Flexible Ontology-Driven Educational Apps and Social Media for Learners with a Disability

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Abstract. This paper explores how to build ontology-driven learning systems from a flexible disability-aware mentality and augment them into a learning blend that embraces social media. The approach emphasizes the use of user centered flexible software in a blended approach to learning. The paper starts with a discussion of how learners learn, including their recent fascination with Apps and social media. The need to provide disability-aware personalization of the educational Apps that are developed is discussed. The emphasis is on designing learning systems for learners with disabilities rather than providing for them as an afterthought. The paper introduces social media as a way of facilitating and supporting e-learning. It notes the recent changes that have taken place in the use of social media. Taking e-learning as a case study the paper demonstrates how various models of e-learning, emphasizing flexible learning, can be enhanced linking back the whole while of integrating into disability-aware information systems. Some practical approaches to modeling the learner with ontologies are provided. Finally, caution is noted on how we have to use social media. We detail some of the potential problems and pitfalls that may be a contemporary consequence of using this media, then offer some suggestions and work rounds.

Keywords: Human Computer Interfaces Design, Virtual Communities, Social Computing, Social Networks.

1 Introduction

With the explosion and increased diffusion of information technology devices comes a massive increase in the number of information systems that are being developed to respond to the ever-increasing demands of users. With the advent of social media, the facilities and networking potential of these users is greatly enhanced. However, designers and developers of information systems by default, tend to design for users without disabilities (Nganji, 2019, 2021). This has enormous consequences for people with disabilities, especially when they are not able to access the systems that have been designed. Thus, the need for a careful consideration and inclusion of their needs.

This paper therefore aims to propose an ontology-driven and disability-aware approach that ensures the needs of all learners, including those with disabilities are captured throughout the development cycle. Practical approaches such as the use of personas to capture the needs of the learner are discussed.

This paper addresses the integration of social media into learning systems. Within the scope of e-learning we show how we can provide increased flexibility for communication and delivery of our material. The information system design and e-learning elements will be of interest to both Psychologists and Computer Scientists, whilst the social computing elements embraces other disciplines as well.

The paper starts with a discussion of learning styles, and in particular the learning styles of people with disabilities. All individuals exhibit preferred learning styles, and this literature will be discussed. In relation to individual learners with disabilities, the preferred style may well be influenced by their actual needs. Any AI methodology that works with the user thus must take this into consideration. Support and increasing motivation are a further key consideration when designing learning technology.

In an analogous manner to the use of Games and Gaming in learning, this paper will discuss how we can include peoples' fascination with Apps and social media as motivational provisions within technology enhanced learning. We see and hear daily how people are glued to their social media apps. Social media also provides a means of supporting collaboration, both peer-to-peer and student-teacher collaborations. In the recent age of lockdowns, social media has been a vital communication tool and is already a big part of many users' technologies landscapes. For people with disabilities these lockdowns have meant social media has taken on a leading role in communication and interaction. We here explore how this might be developed within the learning context.

Following on from this we discuss the need to provide disability-aware personalization of the educational Apps that are developed. The emphasis is on designing learning systems for learners with disabilities rather than providing for them as an afterthought. The paper introduces social media as a way of facilitating and supporting e-learning. Taking e-learning as a case study the paper demonstrates how various models of e-learning, emphasizing flexible learning, can be enhanced linking back the whole while to integrating disability-aware information systems. We introduce inclusive learning personas as a method for effective user profiling including collaboration preferences and histories. Such personas can then be used as an effective way of designing the learning environment which puts the users as the central core, both in the design of learning environment and the design and use of social media. Then using these ontologies to model the learner and social media consideration, appropriate and personalized educational Apps can be designed and implemented. Some practical approaches using this methodology to model the learner with ontologies are provided.

Finally, when we are dealing with social media, we must note some words of caution. We detail some of the potential problems and pitfalls that may be a consequence of using this contemporary media and go on to offer some suggestions and work arounds that enable such problems to be faced and managed.

