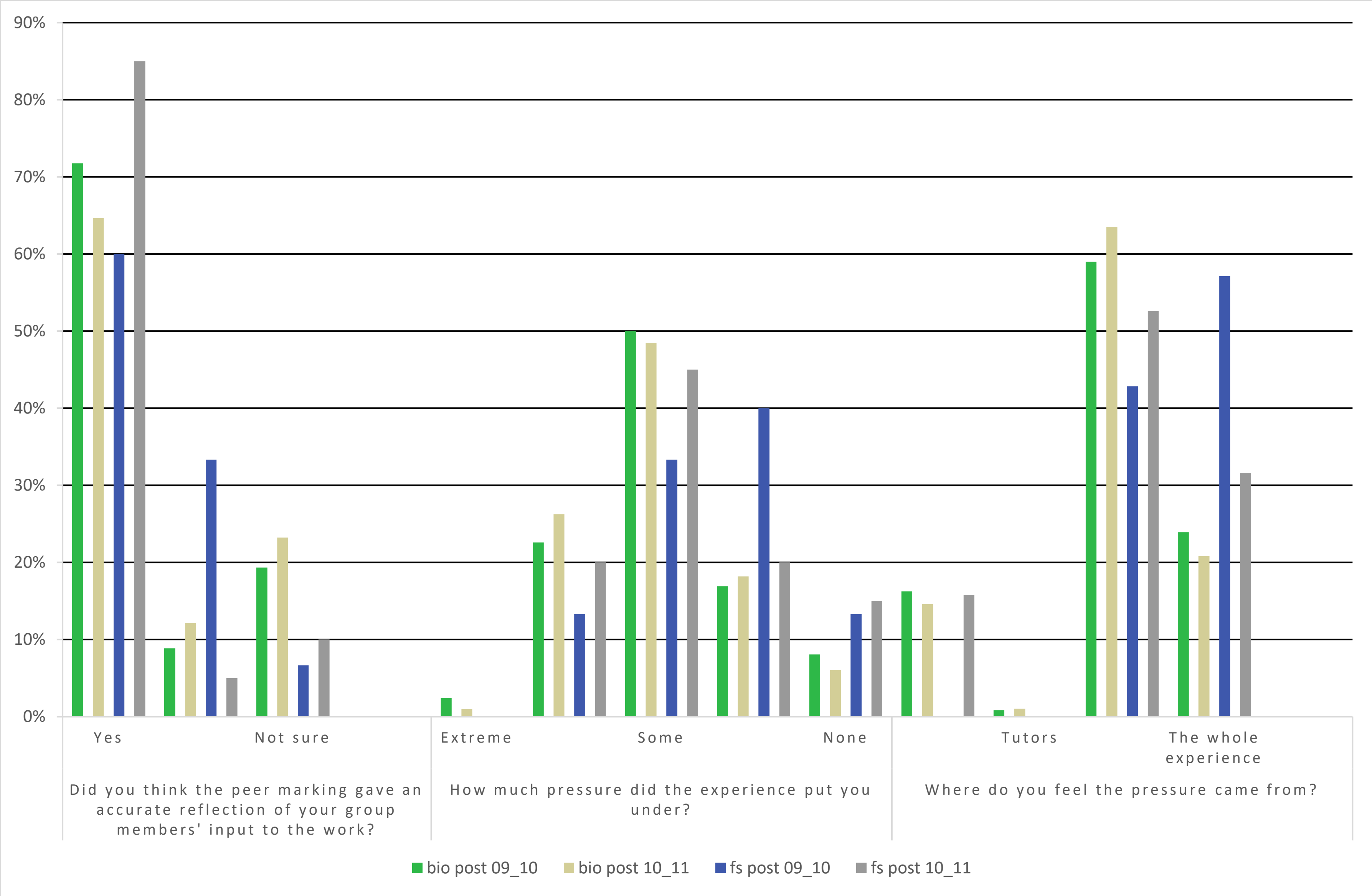


*Figure 23 Bioscience students' views about influences on peer assessment 09/10 to 10/11*

The majority of bioscience students reported that relationships did not influence the scores they gave in the assessment ($p<.05$) and there was a mixed response as to whether there was any pressure or conflict during the assignment (Figure 24). The majority of bioscience students ($p<.05$) also agreed that the self and peer assessment increased their motivation to carry out the group work task. This was a significant finding and is discussed further in section 5.11.4.

The majority of forensic science students disagreed or strongly disagreed that relationships influenced the scores they gave in the assessment but gave mixed views on whether there was any pressure or conflict amongst team members during the assignment. However, the majority of forensic science students ($p<.05$) reported that self and peer assessment increased their motivation to carry out the group work task (Figure 24).

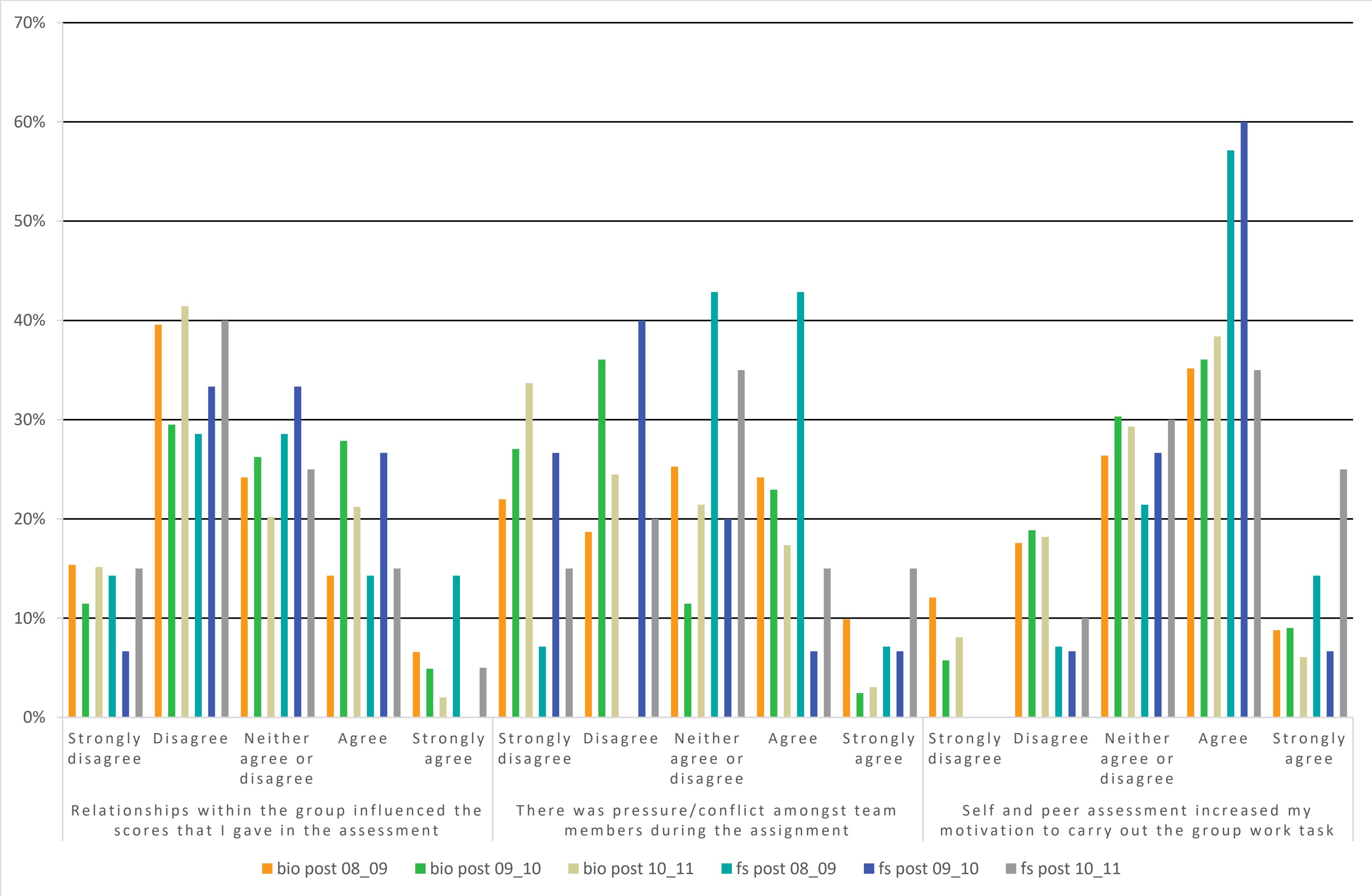


*Figure 24 Bioscience students' views on the influence of group interactions on peer assessment 08/09 to 10/11*

A narrow majority of bioscience students said that they would not use self or peer assessment in other modules, with the rest being unsure or willing to undertake self and peer assessment in other modules (Figure 25). In contrast the forensic science students across the years reported being more willing to undertake self and peer assessment in other modules on their course (Figure 25).

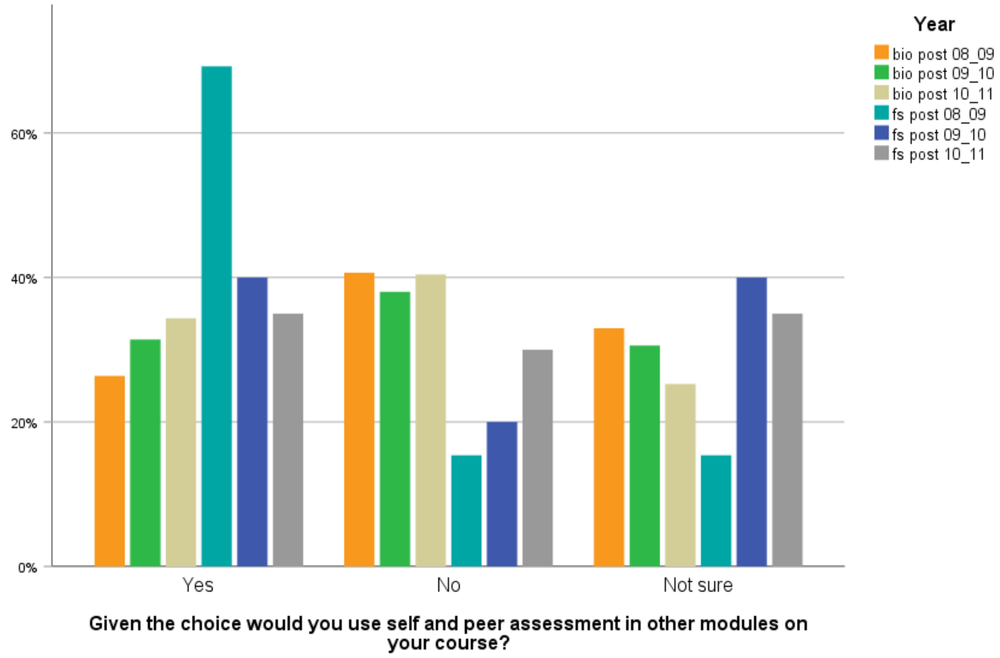


*Figure 25 Bioscience and forensic science students' views on retaking self and peer assessment*

## 5.6 STUDENT POST-STUDY REFLECTIONS ON PEER ASSESSMENT

In 08/09 students were specifically asked for general comments about what they liked about peer assessment, what they disliked about peer assessment and if they would make any changes to the peer assessment process. The number of survey responses for each cohort are shown in Table 20.

*Table 20 Number of post-survey respondents in 08/09*

| Subject/survey year | Number of survey responses |
|---|---|
| Bioscience post 08_09 | 91 |
| Forensic science post 08_09 | 14 |

### 5.6.1 Positive views of peer assessment

The main theme to arise for the bioscience students was that they felt it allowed fair marking. Other themes also emerged and sample comments are shown in Table 21.

*Table 21 Bioscience students' comments about liking peer assessment*

| **Themes around liking peer assessment** | **No. of responses for each theme** | **Response [survey year]** |
|---|---|---|
| Fair marking | 26 | *"those people in the group who did very little get the mark they deserve." [bio 08/09]*<br><br>*"It encouraged me to analyse the work ok other people in a fair and honest way" [bio 08/09]*<br><br>*"It is a better way of judging because sometimes all the hard work does not reflect through a group work but it is nice to be recognised for the individua efforts put together to make the final project." [bio 08/09]*<br><br>*"having a say in the marks" [bio 08/09]* |
| Anonymous marking | 9 | *"It gave me an opportunity to express how i felt other members of my group wokred in an annonymous way." [bio 08/09]*<br><br>*"Being able to tell your true thoughts about the members of our group, n them not really knowing what you have put." [bio 08/09]*<br><br>*"The making process is anonymous therefore do not feel inhibited in giving appropriate marks." [bio 08/09]* |
| Like peer assessment | 9 | *"I liked the idea of self-assessment" [bio 08/09]*<br><br>*"it was easy" [bio 08/09]*<br><br>*"its a good way of seeing what people in your own situation think of" [bio 08/09]* |

| Themes around liking peer assessment | No. of responses for each theme | Response [survey year] |
|---|---|---|
| Appropriate marking scheme | 3 | *"It was a clear and understandable grading system." [bio 08/09]*<br><br>*"It wasnt just a single mark out of 50, it was divided up into sepcific areas to give marks out of 10 so you can decide more easily what marks people deserve." [bio 08/09]*<br><br>*"Easy set out questions" [bio 08/09]* |
| Reflect on performance | 3 | *"Makes you think about your input." [bio 08/09]*<br><br>*"You get to see what other people in your own group think of your work." [bio 08/09]* |
| Tutor aware of contributions | 3 | *"gives the lecturer a chance to find out who didnt do as much or weren't as involved in the over all presentation." [bio 08/09]*<br><br>*"I liked being able to rate the performance of my peers and give feedback as to how individuals performed. It makes sure that the person assessing the final product is aware of how much effort was put in by different people." [bio 08/09]"* |
| Improved the group work | 3 | *"It made the group work better because we were all aware we were assessing each other" [bio 08/09]*<br><br>*"It allows each person to honestly rate others for the amount of effort they put in. Encourages all students to contribute becuase they know they will be peer assessed." [bio 08/09]* |
| Skills development | 3 | *"Its hard to enjoy the process of peer assessment, its a very subjective method of assessing work. I wouldn't say I was completely comfortable doing it but its an experience all the same and is used within the work force so its worth bringing it to our attention as an alternative method of assessment." [bio 08/09]*<br><br>*"Peer assesment was useful for gaining transferable skills." [bio 08/09]* |

All the comments received from forensic science students were about the peer assessment allowing fair marking and sample comments are shown in Table 22.

*Table 22 Forensic science students' comments about liking peer assessment*

| **Themes around liking peer assessment** | **No. of responses for theme** | **Response [survey year]** |
|---|---|---|
| Fair marking | 5 | *"you got to reward the group members who deserved it, and punish those that didn't" [FS 08/09]*<br>*"Giving the others exectly what they deserved based on what they did." [FS 08/09]*<br>*"It gave you the chance to reward people who worked harder." [FS 08/09]* |

### 5.6.2 Concerns of peer assessment

The most common concern to arise was that of unfair marking or not being clear about the marking process. Several other themes also emerged and sample comments are shown in Table 23.

*Table 23 Bioscience science students' comments about disliking peer assessment*

| **Themes around not liking peer assessment** | **No. of responses for theme** | **Response [survey year]** |
|---|---|---|
| Unfair marking | 18 | *"some people would not of been honest" [bio 08/09]*<br>*"It could be affected by people's personal feelings, ie the results could be biased." [bio 08/09]*<br>*"some people were biased against group members, or givng every group member the same mark and not putting thought into it" [bio 08/09]* |
| Unclear marking process | 12 | *"lack of qualitative information to submit" [bio 08/09]*<br>*"With the questions asked, could not give true answers.[ bio 08/09]*<br>*"i found it quite hard to know what marks to give" [bio 08/09]* |

| Themes around not liking peer assessment | No. of responses for theme | Response [survey year] |
|---|---|---|
| Nothing to dislike | 10 | *"I can't think of anything. [to dislike about peer assessment]" [bio 08/09]*<br>*"nothing" [bio 08/09]* |
| Anxiety/ marking pressure | 8 | *"It kind of put you in a akward positon. Whether to tell the truth or not." [bio 08/09]*<br>*"Despite liking the ability to mark people on their efforts, its hard to be as critical as i would like in case of hurting someones feelings!" [bio 08/09]* |
| Had to self assess | 8 | *"I found it difficult to assess myself when compared to others. It is like asking how good are you at something. I don't think that anyone will want to say that they are brilliant." [bio 08/09]*<br>*"i didn't like having to mark my own work" [bio 08/09]* |
| Not tutor marked | 4 | *"slightly pointless, i take more weigh from the examiners comments" [bio 08/09]*<br>*"I don't feel it is a good refelection on each student, as only the teacher has had experience in the work and knows how to mark it." [bio 08/09]* |

Only five comments were made by forensic science students relating to concerns with the peer assessment process and examples of the comments are shown in Table 24.

*Table 24 Forensic science students' comments about disliking peer assessment*

| Themes around not liking peer assessment | No. of responses for theme | Response [survey year] |
|---|---|---|
| Unfair marking | 4 | *"even though from the peer assessment you can see group members who put little or no effort in, they still get all the marks earned by the group assignment which is worth more. i feel that they dont really deserve these marks and it isnt fair on the group members who put a lot of effort in" [FS 08/09]*<br>*"No room for comment to explain how we feel. The bias in the marks is unfiar - If we give someone a zero because* |

| Themes around not liking peer assessment | No. of responses for theme | Response [survey year] |
|---|---|---|
| | | *they actually did no work then this might count against us becasue it looks like we are biased, even though it's the truth." [FS 08/09]* |
| Unclear marking process | 1 | *"Not sure if everyone completed or understood it" [FS 08/09]* |

### 5.6.3 Recommended changes for peer assessment

When asked if they would change anything about the peer assessment process, most comments said they would not change the process (Table 25). The other main theme to emerge was a request to be able to add open comments to justify the marks they had given. In 08/09 the WebPA software did not allow for open text comments but this was resolved the following year.

*Table 25 Bioscience students' comments about changing the peer assessment process*

| Themes around changing peer assessment | No. of responses for theme | Response [survey year] |
|---|---|---|
| No | 30 | *"I wouldn't change the system" [bio 08/09]*<br>*"no" [bio 08/09]*<br>*"No, I would not." [bio 08/09]* |
| Written comments | 5 | *"add more open ended quetions" [bio 08/09]*<br>*"Not really. May be a section where you could actually make comment on the other group members participation." [bio 08/09]* |
| General comments | 4 | *"It would be helpful if each individuals piece of work was uploaded aswell as the final finished piece, this would mean that it would be easy to determine who had put the effort in with the work." [bio 08/09]*<br>*"I don't think you should be able to give a mark for yourself because everyone will think they worked as well as they could" [bio 08/09]* |

Only three comments were received from forensic science students about changing the peer assessment process and are shown in Table 26.

*Table 26 Forensic science students' comments about changing the peer assessment process*

| Themes around changing peer assessment | No. of responses for theme | Response [survey year] |
|---|---|---|
| Written comments | 2 | *"Perhaps the oppertunity to write comments on the other memebers of the group, allowing us to provide justifications for low or high marks." [FS 08/09]*<br>*"Make it so you can add any comments or justifications underneath each section." [FS 08/09]* |
| General comments | 1 | *"An extra box for "contributed nothing" that doesn't count against you as biased." [FS 08/09]* |

## 5.7 Bioscience group interview sessions

In 09/10 and 10/11 academic years, two interview sessions were organised for bioscience students. In 09/10 bioscience students were invited to a liquid café interview and in 10/11 bioscience students were invited to a focus group interview. The following sections now discuss the results from each interview.

### 5.7.1 Bioscience liquid café interview

In January 2010 a liquid café interview was hosted for bioscience students; which was attended by nine students. The interview took place after completion of the OPLA activity but before the students received their assignment marks. The questions asked are listed in Appendix E. Student comments were written on table top covers and transcribed. Part of the student responses directly relating to peer assessment are now discussed.

When asked if they felt they had been adequately briefed about how to peer assess their fellow group members there was a mixture of responses. Some comments claimed they were adequately briefed and others felt they were not:

> *"At the beginning of the group work I did not know to much about peer assessment, that is in the area of doing it. But, I did know what peer assessment was. When we had started the group work, a lot of information was sent via email explaining the importance of peer assessment, and towards the last two weeks emails were sent explaining how to do the peer assessment- these were very helpful."*

> *"Paul set out the requirements right from the offset. Not much needed to be said about how to use the service."*

> *"Peer assessment briefing was adequate, there was not much said on it but its not rocket science."*

> *"it might have been assumed that everyone was familiar with peer assessment because the brief was minimal."*

> *"I conclude that the briefing on how to carry out the peer assessment was not entirely adequate. Although it was emphasised that it would be anonymous, it was not clear how the marks would be allocated or calculated for that matter. The issue of strategic marking was not covered, had it been covered it is possible that less time would have been spent on emails regarding this issue."*

The other question asked relating to peer assessment was whether they felt peer assessment would produce a mark which they felt was fair. Most comments stated that they did feel it would produce a fair mark but some comments suggested they weren't sure:

*"Yes. Students are often critical about work when marking. However there can be a consensus to support each other. This can increase the mean value of the marks."*

*"Yes. That we know which member of the group has work on the project. It help to mark the students fairly."*

*"Yes, I feel that due to me working well in my contribution to the PowerPoint this will reflect in my marks in the peer assessment."*

*"in my point of view its really fair. But sometimes may lead to unfair as well."*

*"I am of the opinion that, while the peer assessment preserves anonymity, some of the marks may not be fair, or reflect to what extent how hard an individual worked, if there was very little contact within the group, one person may have done a considerably large amount of work than other individuals, yet the other members are not aware of this fact. This could result in a mark that is not fair".*

The comments received from this liquid café interview suggested that there was a mix of opinion over whether the students were adequately briefed about the peer assessment at the start of the OPLA activity. Respondents also felt that the peer assessment process allowed them to give an appropriate mark for their contribution but there was some concern there could be marking bias. The majority of respondents did feel that the peer assessment process would produce a mark that was fair.

### 5.7.2 Bioscience focus group interview

The same questions from the liquid café interview were asked again in a student focus group for bioscience students in 2010/11. The 30 minute interview was conducted by the researcher and audio recorded. When asked the question about whether the students felt they had been briefed adequately about the peer assessment process one student felt the process was unfair because they might be penalised for non-contributing members bringing the peer marks down:

> *"trying to organise meetings for my group, I have no authority when I ask for someone to come so if they don't come, it shouldn't ride on everyone else's back too"*

Group members were not penalised for a lack of contribution of others as long as they had demonstrated they had tried to include everyone, and this information was provided in the briefing at the start of the OPLA activity. This feedback however, suggested that the students were not aware of this in the briefing. Another student commented:

> *"I didn't really know how to [peer assess]…to see how you worked as a group…because me and my group, we met quite a few times but there were one girl who didn't come all the time so I didn't know how to assess people properly"*

The conversation carried on to discuss how they could assess someone who hadn't contributed:

> *"[student 1] that's the trouble I had as well because we had one who didn't turn up for any of the meetings but the rest of us worked really well as a group and you didn't want to downgrade because one person didn't make the effort. I think that one was a bit ill defined. [student 2] "Yeah, like I didn't want to be mean… I didn't want to be horrible 'cos she didn't turn up" [student 1] "I think we understood how to do it before, your emotions kick in when you're trying to do it"*

One student felt unsure whether their peer assessment marks would remain anonymous as they felt they'd been quite harsh on one students and wasn't sure if the marks would be made public.

> *"We used it a lot and by... the deadline you could see who had used it and who posted because we had one person who posted once to say they were coming to meetings and didn't and there was nothing else from him at all and I think the amount of posts on the forum reflect how much work that person's put in"*

Students were asked if they felt they had the opportunity to give a fair mark for their fellow group members and one commented:

> *"I think we had the opportunity its just thinking, because there was someone we never met, we don't know anything he did and we only heard from him on the Sunday night so (was thinking) how is he going to peer assess us, he might just peer assess us down because he doesn't know who any of us are, he's never been to any meetings, he doesn't know what the rest of us did. So I don't know quite know how people who don't get properly involved are supposed to do that fairly, because whatever he's done he's just guessed."*

Students also commented that being able to provide text feedback was beneficial rather than just giving a mark as they could explain reasons for marking and add any additional comments about other group members to inform the tutor what happened. The consensus amongst those present was that written feedback was appreciated and one even commented that they provided the text feedback first and this helped them consider what marks to give, rather than the other way around.

The discussion moved onto the marking scheme and how some felt it was unfair if they had put a lot of effort in whilst others hadn't yet could still conceivably get a share of the marks. This was an implicit reference to the issue of freeloaders which was also echoed later in the discussion when non-contributing members of a group were labelled as lazy. There was also mention of peer pressure over the marking and one student said:

> *"there was one point where someone had missed a meeting and she sent an email to us all saying why don't we just give each other 8s and 9s and I sent it back, like 'no'. So I probably got marked low because I didn't agree to give them high marks."*

Other students also commented that marking might have been biased if group members didn't know each other or if there had been interpersonal conflicts, for example, one student felt awkward because she had to confront someone in class for not communicating with the rest of the group.

When asked if they would be willing to engage in group work again the students said they would be willing to if they could choose their groups. The biggest issue they had with the current group work activity was other members not contributing. They felt that they couldn't force other group members to contribute (no authority to engage other members) so if this issue could be resolved the group work would be much better. One student suggested compulsory meetings where all group members had to attend.

## 5.8 FORENSIC SCIENCE CASE STUDY ON PEER MARKING

In the forensic science cohort for the 2010/11 year there was conflict amongst one group which surfaced at the time of assignment submission. This section provides a case study about this group, which provided additional information about the issue of fair marking by students. The original group consisted of three students but very early on an additional student (student 4) was added to the group for logistical reasons. At first student 1 in the group objected quite vociferously to student 4 joining the group but the next day apologised and accepted the change. Student 2 in the group also emailed the tutor commenting on student 1's reaction:

> *"Hello Paul,*
>
> *Its XXX from group forensic science workshop. Its just to say i have no problem with XXX joining us and i know the other two members dont have an issue either, [student 1] over reacted. But we will definitely welcome her back sorry about the inconvenience XXX."*

After this the group appeared to work well and the group's discussion board records showed they worked online quite collaboratively, posting 58 messages between them, with equal postings (20) from both student 1 and student 4. Additional evidence was available to observe how this group collaborated together as this was the same year the face-to-face workshop was video recorded. Although the recording was such that it was not possible to view the interactions of each group member for the full duration of the workshop, the available footage showed that the students did work collaboratively together. Figure 55 shows a screenshot of the students working collaboratively but the video doesn't capture the presence of student 2 at the time the screenshot was taken.


*Figure 26 Screenshot of students in forensic science workshop*

However, just before the assignment was submitted students 1 and 4 had a major disagreement due to last minute changes to the work by student 1 and not informing student 4, which student 4 felt upset about. This resulted in a confrontation between the two via a phone call, at which point it was brought to the tutor's attention. After the tutor intervention to attempt to resolve the matter the group still had to peer assess each other so the tutor observed the assessment for signs of potential biased marking due to the conflict.

Reviewing the individual marks for the five peer assessment questions within WebPA, both student 1 and student 4 marked each other similarly and comparable to how they marked other group members. Indeed, when asked to assess each other against 'overall contribution to the assignment' both students marked each other exactly the same.

Student 2 also emailed the tutor prior to submitting the peer assessment marks:

> *"hi paul,*
>
> *i have read your e-mail [about resolving the disagreement] and taken everything that was said into account and these disagreements between the group members at the later stage into the report will not be taken in to account when i'm doing the peer review because the team worked really well up until this point.*
>
> *Many Thanks*
>
> *[Name omitted]"*

In addition to the correspondence generated from this group's disagreement, it was possible to gain a further insight into their collaborations by considering their online discussions, observation of the workshop interactions and peer assessment marks in

WebPA. All these observations showed that despite the conflict, they still appear to have peer assessed each other fairly based on observed contributions to the assignment.

This case study outlines a significant group conflict that could have influenced how group members peer assessed each other because of the members' disagreement with each other. Due to the format of the OPLA activity it was possible to develop an understanding of how this group worked by considering their online discussions, observation of the workshop interactions and peer assessment marks in WebPA, as well as emails and direct discussions with the group. All these observations showed that despite the conflict between the group members, they still appear to have peer assessed each other fairly based on observed contributions to the assignment.

## 5.9 PEER ASSESSMENT MARKING INTERVIEWS

Groups of students were asked for their permission to share peer assessment marks in order to gauge their reactions as to how each member had peer assessed each other. For a variety of logistical reasons and lack of student response, not many students were able to be interviewed, except for two full forensic science groups in 2011/12. Each student had to agree to share their marks and was required to sign an agreement form before marks could be shared (Appendix D).

For the two forensic science groups (called group A and B), each student was interviewed separately and asked a series of semi-structured questions.

**Group A**

Table 27 shows the peer assessment marks for members of group A, including their final assignment mark and Table 28 shows the number of messages each group member posted on their discussion board.

*Table 27 Forensic science peer assessment marks for Group A*

| Name | Group | WebPA score | Peer assessment mark | Group mark | Personal report | Final mark |
|---|---|---|---|---|---|---|
| Student 1 | A | 1.00 | 56.96% | 34 | 15 | 53 |
| Student 2 | A | 1.00 | 57.08% | 34 | 17 | 55 |
| Student 3 | A | 1.00 | 56.96% | 34 | 25 | 63 |

*Table 28 Forensic science discussion board postings for Group A*

| Name | Group | Number of discussion board messages |
|---|---|---|
| Student 1 | A | 9 |
| Student 2 | A | 13 |
| Student 3 | A | 10 |

When students submitted their peer assessment marks via WebPA, the marks were moderated according to how students marked other group members and how they are marked by their fellow group members. The WebPA score they received was based on how they marked others (subjectively referred to as 'marking fairly') and how others marked them (receiving a 'fair' mark). A score of 1 was the balance a student can receive in their moderation between marking others appropriately for their efforts (marking fairly) and receiving an appropriate (fair) mark from their fellow students. The actual WebPA algorithm for deriving the peer assessment score is detailed in section 3.8.4.

In the case of Group A, this resulted in all three group members scoring the same mark and this resulted in each being given the same mark for the group report which was marked by the tutor. That is, the tutor marks the group report (the product) which scored

34 in this example, and the student's individual mark is their WebPA mark multiplied by the group mark e.g. 1 x 34.

When each student was interviewed, they were asked about how they worked in their group and what they felt about their group marks. They were asked how they communicated via the VLE and each said they checked it regularly but that they used other communication routes too (text and phone calls). Student 3 said:

> *'eBridge helped a lot- don't think it would have worked otherwise'*

whilst student 1 said

> *'good for asking questions – often online'*

and student 2 commented

> *'good for sharing documents and collaborating online – file sharing'.*

When asked if the level of communication was an indicator of contribution to the group work student 2 said it was, with an even contribution. Student 1 said

> *'No, all used eBridge equally but also other routes too'*

and student 3 said

> *'Everyone wrote on everything. Everyone tried hard'.*

When asked about their peer assessment marks student 3 commented that they felt they might have been marked down because they missed early meetings due to personal reasons but was relieved their mark wasn't affected by this. This was the only student concern about the process and the other two students were not concerned about how they would be marked. Student 1 commented:

> *'Its accurate – would have liked a better mark [for the group report] but in terms of peer assessment it seems fair'.*

All three students agreed that the peer assessment process was a good way of contributing marks and would be willing to peer assess for other assignments. Indeed, student 1 commented that it should be used for every group assignment.

Each student was asked about their views on marks and ranking for the process and two (student 1 and 2) were not concerned about their rank as they considered the mark more important. Student 3 was interested in the rank because they said they were competitive and even if they got a good mark they'd be disappointed with a low rank.

When the students were given the marks they all felt they reflected how each other had contributed to the group activity. As Table 27 shows, they all ended up with the same peer assessment mark. Student 1 and 2 commented that they thought student 3 might have been marked down slightly for missing early meetings but were not concerned overall. Indeed, despite these comments, neither student actually did penalise student 3 for missing the early meetings. Similarly, student 1 thought they might be marked down since student 2 and 3 had identified themselves as being friends and thought there might be some bias. Once they saw their marks however, student 1 was pleased they had been marked fairly by the other two.

Overall, each group member was satisfied with the peer assessment process and felt that it was fair. Only student 1 was concerned about ranking since they said they were competitive. Student 1 disclosed that

> *'student 2 and 3 were friends but felt they were fair'*

and student 3 commented that

> *'I thought student 1 might have marked me down [because of my absence]'.*

It is clear therefore from the interviews that the group worked well together and felt the peer assessment process was fair. Despite concerns about how they might mark each other, all members actually did mark each other consistently in a way which each member agreed was 'fair'.

**Group B**

Table 29 shows the peer assessment marks for group B based on the tutor mark for the group report and the WebPA peer assessment marks submitted by each member of group B. Table 30 shows the number of messages each group member posted on their discussion board.

*Table 29 Forensic science peer assessment marks for Group B*

| Name | Group | WebPA score | Peer assessment mark | Group mark | Personal report | Final mark |
|---|---|---|---|---|---|---|
| Student 4 | B | 0.88 | 38.56% | 23 | 13 | 42 |
| Student 5 | B | 1.13 | 41.52% | 25 | 18 | 49 |
| Student 6 | B | 0.99 | 39.92% | 24 | 16 | 46 |

*Table 30 Forensic science discussion board postings for Group B*

| Name | Group | Number of discussion board messages |
|---|---|---|
| Student 4 | B | 11 |
| Student 5 | B | 11 |
| Student 6 | B | 7 |

When asked for their views on the use of the VLE for their group work, each member reported being satisfied with the VLE as a communication tool and all reported using it regularly. They used text messages to communicate as well and whilst student 4 and 5 felt the level of messages on the VLE reflected the level of input, student 6 didn't think so.

Each student was asked to comment on the mark they got for the assignment – their overall mark and their peer assessment mark. Student 4 was concerned if the peer assessment mark had affected their mark

> *'I worked hard on this report, not happy if it is peer assessment'.*

Student 5 seemed satisfied

> *'I put more work in than the others – there were language barriers. More effort to proofread work, had to do a lot of re-writing. (Overall) Mark reflects the group effort]'.*

Student 6 was disappointed

> *'Doesn't really help, disappointed a bit. Felt I might have got a higher peer assessment mark'.*

When asked about ranking all three were more concerned about their mark, though student 4 commented that they might be

> *'only to know if I'd contributed enough to the group'.*

When the peer assessment marks were shared student 4 felt the marks were reasonable and commented

> *'Seems fair and felt that the group would have marked based on my efforts, they are well placed to judge.'*

Student 5 commented

> *'I put a lot of effort in - I expected it (my mark) based on my effort so feel happy about the mark'*

and student 6 commented

> *'Ok. Reflects the contributions quite well'.*

All three students felt that overall the peer assessment marks truly reflected their efforts.

From the discussions with the group members and the marks awarded, it is clear that all students felt they had worked hard and were concerned their own mark might have been affected by their peer assessment. They were reminded that their overall mark was a combination of marks and the peer assessment was only one component. When informed about each other's peer assessment marks each student felt that they had been marked fairly according to their efforts. So whilst student 6 had originally commented that they were not happy with their overall mark, they were satisfied the peer assessment score reflected their efforts. Also, student 4 commented that

> *'Marks were fair, student 5 worked harder'.*

Feedback from both groups of students showed that they all used the VLE and felt it was beneficial for their work, and used other forms of communication as well. Group A felt they worked well and felt that their equal peer assessment marks reflected the contributions each made to the overall work. Despite some concerns over marking differences each student marked fairly and felt that they had received a fair mark for their work. Group B had different peer assessment scores and were not all satisfied with their marks, initially feeling their overall mark had been affected by the peer assessment mark. Once the marks were shared however, each student felt that the peer assessment marks did reflect the efforts made by each group member. Overall, all students across both groups felt that the peer assessment process enabled them to give each other a mark that truly reflected their efforts.

## 5.10 Discussion

The results in this chapter focussed on student attitudes to peer assessment and triangulation of other data from the study to evaluate the use of peer assessment as a valid form of assessment. The results provided information on various aspects of self and peer assessment and student views about how they felt about the whole process. This included student concerns about freeloading, validity of marking and changes in attitudes before and after the OPLA activity. These themes are now discussed in more detail.

### 5.10.1 Self-assessment

The results showed that most bioscience and forensic science students had undertaken self-assessment prior to the OPLA activity (Figure 10). Bioscience students generally did not like self-assessment but forensic science students were slightly more in favour of it (Figure 10). Both bioscience and forensic science students reported risk of bias as being the main reason for not liking self-assessment, citing risk of over or under-estimating their marks or other students artificially inflating their own marks. This finding concurs with Kirby and Downs (2007), Cassidy (2007), Davies (2006) and Sullivan and Hall (1997).

Sullivan and Hall (1997) reported that students were disappointed with the discrepancy between their own assessment and that of the tutor but one benefit of self-assessment reported was that when the lecturer interviewed students who over-inflated their marks they were able to foster a positive attitude about benefits of self-assessment in relation to their own learning. This study included self-assessment to support students in reflecting on their own learning as well as others, which also helped improve their critical thinking and peer assessment skills. This approach is supported by Reinholz (2016) and Wanner and Palmer (2018), who argued that learning is supported by linking self-assessment with peer assessment. This finding was also reinforced by Hanrahan and Isaacs (2001) who reported learning benefits of self-assessment by students analysing their own work.

For this study, students initially gave mixed views on liking self-assessment (Figure 11), with bioscience students giving mixed views on whether they felt comfortable marking their peers, though forensic science students were slightly more confident (Figure 11). Afterwards students had increased their confidence (Figure 21, 22) and commented that they liked self-assessment (Table 21). Both bioscience students (Table 16) and forensic science students (Table 17) also acknowledged the potential benefits of self-assessment prior to the OPLA activity such as promoting self-reflection and personal motivation and this was confirmed afterwards (Table 21, 22). Students therefore felt self-assessment had improved their confidence to peer assessment and increased self-reflection, which echoes other research findings (Kearney et al., 2016; Seifert & Feliks, 2019b).

### 5.10.2 Peer assessment

The majority of both bioscience and forensic science students had previously undertaken peer assessment and showed mixed results as to whether they liked it or not (Figure 13). Bioscience students gave a mixed view with some liking, not liking or liking peer assessment sometimes. Forensic science students reported liking peer assessment more, with a clear preference for peer assessment. Possible reasons for this difference in attitude are discussed in section 5.11.2 but both cohorts of students agreed that students should assess their peers however (Figure 15).

In the pre-survey comments students discussed key concerns and benefits that peer assessment could provide (Table 18 and 19). The most common concern cited relating to previous experience of peer assessment was marking bias. As with initial views of self-assessment both bioscience and forensic science students felt peer marking could be biased. Another concern highlighted by bioscience but not forensic science students was potential pressure or anxiety the process could cause (Table 18). In terms of benefits in the pre-survey, both bioscience and forensic science students reported liking peer assessment and helped their development, such as promoting critical thinking skills (Table 18 and 19). Since most students had previously undertaken peer assessment it was clear they were aware of the potential benefits and pitfalls of peer assessment.

In relation to several other pre-survey questions about attitudes to peer assessment bioscience students reported mixed views about confidence in being able to peer assess, whereas the forensic science students were more confident that they would be able to peer assess appropriately. Both bioscience and forensic science students had mixed views about how positive they felt about peer assessment. Overall, bioscience and forensic science students had a mixed, and could be argued, cautious view of peer assessment, with no overwhelming views for or against peer assessment.

After the OPLA activity the majority of bioscience and forensic science students all agreed that peer assessment was an appropriate assessment method and that students should assess their peers (Figure 21, 22). These results are similar to those of Gatfield (1999) where students agreed that students should assess peers. The majority of bioscience and forensic science students also said they were satisfied with the peer assessment process and that the marking scheme was easy to understand (Figure 19, 20), similar to findings by McGloughlin and Simpson (2004). Whilst the marking scheme from their study was different to this study, the attitudes are relevant to both studies since they both demonstrated that a pre-planned peer assessment process explained to students can improve satisfaction with the process. This therefore indicated a positive shift in attitude towards the associated peer assessment schemes.

This positive attitude to students assessing their peers had strengthened after the OPLA activity with bioscience and forensic science students agreeing more strongly that students should assess their peers (Figure 21, 22). Although they retained an overall positive attitude to peer assessment (Figure 18), the forensic science students were slightly less positive than beforehand (Figure 14). Part of the reason for this might be explained by the several student comments received, claiming unfair marking such as:

> *"even though from the peer assessment you can see group members who put little or no effort in, they still get all the marks earned by the group assignment which is worth more. i feel that they dont really deserve these marks and it isnt fair on the group members who put a lot of effort in"*

Another possible explanation might be that the forensic science OPLA activity involved a challenging assessment which the students were not familiar with (investigating a real, former murder case). This argument is supported by the results showing that forensic science students (year level 6/7) felt more pressure from the whole assignment experience than bioscience students (year level 4) (Figure 23).

## 5.11 Factors influencing self and peer assessment

There were several factors identified which had an influence on student attitudes to self and peer assessment. Such factors included how students felt peer assessment would reflect other students' contributions to work, motivation, peer influences and perceived maturity or confidence to peer assess. Each of these factors are now discussed.

### 5.11.1 Contributions to group work

In the pre-survey bioscience students had mixed views of whether peer assessment would give an accurate reflection of group members' input to the work, with some students feeling it would not (Figure 15). Forensic science students were more positive generally, being either positive or unsure (Figure 15). After the OPLA activity however, the majority of both bioscience and forensic science students felt the peer marking did give an accurate reflection of group members' input into the work (Figure 23). These results show a clear positive shift in attitudes with all students agreeing that the peer marking gave an accurate reflection of the group members' input into the work. This result raises a further consideration about peers' contributions to group work.

The result of students agreeing that the peer marking gave an accurate reflection of peer contributions was based on student responses prior to them receiving their assessment marks. So despite not knowing what final assessment marks their peers received, students felt their peer marking had accurately reflected their contributions to the work. This means that although final marks were unknown individual students felt they had peer assessed their fellow group members appropriately – based at least on their own perceptions.

This result is supported by additional feedback from the bioscience (Table 21) and forensic science (Table 22) students where the main comments were supportive of peer assessment allowing fair marking. There were other comments voicing concern about unfair marking but these were fewer. This finding provides evidence about student positive perceptions of peer assessment, and further investigation about peer assessment as a valid form of assessment is discussed in section 5.12. Other findings were able to consider the 'fairness' of peer assessment further and are discussed in the next section.

### 5.11.2 Fairness of marking

Initial student views about peer assessment were generally mixed, though forensic science students were somewhat more positive than bioscience students (Figure 14). In 08/09 after undertaking the OPLA activity bioscience and forensic science students were explicitly asked if peer assessment was a fair way to allocate marks (Figure 21). The forensic science students agreed but the bioscience students disagreed. However, the majority of bioscience students in the same year (08/09) agreed that peer assessment was an appropriate assessment method, with forensic science students agreeing even more strongly. So, did this mixed view of peer assessment persist across the other years in this study?

Unfortunately a limitation of this study arose through asking slightly different questions in 09/10 and 10/11. In these years, students were asked about their attitudes to marking their peers (Figure 22). The results did show however that students did feel that students should assess their peers and that they had made a fair and responsible assessment of their peers. So, whilst a direct comparison could not be made across all three years, the results gave an indirect suggestion that even if there were mixed views about peer assessment being fair, there was a feeling peer assessment was an appropriate assessment method.

The results are similar to that of Yu (2011) who reported student satisfaction with peer assessment models and the associated '*fairness*' of being able to give feedback on their peers. The actual peer assessment schemes were not discussed by Yu but students appreciated being able to peer assess a group of students rather than just one person and valued the learning benefits of peer assessment, as shown in this study. This contradicts the findings of McConlogue (2010) however, who reported that students found the peer assessment process unfair. This was because students were presented with a range of peer marks (rather than the final, moderated mark in this study) and felt the process was too subjective. Other research has addressed this by stating that peer assessment marks should be explicit and understood by the students (Kearney, 2013; van Hattum-Janssen et al., 2006).

The clarity of the peer assessment marking was supported in this study with the majority of both bioscience and forensic science students agreeing that the marking scheme was easy to understand and that the marking scheme was fair (Figure 19, 20). Since the marking scheme was known by all students from the start of the OPLA activity, it could be argued that students felt the peer assessment method was fair since it was detailed before the group activity started. However, a minority of students did report that they felt peer assessment was not a fair way to allocate marks.

There could be several reasons why the bioscience students in 08/09 felt that peer assessment was not a fair way to allocate marks. Firstly, being first year students, they might have had different expectations about the mark they felt they should have received in relation to just receiving a mark from the tutor. This possibility was reported by McConlogue (2010) where the students felt the tutor mark would have been a better indicator of the 'correct' mark, as opposed to the mark received from peers. This perception of difference of tutor versus peer mark was is widely reported (Boud et al., 2013; Falchikov & Goldfinch, 2000; Lejk & Wyvill, 1996; Ozogul & Sullivan, 2009).

Secondly, Orr (2010) found that even within groups there may be differing views of what constitutes a 'fair' mark and this result may have been the views of this particular set of students in one year. Thirdly, even though the bioscience students in 08/09 felt peer assessment was not a fair way to allocate marks, they still agreed that the peer assessment marking scheme was fair. Plastow et al. (2010) found in that there was no significant difference between group and personal academic achievement i.e. peer assessment did not detract from an individual's mark, based on individual academic performance, but offered links to non-academic skills attainment. In this study, students completed the questionnaire before knowing their mark so whether their view changed as a result of knowing their mark, was investigated in section 5.9.

The results in this study have shown that fairness of marking may be perceived in different ways by students for different reasons. Both bioscience and forensic science students were clear that they felt the peer assessment marking scheme was fair so the separation of views on fairness could be due to the other factors discussed such as maturity, experience or whether the assessment was high stakes or not. Bioscience students also felt peer assessment did give an accurate reflection of group members' input to the work and in open comments bioscience students commented that the peer assessment allowed for fair marking. So it could be that some students simply need more experience of peer assessment to appreciate the potential benefits is has to offer.

### 5.11.3 Peer influences

Bioscience and forensic science students both reported that relationships within the group had no major influence on the peer marking. Bioscience students also reported a lack of conflict amongst team members during the assignment. There was no direct reference to the reasons for these views in open text comments but the forensic science case study discussed in section 5.9 demonstrated one example of how open group conflict can arise. Forensic science students also had to undertake a high stakes assignment (one which carries significant marks towards their degree), which might have added pressure to the group activity. Isolated examples of conflict aside, or high/low stakes assessment, students did not appear to be influenced much by their peers.

The majority of bioscience and forensic science students reported being only under some or low pressure when peer assessing each other. The bioscience students reported that this pressure mostly came from getting the work completed whereas forensic science students were split between getting the work completed and the whole group work experience. This concurs with the findings from Pope (2005) and Jung et al. (2012), who reported increased levels of stress when undertaking self and peer assessment. However, Pope also found a correlation between stress and improved performance, concluding that this stress helped improve student performance.

### 5.11.4 Motivation

Students were asked after the OPLA activity if self and peer assessment increased their motivation to carry out the group task. The major response from the bioscience and forensic science students was that self and peer assessment did motivate them to carry out the group task. The results in this study support that of Pope (2005) and Eastburg (2013). The forensic science students agreed more strongly that the self and peer assessment had increased their motivation to carry out the group task. It could be argued that the difference in strength of opinion between bioscience and forensic science students was down to the respective low versus high stakes assessment being more of a motivation for self and peer assessment.

Students can sometimes be reluctant to assess their peers (Falchikov, 1995) which can make them feel uncomfortable. Prior to the OPLA activity bioscience students gave mixed views about whether they would feel comfortable making peer assessments, although the majority of forensic science students did think they would feel comfortable beforehand. The majority of all students felt comfortable when assessing their peers afterwards. These findings are counter to those of Hanrahan and Isaacs (2001) who reported students feeling uncomfortable after marking their peers. These results show that there was an increase in student confidence in their ability to peer assess, though there were still some reservations about other students being able to reliably peer assess.

Motivation as a driving factor for promoting student engagement is discussed in section 4.8.3 and peer assessment is one theme that can drive motivation – either intrinsically or extrinsically (Law et al., 2019; Money & Dean, 2019). Sullivan and Watson (2015) argued that peer assessment disengages students if done badly but can engage and motivate students if done correctly. Hearn et al. (2017) investigated face-to-face and online peer assessment and whether face-to-face social influence may motivate students in different ways. They found that students were more likely to differentiate performance online than face-to-face.

Based on the results (Table 21), students reported that the online anonymous marking gave them the opportunity to mark in more open way, presumably without fear of conflict with their fellow group members. This would chime with the findings of Hearn et al. (2017) who argued that face-to-face peer assessment could be socially influenced by peers. This was also reported by Rotsaert et al. (2018a) but who also argued that non-anonymous peer assessment can also be positive. Additional results in this study supported anonymity as students reported that they felt comfortable assessing their peers (Figure 21) and relationships did not influence their peer assessment scoring (Figure 24). Overall therefore, the results showed that even though intrinsic motivation is a better driver for student engagement, online peer assessment as an extrinsic motivator, was effective.

### 5.11.5 Trust

After undertaking peer assessment for the OPLA activity, the majority of both bioscience and forensic science students felt they could assess other students consistently and reliably. This contrasted with mixed views beforehand about whether other students could peer asses reliably. However, students still had mixed views about whether other students could peer assess reliably. This showed that students had developed more confidence in themselves to mark other students reliably, but still appeared to have less confidence in other students marking them reliably. This potential lack of confidence, or trust is highlighted in the literature (Naber et al., 2018; Quesada et al., 2019; Wanner & Palmer, 2018), which relates to face-to-face peer assessment. Similar trust issues are also reported in online environments (Kun-Hung & Chin-Chung, 2012; Rotsaert et al., 2018b; Sun et al., 2019).

Students were asked to self-assess as well as peer assess for the OPLA activity, and post-survey comments directly referenced their views. Some comments made afterwards, such as "*I liked the idea of self-assessment*" and "*Makes you think about your input.*" suggested that students appreciated the opportunity and were confident with self-assessment. Students also reported feeling more comfortable making peer assessments (Figure 22). It could be argued therefore that students developed confidence in their capability to peer assess but a lack of trust did not translate into confidence of other students' abilities to reliably peer assess. This trust judgement is highlighted by other literature (Anker-Hansen & Andrée, 2019; Cheng & Tsai, 2012).

This view of self and peer assessment would appear contradictory but not unexpected, given that the students had confidence in assessing others but had less confidence in other students' capability to peer assess, as the results showed. People (students in this case) often base their capabilities on their own level of self-efficacy (see section 4.8.4). This personal confidence/capability would potentially appear in conflict with the findings of Kirby and Downs (2007) who argued that students new to university life (as with the bioscience students) lacked the capability to self-assess, though could develop with support or training; a point also supported by McDonald (2013). Sullivan and Hall (1997) reported similar findings but argued that students can still benefit from the experience regardless of training. So there appears to be a mismatch with student perceptions of their own confidence or capability to self and peer assess, compared with their perceptions of other students' abilities to do likewise.

This result is similar to that of Kingsley (2010) who explored student attitudes to peer assessment and students' ability to mark each other. Kingsley found students had a positive attitude to peer assessment and '*a strong belief in their ability to mark others' work fairly and objectively*' (p11). Kingsley also found a correlation between students who had a positive attitude towards peer marking, were also more certain about their ability to assess others' work accurately.

A recent study (Izgar & Akturk, 2018) compared peer scores with those from the tutor and found that students appeared to be able to judge similar quality work to that of the tutor. However, qualitative results found that students reported bias due to relationships and personal problems, which Izgar reported as students not trusting each other to mark fairly.

In this study, the bioscience views on other students being able to peer assess reliably were still mixed but with more students agreeing that other students could assess more reliably. Forensic science students' views were positive before and after. Given that the literature is mixed over whether online peer assessment resolves trust issues, the use of online anonymous peer assessment in this study mitigated for any issues of trust.

### 5.11.6 Tutor involvement

Although there was deliberately no tutor involvement in the OPLA it is worth mentioning this theme in relation to student trust. There is a wealth of literature on how peer assessment is compared to grades issued by the tutor (Chang et al., 2012; Falchikov & Goldfinch, 2000; Kwan & Leung, 1996; Stefani, 1994) but there is also the association students make, putting more trust in that of the tutor than peer marks (Hew & Cheung, 2008; Naber et al., 2018; Wilson, 2015). Tutor involvement can promote peer engagement but this raises other challenges.

One challenge is the risk that this takes more time to administer (Rada, 1998) or that this can actually displace learner autonomy if the students become reliant on the tutor to encourage online interaction (Kleinsasser & Hong, 2016). In fact, Domingo et al. (2014) found that tutor involvement in peer assessment caused students to mark more centrally on the tutor mark (as if this was the mark of truth?) rather than marking independently and objectively. Although there are noted benefits of tutor involvement in peer learning and assessment, for this study it was a conscious decision to give students autonomy and one reason for this was to save time, though even this decision can be seen as contentious.

### 5.11.7 Saving time

By definition, engaging students in peer assessment has the potential to save tutor time as there would, in principle be less time needed to administer and assess students directly (Chang & Kang, 2016; Schunn et al., 2016). This should not be done however, at the expense of simply passing the assessment and/or administrative burden onto students. This is a valid point made by Opdecam and Everaert (2018) but who also argue that reducing grading time should never be an incentive for introducing group work. The author would disagree with this however, since the use of technology is as a valuable automation tool, as long as academic quality is maintained, which is probably the sentiment of Opdecam and Everaert's point. The author's argument for automation whilst maintaining academic quality is supported by O'Neill et al. (2019) and is a key reason why WebPA was adopted. This helped save valuable administrative time for large cohorts, but the blended learning approach ensured academic goals and student support were maintained.

### 5.11.8 Maturity

There could be a number of reasons for the difference of views between the bioscience and forensic science students about confidence in their ability to peer assess, with one potential factor being student maturity. Houston and Lazenbatt (1996) argued that first year students were '*just not mature enough to take such responsibility for their own learning*' (p259) and Pope (2001) also reported that postgraduate students raised maturity as a reason why peer assessment would not be suitable for undergraduates.

However, other studies (Ćukušić et al., 2014; Davies, 2006; Freeman, 1995; Jin, 2011) have demonstrated that undergraduates are more than capable of engaging effectively with peer assessment. Some indirect evidence from the results in this study was available to explore this notion.

Whilst the bioscience students were all first year undergraduates, the forensic science students were a mix of third year (BSc.), fourth year (MChem) and postgraduate (MSc.) students, but there was still a mix of ages within both disciplines, due to mature students (students aged 21 or over). So personal (age) maturity alone would not account for potential differences in attitude towards peer assessment. However, maturity could be classed as 'experience of studying at university'; in which case the forensic science students were more 'mature' than the bioscience students. So the differences in attitudes may be more to do with experience and confidence rather than maturity or ability.

This hypothesis is supported by Lee (2017) who argued that it is not related to maturity but more to do with experience – from which also comes confidence. This theme also relates to self-efficacy in someone's confidence or ability to peer assess and is discussed in section 4.8.4. Since this was a single cycle of peer assessment it was not possible to test this further to investigate if student confidence increased with additional cycles of peer assessment. It could not be determined from this study therefore, why there were differences in perceptions of bioscience or forensic science students in trusting other students to peer assess reliably.

### 5.11.9 Confidence

The majority of both cohorts of students were more positive about peer assessment after the OPLA activity (Figure 18) than beforehand (Figure 14). In particular, there was a positive attitude change for the bioscience students from beforehand (Figure 14) to afterwards (Figure 17, 18). These findings are similar to those of Gatfield (1999) and

McGloughlin and Simpson (2004) who reported students feeling more positive about peer assessment afterwards. The forensic science students reported being positive prior to the OPLA (Figure 14) and this remained positive after the OPLA activity (Figure 17, 18). This might be explained by bioscience students valuing the experience of the peer assessment process, as demonstrated in the open comments provided such as: "*i enjoyed being able to take into account peoples effort with the assignment and mark them accordingly*". Irrespective of reason, both bioscience and forensic science students remained positive about peer assessment after the OPLA activity.

In the open text responses the majority of bioscience students reported that they would not change the peer assessment process and that it was fine as it was (Table 25). There were no comments received from forensic science students, either to keep the status quo or make any changes (Table 26). However, the majority of forensic science students said they would use self and peer assessment in other modules. The response from bioscience students was more mixed, with students not being sure overall if they would use self and peer assessment for other modules (Figure 25). However, bioscience students in the focus groups were willing to do so again.

In chapter 4 (Figure 8), the results showed that students valued the group work and most would undertake it again in other modules. Therefore, students were more willing to undertake group work again compared to peer assessment. The main concern from bioscience students was the risk of freeloading. So it may be that bioscience students' reservations about undertaking peer assessment again was not so much about peer assessment itself, but the continued risk of freeloading by other students. Freeloading is discussed below and in more detail in section 2.2.3.

Overall, these results showed that prior to the OPLA activity, all students were positive about peer assessment, though bioscience students were generally not in favour of self-assessment. All students felt confident about their ability to peer assess but were less confident in other students' ability to peer assess reliably. Forensic science students were also generally more positive about self and peer assessment than bioscience students in the pre-survey, possibly due to their greater experience of university (and associated assessment practices). After the OPLA activity however, both bioscience and forensic science students were even more positive about peer assessment, and showed more confidence in their own, and the ability of other students, to peer assess reliably. All students also felt that peer assessment gave a good indication of group members' contribution to the group task.

### 5.11.10Freeloading

Teng and Luo (2015) reported that social loafing (freeloading) affects 'group affective tone', either positively or negatively. Group affective tone represents group affective reactions – how the group feels so social loafing can negatively affect the group. However, despite the effect on the group, this did not influence final grades. They went on to suggest that peer assessment can ameliorate the freeloading but tutors should actually strive to foster a friendly group atmosphere to minimise freeloading. This study strived to address this through the orientation training, whereby students were challenged to be supportive of their peers, rather than penalise students for any problems during the group work, for example if someone missed work due to being ill. Results in section 5.9 provide evidence demonstrating student support for each other in this way.

Freeloading was a concern for students prior to the OPLA activity and is discussed in results section 4.8.9, but concerns were allayed afterwards. Both bioscience and forensic science students made comments about freeloading being addressed through fair marking. For example, one bioscience student reported that the peer assessment allowed “*those people in the group who did very little* [freeloaders] *get the mark they deserve.*’ A forensic science student also gave a similar response: ‘*you got to reward the group members who deserved it, and punish those that didn’t*’. Some forensic science students still commented that the peer assessment didn’t cancel out freeloading: ‘*even though from the peer assessment you can see group members who put little or no effort in, they still get all the marks earned by the group assignment which is worth more.*’

These results showed that whilst peer assessment helped address freeloading for some students, the issue was not completely resolved. Similar results have also been reported by Brooks and Ammons (2003), Tu and Lu (2005), Maiden and Perry (2011), Keppell et al. (2006) and Piezon (2005). Teng and Luo (2015) also reported that positive group interdependence (students being more integrated into the group ethos) reduces the negative effects of freeloading and recommended creating a friendly group atmosphere. Whilst such research acknowledges that freeloading is probably impossible to eradicate, the peer assessment part of the OPLA activity was designed to ameliorate it. This included clarification of the peer assessment criteria at the start during the orientation training (see section 3.4.2), which is echoed by Vu & Dall'Alba (2007) and Maiden & Perry (2011) setting ground rules for the groups (Willcoxson, 2006) and random group selection (Swaray, 2011).

Peer assessment has long been used as a method, either formatively or summatively to address the issue of freeloading (Aggarwal & O'Brien, 2008; Oakley et al., 2004; Piezon, 2005; Shiue et al., 2010). Peer assessment in this study was used to help address freeloading but also to help promote skills development (see chapter 6) through team work. Since the students worked with each other they were best placed to judge if their peers had fully engaged in the team work and if they had freeloaded or not. The results showed, along with the cited literature, that whilst freeloading was not eradicated, the peer assessment was effective enough for students to feel it had significantly addressed the problem.

## 5.12 Validation of peer assessment

One of the key research questions for this study was to investigate whether peer assessment was a valid form of assessment. Previous research on the validity of peer assessment (Falchikov & Goldfinch, 2000; López-Pastor et al., 2011; Magin & Helmore, 2001; Mostert & Snowball, 2012; Stefani, 1994) has often tended to focus on peer assessment scores and the comparison between peer scoring and tutor scores. Topping (1998) reviewed the literature on validity of peer assessment and concluded that it is '*of adequate reliability and validity in a wide variety of applications.*' (p249) Other studies (English et al., 2006; Evans et al., 2007; Lew et al., 2010) still argued whether peer assessment is valid however and even within one study (Chang et al., 2011) it was reported that peer assessment was not valid yet self-assessment was (Chang et al., 2013). This study therefore set out to validate peer assessment based not only on student perceptions and acceptance, but also on their actions and other supporting evidence too.

Validation of peer assessment of student marks compared with tutor marks is one aspect of peer assessment discussed in the literature (Falchikov & Goldfinch, 2000; Gielen et al., 2010; Liu et al., 2019a; Stefani, 1994). However, this approach is predicated on assessment of the product of the students' work i.e. what they produce, whether it be a group report, group presentation or other product. The primary driver of the peer assessment in this study was the process of group work i.e. how well students worked together as a team. Students were therefore best placed to judge this and so it was not appropriate to validate peer assessment against tutor marks.

In this study, the primary concern was not whether the peer assessment scoring itself was valid as discussed above, but whether student perceptions of peer assessment could be validated against online interactions and peer assessment scores i.e. team work. That is, even though students might have viewed peer assessment as being fair, did student views of peer assessment match with the level of online interactions and the actual scores they gave each other? This was achieved by triangulating the views of students themselves, the level of student engagement with online discussion boards and the actual peer assessment marks they gave each other.

### 5.12.1 Triangulating data sources

During the OPLA activity students had the option of collaborating online using a VLE and its associated discussion board. Most bioscience and forensic science groups across the years used this facility to collaborate and communicate. It was possible to use the discussion boards to triangulate against other sources of data to explore if contribution to online interactions reflected an individual's contribution to the group work. Examples of this are shown for the case study (section 5.9), outlining the number of individual student postings and the online collaborations. However, the discussion boards could not necessarily be used in isolation since students reported anecdotally and via reflective reports for their assignments, that they also used other channels of communication such as email, Facebook, text messages and phone calls. Any potential links between discussion board analyses and learning outcomes are discussed in chapter 7 but for the purpose of validating peer assessment, the discussion boards were used in conjunction with other data sources. Another opportunity for triangulating data sources was student views with actual scores and this is now discussed.

### 5.12.2 Validating perceptions against peer assessment scores

Student attitudes to peer assessment in this study were recorded anonymously through pre and post-test questionnaires. Therefore, there was a potential disconnect between what students perceived about peer assessment and how they actually scored each other. Since peer assessment scores were submitted electronically and confidentially via WebPA, students also did not know how other group members scored them, as they were only given a final peer assessment score. It was possible however, to compare student perceptions of peer assessment with actual peer assessment scores, but only if students agreed to share their scores with each other.

In 2011/12 two groups of forensic science students (from a class of 11 groups) agreed to share their peer assessment marks with each other, having completed a disclosure form (which had been agreed through ethical clearance). Although two of the 11 groups contributed to this research, it is in line with other sample sizes reported in the literature from a social science, qualitative perspective (also see section 8.7). Students were interviewed about how they felt their fellow group members had contributed to the group work prior to having their scores shared. The details of these interviews are covered in section 5.9.

Student 1 in group A stated that '*student 2 and 3 were friends but felt they were fair*'. Student 1 had missed some early meetings and was also concerned they would be marked down. This concern was raised by Berk et al. (2004) who suggested that there was a risk of 'buddy bias' for peer rating if the peers were well known to each other. Love (1981) and Magin (2001) however, found no influence of friendship bias on peer assessment and Madland and Richards (2016) argued that buddy schemes can actually positively influence the process. Once the marks were disclosed the students had realised they had been marked fairly and the other group members also felt their peer marks were fair.

### 5.12.3 Validating perceptions against discussion board communications

When group A's discussion board was reviewed all three members felt the discussion board reflected the group members' contributions and each had actually contributed comparable numbers of messages. Group members had also communicated via email and phone calls. Whilst the group had communicated via a range of channels the comparable level of communication on the discussion board did correspond to the student views that they all contributed equally to the group work. Group A therefore felt that the peer assessment process was fair, which was supported by the level of communication on the discussion board; and borne out by the fact that they had marked each other equally. The results showed therefore, that students not only felt that the peer assessment scheme was fair but that on closer inspection of the actual scores, they appreciated that the peer assessment process did reflect the contribution each group member made to the group activity.

Similar results were also found for Group B in the results, where students had reservations about how they would be peer assessed before knowing each other's marks. As with Group A, Group B used other communication channels in addition to the discussion board, citing text messages as the other main communication tool. Students 4 and 5 felt that the discussion board gave a fair reflection of their contribution to the work, whilst student 6 didn't. Student 4 and 5 had contributed equal postings (11 each) and student 6 had posted (7). The view of student 6 therefore appears to contradict that of Group A, though given the volume of messages and small number of students involved, no statistical comparison is possible. Student perceptions that the discussion board reflected student input to the work is therefore inconclusive from this sample.

Once the peer assessment scores were revealed, the actual scores compared with the efforts each student felt they had contributed to the group work. Student 5 felt they had contributed more than the other group members and this was reflected in the scores. Student 4, who scored the lowest, also acknowledged that the other two members had contributed more. Student 6, who claimed the discussion board didn't fully demonstrate their contribution was also comforted that they felt their peer assessment score was fair. Group B therefore compared with Group A – even though students ended up with different peer assessment marks they felt their scores reflected the comparative amount of contribution to the group work.

The results from Group A and B compared favourably with the broader results from the student surveys and focus groups that peer assessment is fair. Students in the groups initially had some uncertainty about whether the peer assessment marks reflected their input to the group work. The discussion boards were not necessarily an accurate reflection of students' input to the work on their own, but students felt aware of how it indicated their involvement, particularly when reporting that they also used other communication channels. So students knew if it demonstrated their contribution or not. Once scores were revealed all students felt they had been marked fairly by their peers. Therefore, by comparing student attitudes with external observations of discussion board contributions, interviews and broader student feedback from the surveys it was possible to validate perceptions of peer assessment against actual peer assessment scores.

Whilst the two groups' peer assessment marks were able to be triangulated against other data sources (discussion boards and interviews) to validate student perceptions against actual peer assessment scores, a caveat must be noted. In comparison to the total numbers of students involved in this study, this only represents two small groups of students. Due to the anonymity of the post-survey it is also not possible to directly link the broader positive views about peer assessment to these two groups. So the validation of student perceptions here is limited to the two groups, but these results do corroborate the broader views of students that peer assessment is fair.

### SUMMARY

The results from this study showed that whilst most students had undertaken self and peer assessment previously, they still had reservations about it as part of the OPLA activity. Initially, a major concern of students was the risk of bias and whether the process would be fair. Bioscience students also initially appeared more cautious about self and peer assessment than forensic science students. After the OPLA activity however, student attitudes were more positive for both bioscience and forensic science students, with both cohorts feeling that peer assessment was a fair assessment method, helped by the marking scheme which they also felt to be fair (Figure 20). Student confidence in their own, and that of other students' ability to peer assess also increased and they felt peer assessment accurately reflected group members' contribution to the group work.

Another finding from the results showed that concerns and perception of freeloading were reported as much less of a concern after the OPLA activity. Students noted concerns about peers being able to assess reliably (Figure 15) beforehand but were more positive afterwards (Figure 22) and stated that they were satisfied with the peer assessment process. Students reported that the peer assessment process had enabled them to score other students appropriately for their efforts (Figure 23) and that students generally had increased their motivation to work as a result of the peer assessment process (Figure 24).

This study also found that students agreed with the peer assessment scores they received from their fellow group members. So student perceptions of peer assessment were supported by comparing data from online contributions and actual peer assessment scores. It can be concluded therefore, that student attitudes and confidence towards peer assessment increased after the OPLA activity; and that student perceptions could also be validated against the scores they gave each other. Student perceptions that peer assessment was an appropriate assessment method was supported by actual peer assessment scores and online communications.

Some literature has attempted to validate peer assessment against tutor marks, whilst other literature has compared peer to peer marks. Validation has been claimed against the statistical correlation of these comparative grades, arguing a close correlation is a sign of validity. Whilst this may be a contributing factor, validity of peer assessment does not just rely on how aligned peer marks are; but also whether their perceptions and actual group activities combine to provide a full picture of how students worked together. By triangulating these different components of peer assessment can we truly investigate whether the peer assessment provided an overall valid assessment of group contributions to the work.

The validity of student marking in this study was addressed using the peer assessment software tool, WebPA. This uses a noted algorithm that mitigates for any potential bias in student marking (Lejk & Wyvill, 2001). The student perceptions of peer assessment as a valid assessment method was recorded in the pre and post-test questionnaires, showing that students agreed that peer assessment was a valid assessment tool. Furthermore, students were given the opportunity to share marks and review these in relation to how they felt students had contributed to the group activity. This was further supported by evidence from the group discussion boards to show students collaborating online. Taken together, these data sources were able to provide a broader verification of peer assessment as a valid assessment tool.

This chapter set out to consider the results in relation to whether electronic peer assessment is a valid form of assessment. The significant results attest to positive student attitudes to electronic peer assessment after undertaking the OPLA activity. The results showed that students had a positive experience of the online peer assessment. Furthermore, the triangulation of data sources demonstrated that students not only perceived electronic peer assessment to be fair but the results also showed it was a valid form of assessment. This verification of the results from different aspects of the blended learning approach has not been reported previously and therefore adds to the literature, strengthening the evidence for peer assessment as a valid assessment tool.

# 6 SKILLS DEVELOPMENT

There is plenty of evidence in the literature (Biasutti, 2011; Faherty, 2015; Falchikov, 1988; Lumpe, 1995) to suggest that students who engage in group work develop new skills. As part of the overall OPLA activity students engaged in various activities which might have influenced their skills development and this was made explicit to them. This chapter focusses on the potential for skills development during the blended learning approach by exploring student views on which skills they feel they may have developed during the OPLA activity.

When both discipline cohorts were introduced to the blended learning activity it was made clear during the orientation training (see section 3.4.2) that one of the goals was to help them develop various skills. Students were made aware that group work can promote good team working skills, including communication and peer appraisal skills, as well as other skills such as increased self-confidence. Also, given that the blended learning actually involved the use of computer technology, and assignments involved the use of Microsoft Office, there was potential to develop additional IT skills.

When engaging students in online group work it was important to take into account of whether the use of the technology itself is a barrier to learning, rather than being a facilitator. The literature discusses the role that technology can play in online collaboration and whether it is a barrier or not (see section 2.5.3). In order to consider if technology might influence students' ability to engage in online group work, students were surveyed about their Information Technology (IT) skills prior to the OPLA activity. Students were asked afterwards to report any change in their IT skills to explore if this had any effect on their engagement with the OPLA activity.

In addition to IT skills, students also communicated and collaborated in an online environment, as well as engaging in other activities directly related to their group work. Furthermore, students undertook self and peer assessment and this can also have an effect on students' skills development. Students were therefore asked for their views about a number of skills to investigate if they reported any skills development as a result of the OPLA activity.

## 6.1 Method

When the bioscience and forensic science students started their respective modules (section 3.2, 3.3) they were asked to rate their skills for some Microsoft Office programs, as well as their confidence communicating and working online. After undertaking the OPLA activity they were asked again about their level of confidence with their IT skills and were also asked if they felt other skills had improved as a result of the group work, including communication, team working and peer appraisal skills.