2 Background

2.1 Learning Styles and Learners with Disability

Human beings are different, even among identical twins, there exist distinguishing traits. In the same way, people have different preferences. In the field of education, learners have different preferences for accessing learning content which could be visual, auditory, or kinesthetic. This preference for learning is what is known as learning styles. There are various learning style models including Kolb Learning Styles Theory (Kolb, 1985) which is based on experiential learning and describes the experiences of the learner. This model consists of four core elements: concrete experience, observation and reflection, the formation of abstract concepts and testing in new situations. In this model, concrete experience and abstract conceptualization are grasping experiences while reflective observation and active experimentation are transforming experiences.

Honey and Mumford's Index of Learning Styles (Honey & Mumford, 1992) on the other hand describes four types of learners: activists who learn by doing and enjoy new experiences, reflectors who learn by observing and reflecting on what happened, theorists who are logical in approach and want to understand the theory behind actions and pragmatists who are very practical in approach.

A model which is of interest to this study, and which relates to learners with disabilities' preferences for learning materials due to their disability type is the VARK model (Fleming, 2001). This model describes four types of learners: visual learners who are those with preference for seeing and hence, find visual aids very useful in their studies. If a learning environment is designed to incorporate video, such as incorporating video-driven social media, these learners will greatly benefit from it and might interact more with the learning environment. Auditory learners are those who learn best by listening, hence have a high preference for audio-based learning materials and benefit from participating in group discussions. Thus, for this group of learners, the presence of social media applications (Apps) within a learning environment will be very useful. Reading/writing preference learners prefer to take notes while a lecture is being delivered and thereafter spend time reading them to synthesize and assimilate the material. Finally, kinesthetic learners learn well by doing, thus involvement in activities such as experiments, practical demonstrations and interaction with the world are very helpful. Also, for this group of learners, collaboration in a social media enriched learning environment could be of great interest.

Learners with disability might find themselves preferring a specific format for learning materials perhaps not because it is influenced by their learning styles, but because of their disability. A learner with dyslexia, depending on its severity may either prefer text-based learning materials or audio materials. Thus, some would use text to speech assistive technologies such as Kurzweil 3000 (which helps with reading and writing) to convert text-based learning materials into audio which will be more beneficial to them. On the other hand, although the disability might influence their choice of the format of learning materials, some students with disabilities might prefer some formats because it is their learning style. Thus, in this case, the interplay between learning style and disability is beneficial to the learner and when the learning materials are presented to

them in the format of their preference, will facilitate their learning. The question now is how we can be effective in designing a learning environment considering this vast array of choices and needs.

With this great diversity of learning preferences, it is still possible to develop educational Apps for all learners but then still design to meet specific individual learner needs, including those with special needs arising from disability. To accomplish this, personalization is the answer. A vast amount of research in e-learning have used learning styles for personalization. For instance, Chookaew et al. (2014) presented a personalized e-learning environment which facilitated programming for learners through a personalization of their learning styles, learning achievement and learning problems. During such personalization and to produce effective and efficient educational Apps that are tailored to the needs of the learner, the learner's knowledge level also needs to be considered (Dwivedi & Bharadwaj, 2013).

2.2 Exploiting Learners' Fascination with Social Media and Apps

The internet is now a communication location of war, conflict, and crime (e.g., Karatzogianni, 2006, 2014). It is also where we interact often sharing our most private and intimate details. Starting with the dawn of email, bulletin boards, and newsgroups, we now have popular Apps like Facebook and Twitter whose very nature are to promote social interaction and communication.

When we look to propose the design of educational Apps and to incorporate social media into contemporary learning environments, it is important to consider why this is important. There are countless Apps available for people to download to their devices and use for various purposes. These Apps are mostly accessed nowadays via mobile devices and people are increasingly also using these devices to access social media. Understanding the need to stay connected, developers have developed social media Apps for users to remain connected with one another even when travelling. Whether this newfound intimacy and bonding is real, and an adequate substitution for face-to-face interaction is an evolving question (Turkle, 2011). This is revisited later when considering the current context of the work reported here.

Undivided attention when studying could be very helpful for a learner, thus as is commonly noticed in communal places nowadays, peoples' fascination with their devices or social media has led to them addictively interacting with their devices in such a way that they may even not notice or perhaps acknowledge others around them (Aagaard, 2016). Although spending a considerable amount of time on mobile devices could lead to musculoskeletal pains (Xie, Szeto, & Dai, 2017), such interest in engaging with content could be exploited to build educational Apps and social media to respond to learners' needs (Nganji, 2018). Educational Apps could be designed for learners to download and interact with in such a way that could help them improve their knowledge on a course and to collaborate with other learners, hence improving performance.

The importance of designing disability-aware educational Apps and incorporate social media for collaboration within learning environments cannot be overemphasized. Educators tend to include learning activities that may require collaboration between peers. Although this may be done asynchronously (for instance via email), this means

does not exploit the available trend and tendency for people to communicate synchronously. Nowadays, with the existence of Apps such as WhatsApp which is a very affordable (for those connected to the Internet) means of synchronous communication allowing for group collaboration (Pacholek et al., 2021), learners are used to and aware of the numerous powerful means of facilitating learning. Even without the direction of educators, learners are forming groups and collaborating to bring about increased knowledge and to also form better relationships with peers. Contemporary learning environments need to respond to the learning needs of learners considering existing trends and technology. This vast choice of Apps and learning resources allows for flexibility in learning.

2.3 Social Media in Times of Lockdown

The role of social media in learning and collaboration has rapidly evolved due to the contemporary (i.e., often lockdown related) situation we have endured. Social Media has often been the only way of talking to people, socializing, and in this context a pathway to learning (e.g., Khan et al, 2021).

What many futurologists have claimed that they saw as possible ways of working in the future and the embrace of working online (and from home) has been brought forward by many years. So how things might have evolved more slowly over a time has been brought into sharp contemporary reality. It is an open question how this rapid change has affected the affordances of this technology and its use in long term relationships compared with a few years ago (c.f. Turkle, 2011). Therefore, the context in which we might have envisaged using this technology, as well as the way we all as users, has changed because of contemporary events.

These changes have involved an increased use of Computer Mediated Communication and the necessity of working and sharing with others. So existing social tools and social media platforms have been pressed into use to provide vital support and enabling platforms for this rapidly adopted new working infrastructure. It is thus most timely to consider how me might use and exploit this new and changing social media use (and our shifting affordances to it), taken together with our existing use of AI, and apply it to learners with disability.

2.4 Ontology-Driven Personalized E-Learning

As earlier discussed, current learning environments do not incorporate the necessary Apps that could be used by students, not to talk of providing personalized content that could be vital for improving the learner's knowledge and hence increased performance. The ability for learners to study electronically is leading to changing roles for the educator (Shaikh & Khoja, 2014) who is no longer the main actor. This shift from traditional systems of learning becomes even more radical when personalization is used to present content to learners (Childress & Benson, 2014; Hsieh, Lee, & Su, 2013; Thalmann, 2014). With personalized provision of educational content for learners, it is easier to find information. To accomplish personalization, it is important to know more about the learner through some of their characteristics and behavior. For instance, if we

understand the studying habits and trends via their past activities, we could tailor search results to meet their needs more precisely and thus provide relevant and specific content (Zhuhadar, Nasraoui, & Society, 2008) to meet their learning needs.

The presence of social media allows for collaboration between learners and this collaboration could also be a means of personalized content provision for the needs of the learner. Although this will encourage students to be involved and active in the learning process, they will often need guidance from experts. Generally, the learner 's profile which contains information about the learner is used to provide them with specific learning materials (Paraskevi Tzouveli, Mylonas, & Kollias, 2008). Personalization based on user profiling (Biletskiy, Baghi, Keleberda, & Fleming, 2009; Kritikou et al., 2008; Paraskevi Tzouveli et al., 2008) can also be used to predict the preferences of the learner to personalize or adapt the learning environment to meet their needs. Thus, educational Apps could be designed and through the learner's profile could be used to push specific content to the learner.

Learning styles which were discussed above could also be used to personalize learning (Klasnja-Milicevic, Vesin, Ivanovic, & Budimac, 2011; Pukkhem & Vatanawood, 2011). By knowing the learning styles of the learner, it is possible to recommend appropriate learning materials (Halbert, Kriebel, Cuzzolino, Coughlin, & Fresa-Dillon, 2011).

The semantic web provides a means for humans to communicate with machines and to understand each other and has been used to provide personalized recommendations (Nasraoui & Zhuhadar, 2010). Bergman (2007) asserts that ontologies can provide a more effective basis for information extraction. Web ontologies can be used to model learning content that can be used for the educational Apps and to also represent the learner through their profile. Ontology-based web personalization has been successfully achieved in news recommendation (Cantador, Ballogin, & Castells, 2008) and could thus be employed to push specific announcements to learners in their learning space. Also, ontologies have been used to recommend learning materials (Liu, Li, & Gao, 2010).