### 6.1.1 Ethical considerations

Since the skills survey questions were part of the same pre and post-test questionnaire administered for all of this study, the same ethical considerations were addressed as discussed in section 4.1.1. The demographic data collected for this part of the study was not sensitive in that none of it could be attributed to individual students and was therefore anonymous.

### 6.1.2 Data collection

The responses collected were a mix of qualitative and quantitative data which were analysed using NVIVO and SPSS respectively. The quantitative data was analysed to consider any statistical changes in skills reported by the students. As well as the qualitative, open text responses provided, it was also possible to compare the results with demographic data provided by the students to investigate if skills development was influenced by additional factors, such as gender.

### 6.1.3 Data analysis

The qualitative data arising from the pre and post-test questionnaires were coded for and analysed using NVIVO. For the quantitative data, SPSS was used to undertake a number of statistical analyses to investigate any statistically significant changes in skills development and any potential statistical correlations between skills development and demographic information. Since most of the quantitative data collected was ordinal data then the tests needed to provide valid results were nonparametric. Based on the fact that the response data was generated using Likert responses, the data could be ranked and therefore the nonparametric test selected was the Mann-Whitney test. A similar test available is the Wilcoxon rank-sum test but Field (2005:525) argued that both are essentially the same.

#### *6.1.3.1 Mann-Whitney U test*

The data in this study arising from the survey questions were Likert responses, producing ordinal data and were not normally distributed. A nonparametric Mann-Whitney U test was therefore used, where the calculations were undertaken on the mean rankings of the data. To calculate the significance between two variables the mean of the ranks of the different sets of ordinal data were compared. This means that from the Likert responses the mean rank order for the responses to the question (e.g.1=low, 5=high, or strongly disagree to strongly agree) were calculated for one variable and then compared to the other variable.

A Mann-Whitney U test can provide information about any significant difference between two variables but not necessarily the effect of the significance i.e. whether the significance is positive or negative.

#### *6.1.3.2 One tailed versus two tailed Mann-Whitney U tests*

To calculate whether a Mann-Whitney U test has a positive or negative significance in SPSS, consideration must be given to the mean rankings of the data. Where the outcomes of potential links between variables were unknown or unexpected, a two-tailed Mann Whitney U test was undertaken. Where outcomes were expected or predicted, a one-tailed test was undertaken. There are different ways of reporting the results of a Mann-Whitney U test but the format selected for this study was: (Mann-Whitney U=, n=, p= two-tailed). U is a measure of the means between two variables, n is the sample size and p is the significance.

## 6.2 RESULTS

To investigate if students reported any positive changes in skills development as a result of the blended learning approach, a quasi-experimental approach was adopted to measure student skills confidence before and after the OPLA activity. Students were asked to judge their skills confidence prior to start of their module and again afterwards. The results are now discussed, outlining any changes attributable to the OPLA activity.

## 6.3 STUDENT VIEWS OF IT CONFIDENCE

In the pre and post-surveys for 09/10 and 10/11, students were asked how confident they felt about working with computers, using standard Microsoft Office tools and working and learning online. In the pre-surveys the majority of bioscience and forensic science students (Figure 27) agreed or strongly agreed that they felt confident working with computers, using MS Word and MS Excel. The majority of both cohorts of students also reported feeling confident about contributing to online discussions and working and learning online. When the disciplines were compared, bioscience students were significantly more confident working and learning online more than the forensic science students (Mann-Whitney U=14384, n=551, p=0.018 two tailed).

The post-surveys (Figure 28) showed no significant reported skills increase for use of computers, MS Word or MS Excel for forensic science students. Bioscience students reported no significant increase in confidence using computers or MS Excel either but reported significant increases for MS Word (Mann-Whitney U=50169, n=705, p=0.04 one tailed). An increase in skills might be expected as a result of the OPLA activity, hence the reason for the one tailed test, instead of a non-presumptive two tailed test.

After the OPLA activity forensic science students reported being more confident with MS Excel than the bioscience students (Mann-Whitney U=3145, n=261, p=0.038 two tailed) and also more confident taking part in online discussions (Mann-Whitney U=3005.5, n=260, p=0.013 two tailed).

A summary of the change in levels of confidence in IT skills for each discipline is shown in Table 31.

*Table 31 Changes in IT confidence from Mann-Whitney U test after the OPLA activity*

| | Bio (1 tailed) | Bio (2 tailed) | FS (1 tailed) | FS (2 tailed) |
|---|---|---|---|---|
| Confident Working with computers | **0.194** | **0.387** | **0.093** | **0.187** |
| Confident using MS Word | **0.04*** | **0.08** | **0.105** | **0.209** |
| Confident using MS Excel | **0.163** | **0.325** | **0.168** | **0.337** |
| Taking part in online discussions | **0.024*** | **0.049** | **0.001*** | **0.001** |
| Working and learning online | **0.207** | **0.413** | **0.011*** | **0.023** |
| *Highlighted cells show significant increases in confidence after the OPLA activity | | | | |

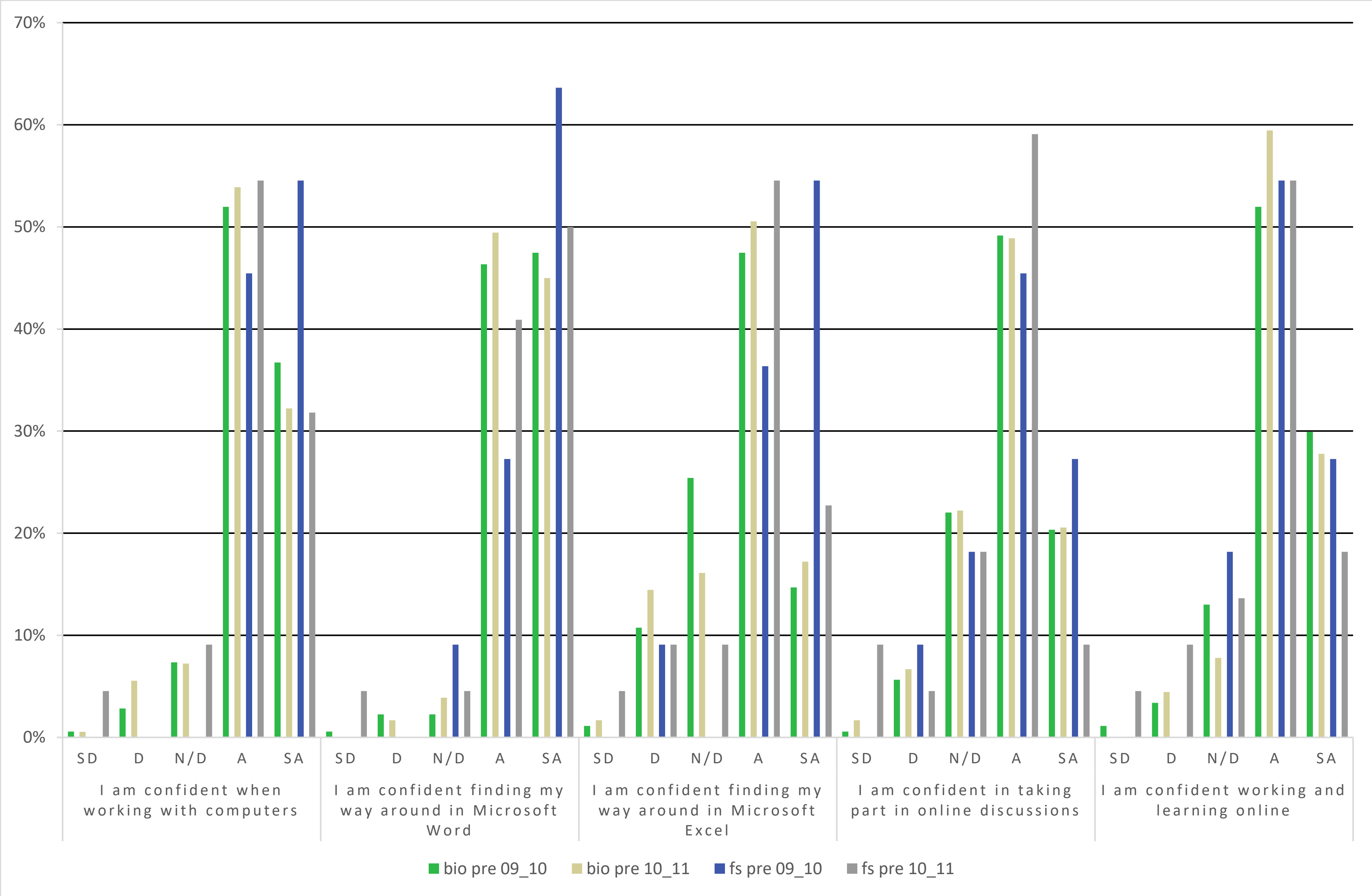


*Figure 27 Bioscience students' pre-survey confidence with IT skills*

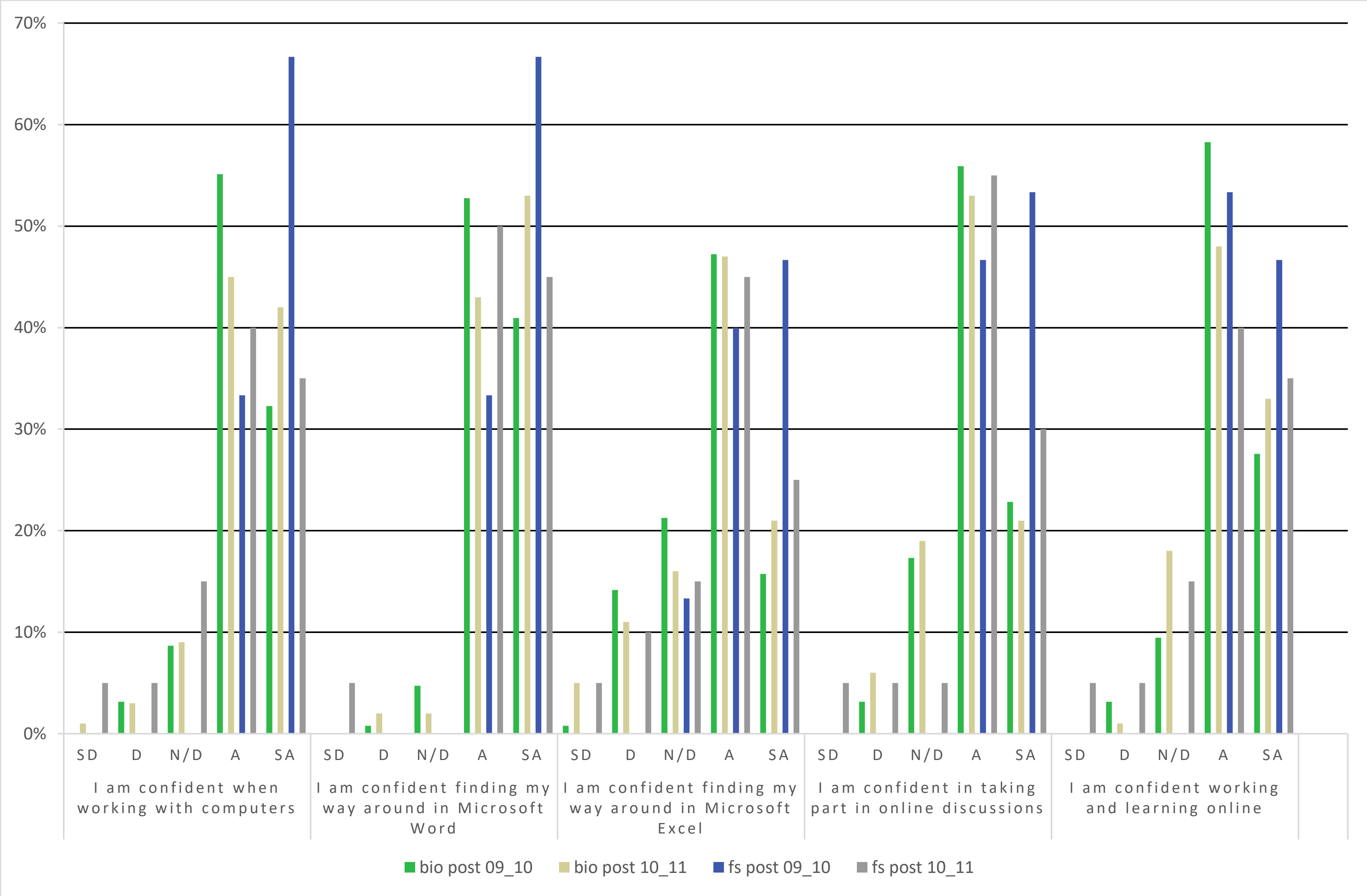


*Figure 28 Bioscience students' post-survey confidence with IT skills*

In the pre-survey the majority of all students reported feeling confident taking part in online discussions and working and learning online (Figure 27). In the post-surveys bioscience students reported a significant increase in confidence for taking part in online discussions (Mann-Whitney U=49229.5, n=225, p=0.049 two tailed); but not working and learning online (Figure 28). Forensic science students reported a significant increase in confidence for both taking part in online discussions (Mann-Whitney U=804, n=106, p=0.001 one tailed) and working and learning online (Mann-Whitney U=927, n=106, p=0.011 one tailed).

### 6.3.1 Gender, age and language differences in IT confidence

In the pre-survey for 09/10 male bioscience males reported being statistically more confident working with computers than females (Mann-Whitney U=3112.5, n=176, p=0.017 two tailed) and also in 10/11(Mann-Whitney U=2647, n=179, p=<0.0001 two tailed). In 10/11 male bioscience students also reported feeling more confident than females using MS Excel (Mann-Whitney U=3152, n=180, p=0.007 two tailed) and more confident taking part in online discussions (Mann-Whitney U=3322.5, n=180, p=0.032 two tailed). For the forensic science students, there were no significant gender differences for any IT skills across 09/10 and 10/11.

For gender, there was no significant difference afterwards, so whilst there were gender differences beforehand as stated above, these gender differences disappeared after the OPLA activity. This was also true for age, where there were significant age differences in confidence beforehand between bioscience and forensic science students ((Mann-Whitney U=14383.0, n=551, p=0.018 two tailed) but none afterwards. This was also echoed for students who reported English as a second language. Students with English as a second language reported less confidence levels beforehand (Mann-Whitney U=14384.0, n=99, p=0.025 two tailed), but no significant differences afterwards.

After the OPLA activity male bioscience students still reported a significantly higher confidence using MS Excel in 10/11 survey (Mann-Whitney U=911.5, n=99, p=0.025 two tailed) than female students, but not in 09/10. Apart from this result however, there were no other significant differences in IT confidence between male and female bioscience students. As with the pre-survey results for forensic science students, there were no significant differences in any of the IT related skills.

When age was investigated for student self-reported views of efficacy for working and learning online there were some differences beforehand. There were no significant differences between age groups within disciplines in their confidence for working and learning online prior to the OPLA activity. Bioscience students however, were more confident than forensic science students before the activity (Mann-Whitney U=1484.0, n=551, p=0.018 two tailed). Afterwards however, there were no statistical differences reported in confidence for working and learning online, based on age. Bioscience confidence did not statistically change but forensic science students, based on age increased in confidence afterwards (Mann-Whitney U=927.5, n=106, p=0.023 two tailed).

## 6.4 STUDENT VIEWS OF SKILLS DEVELOPMENT

After the OPLA activity students were asked if they felt a number of skills had been improved as a result of carrying out the group work. The majority of bioscience students agreed or strongly agreed that their communication, team working skills, peer appraisal skills and self-reflection/appraisal skills had improved ($p<.05$). For problem solving skills, although not the biggest response (i.e. 50% or more) the majority of responses agreed or strongly agreed their problem solving skills had improved (Figure 29). For the forensic science students the majority of students agreed or strongly agreed that their skills had improved in all areas ($p<.05$) (Figure 29).

When comparing the skills development results between bioscience and forensic science students, there was no significant difference between the two discipline cohorts for communication, team working or peer appraisal skills. However, there was a significant difference for problem solving with forensic science students being more confident for problem solving (Mann-Whitney U=5204, n=359, p=<0.0001 two tailed) and for self-reflection/appraisal skills (Mann-Whitney U=6192.5, n=357, p=0.027 two tailed).

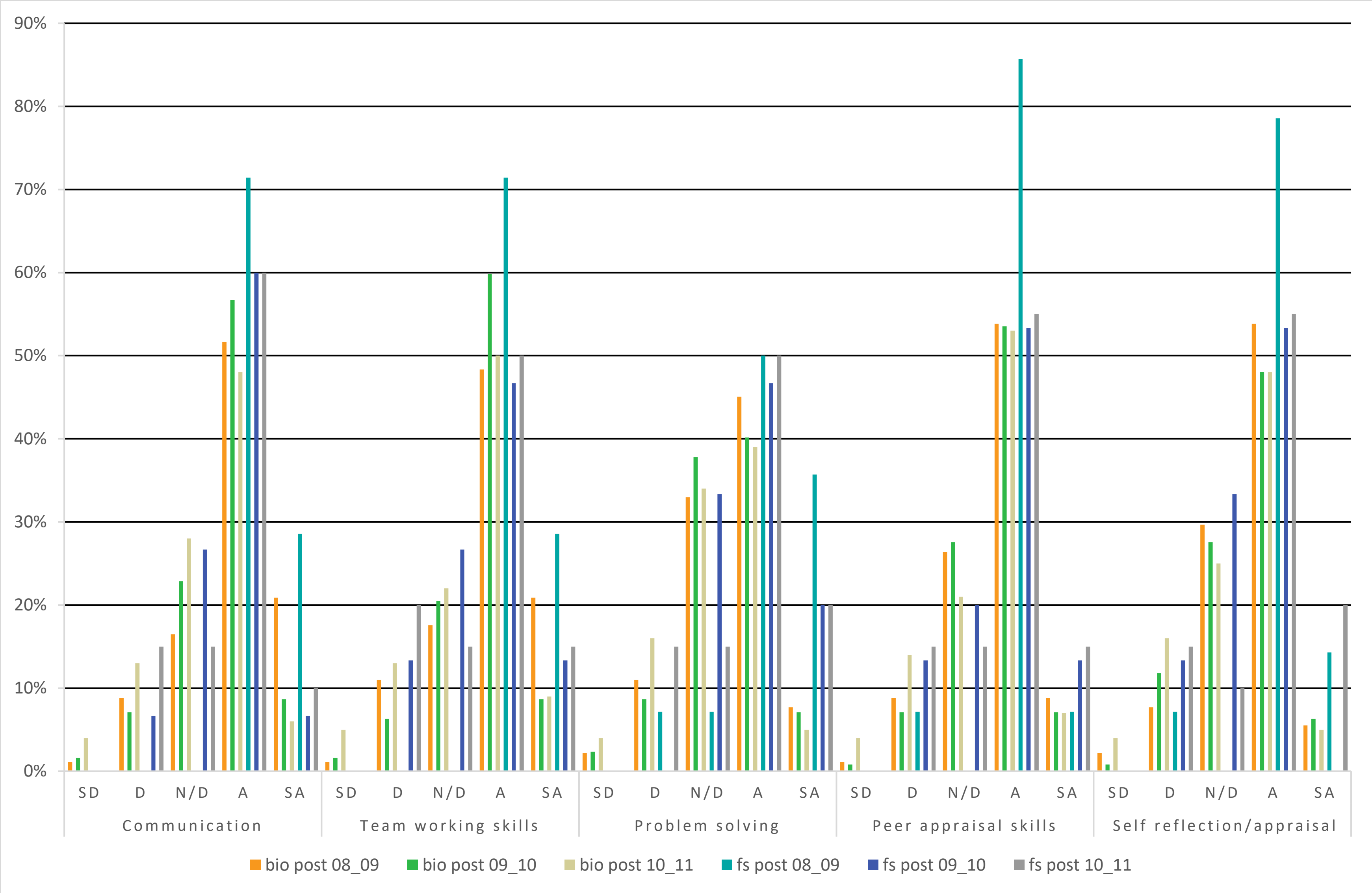


*Figure 29 Bioscience students' skills development from group work*

In 08/09 students were also specifically asked about skills development as a direct result of the peer assessment (Figure 30). This question was only asked this year as part of a collaborative survey with another institution. The main response from bioscience students showed that they felt their communication and team working skills had improved but were unsure about problem solving skills. The majority of bioscience students agreed or strongly agreed that their peer appraisal and self-reflection/appraisal skills had improved. In comparison, the majority of forensic science students for this year stated that all these skills had improved as a result of the peer assessment. By comparison, forensic science students felt their problem solving skills had increased significantly more than the bioscience students (Mann-Whitney $U=396$, $n=102$, $p=<0.022$ two tailed) and also for self-reflection/appraisal skills ((Mann-Whitney $U=352.5$, $n=102$, $p=<0.005$ two tailed). These results exactly mirror those from the broader skills development questions asked in 09/10 and 10/11.These results therefore provided support that peer assessment (alongside the actual group work) helped improve skills.

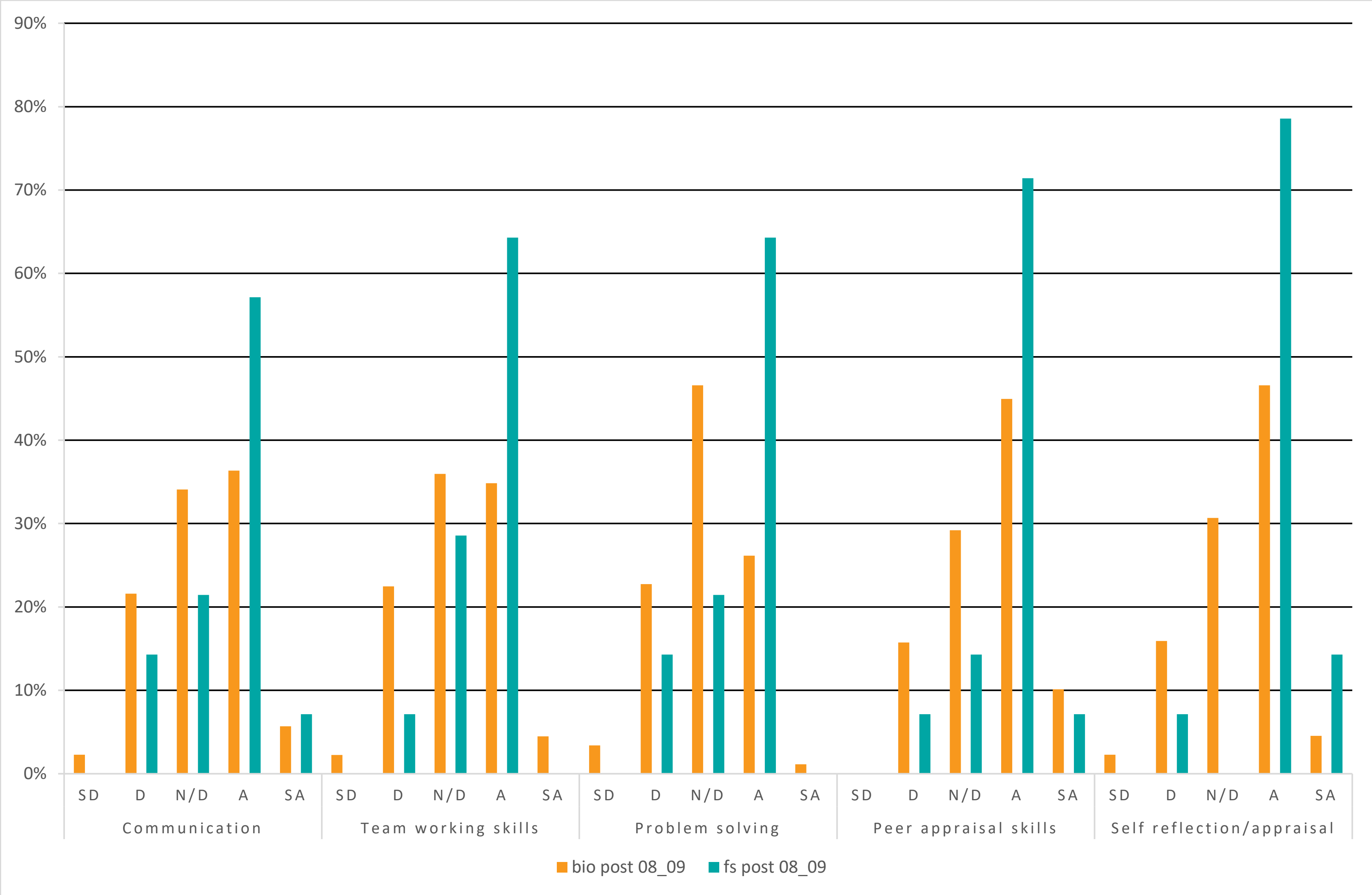


*Figure 30 Bioscience students' skills development from peer assessment in 08/09*

## 6.5 ATTITUDES TO SKILLS DEVELOPMENT FOR GROUP WORK AND PEER ASSESSMENT

In the pre-survey students were not specifically asked about potential skills development opportunities afforded by the OPLA activity. However, a number of themes arose in their responses which made direct reference to skills development opportunities. In the post-surveys, in addition to direct questions about skills development discussed above, students also provided a range of responses about their attitudes to skills development and the results are now discussed.

### 6.5.1 Pre-survey views on skills development opportunities

Students from both cohorts made various comments about skills development opportunities prior to the OPLA activity. Table 32 lists some the themes that arose about skills development made by both student cohorts. From the results it is clear that students were aware of the potential for skills development in a number of areas when asked what they thought about working online in groups.

*Table 32 Bioscience and forensic science students' pre-survey comments about skills development*

| **Skills development theme** | **Response [survey year]** |
|---|---|
| IT confidence | *"Again i am happy to try this only problem i have is that i am capable of doing this as i am not very confident with computers." [bio pre 08/09]*<br><br>*"I feel that this would benefit my own lack of IT skills." [bio pre 08/09]*<br><br>*"I feel it would be a good opporunity to work on your people skills and improve our computer skills too." [bio pre 09/10]*<br><br>*"I need more practice as I am limited to Facebook!" [bio pre 09/10]*<br><br>*"I'm not that confident with computers but am willing to get better." [bio pre 09/10]*<br><br>*"It's useful as you can learn new skills on the computer" [bio pre 10/11]* |

| **Skills development theme** | **Response [survey year]** |
|---|---|
| Communication skills | *"it increases your confidence , communication skills" [bio pre 09/10]*<br><br>*"it may be easier, as people can be more confident online, putting forward more bold idea's that they may not talk about in a face-to-face group" [bio pre 09/10]*<br><br>*"It can be easier than talking face-to-face and may provide moe confidence for timid people." [bio pre 09/10]*<br><br>*"It is an efficient way to communicate as a group" [bio pre 10/11]*<br><br>*"i feel that it could be an easier way of comuunicating within a group" [FS pre 10/11]*<br><br>*"i haven't done alot of online group work but i feel that it could be an easier way of comuunicating within a group" [FS pre 10/11]* |
| Teamwork | *"It acts as a stimulant for teamwork and motivates everyone in the group to do better if they compare themselves to their peers" [bio pre 08/09]*<br><br>*"I find it interesting in getting to work on my social skills as well as improving teamwork." [bio pre 09/10]* |
| Self-reflection/ appraisal | *"It can be helpful to assess each other's work, as students can see how other people approached the work and reflect upon it." [bio pre 08/09]*<br><br>*"Peer assesment plays an important role in critical thinking and gaining skills for the future career. It is a good way of guiding people for self improvement." [bio pre 08/09]*<br><br>*"I think that it [self-assessment] would be a good idea- it would allow me to see whether I have worked to the best of my ability." [bio pre 09/10]*<br><br>*"I think it may help me to evaluate myself as I find it very difficult to highlight my own strengths and weaknesses, so I believe the practice will be good." [FS pre 10/11]* |
| Peer appraisal | *"It's a constructive way of learning and helping other peers to learn" [bio pre 09/10]*<br><br>*"I do enjoy marking other people work, as it gives me the chance to see the standard of work across the range of students." [bio pre 10/11]* |

### 6.5.2 Post-survey views on skills development

After undertaking the OPLA activity bioscience and forensic science students made a range of comments about it helping develop their skills in the post-surveys. These comments are provided in Table 33. The results echo views of students perceptions of skills development prior to the OPLA activity. Students felt the online group work could help develop a number of skills beforehand and the post survey results confirm that students did actually report developing these skills as a result of the OPLA activity.

*Table 33 Bioscience and forensic science students' post-survey comments about skills development*

| **Skills development theme** | **Response [survey year]** |
|---|---|
| IT confidence | *"It was very helpful as you gained both IT and communication skills." [bio post 10/11]*<br>*"It [online group work] has its advantages and its disadvantages but i feel it can help improve computer skills" [bio post 10/11]* |
| Communication skills | *"Working online added to communication abilities and I found this to be an advantage." [bio 08/09]*<br>*"I think it is a good way of expanding the personal skills of communication and working to deadlines, as others depend on you completing the work." [bio 09/10]* |
| Teamwork | *"It [peer assessment] made the group work better because we were all aware we were assessing each other" [bio post 08/09]*<br>*"Group work is an important skill, and working online for most people is a very useful tool." [FS post 09/10]* |
| Self-reflection/ appraisal | *"Makes you think about your input." [bio post 08/09]*<br>*"working as group it helped me to know other peaple and their education level. so I got better idea about myself." [bio post 10/11]* |
| Peer appraisal | *"Peer assesment was useful for gaining transferable skills." [bio post 08/09]* |
| General comments | *"Overall i enjoyed this assignment and feel that the peer-assesment gave very good self-motivation" [bio post 08/09]*<br>*"I think its [online group work] a very good idea and builds up confidence for those who struggle with computers or who are shy when working fact to face in a group." [bio post 10/11]* |

| Skills development theme | Response [survey year] |
|---|---|
| | *"I think this is good because it improves people skills working online and working in groups because it is harder to do this online rather than face-to-face." [bio post 10/11]* |

## 6.6 Discussion

When considering online group work using technology, probably the initial consideration is if the technology itself is a barrier to engaging students in online group work. With the growing ubiquity of desktop computers, personal laptops and even mobile devices in higher education, there has been a de facto adoption of Microsoft Office as the standard suite of IT tools used to support students, particularly during the time of this study. This included MS Excel for data management, MS Word for report and essay writing, and general use of computers as an indication of computer literacy, as outlined in the SCONUL digital lens as part of its seven pillars of information literacy. At the start of this study students were surveyed therefore, about their confidence with the use of MS Office tools, communicating online and learning online. This was used as an indicator of their IT proficiency (self-reported) and whether this was a barrier to online group work.

### 6.6.1 IT skills development

Prior to undertaking the OPLA activity students were surveyed about their confidence in using computers and MS Office tools, namely Word and Excel. The results showed that initial confidence was high for both bioscience and forensic science students. Whilst the literature shows that student confidence is sometimes higher than their actual abilities (Grant et al., 2009), the results at least demonstrated a strong self-confidence in using IT. These results therefore suggest that students did have the IT skills, or confidence at least, to engage in the OPLA activity.

The findings about IT confidence in this study reflected those of MacDonald (2003) who reported that students '*had mastered the necessary IT skills, and were all confident inputting messages to a conference [discussion board] on a course topic,…*" (389). The importance of IT literacy of students engaging in online learning is also recognised by the Open University (Heiser et al., 2013) who do not take IT skills for granted and provide training in ICT skills; something which others (Jeffrey et al., 2011; Muilenburg & Berge, 2005) also recognise as a potential barrier if not addressed.

This counters the original argument put forward by Prensky (2001) that '*today's students*' are digital natives who have mastered IT skills from an early age, though he later revised this view to the notion of '*digital wisdom*' (Prensky, 2009). Selwyn (2009) also argued against the notion of a digital native, claiming that students are not as digitally aware as we might suppose; a claim supported by Heiser et al. (2013) who said that students are not necessarily able to use online tools proficiently. The issue of IT confidence being a potential barrier to online group work was therefore an important factor to be aware of, but appeared not to be of concern to any of the students in this study. This is a similar conclusion to that of Pritchard and Morrow (2017).

After the OPLA activity students were surveyed again with the same questions to compare any reported change in IT skills development. For bioscience students, there was a significant increase in confidence with MS Word. Probably the main reason for this was because the bioscience students were being taught word processing skills during the module which the OPLA activity was part of. Both bioscience and forensic science students still reported being confident with working with computers, Word and Excel. There were significant changes in the reported confidence of bioscience and forensic students for taking part in online discussions and for forensic science students when working and learning online.

No significant increase in Excel confidence was noted for either discipline. This is counter intuitive for the bioscience students since they were also taught Excel. Excel teaching was introductory level, so it could be that student initial confidence was maintained but advanced skills were not generated so confidence remained stable. Excel was also not part of the OPLA assessed work.

Jeffrey et al. (2011) discussed some of the challenges with developing what they called ‘digital information literacy’, including socio-economic standing, gender (discussed later) and self-efficacy. Technology and definitions have moved on rapidly and JISC now talk about ‘digital capabilities’ (JISC) yet some challenges still remain, for example self-efficacy is still a considerable challenge for mature students who find engaging with technology time consuming due to family commitments (Henderson et al., 2017). This challenge was not reported in this study however, perhaps due to a benefit of the blended approach allowing students to meet face-to-face as well, thus minimising time pressures.

It is worth mentioning that the pre and post-test questionnaires reported student perceptions of their skills development, based on individuals’ self-efficacy i.e. how they perceive themselves and their capabilities. This is discussed in section 4.8.4 and one noted challenge with self-efficacy relates to gender differences, which is discussed below (section 6.6.4). However, although IT skills were self-reported in this study i.e. not actually tested for potential pre and post-test changes; the OPLA activity allowed for students to develop their own approaches to learning so it is worth mentioning their own development from a social constructivist viewpoint of knowledge generation.

### 6.6.2 Knowledge generation

There is a wealth of literature on how a social constructivist approach to blended learning can support knowledge generation (Dixon et al., 2006; Luckin, 2002; Muire, 1999; Oliveira et al., 2011). This is based on the pedagogical principle that meaning is constructed in the minds of individuals (Swan, 2005) and that this can be promoted through online collaborative learning (Remesal & Colomina, 2013). This study provided such a platform for students to interact online, as well as face-to-face for their own knowledge generation.

Tutor involvement has been noted as one approach to promote student engagement online, which helps promote social interaction and ultimately student generated knowledge acquisition. Zhao et al. (2014) found that fully online collaboration does not in itself promote student engagement and concluded that evaluation 'based on one dimension alone' cannot fully assess the level of collaboration. Whilst there was no tutor involvement in this study, the blended learning approach provided additional dimensions for students to collaborate with each other and independently (of the tutor) develop knowledge.

Zhao et al.(2014) also reported that collaboration required participation and that social presence helped realise this collaboration. Tutor involvement can scaffold social presence and knowledge generation, but there is also a risk that this can diminish learner autonomy. This is reflected in peer assessment where students can see tutor marks as more reliable (Cheung-Blunden & Khan, 2018) than peer marks, when the opposite can actually be more beneficial.

Duarte (2018) discusses this point, suggesting that whilst students generally demonstrate a lot of learner autonomy, some students do not and would benefit from tutor involvement. It is not clear from the results in this study whether skills development was negatively influenced by lack of learner autonomy but the results did not suggest this, given that students reported various skills developments. Further research on this would be needed, to explore how much knowledge generation comes from learner autonomy, particularly for students who may not have engaged so much in the online peer learning.

### 6.6.3 Communicating and working online

In the post-surveys bioscience and forensic science students reported a significant increase in confidence for taking part in online discussions. Since students used the VLE to communicate online during the OPLA activity it can be argued that this increase in positive confidence is a direct consequence of engaging in the online communications. In addition, MacDonald (2003) argued that students working online developed new skills including team work and negotiation skills as a consequence of collaborating on a common task. MacDonald went on to say that online collaborative working can have an advantage over face-to-face collaboration because the medium provides a written record of their interactions. This finding is similar that of Lee (2013), who found that students are more likely to engage in online discussions if they appreciate the link it has to learning opportunities.