3 A Case Study in E-Learning

3.1 New Approaches to Education

Social computing marks a new interface between people and learning technology. This new interface changes how schools and universities can work. Physically, co-location is no longer a pre-requisite. In this paper modes of delivery, assessment, management, analytics, and pedagogical blending are re-visited for students with disabilities. We wish to reimage how universities can evolve from traditional models, change in terms of working, and blend into the world of learning and social computing that can scale for those who traditional attendance is an issue. New channels of learning offer novel mixtures of delivery media and pedagogy allowing for a blended approach to be exploited. Learning can be either highly personal or very shared. Delivery can be via a traditional location but using social computing software. Such blending of tracks leads to new didactics and management of these voyages and the extended analytics that they

now afford. Such analytics can be a major influence on content, design, and management (Okoye et al, 2020). The lack of physical constraints in the interaction also allows a fundamental review of what we do and how. As a delivery device, social computing plays a new evolutionary role. It changes our presence with and affordances to educational material.

We are by our very nature a social animal and there is no surprise that when we attend school, college, or university a big part of that experience is social. Ties and bonds may last for a long time. That there is a relationship between social interaction and learning is long established (Vygotsky, 1934; Bruner, 1961, 1966; Wood, et al., 1976). It is thus timely to look at how this can be revisited in the world of social computing and how a blended, multi-pedagogic approach might benefit learners. The advent of social media and social networking allows us to look at this anew.

Allen (2007) introduced the idea of blended learning, that providing different approaches side by side that blend, results in a better learning experience. Given that we can now develop this to include different social media in this blend and different delivery modes e.g., via Webinars, MOOCS (Massive Open Online Courses) and virtual and augmented reality, then we are able to think about what we can now deliver, and how and when to deliver. We are now in the position to choose how to do this, considering the needs of learners with disability, in the context of disability-aware software – that this social media can not only carry content but also the social aspects of university life is a double bonus.

Flexible learning (Higher Education Academy, 2013; Gordon, 2014; Ceretta et al, 2002) alongside blending has been highlighted as an important educational goal. The notion of flexibility has been an important notion running centrally throughout this paper. For our target audience again, we can look at what and how to deliver our educational material. As we have noted before, sometimes the disability itself may dictate the media choice. In both blended and flexible approaches, the actual paradigm of instruction employed may also change. So too might the type of interaction that you have. Fordham and Goddard (2013) present two case studies using Facebook, to show some activities can be better supported using specific Facebook tools. For instance, Facebook Timeline was shown to help teach a curriculum, support homework, revision, debates, peer mentoring and tutoring, allow sharing of ideas, and other media resources. Bruff (2011) talks about using specific Twitter resources, Conference Backchannel. Dunn (2014) discusses 100 ways to use Twitter in education, differentiating them by degree of difficulty.

In the context of the current paper, we can look at how we might exploit social media in our e-learning context to work as an adjunct to our disability-aware design mentality. Rather than re-invent the wheel we can look to use social media as an add-on to our existing software. They typically have APIs (Application Programming Interfaces) which allow both tight or loose coupling with the e-learning system.

In terms of e-learning provision, social media can support content provision, and interaction both peer-to-peer and group interactions. Wiki and Blogs – offer tools that can support cooperation and joint discussion and problem solving. They may enable social networking and this in turn can provide vital encouragement, support, and lead to the construction of a learning community (e.g., Holton, 2013). Studying by yourself

and at a distance can be a very lonely experience (e.g., *Willems, 2007)* and being able to share that experience via social media stands a chance of mitigating against this. This social media interaction could be very helpful for some students with disabilities who might not be able to interact with others in a physical classroom due to anxiety or other disability. Other groupware tools can also help e-learners e.g., WebPA (Gordon, 2008) allows students to submit a judgment of team members' relative contributions, which in turn generates a weighting to allocate an individual mark (allowing for individual marks from group task).