Bioscience students reported no significant increase for confidence in online learning but forensic science students did. For all students a primary purpose of using the VLE was for online communications rather than structured learning online so it would initially be difficult to explain why forensic science students felt their confidence in online learning had significantly increased, whilst bioscience students did not think so. No additional direct evidence was available from the results to explain this outcome, but there could be several possible reasons, based on discipline, level of study or even demographic themes covering age, language and gender.

For level of study, it could be postulated that the differences in confidence before and after might be due to levels of study (differences between the level 4 and level 7 assignments) and the fact that forensic science students were from mixed courses, so saw online communication as more convenient, given their different timetables. A different possibility linked to course differences might be that for the bioscience students the assessment was low stakes (not counting towards their degree) but high stakes for the forensic science students.

It could be that the forensic science students increased their confidence for online learning more than the bioscience students due to higher engagement with the higher stakes assignment. This argument was made by Gerbic (2006) who suggested that postgraduate students would have more developed interpretation and reasoning skills than undergraduates that would encourage them to engage in meaningful online discussions. Alternatively, it might have been that the forensic science students were less used to collaborating online and therefore valued the experience more.

When demographic data was investigated there some significant differences beforehand. There were some gender differences beforehand, which has been discussed in the literature around self-efficacy (section 4.8.4) and there were also differences for students who reported English as a second language. Age was a significance for forensic science students but not bioscience students, i.e. the higher the age the lower the confidence. However, afterwards these gender, age and language differences disappeared. That is, after the OPLA activity, regardless of gender, age or language, all students reported an increase in confidence working and learning online.

### 6.6.4 Gender issues in skills development

The results showed that bioscience males were significantly more IT confident than females prior to the OPLA activity but there was no significant gender difference afterwards, which echoes early research (Venkatesh & Morris, 2000) demonstrating initial gender differences in self-efficacy of technology confidence. Hargittai and Shafer (2006) also reported similar findings, showing that whilst females demonstrated similar skills to males, males had more confidence in their '*online abilities*' (p432). This gender difference is not restricted to IT confidence however, for example males have reported higher confidence for self-perceptions of abilities (Beyer & Bowden, 1997) or maths abilities (Jakobsson, 2012).

The difference in gender self-efficacy is reported by Henri et al. (2018) who discussed the challenges of learner self-autonomy and whether it changes during higher education, or remains constant – at least as perceived by the student. This is something they termed the 'moving goalpost' hypothesis. They discuss two considerations, that learner autonomy is fixed or can change. Their longitudinal study across two years found no change in autonomy, compared to this study in relation to skills development. Students clearly reported an increase in skills development during the study but it is difficult to translate that into broader views of self-efficacy. The approaches taken for each study were very different so further research would be needed to consider if the gender differences in relation to IT self-efficacy in this study demonstrated any real, long term shift in IT, or other skills confidence.

Bioscience males still reported significantly higher levels of confidence for MS Excel afterwards and this might be explained by males being more confident 'playing' with software that may be considered technical (Padilla-Meléndez et al., 2013). During the time the students were engaged in the OPLA activity they would also have been engaged in other aspects of their studies which may have contributed to an increase in IT confidence. So the increase in IT confidence for females cannot necessarily be directly attributed to the OPLA activity but may suggest that engagement with the

OPLA activity indirectly helped improve female IT confidence, particularly for taking part in online discussions and working and learning online.

Possible reasons why the OPLA activity itself might have directly contributed to an increase in IT confidence for females might have been due to the experience they gained from collaborating online. Also, if the males had overestimated their levels of IT confidence to start with; this may have levelled out during the activity. This could be because male confidence fell back in line with that of females when working together or females increasing their confidence to the level of the males, or a mixture of both. During the OPLA activity both males and females would also have been able to benchmark their IT skills against each other and this may have had an influence in how the differences in IT confidence diminished.

Other results that might support this hypothesis was the fact that female bioscience students showed a significant increase in confidence taking part in online discussions, with no significant increase for males. This was echoed by female forensic science students who showed significant increases in confidence for online discussions and working and learning online, with no corresponding increase for males. Regardless of the reasons, the results clearly showed more significant increases in skills development perceptions for females compared to males, irrespective of discipline.

### 6.6.5 Language differences in skills development

The demographic makeup of students who reported English as their first language was 78.1% for bioscience, and 10.1% as not their first language. The slight discrepancy in percentages is due to non-reported data. For forensic science students this was 74.2% as English and 14.2% as non-English (see sections 3.2, 3.3 for full details of student participants). This slightly higher figure for forensic science students was due to internationals MSc. students. As reported above, perceptions of skills development based on language differences disappeared afterwards and it can be argued that this was due to the benefit of the blended learning approach, where students communicated online.

Self-efficacy of international students for collaborating online has been noted (Jung et al., 2012) where Japanese students lacked confidence in communicating in English, as part of a blended learning course. This was identified as the most important factor as a cause of stress but they also found that technology use was another factor, which wasn't reported in this study. Student confidence in writing online could also be a contributing factor, as reported by Ciftci and Kocoglu (2012) and Gharehbagh et al. (2019). This is further supported by Banditvilai (2016) who argued that e-learning allowed students to study independently and improve their English. One forensic science student actually stated "*Iam confident working,speaking and writting on computer because Iam international student[sic]*" so this study also found evidence that a blended learning approach was helpful for non-native English speakers, as they could reflect on the asynchronous communications before responding.

### 6.6.6 Age differences in skills development

Alongside gender and language, age was another observed demographic to consider for any impact of the blended learning activity. Bioscience students showed no change due to age, which would be expected given that most were 18-21 years old. For the forensic science students, the age range was slightly higher given that they were level 6 and 7 students but there was still no reported difference is skills perceptions based on age. Taking all demographic data together (age, gender, language) whilst there were some differences reported beforehand, there were no differences afterwards. This suggests that demographic dimensions have no bearing on students ability to engage in online learning, and this is what Porter (2015) also found. Counter to this, Morin et al. (2019)

found that older students did have more confidence. However, their older students were ‘more than 30 years of age’ and whilst they suggested age is an important factor to consider, it appeared not to be an issue in this study.

### 6.6.7 General skills development

After the OPLA activity all students reported an increase in a range of skills covering communication, team working, problem solving peer appraisal and self-reflection/appraisal skills. Whilst bioscience students did report an increase in all of the skills, the reported increases were not as high as reported by forensic science students for some skills. That is, forensic science students reported a significant increase in problem solving and self-reflection/appraisal skills by comparison. Similar student-reported findings were found by McMahon (2010) who argued that peer assessment in group work promoted critical reflection. As discussed above and noted by Henri et al. (2018), such skills developments were student-reported perceptions so actual abilities were not measured independently.

The significant difference in perceived problem solving confidence and self-reflection could be explained by the nature of the OPLA assignment, where the forensic science students were given a task specifically to address their problem solving skills through a murder investigation and to reflect on their group work activities. Since the forensic science problem solving skills were part of the assignment it follows therefore that they would be expected to improve these skills, and this is borne out by the results. This is also the same for self-reflection skills, since they were asked to write a reflective report. So the skills development opportunities presented in the assignment had a positive effect, as reported by the students.

### 6.6.8 Discipline differences for skills development

Since both cohorts completed the same post-surveys it was possible to compare results by discipline. In terms of skills comparison there was no significant difference in levels of MS Excel confidence beforehand between bioscience and forensic science students but forensic science students reported feeling more confident with MS Excel afterwards. Neither cohort were required, or expected to use MS Excel during the group work or assignment so the results may only suggest that this change in confidence was due to any use of MS Excel outside of the OPLA activity.

Another discipline difference identified was that bioscience students were more confident working and learning online before the OPLA activity but there were no significant differences reported afterwards. It is possible that this observation might be down to experience at the time of the study. Back in 2009-11, the level 6 and 7 forensic science students might not have had as much experience as the level 4 biosciences students with working online. Furthermore, there was a reasonable contingent of international forensic science students who may also have had less experience of working online. With both cohorts undertaking online working during the study the forensic science students would have increased their confidence working online, hence there being no significant difference in confidence of online working afterwards.

One final observation made from the results was that forensic science students reported being more confident taking part in online discussions than bioscience students. This might be explained by the possibility that if forensic science students were initially less experienced or confident than the bioscience students (as with working online above) they gained more from the experience afterwards. This may seem counter-intuitive to the previous hypothesis about bioscience students having more prior experience of taking part in online discussions. However, if the forensic science students started from a lower level of self-efficacy, then their perceived learning gains might have been greater, and thus explaining why they reported significantly greater skills in taking part in online discussions afterwards. Again, as with the possible link to their assignment (low stakes versus high stakes) this may have motivated the forensic science students more, resulting in more engagement and therefore developing more confidence.

### SUMMARY

In the pre-surveys students reported high levels of IT confidence, taking part in online discussions and working and learning online. The literature shows that anxiety about IT can be a barrier to its adoption (Jung et al., 2012; Mac Callum et al., 2014). However the results demonstrating this initial confidence meant that students did not see technology, or the prospect of working and collaborating online as a barrier, similar to the findings of Sakulwichitsintu (2014). In addressing the research question about whether students develop skills when engaging in online peer learning and assessment, IT is not a barrier, and indeed, the results showed that it was an enabler to further skills development.

The results statistically showed that students developed a range of IT skills based on their reported self-efficacies, particularly developing their confidence taking part in online discussions. Students also reported the development of a range of other skills too, including team work, problem solving and peer appraisal skills. There were some gender differences initially and this corroborates other findings from the literature (Caspi et al., 2008; Hargittai & Shafer, 2006; Venkatesh & Morris, 2000). There were also some differences in level of skills development reported after the OPLA activity between the bioscience and forensic science students. Given that bioscience and forensic science students were engaged in different tasks these differences could be linked to the nature of the OPLA activity.

These results demonstrated that the type of skills development is linked to the type of activity the students are engaged in and the type of skills development will be influenced by the nature of the OPLA activity. For example, forensic science students were engaged in a problem based assignment so it is no surprise that they reported developing problem solving skills. Furthermore, bioscience students reported increases in their confidence of taking part in online discussions. Therefore, whilst it is acknowledged these were self-reported skills developments based on self-efficacies; the results showed that this was positive as a result of engaging in the OPLA activity and promoted the perception of positive skills development.

# 7 INVESTIGATING LINKS BETWEEN ONLINE COMMUNICATIONS AND STUDENT GRADES

It is often very difficult to make a direct connection between a teaching and learning innovation and improvements in student grades. However, there is a body of research which explores a link between online communication and whether level of engagement in an online environment is an indicator of academic performance (Bliuc et al., 2010; Ellis et al., 2004; Lee, 2013; Tayebinik & Puteh, 2013). In this study students used a discussion board to communicate online; therefore, any potential relationship to grades could be investigated.

Given that the online discourse of students' conversations could be analysed, could the level of online communication by individuals and groups provide an indicator of how well the students performed in terms of grades achieved for the OPLA activity? By measuring the level of online communication by individuals and comparing this with their overall, final grades, it was possible to investigate any correlation between both. Therefore, online communication could be investigated as a potential indicator of overall student academic achievement for this OPLA activity.

The primary communication channel provided and recommended for students during the OPLA activity was a discussion board facility provided in the VLE. Additionally, students reported that they used a variety of other communication channels alongside the discussion board to collaborate on their group assignment. These included meeting face-to-face, phone calls and text messaging and other online media such as Facebook. Therefore, the use of discussion boards in themselves was only one potential factor for investigating any link between online collaboration and group/personal 'performance' (i.e. grades), albeit the primary recommended channel. This chapter now presents and discusses the results of the correlations investigated between discussion board interactions and student grades.

## 7.1 METHOD

As described in section 3.4 students undertook a blended learning approach to peer learning and assessment, with a summative assessment at the end. Part of the blended learning involved each group having access to its own discussion board area, primarily for communication but also for online collaboration if the groups worked in this way. After the activity had ended the content of each group's discussion board was analysed and the outputs were compared with the grades each student received.

### 7.1.1 Ethical considerations

During the period of this study there were no formal institutional ethic committees or expectations required to undertake this social research. However, due care and attention was paid to potential ethical issues and students were made aware at the start that teaching staff would have access to the discussion boards for evaluation purposes. Students were fully notified that this information and other information collected during this study was being collected and appropriate consent was collected and data stored securely. Although formal ethical clearance was not required initially, retrospective clearance was sought and agreed from the Faculty of Science ethics committee, to ensure due consideration was made in relation to collecting and managing the data at the time.

### 7.1.2 Data collection

After classes had finished and all assessed work had been submitted by students, the content of each group discussion board was exported and imported into NVIVO for qualitative analysis. It was also possible to undertake quantitative analysis based on volume of postings per group and per individual. The qualitative analysis involved a process called ‘discourse analysis’ whereby the text comments were coded and grouped based on theme.

### 7.1.3 Data analysis

The primary data for analysis was the discussion board data, which was exported from the VLE, imported into NVIVO and then coded and analysed using a process called discourse analysis.

#### *7.1.3.1 Discourse analysis*

Discourse analysis, as its name suggests, is the process of analysing a discourse, in this case, the written comments on the discussion boards. The principle of discourse analysis has been around for a long term, for example, Harris (1952) suggested an early method for discourse analysis of written text. Henri (1992) was one of the early attempts to analyse online discussions using an analytical model based on a cognitive concept that focussed on the ‘process’ of learning and not the ‘product’. Henri proposed a framework with five dimensions: participative, social, interactive, cognitive and metacognitive. In developing the framework Henri claimed what was lacking in pre-existing methodologies was not to show *what* was said but *how* it was said.

Warren and Rada (1998) undertook a discourse analysis of student online discussions using five criteria where they assessed student contributions in the online communications. In addition quantitative analysis is undertaken on the volume and type of messages posted by students. Garrison et al. (2001) took a different approach to discourse analysis using a ‘practical enquiry model’ which looked at four phases of student communication: triggering, exploration, integration and resolution. The phases appeared to equivalent to Kolb’s learning theory (Kolb, 1984) in the way learning was addressed, acted on (discussed) and then internalised. Different approaches have therefore been developed over the years to undertake discourse analysis.

Over the years different researchers have adopted different approaches and coding methods for discourse analysis (Chen & Wang, 2009; Hammond & Wiriyapinit, 2005; Ling, 2007; Romero et al., 2013). Such researchers adopted different approaches and used various coding methods and a summary of some common discourse models are summarised in Table 34.

*Table 34 Summary of discourse analysis models commonly cited*

| **Author(s)** | **List of codes** | **Reference** |
|---|---|---|
| Henri | participative, social, interactive, cognitive and metacognitive | (Henri, 1992) |
| Garrison, Anderson *et al* | triggering, exploration, integration and resolution | (Garrison et al., 2001) |
| Hammond and Wiriyapinit | 'independent', 'interactive', and 'strongly interactive' | (Hammond & Wiriyapinit, 2005) |
| Chen and Wang | Domain, Coordination, and Social talk | (Chen & Wang, 2009) |
| Ling | cognitive, social and teaching | (Ling, 2007) |
| Penny and Murphy | cognitive, mechanical, procedural/managerial and interactive | (Penny & Murphy, 2009) |
| De Leng, Dolmans *et al* | vertical questioning, horizontal questioning, reflections , statements , scaffolding | (de Leng et al., 2010) |
| van Drie, van Boxtel *et al* | Task , procedures, program, social and greeting | (van Drie et al., 2005) |

The discussion boards for each student group consisted mainly of a single threaded discussion board, i.e. there was only one discussion board for each group but they could create more than one discussion thread. There was no obligatory directive to use the discussion boards for the actual group work activity, since students were able to meet face-to-face if they wished. However, as part of the orientation training (section 3.4.2) each group was advised to record activities of their work on the discussion board as a reference point to at least keep evidence of their collaborations.

The discussion board was used to facilitate discussions if there were difficulties with students meeting face-to-face. This reference point would allow members of the group to quickly catch up with progress if they'd been absent, for example through illness; and also act as a record of who had done what during the group work project.

The discussion boards in this study had a primary role as a communication tool so it was the process more than the content that was being studied. The codes decided upon for the discourse analysis were based on the interactions that took place and are outlined in Table 35.

*Table 35 List of codes used to analyse online discussion forums*

| Code | Level | Description |
|---|---|---|
| Social | 1 | Correspondence not deemed directly applicable to any on topic work (off topic). This also includes off topic references which provide personal information e.g. I've got childcare, its my birthday... |
| Acknowledge - ment | 2 | This code will include introductions, greetings and affirmative responses during meetings (such as 'yes, that fine' or 'I agree'). Acknowledgments will include utterances relating to the start of end of any work activity as outlined by van Drie (van Drie et al., 2005) |
| Procedural/ managerial | 3 | Discussion about procedural or managerial activities. This may relate to arrangement of meetings, collation of work or discussing submission dates. It will also include discussions |

| Code | Level | Description |
| --- | --- | --- |
| | | arranging meetings. To include task based comments. Stuff that is on task generally |
| Content | 4 | Any utterances related to the content of the activity. This also includes comments about the content but not actually discussing the nature of the content. This is linked to any cognitive related codes in Table 2 where discussion at content level will include postings relating to the topic of the activity. |

When assigning codes, the approach taken by McLoughlin and Mynard (2009) for ‘coding up’ up ‘coding down’ was used. This is where a ‘higher’ code was used where an utterance covered more than one code and a ‘lower’ code was used if the purpose of the utterance could not be readily determined. Further detail about this can be found in section 1.9.2.

Whilst it is acknowledged (Chen & Wang, 2009) that social online discourse can be important, the focus of the student activities in this study was to support communication about the content being studied. For this reason the coding up or down of messages takes the social discourse as the ‘baseline’ starting point code. Acknowledgement was then coded higher as level 2, followed by procedural/managerial and then content at level 4. This use of levels did not therefore indicate any order of importance, simply a categorisation between social discourse and comments relating directly to knowledge acquisition. Since there were common themes emerging for similar topics across each year of the survey and for each subject, the responses were coded against the same themes which are listed in Appendix G.

## 7.2 RESULTS

By undertaking a quantitative analysis of the student discussion boards it was possible to explore any potential links between student engagement with their group discussion board and their final assignment mark. It was also possible to explore how students actually engaged with each other during their discussions by conducting the discourse analysis. The results of this analysis are presented below.

## 7.3 STUDENT USE OF DISCUSSION BOARDS

During the OPLA activity students were provided with access to a secure discussion board for their group to post messages. The number of posts by each group across 08/09 to 10/11 were recorded and individual posts within each group were also counted. Each group for bioscience and forensic science students across the years were named by group number (group 1, 2, 3 etc.) and the results for each year are shown in Figures 1 and 2.

There were typically between 175-220 bioscience students per year and 33-50 forensic science students each year. The bioscience students were divided into groups of approximately five and forensic science students into groups of three. Figures 31 and 32 show the range in the number of postings per subject group each year respectively, and Table 36 shows the average number of postings per group each year.

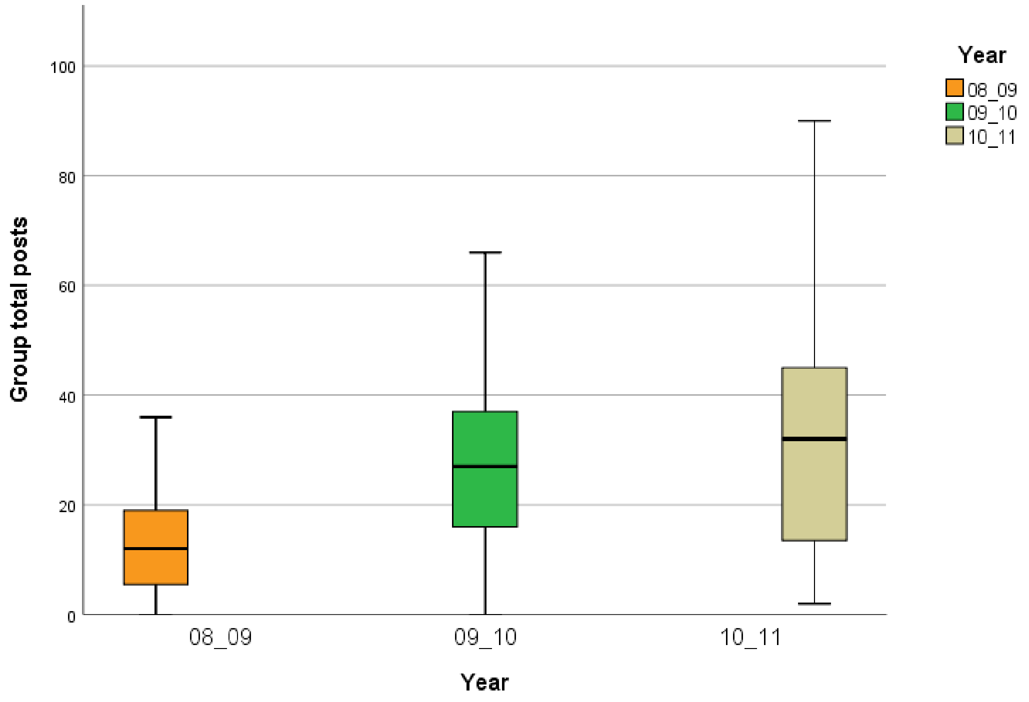


*Figure 31 Number of Bioscience student discussion board postings*

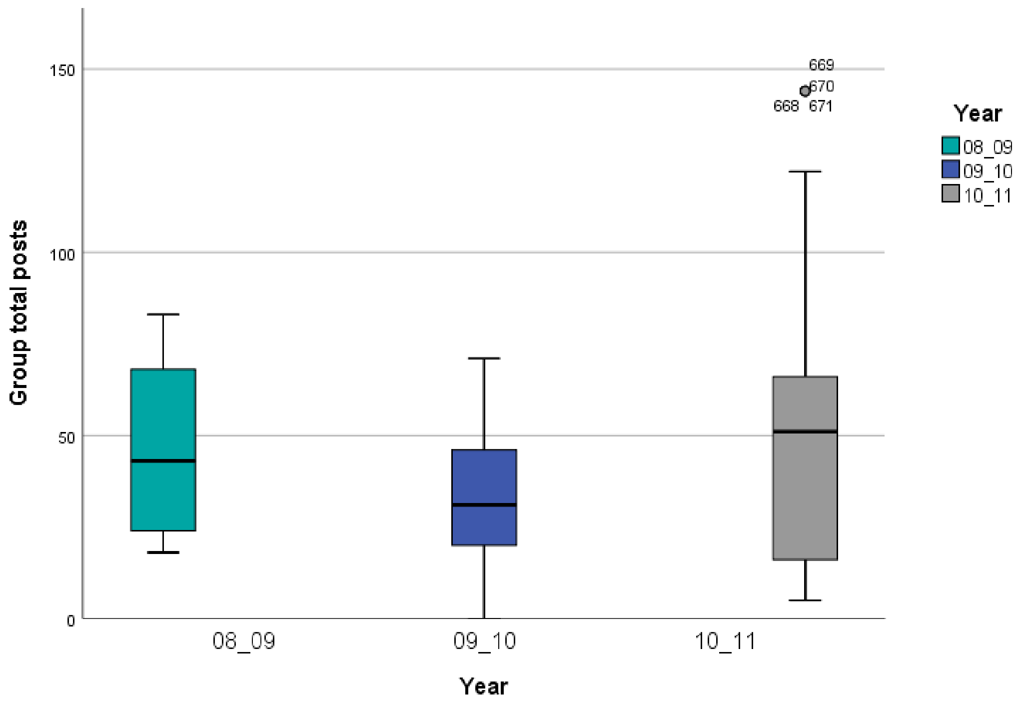


*Figure 32 Number of Forensic science student discussion board postings*

*Table 36 Average number of discussion board postings each year*

| Subject | Year | Number of groups | Average number of postings | Median | Standard deviation |
|---|---|---|---|---|---|
| Bioscience | 08/09 | 35 | 13 | 12 | 9 |
| | 09/10 | 44 | 28 | 27 | 15 |
| | 10/11 | 44 | 32 | 32 | 20 |
| Forensic Science | 08/09 | 7 | 45 | 43 | 23 |
| | 09/10 | 11 | 34 | 31 | 20 |
| | 10/11 | 15 | 53 | 51 | 41 |

## 7.4 Discourse analysis

Each discussion board for each group of bioscience and forensic science across the three years were subject to discourse analysis and the results are summarised in Table 37. The results showed that for each discipline very few, if any posts were attributed to being social. Acknowledgements were the second most common theme and procedural-managerial posts were the most common theme for all groups. Actual content postings were also low but as a percentage of overall postings, ranged between 4.9-10.8% for bioscience students across the years and 13.2-21.4% for forensic science students across the years. This showed that forensic science students posted proportionately more messages directly related to discussing their assignment than the bioscience students. Potential reasons for this are discussed later.

*Table 37 Discourse analysis of student discussion boards showing total number of postings*

| Year | | Social | Acknowledgement | Procedural-managerial | Content (% of total) |
|---|---|---|---|---|---|
| 08_09 | Bio | 2 | 106 | 289 | 48 (10.8) |
| 09_10 | Bio | 6 | 325 | 757 | 56 (4.9) |
| 10_11 | Bio | 1 | 262 | 1040 | 76 (5.5) |
| 08_10 | FS | 0 | 18 | 225 | 66 (21.4) |
| 09_10 | FS | 0 | 40 | 275 | 48 (13.2) |
| 10_12 | FS | 0 | 101 | 453 | 136 (19.7) |

## 7.5 STUDENT GRADES

The assignment for the OPLA activity consisted of two components: a single group mark for each student (which was then moderated by peer assessment) and an individual report mark, combined to give an individual student final mark. Final student grade marks were compared against the number of individual and group postings and significant relationships were found with a weak positive correlation between both number of postings and grades for a Spearman correlation test (Spearman's rho) (Table 38) for bioscience students.

*Table 38 Spearman's rho correlations between number of postings and student grades for bioscience students*

| | | | **Student grade** |
|---|---|---|---|
| Individual final mark | Number of individual posts | Correlation coefficient | 0.189 |
| | | Significance (2 tailed) | <0.001 |
| | | N | 592 |
| Individual final mark | Group total postings | Correlation coefficient | 0.007 |
| | | Significance (2 tailed) | 0.866 |
| | | N | 592 |
| Group mark | Group total postings | Correlation coefficient | 0.262 |
| | | Significance (2 tailed) | <0.001 |
| | | N | 592 |

Similar findings were also found for the forensic science students (Table 39).

*Table 39 Spearman's rho correlations between number of postings and student grades for forensic science students*

| | | | **Student grade** |
|---|---|---|---|
| Individual final mark | Number of individual posts | Correlation coefficient | 0.217 |
| | | Significance (2 tailed) | 0.018 |
| | | N | 118 |
| Individual final mark | Group total postings | Correlation coefficient | 0.159 |
| | | Significance (2 tailed) | 0.085 |
| | | N | 118 |
| Group mark | Group total postings | Correlation coefficient | 0.280 |
| | | Significance (2 tailed) | 0.002 |
| | | N | 118 |

The results from the Spearman's rho correlations showed that there were weak positive correlations between individual student scores and the individual postings to the discussions boards for all students (both bioscience and forensic science students). There were also weak positive correlations between group scores and group discussion board postings. However, there were no correlations between group discussion board postings and an individual student's final mark.

## 7.6 GENDER DIFFERENCES

Due to the nature of the information available through central student records and for ethical reasons, data was not available on a case by case basis to compare an individual's age and language with their final grade. This would have allowed an investigation to compare and potential impact of age or language (English as a second language) on grades. However, it was possible to record gender and on this basis it was possible to explore any gender differences in relation to grades.

When investigating any potential gender differences in grades, bioscience females gained significantly higher grades than their male counterparts (Mann-Whitney $U=39266.5$, $n=592$, $p=0.035$ two tailed). There were no significant differences in grades for forensic science female students with males. In terms of number of postings to the discussion boards there were no significant differences in gender for bioscience female students but forensic science female students posted significantly more messages (Mann-Whitney $U=1210$, $n=117$, $p=0.006$ two tailed) than their male counterparts. Therefore, bioscience females posted similar numbers of messages but gained higher marks than males and forensic science female students posted significantly more messages than males but there were no differences in final individual marks.

## 7.7 Student comments about online communication

In addition to analysing how students communicated through the discussion boards, it was possible to triangulate their actions with their views about communicating online. After the OPLA activity students were asked what they liked or disliked about working online with the VLE and a number of comments were made in relation to the discussion boards. Other comments about the discussion boards were also recorded from other open text responses. Examples of these comments are provided in Table 40.

*Table 40 General student comments about discussion boards*

| **Working online theme** | **Response [survey year]** |
|---|---|
| Good way to communicate | *"I liked the use of the discussion board to communicate with everyone at once." [bio post 08/09]*<br><br>*"I thought the discussion boards and especially the file exchange were excellent, as it can be difficult to keep meeting up and showing the work in person. Made it a lot easier." [bio post 08/09]*<br><br>*"it was an easy way to communicate" [FS post 08/09]*<br><br>*"The level of communication is a lot more effective. It is very easy to contact people, and work can easily be amended and passed around the group." [bio post 09/10]*<br><br>*"I enjoyed the fact that when I communicated with the group I would get a response back straight away from them." [bio post 09/10]*<br><br>*"everything is there to look back at and if some one hasnt got the confidence to say what they want to in a group environment they can do it online" [FS post 10/11]* |
| Meet new people | *"Discussion Boards are great, easy communication with oter group members. Nice social exercise, enjoyed getting to know new people and being a little out of my comfort zone." [bio post 08/09]*<br><br>*"It also encouraged us to communicate with people we might not have talked to otherwise." [bio post 08/09]*<br><br>*"It allowed us to meet new people and using blackboard meant we were able to communicate with each other without having to meet in person." [bio post 10/11]* |

| **Working online theme** | **Response [survey year]** |
|---|---|
| No need for face-to-face meetings | *"The discussion board made it easy to share information without the hassle of arranging a meeting." [bio post 08/09]*<br><br>*"Using forums is easier than meeting face-to-face" [bio 09/10]*<br><br>*"It was very easy to talk to other group members without having to arrange to physically meet them." [bio post 10/11]*<br><br>*"The people you were working with would always turn up to the meeting as it is online. You could discuss and bounce ideas and everyone would have an imput, even those otherwise shy." [bio post 10/11]* |
| Flexible communication | *"It gave the option to communicate with group members outside of lesson hours." [bio post 08/09]*<br><br>*"Blackboard did make it easier to communicate within the group and pass on information and files.  Allowed me to work easily from home, which is really good as I have a tight schedule to adhere to." [FS post 08/09]*<br><br>*"If I was very busy then some things could have been discussed online instead of meeting face-to-face, as I would have to get a bus and it would have taken too much time." [bio post 09/10]*<br><br>*"Avoids time-table clashes as we could communicate as and when it was convenient." [FS 09/10]* |
| Different mode of communication | *"It encourages communication in different ways, e.g. using blackboard, e-mail and face-to-face interaction" [bio post 08/09]*<br><br>*"It was a lot easier than having to meet up to discuss simple things or using phones as that can get quite tricky. Especially between four people." [FS post 10/11]*<br><br>*"Its not as frustrating as relying on meet ups when not everyone is available at the same time or the phone which people dont answer." [bio post 09/10]*<br><br>*"It was easy to share work and communicate about what we needed to do without having to all meet up each time or have to email round individually. It was a much easier, more practical way of communicating." [bio post 10/11]* |

These comments made about the discussion boards were the most common made, although there were several comments made about communication problems with the discussion board and these are discussed in more detail in sections 4.5.3 and 4.5.4. It is clear from the range of comments received that students found the discussion boards advantageous for general communication, sharing work and ideas and online meetings, amongst other benefits.

## 7.8 Discussion

This chapter set out to investigate if there was any supporting evidence that the online group work reflected student grades. There is no direct measurement in this study that can link student grades to improved learning outcomes, but other literature (discussed below) does provide evidence. Regardless, the implication for this study is that by creating the online environment to support online group work, the outcome is that students' engagement in online learning could be reflected in student grades.

Whilst the benefits of online collaboration for learning are known, the primary aim of this study was to use discussion boards for online communication, not directly for learning *per se*, although the blended learning activity did provide the environment for online learning. For example, whilst tutor involvement in online group discussions can promote online learning (Rada, 1998; Solimeno et al., 2008), there were no tutor interventions, though initial guidance was provided. Students in this study used a range of electronic tools to communicate, with the primary communication tool provided for the group activity being the discussion board. So the environment was created to support online learning and facilitated primarily to support online communication.

Whilst students did use other communication methods such as text, Facebook and face-to-face meetings, there were no data available however to consider which was the most dominant tool used, but students were recommended to use the discussion board as their primary communication tool for the OPLA activity. One reason for this recommendation was that it would act as an online record of communication between group members. The results showed that most groups engaged with the discussion boards, with some using them more than others.

The promotion of learning in an online environment can be facilitated in a number of ways. Gikandi et al. (2011) reviewed the literature on formative assessment and discussed how online tools such as self-test quiz tools, discussion forums and e-portfolios can improve learning engagement. An analysis of online asynchronous discussion by Nandi et al. (2012) highlighted factors for promoting online collaboration which were also highlighted by Thomas (2013), such as tutor involvement in online discussions. Matheson et al. (2012) also discussed how discussion boards can promote critical thinking. There is also other research that showed how online collaboration can promote learning in general (Meyer, 2003; Wu & Hiltz, 2004; Zha & Ottendorfer, 2011) and specifically through reflection (Dewiyanti, 2005; Green et al., 2010; Salmon, 2002). Creating the environment for online communication in this study through the discussion boards promoted online collaboration and supported the opportunity for online learning.

Possible links between online interactions were considered by exploring possible correlations between discussion boards and grades. The results showed that there was a significant relationship with a weak positive correlation between the number of posts students made on the discussion boards and the individual mark they got for their assignment. A similar correlation was also found for the total number of group postings and the group mark. There was no correlation found between an individual's final mark and the group's total postings, but this might be expected. The reason for this is that the group mark for the assignments was only part of the overall student work and all students also had to produce an individual report. So an individual's final mark was partly influenced by the group mark and their own mark for their individual report.

Despite students using a range of communication tools, the results showed that there was a correlation between use of discussion boards with group and individual marks. This finding is contrary to that of Dunn and Kennedy (2019) who found that discussion boards were not independent predictors of grades. They explored TEL (Technology Enhanced Learning) in relation to motivation, engagement and academic achievement. They found intrinsic motivation predicts engagement with TEL and extrinsic motivation predicts usage. They did find however, that as TEL engagement increases, so too does grade. So Dunn and Kennedy did find a link between TEL and grade predications but not specifically discussion boards, as was the case in this study.

Individuals who contributed to online discussions in this study gained higher individual final marks and groups as a whole received better grades when group members collectively contributed more to the discussion board. The discussion boards were also used for sharing work and ideas, and for gaining feedback about the work or assignment as a whole. It follows therefore, that the more an individual or a group collectively, contributed to the online communication and collaboration, then the higher grade they received.

It would appear that even if the discussion boards were only created to primarily support online communication, since the environment was set to also support online collaboration and learning; students benefited. Vonderwell (2003) argued that online asynchronous communication (such as discussion boards) must be designed effectively to help students '*gain learner autonomy*'. Gikandi et al. (2011) also discussed the role of the tutor to foster a shared purpose and promote learning. This includes integrating the use of discussion boards into the student activity and not merely provide access without purpose. Appropriate guidance for online collaboration and using the discussion boards was provided in the orientation training and therefore this echoed recommendations in the literature on promoting student collaboration and learning.

This work is supported by Lee (2013) who showed that the better students understand how online discussions can help their learning, the more they are willing to contribute. Tayebinik and Puteh (2013) also highlighted the potential links to improved learning through online communication. Similar to the findings of this study, Tayebinik and Puteh (2013) also reported that the more students participated in online interactions, the more likely they were to '*secure the passing grades*', which concurred with other research that found a link between online interactions and grades (Davies & Graff, 2005b; Handelsman et al., 2005; Romero et al., 2013). Tayebinik and Puteh (2013) only discussed the significant link to online interactions and achieving passing grades not the level of pass, compared to this study which demonstrated a significant correspondence between level of online interactions and actual grades.

When considering gender differences the forensic science results supported those of Caspi et al. (2008) who found that females posted more online messages than males. The results also showed that bioscience females tended to achieve higher grades than their male counterparts and this is echoed by Ding et al. (2011). The female bioscience students did not post significantly more messages than their male counterparts however. A caveat here is that although Ding et al. (2011) found that females outperformed males, the study was with secondary school students, as opposed to university students. These results were not reflected in the case for female forensic science students however, who showed no significant differences in grades. Potential arguments about gender bias do not seem clear in this instance, given that female forensic science students posted more messages than males, but not higher grades; whereas bioscience females scored higher grades but didn't post more messages.

The reason, or reasons, for female forensic science students posting more messages are not clear, though female students have been shown to be less risk averse (Lam & Ozorio, 2013) and undertake more work to ensure good grades (Nekby et al., 2015). So female forensic science students might have contributed to online discussions more in the hope of gaining better grades. Some additional information could be found from other results in this study to try to explain the gender differences in posting messages online, namely in relation to IT confidence for online communication (as discussed in section 6.3).

Bioscience female students were initially less confident taking part in online discussions than their male counterparts (see section 6.3.1) so this might suggest they were less confident at posting messages, but the results did not support this. That is, after the OPLA activity female bioscience students reported no significant difference in confidence for online discussions compared with male students. Therefore, engaging in the online discussions increased female confidence and it would appear as a result, female bioscience students contributed more to the discussion board conversations.

Hung et al. (2010) also found no gender differences when considering students' confidence in online learning. This would explain why there were no gender differences in confidence afterwards and Caspi et al. (2008) suggested female students might prefer written communication more than males. However, it does not explain why female bioscience students posted significantly more messages compared to male bioscience students. An additional factor for the forensic science students is that there were more international male students in the groups and there may have been a cultural difference with posting online. Unfortunately detailed data were not available to confirm this or not.

The non-significant differences in grades for female and male forensic science students could be due to maturity, with both genders more willing or able to work more collaboratively together. This argument is supported by the initial positive attitudes to group work and peer assessment of the forensic science students (section 4.5). For the bioscience students, a gender difference was found, with female students recording statistically higher grades than males. The separate results for bioscience and forensic science therefore support the findings of other research on gender differences (Ding et al., 2011; Hargittai & Shafer, 2006; Jakobsson, 2012).

Another possible reason for the differences between the discipline cohorts might be explained by the difference in their levels of study (level 4 compared with levels 6 and 7) or the differences in the nature of the group activities undertaken by each discipline group. The assignment set for the bioscience students was set at level 4 and the nature of the assignment (task based) might have allowed for a greater spread of marks. The forensic science assignment was set at level 6 and was therefore more focussed on higher order assessment (critical thinking, interpretation etc.).

### SUMMARY

There has been research over the years demonstrating that increased student engagement increases grades (Handelsman et al., 2005) though this has been contrasted with online studies that counter this (Davies & Graff, 2005a). However, other research has provided additional evidence that online engagement can increase grades (Tayebinik & Puteh, 2013). It has been argued that grade improvement comes about not just as a result of time spent online, but when this time is interactive with group members (Castaño‐Muñoz et al., 2014). One thing is clear, the literature shows that students communicating and collaborating online has clear learning benefits (Ćukušić et al., 2014; Lee, 2013). For this reason, student academic performance was also considered in this study to investigate any link with student online collaboration with grades.

The results showed a weak positive correlation between level of online interactions and students' grades. Groups who contributed more messages to online discussions achieved higher grades than groups who contributed less to online discussions. This was also true of individual student performance, where a correlation was found between number of individual postings and an individual's final grade. This was despite the fact that an individual's final grade was partially dependent on an individual report that was not directly linked to the online collaborations. So an individual's contribution to the group discussion board was still a reasonable indicator of their final grade. Gender differences were found for bioscience females achieving higher grades than their male counterparts (but not for number of postings), and forensic science females posted significantly more messages than forensic science males (but no significant differences in grades).

Since a clear correlation was found between online discussions and grades, including separate gender indicators, this provides additional evidence to the literature on grade performance linked to online collaboration and engagement. These results provide additional research data supporting the argument that more engaged students achieve better results. Therefore, if the conditions are created to promote online collaboration student grades can be positively impacted if students actively engage with their peers.

# 8 DISCUSSION

Peer learning and its associated activity, peer assessment are well established pedagogies to support learning. Students who collaborate effectively with their peers are more engaged in the learning process and benefit not only academically, but through other ways such as improved self-esteem and skills development. Peer assessment, whether formative or summative helps students to reflect on their own performance and development. Reviewing the efforts of other students provides students with a valuable insight into their own performance and helps improve their future development. The use of technology to support peer learning and assessment adds a new dimension to engaging students and brings its own challenges and opportunities.

This study set out to investigate ***student experiences of online group work and peer assessment*** by investigating a blended learning approach to teaching. This blended learning approach involved peer groups and creating the environment to foster good group communication and collaboration. Electronic peer assessment was also employed to help assess the students' group performance and consider if electronic peer assessment was a valid form of assessment. It was also possible to investigate additional aspects of the online group work, that of skills development and effects on learning.

In order for students to engage with peer learning and assessment they must understand the purpose and opportunities that come with it. This engagement must be effectively facilitated so that students can develop their confidence in peer learning and assessment. If students are simply left to create their own environment for peer learning to take place, there are a number of ways in which it can result in failure. This can include not knowing how to effectively communicate with each other, manage the work or know how to support each other in a constructive manner. To investigate the student experiences, two key research questions were asked, which also have several supplemental questions.

The first research question was to ask "*Do students have a positive experience of online peer learning and assessment based on a structured blended learning model*?". The academic goal of the author was to provide a positive learning experience for the students, so this is a vital research question to ask, if students are to positively engage with the process. Supplemental questions arising from this relate to skills development and are addressed later. Peer assessment is another well-established pedagogy to support learning and can promote a range of skills. Some students find peer assessment difficult to engage with however, partly because they do not always view it as valid. So, the second key research question for this study was to ask "*Is online peer assessment a valid form of assessment?*". By addressing these two key research questions it was possible to explore how students would engage with a blended learning approach to peer learning and assessment.

Promoting effective peer learning depends on a number of factors so it is important to consider how these factors combine to help students collaborate successfully. They include consideration for how the groups are formed and what numbers may make effective group size. The ground rules for communicating and behaving in a group are also key, to avoid unnecessary conflict and misunderstandings arising. Additional support in helping students work effectively is particularly essential when working online, so students understand the role of technology in effective communication. For example, setting expectations for responding to online messages. The use of peer assessment and how students were informed about its use is also vital.

Students can quickly become dismissive of peer assessment if it is not planned, explained and understood by them. Challenges exist such as the risk of bias and other psychological issues students can face when having to judge their fellow peers. There is also the perennial challenge of freeloaders in a group and the sense of unfairness students feel if these freeloaders are perceived to receive credit for lack of effort. The use of electronic peer assessment in this study helped address many of these issues and reduce the risks by enabling students to assess their peers in a confidential setting. Therefore, by considering the key research questions of this study it was possible to investigate the creation of an environment to promote student promote a positive experience of blended peer learning and assessment.

To help demonstrate student confidence in peer learning and assessment for this study, a structured blended learning approach for peer learning and assessment was devised. Student responses, activities and attitudes were analysed and the results were able to demonstrate whether the students had demonstrated confidence in the process. Students were placed into groups and provided with formal guidance and support for working and collaborating online. They were also asked to peer assess each other's contributions to the group work and the marks were compared with student views about how they assessed each other. From these results it was possible to investigate if students valued the process by considering their views of online group work, peer assessment, skills development and any learning gain opportunities.

With consideration of the published research on blended learning and peer assessment, this study adds to the literature by demonstrating an effective model of online peer learning and assessment that supports a positive student experience and confirmation that the approach to peer assessment in this study provides a valid form of assessment for students. This study highlighted a number of additional positive outcomes, such as flexibility of communication, social engagement and overall satisfaction with the process. The results also found new evidence to support positive student attitudes to online group work who understood the benefits of working online. As well as the positive results for the peer learning, positive results were also reported for the students' engagement with peer assessment.

## 8.1 Blended learning

Blended learning has long been demonstrated to provide benefits such as increased social presence (Hostetter & Busch, 2006; Kreijns et al., 2003; Picciano, 2002) which itself can lead to increased motivation (Gomez et al., 2010; Hannaford, 2017; Liu, 2009) and learning outcomes (Liu et al., 2019a; Siow, 2015), and even administrative efficiencies (James et al., 2018). How a blended learning environment is created however is vital to how successful it can be. This study adds to the literature by reviewing the key factors involved in creating an effective blended learning model to produce a positive online experience for students.

A key driver of this study was to provide a positive learning experience for students, particularly for the large cohorts of bioscience students. The blended learning planning needed to take account of this by carefully planning the group sizes that would work appropriately for the assignment. This also involved consideration for tutor involvement, motivation, support and the technology itself. Much of the literature in this field often focusses on only one or two aspects of the factors that promote a positive blended learning experience but this study took a holistic approach to investigate how all these factors need to be considered together to be truly effective.

Blended learning involves a number of factors which need to be considered to provide an overall coordinated approach to support students. The literature is mixed when it comes to consideration of group size and formation for group work, with some arguing for different optimal group size (Gannaway et al., 2018; Oakley et al., 2004; Qiu et al., 2014) and formation based on different criteria such as learning styles (Kyprianidou et al., 2012) or prior academic achievements (Ireson & Hallam, 1999). This study found that group size was best determined by the scope of the assignment, which echoes the findings of Bacon et al. (1999) and Shaw (2013).

In this study, group formation was based on promoting social engagement by deliberately mixing students up, something which was found to be successful. This involved mixing students based on course, age, and English/non-native English speakers. The results found that this approach to group formation was effective and that students not only engaged with the activity, but that there was no negative impact on experience based on the demographic makeup of students.

Student prior experience can have a positive or negative effect for blended learning depending on their self-efficacy (Kerr, 1989; Piezon, 2005), that is, their personal confidence. It is interesting to note that whilst the results picked up some expected differences in self-efficacy initially, such as gender differences, no differences were reported afterwards. A positive outcome of this study therefore showed that a carefully designed blended learning activity can mitigate for demographic differences. This also had a positive knock on effect for motivation.

Motivation can be intrinsic or extrinsic and the literature discusses the impact both can have on student engagement with blended learning (Hannaford, 2017; Law et al., 2019; Li, 2019). The motivation in this study was primarily extrinsic, with students having to submit a summatively assessed assignment. Although the literature shows that intrinsic motivation can lead to more engaged students (Widjaja & Chen, 2017) and better academic outcomes (Dunn & Kennedy, 2019; Hsia et al., 2016) students reported that they had felt they had become more motivated to complete their group task. Students also reported being under relatively little or no external pressure from their peers or the assignment, so intrinsic motivation can be promoted given the right circumstances. One of the contributing factors to this is the development of social presence.

Social presence has been widely reported as important as a positive factor for promoting learning online (Beckett et al., 2010; Ngoyi & Malapile, 2018; Postmes et al., 2001). Much of the literature discusses how intrinsic motivation, student engagement and academic performance can develop as a result of social presence (Kim et al., 2011; Picciano, 2002). Social presence was not actively promoted in this study yet the results showed that student engagement developed regardless. This contrasts with the literature on social presence, so although social presence can, and has been shown to promote online learning, actively promoting social presence is not necessarily essential. Social presence is often promoted by tutor involvement and this is another area where this study produced new results that differ to the current literature.

The development of social presence online is sometimes reported in the context of requiring tutor involvement to initiate and nurture it (Zilka et al., 2018). The use of tutors to facilitate and promote the development of social presence is reported (Chen & Wang, 2009; Pozzi, 2010) but can also have drawbacks such as over-influencing the group or students becoming reliant on the tutor rather than their own learner autonomy (Fotiadou et al., 2017). Tutor involvement also involves staff time which can increase administrative burdens on the tutor (Chang & Kang, 2016; Rada, 1998).

The literature discusses how tutor involvement can promote online learning (Chang et al., 2012; McDonald, 2013) and also help the development of social presence (Kreijns et al., 2003) . Social presence itself has also been shown to promote student motivation and engagement in online learning (Ngoyi & Malapile, 2018). There is a challenge however in that tutor involvement can influence student collaboration (Sansone et al., 2018) and is more time consuming (Chang & Kang, 2016; Rada, 1998). So is there a compromise that supports student engagement, whilst managing the administrative burden of blended learning?

This study deliberately did not include tutor involvement in the online collaboration, partly to manage the increasing administrative costs of increasing class sizes, particularly for the bioscience students. This begs the question however, of whether this compromises the quality of the learning experience for students? The results found that this was not the case and that by planning the approach to blended learning, students reported having a positive experience.

Whilst the literature discusses the potential benefits of tutor involvement (Parks-Stamm et al., 2017) this study actually found that by creating the environment for student-managed online collaboration, social presence developed. Social presence has been shown to be beneficial in promoting student engagement but mostly with tutor involvement. For example, Zhu et al (2019) was able to promote social presence but required tutor involvement. Thomas and Thorpe (2019) also found this challenge, alongside the administrative burdens. This study found however, that social presence was able to develop without tutor involvement and an associated increase in student motivation was also self-reported. It also promoted conditions for learner autonomy (see section 4.8.4). This blended learning model was therefore able to promote social presence and motivation, whilst minimising administrative overheads.

The approach taken in this study to develop an effective blended learning environment adds to the literature by building on accepted pedagogical approaches and combining a novel holistic, practical approach. The blended learning environment set up the circumstances whereby they could effectively collaborate online and develop motivation through social presence. Counter to some studies, this was also achieved without tutor involvement, through extrinsic motivation of the summative assessment and was manageable for large cohorts without excessive administrative costs. Most importantly, the results demonstrated that students had a positive experience of their blended learning activity, irrespective of educational or demographic background.

## 8.2 VALIDATION OF PEER ASSESSMENT

Peer assessment is a well-established assessment tool that offers the potential to provide a number of benefits. At its core, as an assessment tool peer assessment can promote student learning and self-reflection (Li et al., 2010; Ma & Ng, 2002; Sadler & Good, 2006). Given the collaborative nature of peer assessment, there are other benefits such as increased self-efficacy, student-generated knowledge, and motivation. However, there are also potential challenges which may turn students away from the benefits of peer assessment if not managed effectively.

Students can quickly become dismissive of peer assessment if it is not planned, explained, understood and, importantly owned by them. Challenges exist such as the risk of bias and other psychological issues students can face when having to judge their fellow peers. There is also the perennial challenge of freeloaders in a group and the sense of unfairness students feel if these freeloaders are perceived to receive credit for lack of effort. This study set out to investigate the key factors involved in promoting constructive peer assessment and the results produced new findings that add to the literature.

Online peer assessment was employed for this study as it removed some face-to-face challenges such as peer pressure and other social influences that might impact on how students assess each other (Mostert & Snowball, 2013; Pozzi et al., 2016). The results showed that this was effective and eliminated various risks such as gender or other demographic biases. Peer assessment also acted as a positive extrinsic motivator and helped improve student self-confidence. A major benefit however, as reported in the literature was the ability of the online peer assessment to mitigate for freeloading (Orr, 2010; Shiue et al., 2010).

Freeloading, also called social loafing, is a commonly cited problem with peer assessment (Maiden & Perry, 2011; Teng & Luo, 2015). When students peer assess, or peer review each other's work there is concern that students feel that other students are not able to accurately mark their work and that the tutor is best placed to do this. The reality however is that students can be just as accurate, especially with training (Grez et al., 2012; Sluijsmans et al., 2004; Stefani, 1998). In this study students were not peer assessing each other's work but *how* they worked together as a group, so the tutor was not best placed to judge, as mentioned in section 3.6.1. Students therefore had primary responsibility to deal with the problem of freeloading themselves.

The peer assessment process of group work was fully discussed with students in this study, explaining that they were best place to judge each other's contribution to the work and it was this group work that would be peer assessed. This was discussed as part of the orientation training so that students understood the benefits and potential skills development opportunities of group work. Initially, students expressed concerns about freeloading but afterwards this concern was not reported as a major issue.

Although freeloading is a major challenge with peer assessment, if students are fully engaged and take ownership of the process then it can provide a number of benefits. Students in this study reported improvements of their views about being able to peer assess and reflect on their own work with more confidence. Freeloading was still reported as a concern but in relation to their initial views, this was only a minor concern, demonstrating that students were satisfied that the peer assessment process had largely address any concerns about freeloading students.

The use of electronic peer assessment in this study helped address many of these issues and reduce the risks by enabling students to assess their peers in a confidential setting. Students reported being under relatively little pressure from their peers, and even the forensic science case study demonstrated that despite a group conflict, all group members felt they were assessed fairly by their peers. So, by carefully considering the online peer assessment to ensure students took ownership of the process, it was possible to create an environment that promoted student confidence in peer learning and assessment.

Whilst there is a wealth of research discussing peer assessment as a valid form of assessment (Cheung-Blunden & Khan, 2018; Nordberg, 2008; Xu, 2012) it often relates to comparisons of marks between that of the tutor and the students (Jackson, 2013; Ryan et al., 2007). There is a problem with this approach however, since it makes the assumption that the tutor mark is the 'correct' benchmark by which to assess the students against. This is because the literature shows that even tutors can disagree in their marking and that students can assess just as accurately (Black et al., 2010; Jeffery et al., 2016). Since this study used peer assessment to assess how the students worked together, assessing the process of the group work, not the product it was the student perceptions of peer assessment which could be investigated.

Students were asked about their views of peer assessment beforehand and were compared afterwards. This self-reported view demonstrated that students felt that the peer assessment process was fair and reflects other literature that considered students views as validation of peer assessment (Hyun Bae et al., 2018; Kingsley, 2010). Whilst these positive student views reflected a sense of acceptance of peer assessment, this study investigated this further to explore if student views could be corroborated from other sources.

Since students used discussion boards within a VLE to communicate and collaborate online, this provided an additional source of data to compare student perceptions against actual collaborations. Furthermore, students only saw their own final grades so did not actually know what final mark their fellow group members got. This led some students to still suggest that potential freeloaders got higher marks than they deserved. Part of this study invited some students to share scores so fresh judgements could be made based on actual scores and not assumptions. This triangulation of data is novel in the literature for attempting to assess the validity of peer assessment.

Research on peer assessment has sought to validate it against student views, tutor marks, marking algorithms but has not previously combined the different aspects of group work. This study investigated peer assessment by not only considering student perceptions but also how the students worked together and compared actual scores. This collective approach was therefore able to comprehensively demonstrate that peer assessment was indeed a valid assessment tool, based not only on student perceptions but actual evidence of their group work too.

## 8.3 Skills development

The opportunity for group work to promote skills development has long been reported in the literature (Boud et al., 1999; Falchikov, 1988; Gupta, 2004; Volet & Mansfield, 2006). Some of this literature focusses on student self-reported skills (Ashwin, 2003; Drake et al., 2006) and it has been argued that this is less to do with actual assessment of skills but more to do with motivation and self-efficacy (Henri et al., 2018; Panadero & Romero, 2014). Whist this is a valid argument, the fact that students report increases in self-efficacy has also been shown to increase intrinsic motivation (Hsia et al., 2016) and this in itself aids skills development (Ramon-Casas et al., 2019). Therefore, whilst self-reported skills development is not a direct measurement of actual skills, it can arguably be used as an indirect proxy for skills development.

An explicit goal of the group work explained to the students in this study was to promote several skills, including communication, group working and problem solving. Alongside this was the opportunity for students to develop their IT skills as a result of the blended learning and act as a source of knowledge generation through their online and face-to-face collaboration. Students were asked to self-report their level of skills confidence before and after the study and as well as comparing changes in perceptions of skills development, it was also possible to explore other potential impacts on skills development, such as demographics and the role peer assessment has on skills development.

In relation to direct group working skills, students reported improvements in various skills, including communication skills, team working and problem solving skills. This result in itself should not be surprising, given that the students were engaged in these activities and it was made explicit to them that the group work was designed to support these skills. Improvements in problem solving skills were also specifically noted by the forensic science students as their assignment was mostly based around a problem solving activity (solve a murder case). In relation to IT skills development, some obvious improvements were reported and some less obvious ones.

When expecting students to collaborate online, with the aid of technology it is important to consider if technology itself is a barrier (Chang & Kang, 2016; Prensky, 2001). As reported by the students, they felt confident using computers and reported no problems, reporting that their IT skills had improved due to the online group work. This is not unexpected, particularly for the bioscience students since they were being taught some

IT skills alongside their group work. Perhaps the less expected results were students reporting increases in working and learning online.

Section 6.6.3 discusses the possible reasons for increased confidence in communications and working online. Whilst it was not possible to fully explain this during this study, some potential indirect evidence may account for it. Taking a collective view of the student data and feedback comments, whilst this study deliberately did not promote online social presence (see section 3.6.2) students reported the development of social presence, for example making comments like: "*I also enjoyed making new friends who I speak to on a regular basis.*" [bio 08/09]. This may, in part at least, explain the increased confidence in online communication and working due to students developing a natural social presence with each other. In addition to these skills, a range of other skills improvements relating to peer assessment were also self-reported.

Students experiences were positively self-reported by the students for a number of skills. Students reported increased self-efficacy for a range of skills including IT skills, self-reflection and peer appraisal skills. This demonstrated that although the primary driver was extrinsic motivation, students increased their intrinsic motivation to complete the task. This is somewhat contrary to other research that argues that students can engage when they are naturally more intrinsically motivated.

The challenge of student motivation to encourage engagement in blended learning is discussed by Li (2019) who argued that training is required for peer assessment. This is echoed by others (Liu & Li, 2014; Liu et al., 2018; Lock & Johnson, 2015) and was addressed in this study through orientation training. However, there was no specific proactive training once the activity had started and no tutor involvement, yet the results showed evidence of increased student motivation. This provides evidence therefore that with the right conditions and planning, students can increase their intrinsic motivation without necessarily the need for additional training or practice, or tutor support.

Peer assessment literature has been published to promote skills development (Faherty, 2015; Schonrock-Adema et al., 2007) and similar results were also recorded in this study. Students reported that the self and peer assessment had increased their motivation to carry out group work and that their peer appraisal and self-reflection skills had also improved. Students also reported that they felt more positive about online group work and that they even liked it and would be willing to undertake it again. So the whole blended learning activity, incorporating peer assessment produced positive self-reported improvements in skills development.

The teaching and learning activities for the students in this study set out to provide a number of skills development opportunities. The blended learning approach provided the environment for this by engaging students in group work, using IT for collaboration and peer assessment to promote peer review and self-reflection skills. Students reported various skills developments, which is in line with other literature on skills development. As well as confirming results from similar studies this research also produced new findings on how students develop new skills.

Skills development was part of the broader aim of this study; and to explore student perceptions of online group work and peer assessment. Other literature in this field is limited in relation to the scope of this study (Henderson et al., 2017; Schmulian & Coetzee, 2019; To & Panadero, 2019; Wilson et al., 2018) as it did not explore how different aspects of skills develop combine to provide a holistic, positive student experience of blended learning. Also, the literature discusses how social presence and tutor involvement are necessary for online group learning and student-centred knowledge generation (Ngoyi & Malapile, 2018; Warden et al., 2013; Zilka et al., 2018). This study found however, that with the appropriate orientation training, students were capable of collaborating effectively in a blended learning environment and this also led to a more natural development of social presence, with the need for direct tutor input, as the literature suggests (Thomas & Thorpe, 2019).

## 8.4 ACADEMIC DEVELOPMENT

A key research question for this study was to ask "*is online peer assessment a valid form of assessment?*". This question was addressed by triangulating data from different sources to compare student perceptions of the peer assessment process with evidence of how they collaborated online and how they actually peer assessed each other. This approach to validation of peer assessment has not been covered in the literature to date. The results were able to confirm that not only did students perceive peer assessment to be fair (i.e. valid) but that peer collaboration and the grades they gave each other corroborated their views. The result was student confidence that the summative assessment was a fair reflection of their group contributions.

The use of summative assessment is a core pedagogic approach for evaluating a student's understanding of a topic, or the ability to demonstrate their competence of a skill. In this case, students were being peer assessed on the group work and a range of associated skills, as discussed above. A subsidiary question arising from the primary research question therefore, was whether this blended learning approach could actually help improve student academic development?

This question is not easy to answer, as academic development can arise from a number of different factors, such as motivation (intrinsic or extrinsic), nature of the assignment or for other reasons such as level of student engagement with the process. An additional difficulty is that academic development might be measured against previous knowledge or academic attainment. What could be investigated in this study however, was any potential link between student engagement with the blended learning activity and grades, to explore any potential correlation.

Student academic development is linked to motivation and engagement, and it was possible to explore student engagement from their contributions to the discussion boards. A significant caveat here is that students engaged with each other and the assignment in the classroom and using different media (e.g. email, text, Facebook) so using the discussion board as a sole indicator of student engagement only provided a limited view of the student overall engagement with the assignment activities. However, the results did show that there was a positive correlation between use of the discussion boards and student grades.

Another consideration for student engagement and motivation is the nature of the task, and demographic makeup of the students in relation to skills development. In this study two different discipline cohorts, at differing levels of study, were investigated. In terms of demographic differences, the bioscience students were generally slightly younger, with the module being level 4, compared with the level 6/7 mixed group module for the forensic science students. Both groups had comparable internal mixes of age groups (i.e. some mature students) and students whose first language was not English (mostly international students). These differences could be investigated for any recorded differences in perceptions or outcomes of the blended learning activity.

The results from this study showed that there were initial demographic differences based on self-efficacy of IT skills based on gender, age and language differences. However, these reported differences disappeared afterwards, with increases in self-reported skills development and self-efficacy for working online for all demographic factors. Schmulian and Coetzee (Schmulian & Coetzee, 2019) reported that a culturally diverse student cohort may enhance intercultural collaboration and this may have also been the case with this study. No cultural differences were reported, in fact some students reported how working online and face-to-face helped, particularly being able to reflect before writing online responses.

Whilst a demographic synergy was found for language, this contrasted with the findings of Gonzalez-Betancor et al. (2019) who found gender differences in self-efficacy for self-assessment. However, this was for oral presentations so students were not anonymous. This challenge with anonymous/non-anonymous peer assessment has been reported previously (Güler, 2017; Lin, 2018; Vanderhoven et al., 2015) since peer pressure can be a challenge. This was addressed in this study with the anonymous online peer assessment. There were also some discipline differences beforehand which were not recorded afterwards, though some were, which related to the task.

The blended learning model was the same for each discipline group but forensic science students reported some differences in attitudes and skills development afterwards. Forensic science students reported an increase in problem solving skills, which would be expected due to the problem-based nature of their assignment. Forensic science students also generally reported being more positive about peer assessment afterwards. These differences point to the nature of the assignment, with high stakes versus low stakes assessment. This adds evidence to the literature that the nature of the assignment, which is also linked to the extrinsic/intrinsic motivation of the student; can have a potential impact on student engagement and satisfaction with blended learning.

The results relating to online group work and peer assessment provide a new insight into student engagement and preferences for blended learning. The results showed an increase in confidence with working online and for peer assessment. When offered the choice to work face-to-face or online, the strongest response was a mix of both methods (blended learning). Interestingly, Barak and Usher (2019) found when students worked together, they appeared more innovative face-to-face. It was not possible however to investigate this during the study. Students also felt more positive about peer assessment but responses were mixed over whether they would choose peer assessment for other modules. It appears that students had a positive experience and liked it but were still wary of undertaking peer assessment again.

The results obtained do not give a complete picture, or indeed, a complete explanation of why the students may have had a positive experience of the peer assessment but were still cautious about it. Part of the reason might be explained by the issue of trust reported in the literature (Landry et al., 2015). Students reported that they felt they assessed their peers reliably but were not so confident in the abilities of others. This contradictory belief – trust in oneself but not others, was also reported by To and Panadero (2019) who found that distrust in peers' evaluative competence can affect engagement. Whilst this is a challenge, peer assessment can also provide benefits too.

This finding fits with related literature on assessment whereby increased engagement can improve grades (Ćukušić et al., 2014; Liu et al., 2019b; Liu et al., 2018) and this is logical. The more a student engages then the more motivated they are likely to be, and thus the more likely they are to perform well. What is novel in the results from this study however, was that the discussion boards were primarily set up as a communication tool and not a key driver in promoting academic development. Therefore, the results showed that despite only being one part of the overall blended experience, the discussion boards were able to provide some level of correlation of engagement with grade.

## 8.5 CONCLUDING REMARKS

This study started from a drive to promote a positive student learning experience in a blended learning environment. The research therefore focussed on exploring ***student***

***experiences of online group work and peer assessment***. Two primary research questions were asked to explore the student experiences of online group work and peer assessment. The first was "*Do students have a positive experience of online peer learning and assessment based on a structured blended learning model?*". In asking this question other research sub-questions arose such as 'what factors are involved in creating a blended learning environment conducive to a positive learning experience' and 'do students develop any skills as a result of collaborating online in groups'? By asking these questions it was possible to explore how best to promote a positive online learning experience.

The second key research question asked in this study related to the use of self and peer assessment. The question was "*Is online peer assessment a valid form of assessment*?". To investigate this question, it was necessary to consider student perceptions of peer assessment and compare these with evidence from the peer marks and how students collaborated with each other. By triangulating student perceptions with their actions and peer assessment marks it was possible to investigate the full validity of peer assessment. A supplemental question to this blended learning activity was whether it could actually help improve student grades. The use of peer assessment was therefore a key component in contributing to a positive experience of online group work.

A model of blended learning was developed, informed by previous research which considered a range of factors that contributed to an overall constructive approach to peer learning and assessment. These factors included group formation, orientation training for students, guidance for online collaboration, student involvement in peer assessment criteria creation and anonymous online peer assessment. This model then set the scene for students to work collaboratively in groups and peer assess each other's contribution to the group work.

A mixed methods approach was adopted to investigate the student experience of engaging with this blended learning model, considering a qualitative and quantitative approach. A quasi-experimental approach was taken for some of the data collection, based on social research principles that allowed this study to compare two different discipline cohorts of students. Finally, since students were in control of their own group learning experience it was possible to take a socio-constructive view of their learning and knowledge generation. This combined mixed methods approach provided an opportunity to collect a rich set of data which yielded new research that adds to the current literature.

To investigate student experiences of online group work and peer assessment it was necessary to consider the factors which contributed to an effective blended learning experience. A review of the literature showed that group size and formation was important in creating the environment for students to collaborate and develop social presence. This was also linked to student engagement and motivation, which is impacted somewhat on the nature of the task. The results showed that students had a positive experience of the blended learning activity and reported increased self-efficacy and engagement. Peer assessment can contribute to this and this study showed that this helped increase student motivation, as well as contribute to skills development.

Many of the results confirmed findings from other studies on blended learning, such as effective group size for the task, how asynchronous communication can facilitate online collaboration and increased confidence for working and learning online. However, it added additional evidence that a common blended learning approach can be applied across different disciplines of bioscience and forensic science. This is highlighted by Ashenafi (2017) who mentioned a lack of common standards for investigation of group work and peer assessment in related disciplines.

When considering skills development, Sridharan and Boud (2019) reported that "*empirical research on the effects of feedback on developing soft skills is limited or dated*" (p895), where 'soft skills were listed as team work behaviour and self-assessment ability. The results from this study help address this gap in the literature by showing how students reported increases in self-reported ability to work in teams and for self-reflection/appraisal. Students also reported other benefits such as social interaction and being able to work collaboratively online. Whilst these results were student self-reported views, it did demonstrate a clear increase in self-efficacy for the skills.

In addition to providing fresh research showing that students had a positive experience of online group work, it also confirmed that peer assessment is a valid assessment tool. Although other studies have provided evidence that peer assessment is a valid assessment tool (Evans et al., 2007; García-Ros et al., 2018; Huff & Stephen, 2001) this is often based on only statistical analyses between students or tutors. Up until now, there have been no direct studies investigating a holistic approach to assessing the validity of peer assessment.

The results from the actual peer gradings students gave each other could be triangulated against their contributions to the group discussion boards and from students directly when they shared their peer assessment marks with each other. This showed that student perceptions corresponded to the actual online group interactions, confirming peer assessment as a valid assessment tool. Martinez-Izaguirre et al. (2019) also found that students appreciated the benefits of discussion boards and this study was able to investigate if discussion boards could be linked to indications of student performance by measuring grades.

Student performance is linked to a number of factors, particularly in relation to blended learning, such as motivation, student and tutor engagement. Research on grade analysis in an online setting is limited however. O'Neill et al. (2019) discussed the use of a peer assessment tool to measure skills development and reported reliable inter-rater ratings. However, this was based on statistical analyses of the ratings, with no investigation of student perceptions and openly acknowledges there was no investigation into possible links to grades. Even current research therefore still has not fully investigated blended learning links to potential student grades. This study has therefore added some evidence to the existing literature that student engagement in online collaboration can be linked to student academic performance.

To date, research has focussed on specific aspects of online group work and peer assessment but not taken a holistic view of the student experience, as covered in this study. Research has focussed on aspects such as the student population, group dynamics, online collaboration, student engagement and peer assessment. This study addressed this by exploring student experiences of online group work and peer assessment. One recent study however, did attempt to address this, by proposing a theoretical model based on a review of the literature.

Money and Dean (2019) undertook a literature review and identified that they called '*key descriptors and processes that prove essential for defining online student support*' (p57). Although their search strategy is limited, missing many key current studies based on a slightly overly-broad approach to key search terms, they do identify the key descriptors, which have been termed 'factors' in this study. They go on to describe a conceptual model for online learning based on these studies.

The model described by Money and Dean provides a valid conceptual joined up approach to supporting online learning but acknowledges further research is needed to provide additional evidence about effective online learning. It also did not cover research relating to peer assessment. The unique focus of this study adds to the work by Money and Dean by proposing a practical model for online group work and peer assessment, based on the longitudinal results across three years.

## 8.6 A MODEL FOR ONLINE LEARNING AND GROUP WORK

The results from this study showed that prior to the online peer assessment (OPLA) activity, students had engaged in face to face group work and self and peer assessment. Fewer students had engaged in online group work and some attitudes to group work and peer assessment, particularly online; were mixed and could be described as ‘cautious’. After engaging in the OPLA activity the results showed that students reported being more positive about the online group work and peer assessment process.

The results successfully identified a number of benefits students gained from the experience. Students self-reported increases in confidence for online learning and peer assessment, and also reported increased self-efficacy for a number of skills, including IT, communication and peer appraisal skills. One tutor benefit was the saving in administrative costs, whilst maintaining a positive student learning experience. Based on these findings therefore a model for online peer learning and assessment is proposed. The following model provides guidance for educators wishing to adopt online learning and peer assessment to promote a positive blended learning experience for their students.

### 8.6.1 Group formation

Group size is recommended to be between 3-5 students, based on the complexity of the task. How the groups are formed will partly depend on academic and collaborative goals. Social presence can be fostered if groups are selected to work together effectively and students should be clear about the purpose of the activity to ensure engagement and motivation. Students can self-select their groups, but it may be more advantageous for social development, for tutor-selected groups.

### 8.6.2 Orientation training

It is essential that students are engaged in the process with appropriate briefing and training prior to the task. This will include setting ground rules of behaviour, how to communicate and collaborate online, and how to manage team work challenges such as freeloaders and conflict management.

### 8.6.3 Tutor involvement

Tutor involvement can depend on the nature of the task. Since tutor involvement can promote social presence and increased student engagement and motivation, it might be desirable to have tutor input into online collaborations. This comes with an administrative cost however so if the purpose of the task is more goal orientated, then tutor involvement is not so essential, as long as orientation training is implemented appropriately.

### 8.6.4 Online collaboration

Provide appropriate tools for students to communicate, and collaborate online, such as sharing work and arranging meetings. For a blended learning environment, it is advised that students meet face-to-face initially as this will aid social integration and foster social presence. Guidance should also be provided in the orientation training on how to work effectively as a group, such as how to organise meetings, having rotating leadership roles and providing support for group members.

### 8.6.5 Peer assessment

It is important that students take ownership of the assessment process and this can be helped by co-creation of the assessment criteria. At the very least, there should be a formal briefing session whereby students are engaged in reviewing the criteria so they can take personal ownership of what is expected of them. It is also important that students submit peer assessment scores anonymously to mitigate for potential issues of peer pressure.

By paying careful attention to the factors outlined in the model above, this study has shown that it is possible to create an effective blended learning environment for students. Students have been shown in this study to have a positive experience of online group work and peer assessment and the results have added to the literature, building on previous literature in the field.

## 8.7 LIMITATIONS OF STUDY

The methodologies used to collect qualitative and quantitative data for this study were robust and based on good practice as outlined in the literature. However, there were a few limitations of this study that should be reported. The first potential limitation of this study is that the pre and post-questionnaires were anonymous so it was not possible to make individual pre and post activity comparisons. However, this was mitigated for from the quasi-experimental approach for whole cohort comparisons were response rates were typically over 50% for bioscience and 30-40% for forensic science students.

Another limitation of the survey questions was some slight variation in one or two questions across the years. This meant that not all questions were asked across three years and so the full longitudinal comparisons could not always be made. This was due to an accidental clash of data collection methods with a project partner during the JISC WebPA project. There was an attempt to deliver similar questions between two different institutions which resulted in some continuity problems across the years. Regardless, all questions revealed relevant information which has been fully reported in this study.

It could also be argued that the volume of data collected for parts of this study was a limiting factor in drawing out key conclusions. For example, the validation of the peer assessment was partly based on two groups of three students, with additional feedback from the forensic science case study. However, this is in line with other studies who have reported on small study sizes, but with rich qualitative data. This includes Falchikov (1988) (4 students), Yu et al. (2019) (3 students) and To and Panadero (2019) (11 students) so the small student numbers in this study still have relevancy.

## 8.8 FUTURE RESEARCH

In addition to the findings of this study, there are additional research opportunities which can be explored. This study reviewed literature on the development of social presence and Kirschner (2005) and Chen and Wang (2009) both argued that simply setting up groups and allowing them to evolve on their own will not promote social presence. In this study, there was no tutor involvement but initial guidance was provided in the orientation training and the development of social presence was still recorded. Further research would help in understanding the factors that promote social presence, with or without tutor involvement.

Freeloading is well cited in the literature and this study found that freeloading was ameliorated for with the use of peer assessment. However, when asked if they would do peer assessment again, they were cautious, even though they stated that they felt the peer assessment gave an accurate record of peer input into the work. Why did they appear confident in the peer assessment process yet still a bit cautious about doing it again? Student perceptions of peer assessment and freeloading could be investigated further to explore if it can be eradicated – not in actuality but from the student perspective that peer assessment will fully address student concerns about freeloading.

This study found some evidence to support a link between online collaboration and student grades. Dunn and Kennedy (2019) argued that frequency of use of technology is likely to be a poor indicator of academic attainment. Further research on this topic could consider how much students interact in a blended learning environment and explore if, or how this might correlate to student academic attainment.

Whilst this study found no significant differences or challenges for students based on demographic differences, more data could be collected to verify this. Other studies, with a greater depth of analyses of demographic data, including individual analyses through interviews say, could explore student perceptions of blended learning and peer assessment based on characteristics such as age, gender and language.

One other potential area of additional research could focus on discourse analysis and student contributions to online communication. The current literature has reviewed how discourse analysis can shed light on student interactions but this can be laborious and time consuming. Technology such as Badgr (Concentric) now has the potential to automatically issue digital badges for student contributions to online discussion forums. This technological capability is relatively new and their potential could be explored further, for example how does Badgr assess the quality of a message?

# 9 APPENDICES

## 9.1 APPENDIX A - PRE QUESTIONNAIRE

<table>
<tr><td>Question number</td><td colspan="5">Question</td></tr>
<tr><td>1</td><td colspan="5">What is your gender? (Male/Female)</td></tr>
<tr><td>2</td><td colspan="5">Are you: (Under 18/18-21/22-35/Over 35)</td></tr>
<tr><td>3</td><td colspan="5">Is English your first language? (Yes/No)</td></tr>
<tr><td>4</td><td colspan="5">How confident are you at doing the following things?<br>Please indicate your preference from the options</td></tr>
<tr><td></td><td>Strongly disagree</td><td>Disagree</td><td>Neither disagree or agree</td><td>Agree</td><td>Strongly agree</td></tr>
<tr><td>a. I am confident when working with computers</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>b. I am confident finding my way around in Microsoft Word</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>c. I am confident finding my way around in Microsoft Excel</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>d. I am confident in taking part in online discussions</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>e. I am confident working and learning online</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>5</td><td colspan="5">As part of your pre-University education, have you worked face-to-face in groups with other students? (Yes/No/Not sure)</td></tr>
<tr><td>6</td><td colspan="5">If you answered 'No' to the previous question please leave this question blank.<br>Did you enjoy working face-to-face in groups with other students? (Yes/No/Not sure)</td></tr>
<tr><td>7</td><td colspan="5">Regardless of whether or not you've worked face-to-face in groups; in general what do you feel about working face-to-face in groups? (Please comment)</td></tr>
<tr><td>8</td><td colspan="5">As part of your pre-University education, have you worked online in groups with other students? Working online includes things like communicating and sharing work with other students through discussion boards, email and other computer technology. (Yes/No/Not sure)</td></tr>
<tr><td>9</td><td colspan="5">If you answered 'No' to the previous question please leave this question blank.</td></tr>
</table>

| | |
|---|---|
| | Did you enjoy working online in groups with other students? (Yes/No/Not sure) |
| 10 | Regardless of whether or not you've worked online in groups; in general what do you feel about working online in groups? |
| 11 | Have you ever been asked to give yourself a mark for your work? This is sometimes called 'self assessment'.(Yes/No/Not sure) |
| 12 | If you have undertaken self assessment, do you like it as a form of assessment? (Yes/No/Not sure) |
| 13 | Regardless of whether or not you have undertaken self assessment what do you think about the idea of this form of assessment? Please comment and add anything you might like or dislike about the idea of self assessment. |
| 14 | Have you ever been asked to give other students a mark for their work? This is sometimes called 'peer assessment'.(Yes/No/Not sure) |
| 15 | If you have undertaken peer assessment, do you like it as a form of assessment? (Yes/No/Not sure) |
| 16 | Regardless of whether or not you have undertaken peer assessment what do you think about this form of assessment? Please comment and add anything you might like or dislike about the idea of peer assessment. |
| 17 | Do you think students should take part in assessing their peers? (Yes/No/Not sure) |
| 18 | Do you believe a first-year student should be able to assign grades to peers in a responsible manner? (Yes/No/Not sure) |
| 19 | Do you think you will feel comfortable in making peer assessments (Yes/No/Not sure) |
| 20 | Do you think you will make a fair and responsible assessment of your peers? (Yes/No/Not sure) |
| 21 | Do you think the peer marking will give an accurate reflection of your group members' input to the work? (Yes/No/Not sure) |
| 22 | How positive do you feel about the idea of peer assessment? (Very positive; positive; neutral; negative; very negative) |

## 9.2 Appendix B - Post questionnaire

<table>
<tr><td>Question number</td><td colspan="5">Question</td></tr>
<tr><td>1</td><td colspan="5">What is your gender? (Male/Female)</td></tr>
<tr><td>2</td><td colspan="5">Are you: (Under 18/18-21/22-35/Over 35)</td></tr>
<tr><td>3</td><td colspan="5">Is English your first language? (Yes/No)</td></tr>
<tr><td>4</td><td colspan="5">How confident are you at doing the following things?<br>Please indicate your preference from the options</td></tr>
<tr><td></td><td>Strongly disagree</td><td>Disagree</td><td>Neither disagree or agree</td><td>Agree</td><td>Strongly agree</td></tr>
<tr><td>a. I am confident when working with computers</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>b. I am confident finding my way around in Microsoft Word</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>c. I am confident finding my way around in Microsoft Excel</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>d. I am confident in taking part in online discussions</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>e. I am confident working and learning online</td><td>○</td><td>○</td><td>○</td><td>○</td><td>○</td></tr>
<tr><td>5</td><td colspan="5">As part of your pre-University education, have you worked face-to-face in groups with other students? (Yes/No/Not sure)<br>If you answered 'No' to the previous question please leave this question blank.<br>Did you enjoy working face-to-face in groups with other students? (Yes/No/Not sure)</td></tr>
<tr><td>6</td><td colspan="5">Have you ever been asked to give yourself a mark for your work? This is sometimes called 'self assessment'.</td></tr>
<tr><td>7</td><td colspan="5">Have you ever been asked to give other students a mark for their work? This is sometimes called 'peer assessment'.</td></tr>
<tr><td>8</td><td colspan="5">What did you enjoy about working online in groups with the support of eBridge? (Please comment)</td></tr>
<tr><td>9</td><td colspan="5">What did you dislike about working online in groups with the support of eBridge? (Please comment)</td></tr>
<tr><td>10</td><td colspan="5">Would you make any changes to this online group work? (Please comment)</td></tr>
<tr><td>11</td><td colspan="5">After doing this work, how do you feel about online group work? (Very positive; positive; neutral; negative; very negative)</td></tr>
</table>

| | |
|---|---|
| 12 | How effectively did you feel you were able to work online as a group? (Very effectively; Effectively; Neither effective or ineffective; Not effectively; very ineffectively) |
| 13 | Do you feel you could have worked more effectively working face-to-face as a group? (Yes/No/Not sure) |
| 14 | How willing would you be to undertake online work in a group in future? (Very willing; willing; not sure; unwilling; very unwilling) |
| 15 | Weighing up the advantages of working face-to-face and online, which method would you prefer when working in groups? (Online; Face-to-face; Mix of both methods; no opinion) |
| 16 | In general what do you feel about working online in groups? (Please comment) |
| 17 | Having engaged with a peer assessment activity how positive do you feel about the idea of peer assessment? (Very positive; positive; neutral; negative; very negative) |
| 18 | Do you think students should take part in assessing their peers? (Yes/No/Not sure) |
| 19 | Do you believe a first-year student should be able to assign grades to peers in a responsible manner? (Yes/No/Not sure) |
| 20 | Did you feel comfortable when you made peer assessments? (Yes/No/Not sure) |
| 21 | Do you think you have made a fair and responsible assessment of your peers? (Yes/No/Not sure) |
| 22 | Did you think the peer marking gave an accurate reflection of your group members' input to the work? (Yes/No/Not sure) |
| 23 | How much pressure did the experience put you under? (Extreme High Some Low None) |
| 24 | Where do you feel the pressure came from? (Peers; Tutors; Getting the presentation work completed; The whole experience) |
| 25 | Was the marking scheme easy to understand? (Yes/No/Not sure) |
| 26 | Was the marking scheme fair? (Yes/No/Not sure) |
| 27 | Would you change anything about the marking scheme? (Please comment) |
| 28 | Given the choice would you use self and peer assessment in other modules on your course? (Yes/No/Not sure) |
| 29 | Please indicate your agreement with the following statements (strongly agree; agree; neither agree or disagree; disagree; strongly disagree)<br>• Relationships within the group influenced the scores that I gave in the assessment<br>• There was pressure/conflict amongst team members during the assignment<br>• Self and peer assessment increased my motivation to carry out the group work task |

| | |
|---|---|
| 30 | Do you feel any of the following skills have been improved due to carrying out group work (strongly agree; agree; neither agree or disagree; disagree; strongly disagree)<br>• Communication<br>• Team working skills<br>• Problem solving<br>• Peer appraisal skills<br>Self reflection/appraisal |
| 31 | Do you feel any of the following skills have been improved due to carrying out group work?<br>30.a. Communication<br>30.b. Team working skills<br>30.c. Problem solving<br>30.d. Peer appraisal skills<br>30.e. Self reflection/appraisal |

## 9.3 APPENDIX C - STUDENT INTERVIEW QUESTIONS

### Using eBridge

- How often did you use eBridge to communicate with your group?
- If not often, why not?
- How useful was eBridge as a communication tool for your group?
- Do you think the level of communication on eBridge i.e. those who posted messages, reflected how much people contributed to the group work?
- Which aspects of eBridge helped your communication with the group?
- Which aspects of eBridge hindered your communication with the group?

### Other online communication

- Apart from face-to-face meetings or using eBridge, did you use any other ways to communicate with each other (e.g. text, phone calls, facebook)
- If yes, what did you do and why?
- Do you know if other groups used any additional ways of communicating? E.g. set up a Facebook study group

### Peer assessment

[Tell the student their group report mark and then their own peer assessment mark]

- Without consideration for the actual group mark you got for your report [as this depends on how the content was marked], how satisfied are you with the peer assessment mark you got?

- Did you think the peer marking gave a good opportunity to contribute to assessing the efforts your group members put into the assignment?
- Did you have any concerns about how the others might have marked you?
- Have you been asked to peer assess students before?
- Do you think peer assessment is a good way of contributing to marks?
- Would you be willing to peer assess students again for other assignments?

## Ranking

- Would you like to know how you scored in relation to the other members of the group e.g. ranked first, second etc or are you just interested in your own score?
- Would you like to know your rank order in the group i.e. how you scored in relation to the rest of the group?
- Do you feel the mark each group members gets is more or less important than their rank order?

## Scoring

[to be asked if students are willing to share their scores with each other]

- You scored X marks for your work and were ranked Y in your group [list the full rank order]. How do you feel about that? [don't disclose marks at this point, just rank order]
- Are you bothered about the rank order or more interested in your own mark?
- [this question is similar to the one above but is asked *after* they know their rank order]
- The rest of the group scored...do you think your mark was fair in relation to their marks?
- Do you think others got higher/lower marks than they deserved for the effort they put in?
- Which do you think is more important, rank order or your individual mark?
- Now that you know what each person scored do you think the peer assessment process enables group members to give each other a mark that truly reflects their efforts?

## 9.4 Appendix D - Disclosure of Peer assessment marks – Consent form

Forensic Science group assignment:

Group number…………………………..

DATE………………………………………………

GROUP MEMBERS: ……………………..………

*This form is to be signed by the person who has agreed to share the marks for their peer assessment component of the forensic science assignment with the other* *members of their group. The purpose of this form is to seek consent for the group marks for the purpose of research by The University of Hull. The University of Hull in turn offers a commitment to only use the data for anonymised research purposes and will manage the data appropriately.*

I, the undersigned, consent to the sharing of my peer assessment marks with my fellow group members to be used by *The University of Hull* for research purposes. I understand that only the final peer assessment mark will be disclosed to group members and not the individual peer assessment scores or my final assignment mark.

I understand that disclosure of my marks will not constitute grounds for appeal against my published mark simply on the basis of dissatisfaction with my fellow group members' marks in comparison to my mark. Any such appeal must be pursued independently through normal University procedures.

I agree not to divulge or discuss the details of any marks shared between my fellow group members with any third party without the express permission of all fellow group members.

FULL NAME AND TITLE
________________________________________________

NAME OF
ORGANISATION______________________________________________

CONTACT
TELEPHONE__________________________________________________

EMAIL ADDRESS
_____________________________________________________

SIGNED
__________________________________DATED________________________

## 9.5 Appendix E - Liquid cafe questions

Biology students 09/10

Attendance: 9

1. How adequately did you feel you had been briefed on how to peer assess your group members at the start of the group work?
2. How well did the messages posted on eBridge reflect how well people worked together?
3. Did the use of eBridge help you work and communicate effectively as a group?
4. Please list any problems you had working as a group
5. Please list any benefits you found working as a group

6. Do you feel the peer assessment allowed you to give an appropriate mark for the contributions made by each group member?
7. Do you think the peer assessment will produce a mark for you that is fair?

## 9.6 Appendix F – Liquid café Moderator Guide

The purpose of this focus group is to gauge student opinion on the group work and peer assessment for the PowerPoint assignment. Students were put into groups of (mostly) 5 and given an assignment. After submitting their work they then had to peer assess each other's contribution to the work.

This focus group will ask 7 questions about their experiences and encourage them to be honest and frank. I am also keen to hear about how they worked, what their feelings are so if discussions are a bit stilted, please just nudge them to expand on what they felt. For example, they submitted their marks, but afterwards did they feel they would have marked differently, the same – what where their thoughts when they were submitting their marks.

QUESTIONS

1. How adequately did you feel you had been briefed on how to peer assess your group members at the start of the group work?

[Question about preparation for peer assessment]

2. How well did the messages posted on eBridge reflect how well people worked together?

[Question about their perceptions of interaction reflecting the efforts people made. E.g. few messages from one person reflected the fact they didn't do their fair share]

[check which people attending are from which groups to see if there are more than one member from a particular group]

3. Did the use of eBridge help you work and communicate effectively as a group?

[was online work effective or did they prefer face-to-face, and why]

4. Please list any problems you had working as a group

[expand on survey to ask what they disliked]

5. Please list any benefits you found working as a group

[expand on survey to ask what they liked]

6. Do you feel the peer assessment allowed you to give an appropriate mark for the contributions made by each group member?

7. Do you think the peer assessment will produce a mark for you that is fair?

[what are their thoughts on peer assessment giving a relevant mark related to the effort everyone put in]

1. How adequately did you feel you had been briefed on how to peer assess your group members at the start of the group work?

2. How well did the messages posted on eBridge reflect how well people worked together?
3. Did the use of eBridge help you work and communicate effectively as a group?
4. Please list any problems you had working as a group
5. Please list any benefits you found working as a group
6. Do you feel the peer assessment allowed you to give an appropriate mark for the contributions made by each group member?
7. Do you think the peer assessment will produce a mark for you that is fair?

## 9.7 Appendix G – Discourse Analysis Themes

Survey questions

Pre face-to-face Summary

25/03/2014 19:21

| Name | Number of Coding References | Number of Words Coded | Number of Paragraphs Coded |
|---|---|---|---|
| **Pre face-to-face views on group work** | 0 | | |
| **Prefer working alone** | 18 | 196 | 18 |
| **Like working face-to-face in groups** | 9 | 120 | 9 |
| **Nervous** | 15 | 188 | 15 |
| **Shared workload** | 4 | 20 | 4 |
| **Skills development** | 31 | 325 | 31 |
| **Risk of freeloaders** | 62 | 1,243 | 62 |
| **Share ideas** | 102 | 1,170 | 102 |
| **Its motivating** | 4 | 64 | 4 |
| **Develops confidence** | 17 | 175 | 17 |
| **Don't mind face-to-face groupwork** | 42 | 398 | 42 |
| **Affects my marks** | 3 | 30 | 3 |
| **Better than working alone** | 4 | 33 | 4 |
| **Interesting** | 7 | 92 | 7 |
| **Interpersonal clashes** | 21 | 505 | 21 |

| | | | |
|---|---|---|---|
| **Enjoyable** | 63 | 668 | 63 |
| **Improves learning** | 42 | 410 | 42 |

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Survey questions

Pre online Summary

25/03/2014 19:22

| Name | Number of Coding References | Number of Words Coded | Number of Paragraphs Coded |
|---|---|---|---|
| **Not as good as face-to-face** | 11 | 248 | 11 |
| **improve my online skills** | 5 | 66 | 5 |
| **Happy to work online** | 64 | 531 | 64 |
| **Ok if I am given the skills to work online** | 11 | 147 | 11 |
| **Share ideas online** | 19 | 347 | 19 |
| **Prefer working in person than online** | 63 | 851 | 63 |
| **Pre online** | 0 | | |
| **Don't know what it involves (online)** | 46 | 539 | 46 |
| **convenient communication tool** | 66 | 1,321 | 66 |
| **Can be difficult to communicate** | 42 | 733 | 42 |
| **Easier than working face-to-face** | 7 | 71 | 7 |
| **good way to work (online)** | 61 | 964 | 61 |
| **Good way of working** | 13 | 213 | 13 |
| **Good for sharing information** | 33 | 547 | 33 |

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Survey questions

Pre self assessment Summary

27/03/2014 12:00

| Name | Number of Coding References | Number of Words Coded | Number of Paragraphs Coded |
|---|---|---|---|
| **Self motivating** | 15 | 364 | 15 |
| **Risk of bias** | 129 | 2,903 | 129 |
| **Tutor assessment better** | 40 | 832 | 40 |
| **Yes - like peer assessment** | 58 | 807 | 58 |
| **Unsure** | 23 | 326 | 23 |
| **No - don't like self assessment (pre survey)** | 70 | 1,214 | 70 |
| **Can't compare my performance** | 18 | 366 | 18 |
| **peer assessment better** | 16 | 353 | 16 |
| **Promote self reflection** | 69 | 1,530 | 69 |
| **Pre self assessment** | 0 | | |

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Survey questions

Pre peer assessment Summary

25/03/2014 19:23

| Name | Number of Coding References | Number of Words Coded | Number of Paragraphs Coded |
|---|---|---|---|
| **Pre peer assessment** | 0 | | |
| **Not effective** | 21 | 515 | 21 |
| **Shared experiences** | 14 | 335 | 14 |
| **Unsure** | 14 | 157 | 14 |
| **Tutor assessment better** | 28 | 625 | 28 |
| **Marking bias** | 81 | 2,097 | 81 |
| **Developmental** | 77 | 2,032 | 77 |
| **Cause anxiety_marking pressures** | 60 | 1,405 | 60 |
| **Dislike** | 18 | 252 | 18 |
| **Like** | 78 | 1,776 | 78 |
| **Honest_fair mark** | 10 | 194 | 10 |

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Survey questions

Post working online Summary

25/03/2014 19:21

| Name | Number of Coding References | Number of Words Coded | Number of Paragraphs Coded |
|---|---|---|---|
| **Post working online** | 0 | | |
| **Make friends** | 5 | 255 | 5 |
| **Uncooperative group members** | 52 | 1,463 | 52 |
| **Prefer face-to-face** | 41 | 1,170 | 41 |
| **Like** | 148 | 3,424 | 148 |
| **Dislike** | 40 | 1,060 | 40 |
| **Blended approach preferable** | 27 | 744 | 27 |
| **Lack of contact** | 29 | 977 | 29 |
| **Flexible_convenient** | 51 | 1,500 | 51 |

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Survey questions

Dislike VLE Summary

25/03/2014 19:17

| Name | Number of Coding References | Number of Words Coded | Number of Paragraphs Coded |
|---|---|---|---|
| **Freeloaders** | 24 | 477 | 24 |
| **Lack of contact** | 70 | 1,014 | 70 |
| **Not able to meet face-to-face** | 12 | 198 | 12 |
| **Difficult arranging meetings** | 22 | 477 | 22 |
| **Disliked VLE** | 0 | | |
| **Excuse not to work** | 28 | 676 | 28 |

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Survey questions

Post disliked peer assessment Summary

25/03/2014 19:20

| Name | Number of Coding References | Number of Words Coded | Number of Paragraphs Coded |
|---|---|---|---|
| **Post dislike peer assessment** | 0 | | |
| **Unclear marking process** | 13 | 186 | 13 |
| **Unfair marking** | 22 | 497 | 22 |
| **Nothing to dislike** | 10 | 31 | 10 |
| **Anxiety_marking pressure** | 8 | 107 | 8 |
| **Had to self assess** | 8 | 182 | 8 |
| **Not tutor marked** | 4 | 82 | 4 |

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Survey questions

Post change to marking scheme Summary

25/03/2014 19:16

| Name | Number of Coding References | Number of Words Coded | Number of Paragraphs Coded |
|---|---|---|---|
| **General observations** | 15 | 504 | 17 |
| **Fine as is** | 1 | 74 | 1 |
| **Not sure** | 13 | 52 | 13 |
| **No** | 150 | 344 | 150 |
| **Fewer marking penalties** | 1 | 16 | 1 |
| **Bigger penalties** | 4 | 79 | 4 |
| **Allow written comments** | 6 | 75 | 6 |
| **different marking format** | 12 | 214 | 12 |
| **Changes to marking scheme** | 0 | | |

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Survey questions

Post change to peer assessment process Summary

25/03/2014 19:14

| Name | Number of Coding References | Number of Words Coded | Number of Paragraphs Coded |
|---|---|---|---|
| **observations** | 5 | 94 | 5 |
| **Written comments** | 7 | 108 | 7 |
| **Change PA process** | 0 | | |
| **no** | 30 | 54 | 30 |

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Survey questions

Post general comments Summary

25/03/2014 19:18

| Name | Number of Coding References | Number of Words Coded | Number of Paragraphs Coded |
|---|---|---|---|
| **General comments** | 0 | | |
| **Problem with freeloaders** | 5 | 179 | 5 |
| **Did not enjoy it** | 4 | 115 | 4 |
| **Enjoyed it** | 7 | 94 | 7 |

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# 10 REFERENCES

AbuSeileek, A. F. (2012) The effect of computer-assisted cooperative learning methods and group size on the EFL learners' achievement in communication skills. *Computers & Education*, 58(1), 231-239.
Aggarwal, P. & O'Brien, C. L. (2008) Social loafing on group projects structural antecedents and effect on student satisfaction. *Journal of Marketing Education*, 30(3), 255-264.
Aghaee, N. & Keller, C. (2016) ICT-supported peer interaction among learners in Bachelor's and Master's thesis courses. *Computers & Education*, 94, 276-297.
Allport, F. H. (1924) *Social Psychology*Houghton Mifflin.
Altınay, Z. (2017) Evaluating peer learning and assessment in online collaborative learning environments. *Behaviour & Information Technology*, 36(3), 312-320.
Altrichter, H., Posch, P., Somekh, B. & Feldman, A. (2005) *Teachers investigate their work: An introduction to action research across the professions*Routledge.
An, H. & Kim, S. (2006) The Benefits and Limitations of Online Group Work in a Teacher Education Program. *Technology and Teacher Education Annual*, 4, 2465-2472.
An, H., Shin, S. & Lim, K. (2009) The effects of different instructor facilitation approaches on students' interactions during asynchronous online discussions. *Computers & Education*, 53(3), 749-760.
Anker-Hansen, J. & Andrée, M. (2019) Using and rejecting peer feedback in the science classroom: a study of students' negotiations on how to use peer feedback when designing experiments. *Research in Science & Technological Education*, 37(3), 346-365.
Arabi, E. (2016) Course design for blended learning: a case study of technology adoption and learner experience.
Ashenafi, M. M. (2017) Peer-Assessment in Higher Education--Twenty-First Century Practices, Challenges and the Way Forward. *Assessment & Evaluation in Higher Education*, 42(2), 226-251.
Ashwin, P. (2003) Peer facilitation and how it contributes to the development. *Research in Post-Compulsory Education*, 8(1), 5 - 18.
Bacon, D. R., Stewart, K. A. & Silver, W. S. (1999) Lessons from the Best and Worst Student Team Experiences: How a Teacher can make the Difference. *Journal of Management Education*, 23(5), 467-488.
Banditvilai, C. (2016) Enhancing Students' Language Skills through Blended Learning. *Electronic Journal of e-Learning*, 14(3), 220-229.
Barak, M. & Usher, M. (2019) The innovation profile of nanotechnology team projects of face-to-face and online learners. *Computers & Education*, 137, 1-11.
Barkley, E. F., Cross, K. P. & Major, C. H. (2005) *Collaborative learning techniques : a handbook for college faculty*, 1st edition. San Francisco: Jossey-Bass.
Bayat, A. & Naicker, V. (2012) Towards a learner-centred approach: Interactive online peer assessment. *South African Journal of Higher Education*, 26(5), 891-907.
Beckett, G. H., Amaro-Jiménez, C. & Beckett, K. S. (2010) Students' use of asynchronous discussions for academic discourse socialization. *Distance Education*, 31(3), 315 - 335.
Berk, R. A., Naumann, P. L. & Appling, S. E. (2004) Beyond Student Ratings: Peer Observation of Classroom and Clinical Teaching. *International Journal of Nursing Education Scholarship*, 1(1), 10.

Beyer, S. & Bowden, E. M. (1997) Gender differences in seff-perceptions: Convergent evidence from three measures of accuracy and bias. *Personality and Social Psychology Bulletin*, 23(2), 157-172.
Bhalerao, A. & Ward, A. (2001) Towards electronically assisted peer assessment: a case study. *Alt-J| Association for Learning Technology Journal*, 9(1), 26-37.
Biasutti, M. (2011) The student experience of a collaborative e-learning university module. *Computers & Education*, 57(3), 1865-1875.
Biggs, J. B. (2003) *Teaching for quality learning at university : what the student does*, 2nd edn edition. Maidenhead :: Open University Press.
Black, P., Harrison, C., Hodgen, J., Marshall, B. & Serret, N. (2010) Validity in teachers' summative assessments. *Assessment in Education: Principles, Policy & Practice*, 17(2), 215-232.
Bliuc, A.-M., Ellis, R., Goodyear, P. & Piggott, L. (2010) Learning through face-to-face and online discussions: Associations between students' conceptions, approaches and academic performance in political science. *British Journal of Educational Technology*, 41(3), 512-524.
Bliuc, A.-M., Ellis, R. A., Goodyear, P. & Piggott, L. (2011) A blended learning Approach to teaching foreign policy: Student experiences of learning through face-to-face and online discussion and their relationship to academic performance. *Computers & Education*, 56(3), 856-864.
Bostock, S. (2000) *Student Peer Assessment*, 2000. Available online: [Accessed 14/07/10].
Bostock, S. J. (1998) Constructivism in Mass Higher Education: a Case Study. *British Journal of Educational Technology*, 29(3), 225-240.
Boud, D., Cohen, R. & Sampson, J. (1999) Peer Learning and Assessment. *Assessment & Evaluation in Higher Education*, 24(4), 413.
Boud, D., Cohen, R. & Sampson, J. (2001) *Peer learning in higher education : learning from & with each other*. London: Kogan Page.
Boud, D., Lawson, R. & Thompson, D. G. (2013) Does student engagement in self-assessment calibrate their judgement over time? *Assessment & Evaluation in Higher Education*(ahead-of-print), 1-16.
Boud, D. & Lee, A. (2005) 'Peer learning' as pedagogic discourse for research education. *Studies in Higher Education*, 30(5), 501-516.
Brooks, C. M. & Ammons, J. L. (2003) Free Riding in Group Projects and the Effects of Timing, Frequency, and Specificity of Criteria in Peer Assessments. *Journal of Education for Business*, 78(5), 268-272.
Bruffee, K. (1981) Collaborative Learning. *College English*, 43(7), 745-747.
Burnham, W. M. H. (1910) The group as a stimulus to mental activity. *Science*, 31(803), 761-767.
American Journal of Distance Education, *Group Projects: Student Perceptions of the Relationship Between Social Tasks and a Sense of Community in Online Group Work* (2009) 23. Written by 20-33 [Article]. Available online: 10.1080/08923640802664466

[http://search.ebscohost.com/login.aspx?direct=true&db=afh&AN=36606667&site=ehost-live](http://search.ebscohost.com/login.aspx?direct=true&db=afh&AN=36606667&site=ehost-live) [Accessed.
Carlson, P. A. & Berry, F. C. (2003) Calibrated peer review™ and assessing learning outcomes. *Proceedings, Frontiers in Education Conference*.
Carlson, P. A. & Berry, F. C. (2005) Calibrated Peer Review: A Tool for Assessing the Process as Well as the Product in Learning Outcomes. *2005 ASEE Annual Conference & Exposition: The Changing Landscape of Engineering and Technology Education in a Global World*, 2005.

Carr, W. & Kemmis, S. (2003) *Becoming critical: education knowledge and action research*Routledge.
Carter, I., Damianakis, T., Munro, S., Skinner, H., Matin, S. & Nash Andrews, T. (2018) Exploring Online and Blended Course Delivery in Social Group Work. *Journal of Teaching in Social Work*, 38(5), 486-503.
Caspi, A., Chajut, E. & Saporta, K. (2008) Participation in class and in online discussions: Gender differences. *Computers & Education*, 50(3), 718-724.
Cassidy, S. (2007) Assessing 'inexperienced' students' ability to self-assess: exploring links with learning style and academic personal control. *Assessment & Evaluation in Higher Education*, 32(3), 313-330.
Castaño‐Muñoz, J., Duart, J. M. & Sancho‐Vinuesa, T. (2014) The Internet in face‐to‐face higher education: Can interactive learning improve academic achievement? *British Journal of Educational Technology*, 45(1), 149-159.
Chang, B. & Kang, H. (2016) Challenges facing group work online. *Distance Education*, 37(1), 73-88.
Chang, C.-C., Liang, C. & Chen, Y.-H. (2013) Is learner self-assessment reliable and valid in a Web-based portfolio environment for high school students? *Computers & Education*, 60(1), 325-334.
Chang, C.-C., Tseng, K.-H., Chou, P.-N. & Chen, Y.-H. (2011) Reliability and validity of Web-based portfolio peer assessment: A case study for a senior high school's students taking computer course. *Computers & Education*, 57(1), 1306-1316.
Chang, C.-C., Tseng, K.-H. & Lou, S.-J. (2012) A comparative analysis of the consistency and difference among teacher-assessment, student self-assessment and peer-assessment in a Web-based portfolio assessment environment for high school students. *Computers & Education*, 58(1), 303-320.
Charters, J. & Newcomb, T. M. (1952) Some Attitudinal Effects of Experimentally Increased Salience of a Membership Group. *Readings in Social Psychology*, 415-20.
Chen, F.-C. & Wang, T. (2009) Social conversation and effective discussion in online group learning. *Educational Technology Research & Development*, 57, 587-612.
Chen, G. & Chiu, M. M. (2008) Online discussion processes: Effects of earlier messages' evaluations, knowledge content, social cues and personal information on later messages. *Computers & Education*, 50(3), 678-692.
Chen, N.-S., Kinshuk, Wei, C.-W. & Liu, C.-C. (2011) Effects of matching teaching strategy to thinking style on learner's quality of reflection in an online learning environment. *Computers & Education*, 56(1), 53-64.
Chen, N.-S., Wei, C.-W., Wu, K.-T. & Uden, L. (2009) Effects of high level prompts and peer assessment on online learners' reflection levels. *Computers & Education*, 52(2), 283-291.
Cheng, K.-H. & Tsai, C.-C. (2012) Students' Interpersonal Perspectives on, Conceptions of and Approaches to Learning in Online Peer Assessment. *Australasian Journal of Educational Technology*, 28(4), 599-618.
Cheung-Blunden, V. & Khan, S. R. (2018) A modified peer rating system to recognise rating skill as a learning outcome. *Assessment & Evaluation in Higher Education*, 43(1), 58-67.
Cheung, W. S., Hew, K. F. & Ng, C. S. L. (2008) Toward an Understanding of Why Students Contribute in Asynchronous Online Discussions. *Journal of Educational Computing Research*, 38(1), 29-50.
Chin, P. & Overton, T. (2005) Development of a peer learning and assessment model. *European Variety in Chemistry education*, 38.
Chin, P., Willmot, P. & Crawford, A. (2006) Electronic peer assessment tools for multidisciplinary use. *The International Society for the Scholarship of Teaching and*

*Learning 3rd Annual Conference (ISSOTL), Washington DC USA 9-12 November 2006*.
Chin, P. & Woolston, C. (1995) Simlife in Ecology Teaching. *Life Sciences Educational Computing*, 5(3), 13-14.
Ciftci, H. & Kocoglu, Z. (2012) Effects of Peer E-Feedback on Turkish EFL Students' Writing Performance. *Journal of Educational Computing Research*, 46(1), 61-84.
Coffield, F., Moseley, D., Hall, E. & Ecclestone, K. (2004) *Learning styles and pedagogy in post-16 learning: A systematic and critical review*
Concentric, S. *Badgr*Available online: https://badgr.com/.
Creswell, J. W. (2012) *Qualitative Inquiry and Research Design: Choosing Among Five Approaches*SAGE Publications.
Creswell, J. W. (2018) *Research design : qualitative, quantitative & mixed methods approaches*, 5th edition.

International student edition. edition.
Ćukušić, M., Garača, Ž. & Jadrić, M. (2014) Online self-assessment and students' success in higher education institutions. *Computers & Education*, 72(0), 100-109.
Davies, J. & Graff, M. (2005a) Performance in e-learning: online participation and student grades. *British Journal of Educational Technology*, 36(4), 657-663.
Davies, J. & Graff, M. (2005b) Performance in e‐learning: online participation and student grades. *British Journal of Educational Technology*, 36(4), 657-663.
Davies, M. (2007) *Doing a successful research project : using qualitative or quantitative methods*. Basingstoke :: Palgrave Macmillan.
Davies, P. (2003) Peer-Assessment: No marks required just feedback?–Evaluating the Quality of Computerized Peer-Feedback compared with Computerized Peer-Marking. *Communities of Practice, Research Proceedings of the 10 thAssociation for Learning Technology Conference (ALT-C 2003). Held in*, 8-10.
Davies, P. (2006) Peer assessment: judging the quality of students' work by comments rather than marks. *Innovations in Education & Teaching International*, 43, 69-82.
Davies, P. & Lewis, S. (2004) Computerised peer-assessment that supports the rewarding of evaluative skills in essay writing (CAP) and programming (Coursemaker).
de Leng, B. A., Dolmans, D. H. J. M., Donkers, H. H. L. M., Muijtjens, A. M. M. & van der Vleuten, C. P. M. (2010) Instruments to explore blended learning: Modifying a method to analyse online communication for the analysis of face-to-face communication. *Computers & Education*, 55(2), 644-651.
Deloitte (2016) *There's no place like phone Consumer usage patterns in the era of peak smartphone*, 2016. Available online: https://www.deloitte.co.uk/mobileuk/ [Accessed 27/05/17].
Deng, L. & Tavares, N. J. (2013) From Moodle to Facebook: Exploring students' motivation and experiences in online communities. *Computers & Education*, 68, 167-176.
Dewiyanti, S. (2005) Learning Together: A Positieve Experience. The effect of reflection on group processes in an asynchronous computer-supported collaboratieve learning environment.
Ding, N., Bosker, R. J. & Harskamp, E. G. (2011) Exploring gender and gender pairing in the knowledge elaboration processes of students using computer-supported collaborative learning. *Computers & Education*, 56(2), 325-336.
Dixon, J., Crooks, H. & Henry, K. (2006) Breaking the ice: Supporting collaboration and the development of community online. *Canadian Journal of Learning and Technology/La revue canadienne de l'apprentissage et de la technologie*, 32(2).
Domingo, J., Martinez, H., Gomariz, S. & Gámiz, J. (2014) Some Limits in Peer Assessment. *Journal of Technology and Science Education*, 4(1), 12-24.

Downing, K. J., Lam, T.-f., Kwong, T., Downing, W.-k. & Chan, S.-w. (2007) Creating interaction in online learning: a case study. *ALT-J*, 15(3), 201 - 215.
Drake, R., Goldsmith, G. & Strachan, R. (2006) A novel approach to teaching teamwork. *Teaching in Higher Education*, 11(1), 33-46.
Drouin, M. & Vartanian, L. R. (2010) Students' feelings of and desire for sense of community in face-to-face and online courses. *Quarterly Review of Distance Education*, 11(3), 147.
Du, J., Xu, J. & Fan, X. (2013) Factors Affecting Online Groupwork Interest: A Multilevel Analysis. *Journal of Educational Computing Research*, 49(4), 481-499.
Duarte, M. (2018) Engineering Students perceptions on Learner Autonomy A mixed methodology approach, *2018 3rd International Conference of the Portuguese Society for Engineering Education (CISPEE)*. 27-29 June 2018.
Dunn, T. J. & Kennedy, M. (2019) Technology Enhanced Learning in higher education; motivations, engagement and academic achievement. *Computers & Education*, 137, 104-113.
Durán, E. B. & Amandi, A. (2011) Personalised collaborative skills for student models. *Interactive Learning Environments*, 19(2), 143 - 162.
Eastburg, A. (2013) Effect of Peer Evaluations in Influencing Behavior in a Laboratory Course. Available online: [Accessed 16/08/2015].
Elliott, J. (1991) *Action research for educational change*McGraw-Hill Education (UK).
Ellis, R. A., Calvo, R., Levy, D. & Tan, K. (2004) Learning through discussions. *Higher Education Research & Development.* Carfax Publishing Company.
Elshami, W. & Abdalla, M. E. (2017) Diagnostic radiography students' perceptions of formative peer assessment within a radiographic technique module. *Radiography*, 23(1), 9-13.
English, R., Brookes, S. T., Avery, K., Blazeby, J. M. & Ben-Shlomo, Y. (2006) The effectiveness and reliability of peer-marking in first-year medical students. *Medical Education*, 40(10), 965-972.
Ertmer, P. A., Richardson, J. C., Lehman, J. D., Newby, T. J., Xi, C., Mong, C. & Sadaf, A. (2010) Peer Feedback in a Large Undergraduate Blended Course: Perceptions of Value and Learning. *Journal of Educational Computing Research*, 43(1), 67-88.
Evans, A. W., Leeson, R. M. A. & Petrie, A. (2007) Reliability of peer and self-assessment scores compared with trainers' scores following third molar surgery. *Medical Education*, 41(9), 866-872.
Faherty, A. (2015) Developing enterprise skills through peer-assessed pitch presentations. *Education + Training*, 57(3), 290-305.
Falchikov, N. (1988) Self and Peer Assessment of a Group Project Designed to Promote the Skills of Capability. *Programmed Learning & Educational Technology*, 25(4), 327-339.
Falchikov, N. (1995) Peer Feedback Marking: Developing Peer Assessment. *Innovations in Education and Training International*, v32 n2 p175-87 May 1995.
Falchikov, N. (2001) *Learning together : peer tutoring in higher education*. London ; New York: RoutledgeFalmer.
Falchikov, N. & Blythman, M. (2001) *Learning together: Peer tutoring in higher education*Psychology Press.
Falchikov, N. & Goldfinch, J. (2000) Student peer assessment in higher education: A meta-analysis comparing peer and teacher marks. *Review of Educational Research*, 70(3), 287-322.
Field, A. P. (2005) *Discovering Statistics Using SPSS*Sage Pubns.
Fotiadou, A., Angelaki, C. & Mavroidis, I. (2017) Learner Autonomy as a Factor of the Learning Process in Distance Education, 20(1), 96.

Francescato, D., Mebane, M., Porcelli, R., Attanasio, C. & Pulino, M. (2007) Developing professional skills and social capital through computer supported collaborative learning in university contexts. *International Journal of Human-Computer Studies*, 65(2), 140-152.
Freeman, M. (1995) Peer assessment by groups of group work. *Assessment & Evaluation in Higher Education*, 20(3), 289.
Freeman, M. & McKenzie, J. (2002) SPARK, a confidential web-based template for self and peer assessment of student teamwork: benefits of evaluating across different subjects, Available online: http://www.blackwell-synergy.com/doi/abs/10.1111/1467-8535.00291 [Accessed.
Gannaway, D., Green, T. & Mertova, P. (2018) So how big is big? Investigating the impact of class size on ratings in student evaluation. *Assessment & Evaluation in Higher Education*, 43(2), 175-184.
Gao, Y., Schunn, C. D. D. & Yu, Q. (2018) The alignment of written peer feedback with draft problems and its impact on revision in peer assessment. *Assessment & Evaluation in Higher Education*, 1-15.
García-Ros, R., Fuentes, M. C., Hernàndez i Dobon, F., Villar-Aguilés, A. & Pérez-González, F. (2018) The Development and Validation of a Scale for Assessing Peer-Mentoring Processes in Programs for First-Year University Students. *Electronic Journal of Research in Educational Psychology*, 16(46), 661-679.
Garner, I. (2000) Problems and inconsistencies with Kolb's learning styles. *Educational Psychology*, 20(3), 341-348.
Garrison, D., Anderson, T. & Archer, W. (2001) Critical thinking, cognitive presence, and computer conferencing in distance education. *American Journal of Distance Education*, 15(1), 7-24.
Gatfield, T. (1999) Examining Student Satisfaction with Group Projects and Peer Assessment. *Assessment & Evaluation in Higher Education*, 24(4), 365.
Ge, X., Kelly Ann, Y. & Jack, L. (2000) Pre-class Planning to Scaffold Students for Online Collaborative Learning Activities. *Journal of Educational Technology & Society*, 3(3), 159-168.
Gebhardt, R. (1980) Teamwork and Feedback: Broadening the Base of Collaborative Writing. *College English*, 42(1), 69-74.
Gerbic, P. (2006) To post or not to post: Undergraduate student perceptions about participating in online discussions, *Proceedings ascilite Sydney 2006*.
Gharehbagh, M. J., Stapa, S. H. & Darus, S. (2019) The Effects of Written Corrective Feedback Using Wikis among ESL Learners. *3l-Language Linguistics Literature-the Southeast Asian Journal of English Language Studies*, 25(1), 55-68.
Gielen, S., Dochy, F. & Onghena, P. (2011) An inventory of peer assessment diversity. *Assessment & Evaluation in Higher Education*, 36(2), 137 - 155.
Gielen, S., Tops, L., Dochy, F., Onghena, P. & Smeets, S. (2010) A comparative study of peer and teacher feedback and of various peer feedback forms in a secondary school writing curriculum. *British Educational Research Journal*, 36(1), 143 - 162.
Gikandi, J. W. & Morrow, D. (2016) Designing and implementing peer formative feedback within online learning environments. *Technology, Pedagogy & Education*, 25(2), 153-170.
Gikandi, J. W., Morrow, D. & Davis, N. E. (2011) Online formative assessment in higher education: A review of the literature. *Computers & Education*, 57(4), 2333-2351.
Gilbert, S. W. & Green, K. C. (1986) New Computing: In Higher Education. *Change*, 18(3), 33-50.

British Journal of Educational Technology, *Evaluating the quality of e-learning at the degree level in the student experience of blended learning* (2009) 40. Written by 652-663 [Article]. Blackwell Publishing Limited. Available online: 10.1111/j.1467-8535.2008.00861.x

http://search.ebscohost.com/login.aspx?direct=true&db=afh&AN=41435973&site=ehost-live [Accessed.

Gleason, W. J. (1957) Predicting Army leadership ability by modified leaderless group discussion. *Journal of Applied Psychology*, 41, 231-235.

Gomez, E. A., Wu, D. & Passerini, K. (2010) Computer-supported team-based learning: The impact of motivation, enjoyment and team contributions on learning outcomes. *Computers & Education*, 55(1), 378-390.

Gonzalez-Betancor, S. M., Bolivar-Cruz, A. & Verano-Tacoronte, D. (2019) Self-assessment accuracy in higher education: The influence of gender and performance of university students. *Active Learning in Higher Education*, 20(2), 101-114.

Graham, C. (2006a) Blended learning systems: Definition, current trends, and future directions, 3-21.

Graham, C. R. (2006b) Blended learning systems, *The handbook of blended learning*, 3-21.

Grant, D. M., Malloy, A. D. & Murphy, M. C. (2009) A comparison of student perceptions of their computer skills to their actual abilities. *Journal of Information Technology Education*, 8.

Green, N. C., Edwards, H., Wolodko, B., Stewart, C., Brooks, M. & Littledyke, R. (2010) Reconceptualising higher education pedagogy in online learning. *Distance Education*, 31(3), 257 - 273.

Grez, L. D., Valcke, M. & Roozen, I. (2012) How effective are self- and peer assessment of oral presentation skills compared with teachers' assessments? *Active Learning in Higher Education*, 13(2), 129-142.

Gribbons, B. & Herman, J. (1997) *True and quasi-experimental designs*

Gu, J. (2016) Understanding self-directed learning in the context of mobile Web 2.0 – case study with workplace learners. *Interactive Learning Environments*, 24(2), 306-316.

Guasch, T., Espasa, A., Alvarez, I. M. & Kirschner, P. A. (2013) Effects of feedback on collaborative writing in an online learning environment. *Distance Education*, 34(3), 324-338.

Güler, Ç. (2017) Use of WhatsApp in Higher Education: What's Up with Assessing Peers Anonymously? *Journal of Educational Computing Research*, 55(2), 272-289.

Gupta, M. L. (2004) Enhancing student performance through cooperative learning in physical sciences. *Assessment and Evaluation in Higher Education*, 29(1), 63-74.

Haddadi, L., Bouarab ‐ Dahmani, F., Guin, N., Berkane, T. & Lazib, S. (2018) Peer assessment and groups formation in massive open online courses. *Computer Applications in Engineering Education*, 26(5), 1873-1887.

Hammersley, M. (1987) Some Notes on the Terms 'Validity' and 'Realiability'. *British Educational Research Journal*, 13(1), 73-81.

Hammond, M. (2000) Communication within on-line forums: the opportunities, the constraints and the value of a communicative approach. *Computers & Education*, 35(4), 251-262.

Hammond, M. (2005) A review of recent papers on online discussion in teaching and learning in higher education. *Journal of Asynchronous Learning Networks*, 9(3), 9-23.

Hammond, M. & Wiriyapinit, M. (2005) Learning through online discussion: A case of triangulation in research. *Australasian Journal of Educational Technology*, 21(3), 283.

Hamnett, H. J. & McKie, A. E. (2019) Developing a procedure for learning and assessing peer review in a forensic science programme. *Assessment & Evaluation in Higher Education*, 44(5), 787-798.
Hampel, R. & de los Arcos, B. (2013) Interacting at a distance: A critical review of the role of ICT in developing the learner–context interface in a university language programme. *Innovation in Language Learning and Teaching*, 7(2), 158-178.
Handelsman, M. M., Briggs, W. L., Sullivan, N. & Towler, A. (2005) A measure of college student course engagement. *The Journal of Educational Research*, 98(3), 184-192.
Hannaford, L. (2017) Motivation in group assessment: a phenomenological approach to post-graduate group assessment. *Assessment & Evaluation in Higher Education*, 42(5), 823-836.
Hanrahan, S. J. & Isaacs, G. (2001) Assessing Self- and Peer-assessment: the students' views. *Higher Education Research & Development*, 20(1), 53 - 70.
Hargittai, E. & Shafer, S. (2006) Differences in Actual and Perceived Online Skills: The Role of Gender*. *Social Science Quarterly*, 87(2), 432-448.
Harris, Z. (1952) Discourse analysis. *Language*, 28(1), 1-30.
Hearn, W. M., Turley, F. & Rainwater, L. H. (2017) Virtual versus face to face peer evaluations: On the net, I may not know you, but I know your work. *International Journal of Management Education (Elsevier Science)*, 15(3), 539-545.
Heiser, S. L., Stickler, U. & Furnborough, C. (2013) Ready, steady, speak-online: Student training in the use of an online synchronous conferencing tool. *Calico Journal*, 30(2), 226-251.
Henderson, M., Selwyn, N. & Aston, R. (2017) What works and why? Student perceptions of 'useful' digital technology in university teaching and learning. *Studies in Higher Education*, 42(8), 1567-1579.
Henri, D. C., Morrell, L. J. & Scott, G. W. (2018) Student perceptions of their autonomy at University. *Higher Education*, 75(3), 507-516.
Henri, F. (1992) Computer conferencing and content analysis. *Collaborative learning through computer conferencing: The Najaden papers*, 90, 117-136.
Hew, K. F. & Cheung, W. S. (2008) Attracting student participation in asynchronous online discussions: A case study of peer facilitation. *Computers & Education*, 51(3), 1111-1124.
Hollander, E. P. (1954a) Buddy Ratings: Military Research and Industrial Implications. *Personnel Psychology*, 7(3), 385-393.
Hollander, E. P. (1954b) Peer nominations on leadership as a predictor of the pass–fail criterion in naval air training. *Journal of Applied Psychology*, 38, 150–153.
Hornby, G. (2009) The effectiveness of cooperative learning with trainee teachers. *Journal of Education for Teaching*, 35(2), 161-168.
Horspool, A. & Lange, C. (2010) Applying the scholarship of teaching and learning: student perceptions, behaviours and success online and face-to-face. *Assessment & Evaluation in Higher Education*, 37(1), 73-88.
Hostetter, C. & Busch, M. (2006) Measuring Up Online: The Relationship between Social Presence and Student Learning Satisfaction. *Journal of Scholarship of Teaching and Learning*, 6(2), 1-12.
Houston, K. & Lazenbatt, A. (1996) A peer-tutoring scheme to support independent learning and group project work in mathematics. *Assessment & Evaluation in Higher Education*, 21(3), 251.
Hsia, L.-H., Huang, I. & Hwang, G.-J. (2016) Effects of different online peer-feedback approaches on students' performance skills, motivation and self-efficacy in a dance course. *Computers & Education*, 96, 55-71.

Huang, K. & Law, V. (2018) Learners' engagement online in peer help. *American Journal of Distance Education*, 32(3), 177-189.
Huff, K. L. & Stephen, G. S. (2001) Validity issues in computer-based testing. *Educational Measurement, Issues and Practice*, 20(3), 16.
Hung, M.-L., Chou, C., Chen, C.-H. & Own, Z.-Y. (2010) Learner readiness for online learning: Scale development and student perceptions. *Computers & Education*, 55(3), 1080-1090.
Hyun Bae, Y., Wan Beom, P., Sun-Jung, M., Sang Hui, M. & Jun-Bean, P. (2018) Validity and reliability assessment of a peer evaluation method in team-based learning classes. *Korean Journal of Medical Education*, 30(1), 23-29.
IBM *SPSS*Available online: https://www.ibm.com/uk-en/analytics/spss-statistics-software.
iPeer *iPeer*Available online: http://ipeer.ctlt.ubc.ca/ [Accessed 20/06/17].
Ireson, J. & Hallam, S. (1999) Raising Standards: Is Ability Grouping the Answer? *Oxford Review of Education*, 25(3), 343-358.
Issa, T. (2012) PROMOTING LEARNING SKILLS THROUGH TEAMWORK ASSESSMENT AND SELF/PEER EVALUATION IN HIGHER EDUCATION. *Proceedings of the IADIS International Conference on Cognition & Exploratory Learning in Digital Age*, 90-98.
Izgar, G. & Akturk, A. O. (2018) A Mixed Method Research on Peer Assessment. *International Journal of Evaluation and Research in Education*, 7(2), 118-126.
Jackson, D. (2013) Self-assessment of employability skill outcomes among undergraduates and alignment with academic ratings. *Assessment & Evaluation in Higher Education*(ahead-of-print), 1-20.
Jakobsson, N. (2012) Gender and confidence: are women underconfident? *Applied Economics Letters*, 19(11), 1057-1059.
James, S., Lanham, E., Mak-Hau, V., Pan, L., Wilkin, T. & Wood-Bradley, G. (2018) Identifying items for moderation in a peer assessment framework. *Knowledge-Based Systems*, 162, 211-219.
Jeffery, D., Yankulov, K., Crerar, A. & Ritchie, K. (2016) How to achieve accurate peer assessment for high value written assignments in a senior undergraduate course. *Assessment & Evaluation in Higher Education*, 41(1), 127-140.
Jeffrey, L., Hegarty, B., Kelly, O., Penman, M., Coburn, D. & McDonald, J. (2011) Developing digital information literacy in higher education: Obstacles and supports. *Journal of Information Technology Education: Research*, 10(1), 383-413.
Jin, X.-H. (2011) A comparative study of effectiveness of peer assessment of individuals' contributions to group projects in undergraduate construction management core units. *Assessment & Evaluation in Higher Education*, 37(5), 577-589.
JISC *Building digital capability*Available online: https://digitalcapability.jisc.ac.uk/.
Johnson, D. W., Johnson, R. T. & Smith, K. A. (1991) *Active Learning: Cooperation in the College Classroom*.
Jones, I. & Wheadon, C. (2015) Peer assessment using comparative and absolute judgement. *Studies in Educational Evaluation*, 47, 93-101.
Jones, M. G. & Carter, G. (1994) Verbal and nonverbal behavior of ability-grouped dyads. *Journal of Research in Science Teaching*, 31(6), 603-619.
Joo, Y. J., Lim, K. Y. & Kim, E. K. (2011) Online university students' satisfaction and persistence: Examining perceived level of presence, usefulness and ease of use as predictors in a structural model. *Computers & Education*, 57(2), 1654-1664.
Joyner, S. A. (2015) DEFYING CONVENTIONAL WISDOM: Online Graduate Student Frustrations with Group Work. *Online Classroom*, 15(5), 3-8.

Jung, I., Kudo, M. & Choi, S. K. (2012) Stress in Japanese learners engaged in online collaborative learning in English. *British Journal of Educational Technology*, 43(6), 1016-1029.
Jung, M.-Y. (2016) Peer/Teacher-Assessment Using Criteria in the EFL Classroom for Developing Students' L2 Writing. *Journal of Pan-Pacific Association of Applied Linguistics*, 20(1), 1-20.
Kao, G. Y. M. (2013) Enhancing the quality of peer review by reducing student "free riding": Peer assessment with positive interdependence. *British Journal of Educational Technology*, 44(1), 112-124.
Kear, K. (2004) Peer learning using asynchronous discussion systems in distance education. *Open Learning*, 19(2), 151-164.
Kearney, S. (2013) Improving engagement: the use of 'Authentic self-and peer-assessment for learning' to enhance the student learning experience. *Assessment & Evaluation in Higher Education*, 38(7), 875-891.
Kearney, S., Perkins, T. & Kennedy-Clark, S. (2016) Using self- and peer-assessments for summative purposes: analysing the relative validity of the AASL (Authentic Assessment for Sustainable Learning) model. *Assessment & Evaluation in Higher Education*, 41(6), 840-853.
Kelley, H. H. (1952) Attitudes and judgments as influenced by reference groups. *Readings in Social Psychology. New York: Holt, Rinehart and Winston*, 410-414.
Kemmis, S. (1980) Action Research in Retrospect and Prospect.
Keppell, M., Au, E., Ma, A. & Chan, C. (2006) Peer learning and learning-oriented assessment in technology-enhanced environments. *Assessment & Evaluation in Higher Education*, 31(4), 453-464.
Kerr, N. L. (1989) Illusions of efficacy: The effects of group size on perceived efficacy in social dilemmas. *Journal of Experimental Social Psychology*, 25(4), 287-313.
Kim, J. (2013) Influence of group size on students' participation in online discussion forums. *Computers & Education*, 62(0), 123-129.
Kim, J., Kwon, Y. & Cho, D. (2011) Investigating factors that influence social presence and learning outcomes in distance higher education. *Computers & Education*, 57(2), 1512-1520.
Kim, M. & Ryu, J. (2013) The development and implementation of a web-based formative peer assessment system for enhancing students' metacognitive awareness and performance in ill-structured tasks. *Educational Technology Research and Development*, 61(4), 549-561.
King, A., Staffieri, A. & Adelgais, A. (1998) Mutual peer tutoring: Effects of structuring tutorial interaction to scaffold peer learning. *Journal of Educational Psychology*.
Kingsley, B. (2010) But I'm no expert! Peer assessment by first-year psychology undergraduates. *Psychology Learning and Teaching*, 9(1), 7-15.
Kirby, N. F. & Downs, C. T. (2007) Self-assessment and the disadvantaged student: potential for encouraging self-regulated learning? *Assessment & Evaluation in Higher Education*, 32(4), 475-494.
Kirschner, P. A. (2005) Is Technology-Based Collaborative Learning Antisocial? or, What We Are Doing to Make It So! *Educational Technology*, 45(5), 8-12.
Kleinman, S. (2005) Strategies for Encouraging Active Learning, Interaction, and Academic Integrity in Online Courses. *Communication Teacher*, 19(1), 13-18.
Kleinsasser, R. & Hong, Y.-C. (2016) Online Group Work Design: Processes, Complexities, and Intricacies. *TechTrends: Linking Research & Practice to Improve Learning*, 60(6), 569-576.

Koh, E. & Lim, J. (2012) Using online collaboration applications for group assignments: The interplay between design and human characteristics. *Computers & Education*, 59(2), 481-496.
Koh, M. H., Barbour, M. & Hill, J. R. (2010) Strategies for Instructors on How to Improve Online Groupwork. *Journal of Educational Computing Research*, 43(2), 183-205.
Kolb, D. A. (1984) *Experiential learning : experience as the source of learning and development*. Englewood Cliffs, N.J. ; London: Prentice-Hall.
Kreijns, K., Kirschner, P. A. & Jochems, W. (2003) Identifying the pitfalls for social interaction in computer-supported collaborative learning environments: a review of the research. *Computers in Human Behavior*, 19(3), 335-353.
Kuh, G. D. & Vesper, N. (2001) Do Computers Enhance or Detract from Student Learning? *Research in Higher Education.* Kluwer Academic Publishing.
Kun-Hung, C. & Chin-Chung, T. (2012) Students' interpersonal perspectives on, conceptions of and approaches to learning in online peer assessment. *Australasian Journal of Educational Technology*, 28(4), 599-618.
Kwan, K.-P. & Leung, R. (1996) Tutor versus peer group assessment of student performance in a simulation training exercise. *Assessment & Evaluation in Higher Education*, 21(3), 205.
Kyprianidou, M., Demetriadis, S., Tsiatsos, T. & Pombortsis, A. (2012) Group formation based on learning styles: can it improve students' teamwork? *Educational Technology, Research and Development*, 60(1), 83-110.
Laffey, J., Guan Yu, L. & Yimei, L. (2006) Assessing Social Ability in Online Learning Environments. *Journal of Interactive Learning Research*, 17(2), 163.
Lai, K. (2012) Assessing participation skills: online discussions with peers. *Assessment & Evaluation in Higher Education*, 37(8), 933-947.
Lai, M. & Law, N. (2006) Peer Scaffolding of Knowledge Building Through Collaborative Groups with Differential Learning Experiences. *Journal of Educational Computing Research*, 35(2), 123-144.
Lam, D. & Ozorio, B. (2013) The effect of prior outcomes on gender risk-taking differences. *Journal of Risk Research*, 16(7), 791-802.
Landry, A., Jacobs, S. & Newton, G. (2015) Effective Use of Peer Assessment in a Graduate Level Writing Assignment: A Case Study. *International Journal of Higher Education*, 4(1), 38-51.
Law, K. M. Y., Geng, S. & Li, T. (2019) Student enrollment, motivation and learning performance in a blended learning environment: The mediating effects of social, teaching, and cognitive presence. *Computers & Education*, 136, 1-12.
LeBlanc, T. R. (2018) Learning Styles: Academic Fact or Urban Myth? A Recent Review of the Literature.
Lee, L. (2017) A study on the roles of peer review in the process of PAL. *International Journal of Language and Literature*, 5(1), 60-68.
Lee, S. W.-Y. (2013) Investigating students' learning approaches, perceptions of online discussions, and students' online and academic performance. *Computers & Education*, 68(0), 345-352.
Lejk, M. & Wyvill, M. (1996) A survey of methods of deriving individual grades from group assessments. *Assessment & Evaluation in Higher Education.* Carfax Publishing Company.
Lejk, M. & Wyvill, M. (2001) Peer Assessment of Contributions to a Group Project: a comparison of holistic and category-based approaches. *Assessment & Evaluation in Higher Education*, 26(1), 61-72.

Lejk, M., Wyvill, M. & Farrow, S. (1999) Group Assessment in Systems Analysis and Design: a comparison of the performance of streamed and mixed-ability groups. *Assessment & Evaluation in Higher Education*, 24(1), 5.
Lew, M. D. N., Alwis, W. A. M. & Schmidt, H. G. (2010) Accuracy of students' self-assessment and their beliefs about its utility. *Assessment & Evaluation in Higher Education*, 35(2), 135 - 156.
Lewin, K. (1946) Action Research and Minority Problems. *Journal of Social Issues*, 2(4), 34-46.
Li, L. (2019) Using game-based training to improve students' assessment skills and intrinsic motivation in peer assessment. *Innovations in Education and Teaching International*, 56(4), 423-433.
Li, L., Liu, X. & Steckelberg, A. L. (2010) Assessor or assessee: How student learning improves by giving and receiving peer feedback. *British Journal of Educational Technology*, 41(3), 525-536.
Li, L. K. Y. (2001) Some Refinements on Peer Assessment of Group Projects. *Assessment & Evaluation in Higher Education.* Carfax Publishing Company.
Lin, G.-Y. (2018) Anonymous versus identified peer assessment via a Facebook-based learning application: Effects on quality of peer feedback, perceived learning, perceived fairness, and attitude toward the system. *Computers & Education*, 116, 81-92.
Lin, H.-s., Hong, Z.-R. & Lawrenz, F. (2012) Promoting and scaffolding argumentation through reflective asynchronous discussions. *Computers & Education*, 59(2), 378-384.
Lin, Y.-T., Wen, M.-L., Jou, M. & Wu, D.-W. (2014) A cloud-based learning environment for developing student reflection abilities. *Computers in Human Behavior*, 32, 244-252.
Ling, L. (2007) Community of inquiry in an online undergraduate information technology course. *Journal of Information Technology Education*, 6, 153-168.
Liu, C.-C. & Tsai, C.-C. (2008) An analysis of peer interaction patterns as discoursed by on-line small group problem-solving activity. *Computers & Education*, 50(3), 627-639.
Liu, J., Guo, X., Gao, R., Fram, P., Ling, Y., Zhang, H. & Wang, J. (2019a) Students' learning outcomes and peer rating accuracy in compulsory and voluntary online peer assessment. *Assessment & Evaluation in Higher Education*, 44(6), 835-847.
Liu, J., Guo, X., Gao, R., Fram, P., Ling, Y., Zhang, H. & Wang, J. (2019b) Students' learning outcomes and peer rating accuracy in compulsory and voluntary online peer assessment. *Assessment & Evaluation in Higher Education*, 44(6), 835-847.
Liu, L. (2009) Online Communication and Student Online Learning: Motivation and Performance, *Society for Information Technology & Teacher Education International Conference 2009*. Charleston, SC, USA: AACE.
Liu, X. & Li, L. (2014) Assessment training effects on student assessment skills and task performance in a technology-facilitated peer assessment. *Assessment & Evaluation in Higher Education*, 39(3), 275-292.
Liu, X., Li, L. & Zhang, Z. (2018) Small group discussion as a key component in online assessment training for enhanced student learning in web-based peer assessment. *Assessment & Evaluation in Higher Education*, 43(2), 207-222.
Lock, J. & Johnson, C. (2015) TRIANGULATING ASSESSMENT OF ONLINE COLLABORATIVE LEARNING. *Quarterly Review of Distance Education*, 16(4), 61-70.
Loncar, M., Barrett, N. E. & Liu, G.-Z. (2013) Towards the refinement of forum and asynchronous online discussion in educational contexts worldwide: Trends and

investigative approaches within a dominant research paradigm. *Computers & Education*(0).
López-Pastor, V. M., Fernández-Balboa, J.-M., Santos Pastor, M. L. & Fraile Aranda, A. (2011) Students' self-grading, professor's grading and negotiated final grading at three university programmes: analysis of reliability and grade difference ranges and tendencies. *Assessment & Evaluation in Higher Education*, 37(4), 453-464.
Love, K. G. (1981) Comparison of peer assessment methods: Reliability, validity, friendship bias, and user reaction. *Journal of Applied Psychology*, 66(4), 451-457.
Luckin, R. (2002) Peer to Peer Convergence: Designing a Pedagogical Framework for Personal Learning Networks, *International conference on computers in education*. Auckland, New Zealand, Dec. IEEE, Computer Society.
Lumpe, A. T. (1995) Peer interaction in science concept development and problem solving. *School Science & Mathematics.* School Science & Mathematics Association.
Ma, A. & Ng, E. (2002) Designing an Electronic Assessment to Foster Peer Learning, *International conference on computers in education*. Auckland, New Zealand, Dec. IEEE, Computer Society.
Mabrito, M. (2006) A Study of Synchronous Versus Asynchronous Collaboration in an Online Business Writing Class. *American Journal of Distance Education*, 20(2), 93-107.
Mac Callum, K., Jeffrey, L. & Kinshuk (2014) Comparing the role of ICT literacy and anxiety in the adoption of mobile learning. *Computers in Human Behavior*, 39, 8-19.
Macdonald, J. (2003) Assessing online collaborative learning: process and product. *Computers & Education*, 40(4), 377-391.
Madland, C. & Richards, G. (2016) Enhancing Student-Student Online Interaction: Exploring the Study Buddy Peer Review Activity. *International Review of Research in Open & Distance Learning*, 17(3), 157-175.
Magin, D. (2001) Reciprocity as a Source of Bias in Multiple Peer Assessment of Group Work. *Studies in Higher Education*, 26(1), 53-63.
Magin, D. & Helmore, P. (2001) Peer and Teacher Assessments of Oral Presentation Skills: how reliable are they? *Studies in Higher Education*, 26(3), 287-298.
Maiden, B. & Perry, B. (2011) Dealing with free-riders in assessed group work: results from a study at a UK university. *Assessment & Evaluation in Higher Education*, 36(4), 451-464.
Mao, J. & Peck, K. (2013) Assessment strategies, self-regulated learning skills, and perceptions of assessment in online learning. *Quarterly Review of Distance Education*, 14(2), 75-95,121.
Martinez-Izaguirre, M., Barrenetxea, L. & Diaz-Iso, A. (2019) Peer learning and professional development of students in the Primary Education Degree through the online forums. *Aloma-Revista De Psicologia Ciencies De L Educacio I De L Esport*, 37(1), 45-53.
Masters, K. & Oberprieler, G. (2004) Encouraging equitable online participation through curriculum articulation. *Computers & Education*, 42(4), 319-332.
Matheson, R., Wilkinson, S. C. & Gilhooly, E. (2012) Promoting critical thinking and collaborative working through assessment: combining patchwork text and online discussion boards. *Innovations in Education and Teaching International*, 49(3), 257-267.
McCaslin, N. & Torres, R. M. (1992) Computer network use expands teaching and learning opportunities. *NACTA Journal*, 20-22.
McClure, G. E., Tupes, E. C. & Dailey, J. T. (1951) Research on criteria of officer effectiveness. USAF Hum. Resour. Res. Cent., Res. *Research Bulletin*.

McConlogue, T. (2010) But is it fair? Developing students' understanding of grading complex written work through peer assessment. *Assessment & Evaluation in Higher Education*, 37(1), 113-123.
McDonald, B. (2013) Mentoring and tutoring your students through self-assessment. *Innovations in Education and Teaching International*, 50(1), 62-71.
McLaughlin, P. & Simpson, N. (2004) Peer assessment in first year university: How the students feel. *Studies in Educational Evaluation*, 30(2), 135-149.
McLoughlin, D. & Mynard, J. (2009) An analysis of higher order thinking in online discussions. *Innovations in Education and Teaching International*, 46(2), 147 - 160.
McMahon, T. (2010) Combining peer-assessment with negotiated learning activities on a day-release undergraduate-level certificate course (ECTS level 3). *Assessment & Evaluation in Higher Education*, 35(2), 223-239.
Meer, N. & Chapman, A. (2015) Co-creation of Marking Criteria: Students as Partners in the Assessment Process. *Business and Management Education in HE*, 1-15.
Merrill, M. D. & Gilbert, C. G. (2008) Effective peer interaction in a problem-centered instructional strategy. *Distance Education*, 29(2), 199 - 207.
Meyer, K. A. (2003) Face-to-face versus threaded discussions: The role of time and higher-order thinking. *Journal of Asynchronous Learning Networks*, 7(3), 55-65.
Molina-Carmona, R., Satorre-Cuerda, R., CompaÑ-Rosique, P. & Llorens-Largo, F. (2018) Metrics for Estimating Validity, Reliability and Bias in Peer Assessment. *International Journal of Engineering Education*, 34(3), 968-980.
Money, W. H. & Dean, B. P. (2019) Incorporating student population differences for effective online education: A content-based review and integrative model. *Computers & Education*, 138, 57-82.
Moore, J. L., Dickson-Deane, C. & Galyen, K. (2011) e-Learning, online learning, and distance learning environments: Are they the same? *The Internet and Higher Education*, 14(2), 129-135.
Moreno, J., Ovalle, D. A. & Vicari, R. M. (2012) A genetic algorithm approach for group formation in collaborative learning considering multiple student characteristics. *Computers & Education*, 58(1), 560-569.
Morgan, D. (1993) *Successful focus groups: Advancing the state of the art*Sage Publications, Inc.
Morgan, K., Cameron, B. A. & Williams, K. C. (2009) Student perceptions of social task development in online group project work. *Quarterly Review of Distance Education*, 10(3), 285-294.
Morin, D., Fard, H. S. & Saadé, R. G. (2019) Understanding Online Learning Based on Different Age Categories. *Issues in Informing Science and Information Technology*, 16, 307-317.
Mostert, M. & Snowball, J. (2013) Where angels fear to tread: online peer-assessment in a large first-year class. *Assessment & Evaluation in Higher Education*, 38(6), 674-686.
Mostert, M. & Snowball, J. D. (2012) Where angels fear to tread: online peer-assessment in a large first-year class. *Assessment & Evaluation in Higher Education*, 38(6), 674-686.
Mowl, G. (1996) Innovative Assessment. *Published by DeLiberations (http://lgu. ac. uk/deliberations/assessment/mowl_content. html).*
Muilenburg, L. Y. & Berge, Z. L. (2005) Student barriers to online learning: A factor analytic study. *Distance education*, 26(1), 29-48.
Muire, C. (1999) Web-based technology in a constructivist community of learners. *British Journal of Educational Technology*, 30(1), 65-68.

Naber, A. M., Payne, S. C. & Webber, S. S. (2018) The relative influence of trustor and trustee individual differences on peer assessments of trust. *Personality and Individual Differences*, 128, 62-68.
Nandi, D., Hamilton, M. & Harland, J. (2012) Evaluating the quality of interaction in asynchronous discussion forums in fully online courses. *Distance Education*, 33(1), 5-30.
Nash, J. (2014) Using blended learning to increase student engagement in a large undergraduate class, *Proceedings of the 43rd Conference of the Southern African Computer Lecturers' Association (SACLA), Port Elizabeth, South Africa. Available at:* *https://www. researchgate. net/profile/Jane_Nash/contribution s*.
Nekby, L., Skogman Thoursie, P. & Vahtrik, L. (2015) Gender difference in examination behaviour. *Economic Inquiry*, 53(1), 352-364.
Neuman, L. W. (2006) Social research methods. *Personal International Edition*, 6.
Neus, J. L. (2011) Peer assessment accounting for student agreement. *Assessment & Evaluation in Higher Education*, 36(3), 301 - 314.
Ng, E. (2002) Enhancing Collaborative Learning through Online Discussion and Peer Assessment, *International conference on computers in education*. Auckland, New Zealand, Dec. IEEE, Computer Society.
Ngoyi, L. & Malapile, L. S. (2018) Social Presence and Student Engagement in Online Learning, *Student Engagement and Participation: Concepts, Methodologies, Tools, and Applications*IGI Global, 1228-1237.
Nguyen, V. A. (2017) A Peer Assessment Approach to Project Based Blended Learning Course in a Vietnamese Higher Education. *Education and Information Technologies*, 22(5), 2141-2157.
Nordberg, D. (2008) Fairness in assessing group projects. *The International Journal for Quality and Standards*, 1(2), 373-392.
Nortvig, A.-M., Petersen, A. K. & Balle, S. H. (2018) A Literature Review of the Factors Influencing E-Learning and Blended Learning in Relation to Learning Outcome, Student Satisfaction and Engagement. *Electronic Journal of e-Learning*, 16(1), 46-55.
O'Neill, T., Larson, N., Smith, J., Donia, M., Deng, C., Rosehart, W. & Brennan, R. (2019) Introducing a scalable peer feedback system for learning teams. *Assessment & Evaluation in Higher Education*, 44(6), 848-862.
O'Bannon, B. W., Lubke, J. K. & Britt, V. G. (2013) 'You still need that face-to-face communication': drawing implications from preservice teachers' perceptions of wikis as a collaborative tool. *Technology, Pedagogy and Education*, 22(2), 135-152.
Oakley, B., Felder, R. M., Brent, R. & Elhajj, I. (2004) Turning student groups into effective teams.
OFCOM (2010) *Communications Market Report: UK*.
Office for National Statistics (2012) *Internet Access - Households and Individuals: 2012 Part 2*. Available online: https://www.ons.gov.uk/peoplepopulationandcommunity/householdcharacteristics/homeinternetandsocialmediausage/bulletins/internetaccesshouseholdsandindividuals/2013-02-28 [Accessed 02/06/17].
Oliveira, I., Tinoca, L. & Pereira, A. (2011) Online group work patterns: How to promote a successful collaboration. *Computers & Education*, 57(1), 1348-1357.
Opdecam, E. & Everaert, P. (2018) Seven disagreements about cooperative learning. *Accounting Education*, 27(3), 223-233.
Opie, C. (2004) *Doing educational research*Sage.
Oppenheim, A. N. (1992) *Questionnaire design, interviewing and attitude measurement*, New ed. edition. London: Continuum.

Orr, S. (2010) Collaborating or fighting for the marks? Students’ experiences of group work assessment in the creative arts. *Assessment & Evaluation in Higher Education*, 35(3), 301 - 313.
Orsmond, P., Merry, S. & Reiling, K. (2000) The Use of Student Derived Marking Criteria in Peer and Self-assessment. *Assessment & Evaluation in Higher Education*, 25(1), 23-38.
Ozogul, G. & Sullivan, H. (2009) Student performance and attitudes under formative evaluation by teacher, self and peer evaluators. *Educational Technology Research & Development*, 57, 393-410.
Padilla-Meléndez, A., del Aguila-Obra, A. R. & Garrido-Moreno, A. (2013) Perceived playfulness, gender differences and technology acceptance model in a blended learning scenario. *Computers & Education*, 63, 306-317.
Pai, A., Cole, M., Kovacs, J., Lee, M., Stovall, K. & McGinnis, G. (2017) As Long As You Are Here, Can I Interest in You Some Science? Increasing Student Engagement by Co-opting a Social Networking Site, Facebook for Science Discussions. *Journal of Educational Technology Systems*, 46(2), 153-177.
Panadero, E. & Romero, M. (2014) To rubric or not to rubric? The effects of self-assessment on self-regulation, performance and self-efficacy. *Assessment in Education: Principles, Policy & Practice*, 21(2), 133-148.
Park, J. (2017) ClassPrep: A peer review system for class preparation. *British Journal of Educational Technology*, 48(2), 511-523.
Parks-Stamm, E. J., Maria, Z. & M., P. S. (2017) The effects of instructor participation and class size on student participation in an online class discussion forum. *British Journal of Educational Technology*, 48(6), 1250-1259.
Patton, C. (2011) ‘Some kind of weird, evil experiment’: student perceptions of peer assessment. *Assessment & Evaluation in Higher Education*, 37(6), 719-731.
Paus, E., Werner, C. S. & Jucks, R. (2012) Learning through online peer discourse: Structural equation modeling points to the role of discourse activities in individual understanding. *Computers & Education*, 58(4), 1127-1137.
Peacock, S. & Cowan, J. (2018) Towards online student-directed communities of inquiry. *Journal of Further and Higher Education*, 42(5), 678-693.
Pena-Shaff, J., William, A. & Hugh, S. (2005) Asynchronous Online Discussions as a Tool for Learning: Students' Attitudes, Expectations, and Perceptions. *Journal of Interactive Learning Research*, 16(4), 409.
Pennie, D., Barnett, K., Chin, P. & Dolphin, I. (2001) From virtuous to virtual: the collaborative development of information skills at the University of Hull. *Vine*, 31(1), 17-21.
British Journal of Educational Technology, *Rubrics for designing and evaluating online asynchronous discussions* (2009) 40. Written by 804-820 [Article]. Blackwell Publishing Limited. Available online: 10.1111/j.1467-8535.2008.00895.x

http://search.ebscohost.com/login.aspx?direct=true&db=afh&AN=43676770&site=ehost-live [Accessed.
Piaget, J. (2006) *The psychology of intelligence*. London :: Routledge & Kegan Paul.
Picciano, A. G. (2002) Beyond student perceptions: Issues of interaction, presence, and performance in an online course. *Journal of Asynchronous Learning Networks*, 6(1), 21-40.
Pieterse, V. & Thompson, L. (2010) Academic alignment to reduce the presence of ‘social loafers’ and ‘diligent isolates’ in student teams. *Teaching in Higher Education*, 15(4), 355Á367.
Piezon, S. L. (2005) Online Groups and Social Loafing: Understanding Student-Group Interactions.

Piezon, S. L. & Donaldson, R. L. (2005) Online groups and social loafing: Understanding student-group interactions. *Online Journal of Distance Learning Administration*, 8(4).
Pitt, E. & Winstone, N. (2018) The impact of anonymous marking on students' perceptions of fairness, feedback and relationships with lecturers. *Assessment & Evaluation in Higher Education*, 43(7), 1183-1193.
Plastow, N., Spiliotopoulou, G. & Prior, S. (2010) Group assessment at first year and final degree level: a comparative evaluation. *Innovations in Education and Teaching International*, 47(4), 393 - 403.
Pond, K., Coates, D. & Palermo, O. (2007) Student perceptions of peer review marking of team projects. *Retrieved December*, 17, 2010.
Pope, N. (2001) An Examination of the Use of Peer Rating for Formative Assessment in the Context of the Theory of Consumption Values. *Assessment & Evaluation in Higher Education.* Carfax Publishing Company.
Pope, N. K. L. (2005) The impact of stress in self- and peer assessment. *Assessment and Evaluation in Higher Education*, 30(1), 51.
Porter, M. (2015) Toward an understanding of faculty perceptions about factors that influence student success in online education.
Postmes, T., Spears, R., Sakhel, K. & de Groot, D. (2001) Social Influence in Computer-Mediated Communication: The Effects of Anonymity on Group Behavior. *Pers Soc Psychol Bull*, 27(10), 1243-1254.
Pozzi, F. (2010) Using Jigsaw and Case Study for supporting online collaborative learning. *Computers & Education*, 55(1), 67-75.
Pozzi, F., Andrea, A., Ferlino, L. & Persico, D. (2016) Dyads Versus Groups: Using Different Social Structures in Peer Review to Enhance Online Collaborative Learning Processes. *International Review of Research in Open & Distance Learning*, 17(2), 85-107.
Prensky, M. (2001) Digital natives, digital immigrants part 1. *On the horizon*, 9(5), 1-6.
Prensky, M. (2009) H. sapiens digital: From digital immigrants and digital natives to digital wisdom. *Innovate: journal of online education*, 5(3), 1.
Price, M., O'Donovan, B. & Rust, C. (2007) Putting a social-constructivist assessment process model into practice: building the feedback loop into the assessment process through peer review. *Innovations in Education & Teaching International*, 44(2), 143-152.
Pritchard, R. J. & Morrow, D. (2017) Comparison of Online and Face-to-Face Peer Review of Writing. *Computers & Composition*, 46, 87-103.
Puzziferro, M. (2008) Online Technologies Self-Efficacy and Self-Regulated Learning as Predictors of Final Grade and Satisfaction in College-Level Online Courses. *American Journal of Distance Education*, 22(2), 72-89.
Qiu, M., Hewitt, J. & Brett, C. (2014) Influence of group configuration on online discourse writing. *Computers & Education*, 71, 289-302.
Qiu, M. & McDougall, D. (2013) Foster strengths and circumvent weaknesses: Advantages and disadvantages of online versus face-to-face subgroup discourse. *Computers & Education*, 67(0), 1-11.
Qiu, M. & McDougall, D. (2015) Influence of group configuration on online discourse reading. *Computers & Education*, 87, 151-165.
Quesada, V., Gómez Ruiz, M. Á., Gallego Noche, M. B. & Cubero-Ibáñez, J. (2019) Should I use co-assessment in higher education? Pros and cons from teachers and students' perspectives. *Assessment & Evaluation in Higher Education*, 44(7), 987-1002.
Rada, R. (1998) Efficiency and effectiveness in computer-supported peer-peer learning. *Computers and Education*, 30(3), 137-146.

Ramon-Casas, M., Nuño, N., Pons, F. & Cunillera, T. (2019) The different impact of a structured peer-assessment task in relation to university undergraduates’ initial writing skills. *Assessment & Evaluation in Higher Education*, 44(5), 653-663.
Reinholz, D. (2016) The assessment cycle: a model for learning through peer assessment. *Assessment & Evaluation in Higher Education*, 41(2), 301-315.
Remesal, A. & Colomina, R. (2013) Social presence and online collaborative small group work: A socioconstructivist account. *Computers & Education*, 60(1), 357-367.
Richardson, J. T. E. (2012) Face-to-face versus online tuition: Preference, performance and pass rates in white and ethnic minority students. *British Journal of Educational Technology*, 43(1), 17-27.
Riecken, H. W. (1958) The Effect of Talkativeness on Ability to Influence Group Solutions of Problems. *Sociometry*, 21(4), 309-321.
Romero, C., López, M.-I., Luna, J.-M. & Ventura, S. (2013) Predicting students' final performance from participation in on-line discussion forums. *Computers & Education*, 68(0), 458-472.
Rotsaert, T., Panadero, E. & Schellens, T. (2018a) Anonymity as an instructional scaffold in peer assessment: its effects on peer feedback quality and evolution in students’ perceptions about peer assessment skills. *European Journal of Psychology of Education*, 33(1), 75-99.
Rotsaert, T., Panadero, E. & Schellens, T. (2018b) Peer assessment use, its social nature challenges and perceived educational value: A teachers’ survey study. *Studies in Educational Evaluation*, 59, 124-132.
Rowntree, D. (1977) *Assessing students : how shall we know them?* London :: Harper and Row.
Russell, A. L. (1995) Stages in learning new technology: Naive adult email users. *Computers & Education*, 25(4), 173-178.
Rust, C., Price, M. & O'Donovan, B. (2003) Improving Students' Learning by Developing their Understanding of Assessment Criteria and Processes. *Assessment & Evaluation in Higher Education*, 28(2), 147-164.
Ryan, G. J., Marshall, L. L., Porter, K. & Haomiao, J. (2007) Peer, professor and self-evaluation of class participation. *Active Learning in Higher Education*, 8(1), 49-61.
Sadler-Smith, E. (1996) ‘Learning Styles’ and Instructional Design. *Innovations in Education and Teaching International*, 33(4), 185-193.
Sadler, P. M. & Good, E. (2006) The Impact of Self- and Peer-Grading on Student Learning. *Educational Assessment*, 11(1), 1-31.
Sakulwichitsintu, S., Colbeck, D., Ellis, L. & Turner, P. (2014) Online Peer Learning: Understanding Factors Influencing Students’ Learning Experience, *5th European Conference of Computer Science*.
Salmon, G. (2000) *E-moderating the key to online teaching and learning*. London: Kogan Page.
Salmon, G. (2002) Mirror, mirror, on my screen? Exploring online reflections. *British Journal of Educational Technology*, 00033(00004), 379-392.
Saltan, F. (2016) Blended Learning Experience of Students Participating Pedagogical Formation Program: Advantages and Limitation of Blended Education. *International Journal of Higher Education*, 6(1), p63.
Sansone, N., Ligorio, M. B. & Buglass, S. L. (2018) Peer e-tutoring: Effects on students’ participation and interaction style in online courses. *Innovations in Education and Teaching International*, 55(1), 13-22.
Schertler, M. & Bodendorf, F. (2002) Supporting Communication Processes in E-Learning Networks, *International conference on computers in education*. Auckland, New Zealand, Dec. IEEE, Computer Society.

Schmulian, A. & Coetzee, S. A. (2019) Students' experience of team assessment with immediate feedback in a large accounting class. *Assessment & Evaluation in Higher Education*, 44(4), 516-532.
Schonrock-Adema, J., Heijne-Penninga, M., van Duijn, M. A. J., Geertsma, J. & Cohen-Schotanus, J. (2007) Assessment of professional behaviour in undergraduate medical education: peer assessment enhances performance. *Medical Education*, 41(9), 836-842.
Schunk, D. H. (1991) Self-efficacy and academic motivation. *Educational psychologist*, 26(3-4), 207-231.
Schunn, C., Godley, A. & DeMartino, S. (2016) *The Reliability and Validity of Peer Review of Writing in High School AP English Classes*.
Seel, R. (2006) *Liquid Café*, 2006. Available online: http://www.new-paradigm.co.uk/liquid_cafe.htm [Accessed 26/08/10].
Seidman, I. (2006) *Interviewing as qualitative research: A guide for researchers in education and the social sciences*, 3rd edition. Teachers College Pr.
Seifert, T. & Feliks, O. (2019a) Online self-assessment and peer-assessment as a tool to enhance student-teachers' assessment skills. *Assessment & Evaluation in Higher Education*, 44(2), 169-185.
Seifert, T. & Feliks, O. (2019b) Online self-assessment and peer-assessment as a tool to enhance student-teachers' assessment skills. *Assessment & Evaluation in Higher Education*, 44(2), 169-185.
Selwyn, N. (2009) The digital native-myth and reality, *Aslib Proceedings*. Emerald Group Publishing Limited.
Serrano, D. R., Dea-Ayuela, M. A., Gonzalez-Burgos, E., Serrano-Gil, A. & Lalatsa, A. (2019) Technology-enhanced learning in higher education: How to enhance student engagement through blended learning. *European Journal of Education*, 54(2), 273-286.
Sharp, J. E. (2001) Teaching teamwork communication with Kolb learning style theory. *Frontiers in Education Conference, 2001. 31st Annual*, 2.
Shaw, M. E. (1932) A Comparison of Individuals and Small Groups in the Rational Solution of Complex Problems. *The American Journal of Psychology*, 44(3), 491-504.
Shaw, M. E. (1970) *Theories of social psychology*. New York :: McGraw-Hill.
Shaw, R.-S. (2013) The relationships among group size, participation, and performance of programming language learning supported with online forums. *Computers & Education*, 62(0), 196-207.
Shea, P., Li, C. S., Swan, K. & Pickett, A. (2005) Developing learning community in online asynchronous college courses: The role of teaching presence. *Journal of Asynchronous Learning Networks*, 9(4), 59-82.
Shen, J., Hiltz, S. R. & Bieber, M. (2006) Collaborative online examinations: Impacts on interaction, learning, and student satisfaction. *Ieee Transactions on Systems Man and Cybernetics Part a-Systems and Humans*, 36(6), 1045-1053.
Shiue, Y.-C., Chiu, C.-M. & Chang, C.-C. (2010) Exploring and mitigating social loafing in online communities. *Computers in Human Behavior*, 26(4), 768-777.
Siow, L.-F. (2015) Students' Perceptions on Self- and Peer-Assessment in Enhancing Learning Experience. *Malaysian Online Journal of Educational Sciences*, 3(2), 21-35.
Sixl-Daniell, K. & Williams, J. (2005) Paralinguistic Discussion in an Online Educational Setting: A Preliminary Study, *Proceeding of the 2005 conference on Towards Sustainable and Scalable Educational Innovations Informed by the Learning Sciences: Sharing Good Practices of Research, Experimentation and Innovation.* 1563482: IOS Press, 887-891.
Skinner, E. (2009) Using community development theory to improve student engagement in online discussion: a case study. *ALT-J: Research in Learning Technology*, 17(2), 89 - 100.

Slavin, R. E. (1991) Group Rewards Make Groupwork Work. *Educational Leadership*, 48(5), 89-91.
Slavin, R. E. (1995) *Cooperative learning theory, research, and practice*, 2nd ed. edition. Boston, Mass.: Allyn and Bacon.
Sluijsmans, D., Dochy, F. & Moerkerke, G. (1998) Creating a Learning Environment by Using Self-, Peer- and Co-Assessment. *Learning Environments Research*, 1(3), 293-319.
Sluijsmans, D. M. A., Brand-Gruwel, S., van Merriënboer, J. J. G. & Martens, R. L. (2004) Training teachers in peer-assessment skills: effects on performance and perceptions. *Innovations in Education and Teaching International*, 41(1), 59-78.
So, H.-J. & Brush, T. A. (2008) Student perceptions of collaborative learning, social presence and satisfaction in a blended learning environment: Relationships and critical factors. *Computers & Education*, 51(1), 318-336.
Solimeno, A., Mebane, M. E., Tomai, M. & Francescato, D. (2008) The influence of students and teachers characteristics on the efficacy of face-to-face and computer supported collaborative learning. *Computers & Education*, 51(1), 109-128.
Somervell, H. (1993) Issues in Assessment, Enterprise and Higher Education: the case for self ‐ peer and collaborative assessment. *Assessment & Evaluation in Higher Education*, 18(3), 221-233.
Sridharan, B. & Boud, D. (2019) The effects of peer judgements on teamwork and self-assessment ability in collaborative group work. *Assessment & Evaluation in Higher Education*, 44(6), 894-909.
Stacey, E. (1999) Collaborative learning in an online environment. *Journal of Distance Education*, 14(2), 14.
Stefani, L. A. J. (1994) Peer, self and tutor assessment: Relative reliabilities. *Studies in Higher Education*, 19(1), 69.
Stefani, L. A. J. (1998) Assessment in Partnership with Learners. *Assessment & Evaluation in Higher Education*, 23(4), 339.
Stephens, G. E. & Roberts, K. L. (2017) Facilitating Collaboration in Online Groups. *Journal of Educators Online*, 14(1).
Stewart, H., Gapp, R. & Houghton, L. (2019) Large Online First Year Learning and Teaching: the Lived Experience of Developing a Student-Centred Continual Learning Practice. *Systemic Practice and Action Research*.
Strang, K. D. (2015) Effectiveness of Peer Assessment in a Professionalism Course Using an Online Workshop. *Journal of Information Technology Education: Innovations in Practice*, 14, 1-16.
Stringer, E. T. (2013) *Action research*Sage publications.
Sullivan, D. & Watson, S. (2015) Peer Assessment within Hybrid and Online Courses: Students' View of Its Potential and Performance. *Journal of Educational Issues*, 1(1), 1-18.
Sullivan, K. & Hall, C. (1997) Introducing students to self-assessment. *Assessment & Evaluation in Higher Education*, 22(3), 289.
Sun, Q., Wu, J., Rong, W. G. & Liu, W. B. (2019) Formative Assessment of Programming Language Learning Based on Peer Code Review: Implementation and Experience Report. *Tsinghua Science and Technology*, 24(4), 423-434.
Suthers, D., Hundhausen, C. & Girardeau, L. (2002) Comparing the Roles of Representations in Face to Face and Online Collaborations, *International conference on computers in education*. Auckland, New Zealand, Dec. IEEE, Computer Society.
Swan, K. (2005) A constructivist model for thinking about learning online. *Elements of Quality Online Education: Engaging Communities. Needham, MA: Sloan-C. Retrieved from http://www. kent. edu/rcet/Publications/upload/constructivist% 20theory. pdf.*

Swanson, G. E., Newcomb, T. M. & Hartley, E. L. (1952) *Readings in Social Psychology*Holt.
Swaray, R. (2011) An evaluation of a group project designed to reduce free-riding and promote active learning. *Assessment & Evaluation in Higher Education*, 37(3), 285-292.
Tayebinik, M. & Puteh, M. (2013) Does greater participation in online courses lead to passing grade? An EFL learning context. *British Journal of Educational Technology*, 44(6), E199-E202.
Teng, C.-C. & Luo, Y.-P. (2015) Effects of Perceived Social Loafing, Social Interdependence, and Group Affective Tone on Students' Group Learning Performance. *The Asia-Pacific Education Researcher*, 24(1), 259-269.
Thomas, G. & Thorpe, S. (2019) Enhancing the facilitation of online groups in higher education: a review of the literature on face-to-face and online group-facilitation AU - Thomas, Glyn. *Interactive Learning Environments*, 27(1), 62-71.
Thomas, J. (2013) Exploring the use of asynchronous online discussion in health care education: A literature review. *Computers & Education*, 69(0), 199-215.
Thomas, W. R. & MacGregor, S. K. (2005) Online Project-Based Learning: How Collaborative Strategies and Problem Solving Processes Impact Performance. *Journal of Interactive Learning Research*, 16(1), 83.
Thompson, L. & Ku, H. (2006) A case study of online collaborative learning. *The quarterly review of distance education*, 7(4), 361-375.
Thondhlana, G. & Belluigi, D. Z. (2017) Students' reception of peer assessment of group-work contributions: problematics in terms of race and gender emerging from a South African case study. *Assessment & Evaluation in Higher Education*, 42(7), 1118-1131.
Tirado-Morueta, R., Maraver-López, P. & Hernando-Gómez, Á. (2017) Patterns of Participation and Social Connections in Online Discussion Forums. *Small Group Research*, 48(6), 639-664.
To, J. & Panadero, E. (2019) Peer assessment effects on the self-assessment process of first-year undergraduates. *Assessment & Evaluation in Higher Education*, 44(6), 920-932.
Topping, K. (1998) Peer Assessment Between Students in Colleges and Universities. *Review of Educational Research.*
Topping, K. J. (2005) Trends in Peer Learning. *Educational Psychology*, 25(6), 631-645.
Topping, K. J. & Ehly, S. W. (1998) *Peer-assisted learning*. Mahwah, N.J.: L. Erlbaum Associates.
Tsai, C.-C., Liu, E. Z.-F., Lin, S. S. J. & Yuan, S.-M. (2001) A Networked Peer Assessment System Based on a Vee Heuristic. *Innovations in Education & Teaching International*, 38(3), 220-230.
Tsai, C.-W. (2010) Do students need teacher's initiation in online collaborative learning? *Computers & Education*, 54(4), 1137-1144.
Tu, Y. & Lu, M. (2005) Peer-and-Self Assessment to Reveal the Ranking of Each Individual's Contribution to a Group Project. *Journal of Information Systems Education*, 16(2), 197.
Tufanaru C, Munn Z, Aromataris E, Campbell J & L., H. (2017) *Joanna Briggs Institute Reviewer's Manual*, 2017. Available online: https://reviewersmanual.joannabriggs.org/.
Tuomainen, S. (2017) Role of Reflection in Blended Learning Language Courses in Higher Education. *Proceedings of the European Conference on e-Learning*, 520-526.
Turnitin *PeerMark*Available online: http://www.turnitinuk.com/en_gb/features/peermark.

Tutty, J. & Klein, J. (2008) Computer-mediated instruction: a comparison of online and face-to-face collaboration. *Educational Technology Research and Development*, 56(2), 101-124.
Usher, M. & Barak, M. (2018) Peer assessment in a project-based engineering course: comparing between on-campus and online learning environments. *Assessment & Evaluation in Higher Education*, 43(5), 745-759.
van den Berg, I., Admiraal, W. & Pilot, A. (2006a) Design principles and outcomes of peer assessment in higher education. *Studies in Higher Education*, 31(3), 341-356.
van den Berg, I., Admiraal, W. & Pilot, A. (2006b) Peer assessment in university teaching: evaluating seven course designs. *Assessment & Evaluation in Higher Education*, 31(1), 19-36.
van Drie, J., van Boxtel, C., Jaspers, J. & Kanselaar, G. (2005) Effects of representational guidance on domain specific reasoning in CSCL. *Computers in Human Behavior*, 21(4), 575-602.
van Hattum-Janssen, N., Louren, ccedil, o, J., uacute & lia, M. (2006) Explicitness of criteria in peer assessment processes for first-year engineering students. *European Journal of Engineering Education*, 31(6), 683 - 691.
van Hattum-Janssen, N. & Lourenço, J. M. (2008) Peer and Self-Assessment for First-Year Students as a Tool to Improve Learning. *Journal of Professional Issues in Engineering Education & Practice*, 134(4), 346-352.
Vanderhoven, E., Raes, A., Montrieux, H., Rotsaert, T. & Schellens, T. (2015) What if pupils can assess their peers anonymously? A quasi-experimental study. *Computers & Education*, 81, 123-132.
Veerman, A. L., Andriessen, J. E. B. & Kanselaar, G. (2000) Learning through synchronous electronic discussion. *Computers & Education*, 34(3-4), 269-290.
Venkatesh, V. & Morris, M. G. (2000) Why don't men ever stop to ask for directions? Gender, social influence, and their role in technology acceptance and usage behavior. *MIS quarterly*, 115-139.
Volet, S. & Mansfield, C. (2006) Group work at university: significance of personal goals in the regulation strategies of students with positive and negative appraisals. *Higher Education Research & Development*, 25(4), 341-356.
Vonderwell, S. (2003) An examination of asynchronous communication experiences and perspectives of students in an online course: A case study. *The Internet and higher education*, 6(1), 77-90.
Vu, T. T. & Dall'Alba, G. (2007) Students' experience of peer assessment in a professional course. *Assessment & Evaluation in Higher Education*, 32(5), 541-556.
Vygotsky, L. S., Cole, M. & Cole (eds) (1978) *Mind in society : the development of higher psychological processes*. Cambridge, Mass. ; London: Harvard University Press.
Walther, J. B. (1992) Interpersonal Effects in Computer-Mediated Interaction: A Relational Perspective. *Communication Research*, 19(1), 52.
Walther, J. B. (1996) Computer-Mediated Communication: Impersonal, Interpersonal, and Hyperpersonal Interaction. *Communication Research*, 23(1), 3-43.
Wamser, C. C. (2006) Peer-led team learning in organic chemistry: Effects on student performance, success, and persistence in the course carl. *Journal of Chemical Education*, 83(10), 1562-1566.
Wang, Q. & Woo, H. L. (2007) Comparing asynchronous online discussions and face-to-face discussions in a classroom setting. *British Journal of Educational Technology*, 38(2), 272-286.
Wanner, T. & Palmer, E. (2018) Formative self-and peer assessment for improved student learning: the crucial factors of design, teacher participation and feedback. *Assessment & Evaluation in Higher Education*, 43(7), 1032-1047.

Warden, C. A., Stanworth, J. O., Ren, J. B. & Warden, A. R. (2013) Synchronous learning best practices: An action research study. *Computers & Education*, 63(0), 197-207.
Warren, K. J. & Rada, R. (1998) Sustaining computer-mediated communication in university courses. *Journal of Computer Assisted Learning*, 14(1), 71-80.
Warren, K. J. & Rada, R. (1999) Manifestations of Quality Learning in Computer-Mediated UniversityCourses. *Interactive Learning Environments.* Swets & Zeitlinger, BV.
Watts, H., Malliris, M. & Billingham, O. (2015) Online Peer Assisted Learning: Reporting on Practice. *Journal of Peer learning*, 8(8), 85-104.
Weaver, D. & Esposto, A. (2012) Peer assessment as a method of improving student engagement. *Assessment & Evaluation in Higher Education*, 37(7), 805-816.
Webb, N. M. (1982) Peer interaction and learning in cooperative small groups. *Journal of Educational Psychology*, 74(5), 642-655.
Wellington, J. (2000) *Educational research: Contemporary issues and practical approaches*Continuum Intl Pub Group.
Wen, M. L. & Tsai, C. C. (2006) University students' perceptions of and attitudes toward (online) peer assessment. *Higher Education*, 51(1), 27-44.
Wentzell, C. (2002) Reaping the benefits of online learning. *Benefits Canada*, 26, 9-12.
Wherry, R. J. & Fryer, D. C. (1949) Buddy rating: Popularity contest of leadership criterion. *Personnel Psychology*, 2, 147–159.
White, H. & Sabarwal, S. (2014) Quasi-experimental design and methods. *Methodological Briefs: Impact Evaluation*, 8, 1-16.
Widjaja, A. E. & Chen, J. V. (2017) Online Learners' Motivation in Online Learning: The Effect of Online-Participation, Social Presence, and Collaboration. *LEARNING TECHNOLOGIES IN EDUCATION: ISSUES AND TRENDS*, 72.
Wiersma, W. & Jurs, S. (2000) *Research methods in education: An introduction*Allyn and Bacon Boston, MA.
Willcoxson, L. E. (2006) "It's not Fair!": Assessing the Dynamics and Resourcing of Teamwork,  December 1, 2006. Available online: [Accessed.
Willmot, P. & Crawford, A. (2007) Peer review of team marks using a web-based tool: an evaluation. *Engineering Education*, 2(1).
Wilson, L., Ho, S. & Brookes, R. H. (2018) Student perceptions of teamwork within assessment tasks in undergraduate science degrees. *Assessment & Evaluation in Higher Education*, 43(5), 786-799.
Wilson, M. J., Diao, M, Huang L (2015) 'I'm not here to learn how to mark someone else's stuff': an investigation of an online peer-to-peer review workshop tool. *Assessment & Evaluation in Higher Education*, 40(1), 15-32.
Wise, L., Skues, J. & Williams, B. (2011) Facebook in higher education promotes social but not academic engagement. *Changing demands, changing directions. Proceedings ascilite Hobart*, 1332-1342.
Wu, D. & Hiltz, S. R. (2004) Predicting learning from asynchronous online discussions. *Journal of Asynchronous Learning Networks*, 8(2), 139-152.
Wuensch, K. L., Aziz, S., Ozan, E., Kishore, M. & Tabrizi, M. H. N. (2008) Pedagogical Characteristics of Online and Face-to-Face Classes. *International Journal on ELearning*, 7(3), 523-532.
Xie, K. & Ke, F. (2011) The role of students' motivation in peer‐moderated asynchronous online discussions. *British Journal of Educational Technology*.
Xu, Y. (2012) Developing a comprehensive teaching evaluation system for foundation courses with enhanced validity and reliability. *Educational Technology Research and Development*, 60(5), 821-837.

Yang, S. J. H., Zhang, J., Su, A. Y. S. & Tsai, J. J. P. (2011) A collaborative multimedia annotation tool for enhancing knowledge sharing in CSCL. *Interactive Learning Environments*, 19(1), 45 - 62.
Yi, Z. & LuXi, Z. (2012) Implementing a cooperative learning model in universities. *Educational studies*, 38(2), 165-173.
Young, A. & Norgard, C. (2006) Assessing the quality of online courses from the students' perspective. *The Internet and Higher Education*, 9(2), 107-115.
Yu, F.-Y. (2011) Multiple peer-assessment modes to augment online student question-generation processes. *Computers & Education*, 56(2), 484-494.
Yu, S., Zhang, Y., Zheng, Y., Yuan, K. & Zhang, L. (2019) Understanding student engagement with peer feedback on master’s theses: a Macau study. *Assessment & Evaluation in Higher Education*, 44(1), 50-65.
Yuen, A. H., Deng, L., Fox, R. & Tavares, N. J. (2009) Engaging students with online discussion in a blended learning context: issues and implications, *International Conference on Hybrid Learning and Education*. Springer.
Zafeiriou, G. (2001) Using students' perceptions of participation in collaborative learning activities in the design of online learning environments. *Education for Information*, 19(2), 83-106.
Zha, S. & Ottendorfer, C. L. (2011) Effects of Peer-Led Online Asynchronous Discussion on Undergraduate Students' Cognitive Achievement. *American Journal of Distance Education*, 25(4), 238-253.
Zhao, H., Sullivan, K. P. H. & Mellenius, I. (2014) Participation, interaction and social presence: An exploratory study of collaboration in online peer review groups. *British Journal of Educational Technology*, 45(5), 807-819.
Zhu, M., Herring, S. C. & Bonk, C. J. (2019) Exploring presence in online learning through three forms of computer-mediated discourse analysis. *Distance Education*, 40(2), 205-225.
Ziegler, M., Trena, P. & Marianne, W. (2006) Creating a Climate of Engagement in a Blended Learning Environment. *Journal of Interactive Learning Research*, 17(3), 295.
Zilka, G. C., Cohen, R. & Rahimi, I. (2018) Teacher Presence and Social Presence in Virtual and Blended Courses. *Journal of Information Technology Education: Research*, 17, 103-126.
Zou, Y., Schunn, C. D., Wang, Y. & Zhang, F. (2018) Student attitudes that predict participation in peer assessment. *Assessment & Evaluation in Higher Education*, 43(5), 800-811.
Zydney, J. M., deNoyelles, A. & Kyeong-Ju Seo, K. (2012) Creating a community of inquiry in online environments: An exploratory study on the effect of a protocol on interactions within asynchronous discussions. *Computers & Education*, 58(1), 77-87.