In terms of e-learning style of provision we can see social media being used alongside existing approaches. This can be done in a standard classroom style of delivery or existing e-learning modes of delivery. This can be expanded to other, nontraditional based delivery modes for example:

M-Learning – Mobile Based Learning. Learning on the move anywhere you are. The flexibility to choose where to study. LMS/VLE/MOOCs don't care where you are. The use of social media extends our learning environments. It means that the constraint of co-location with a university campus no longer figures in our choice of course.

G-Learning – Game Based Learning. It has been noted that we tend to play (Homo Ludens) – Huizinga (1955). Given that this is an activity that we undertake for pleasure it is a natural extension to try and use this in an education context. To maximize motivation if somebody enjoys this activity and willingly engages in it – then making this a location for learning is a natural extension. West (Brown and Burton, 1978), Wunpus (Carr and Goldsterin (1977), Stansfield et al., 1976), and Shopping on Mars (Hennessy et al., 1989) are early examples of the use of gaming as a way of teaching. The user engages on a game that at the same time is teaching them some new skill.

P-Learning – Pervasive Based Learning. Increasingly we live in a world surrounded by computers but do not notice them. We live in a world of smart phones, Linux TVs, and the Internet of Things. Ubicom (Brush, 2014) means that we can interact with virtual universities where and when we choose. Given the development of Ubicom delivery devices, the co-location of student and university campus is loosened even further. The constraint now is more one of bandwidth and appropriate receiving device like a Pad or console.

S-Learning – Social Learning. Learning using social media and social exchanges with others. Many now also use social media outlets as their source of news and information.

4 A Practical and Inclusive Approach to Educational Apps Design

Having examined learning styles, the fascination that learners have in engaging with Apps and social media, how learning can be personalized to meet their needs and how this can be used in education, it is important to consider some practical approaches to accomplishing these through a change in mindset, thus adopting a disability-aware mind set.

With the drive to use technology for delivering learning services online, a lot of the technological developments around these areas by default have often focused on meeting the needs of people without disabilities, thus leaving people with disabilities to seek appropriate assistive technologies to interact with such systems

A lot of the difficulties people with disabilities face when interacting with most information systems are related to the lack of consideration of the needs of people with disabilities during the development cycle. In designing technological solutions, designers and developers need to understand that disability could affect different functions related to the senses and how this happens. Such designers need to develop a new mind set when it comes to designing systems that will be used by everyone. The difficulties and failures of existing information systems towards people with disabilities have necessitated the search for a better approach for designing and developing information systems. Thus, this article aims to propose a disability-aware approach to developing educational Apps and incorporating social media in learning systems to respond to the needs of learners with disabilities.

In developing products to meet the needs of people with disabilities, it is important to ensure that adequate analysis of their needs is carried out and that these needs are incorporated into the design. By developing this disability-aware mentality to learning systems design, the result is a flexible, accessible, and usable learning environment with all the Apps to facilitate learning and collaboration.

In the following sections, two practical considerations for developing such inclusive learning environment which leads to personalized content provision will be presented.

4.1 Designing Inclusive Learner Personas for Effective User Profiling

A persona is a representation of an ideal type user when designing the educational Apps and social media to respond to the needs of specific users. In the persona, the learner's characteristics are included. These are information that could be contained in the user's profile in the learning system.

When the needs of the learner are adequately captured in the persona and used to design the educational Apps and learning environment, it ensures that their needs are met, and that the system is also usable. An example persona is that of a learner with anxiety who prefers collaborating with others online rather than in a physical location.

The persona in Figure 1 for instance is that for John Smith, a master’s student studying information systems. John is in his final year of a two-year master’s degree and due to his disability, he requires some accommodation, that of a mentor or a support

worker to accompany him to classes. Although John appreciates the support, he sometimes feels he could be more independent if more of the physical group meetings with his peers to complete their coursework could be better delivered online where he can contribute more effectively and efficiently.

This information in John's persona could be considered when designing the learning environment to meet his needs. John is just one example, but when designing educational Apps and incorporating social media into learning systems, it is important to consider several differing needs and thus design to meet the needs of the learner. This persona could be captured through research sessions involving interactions with John.

John Smith: M.Sc. Information Systems Student

Institution: University of Ottawa

Background: B.Sc. in Library and Information Systems, University of Hull

Computer Skills: Expert, uses social media daily

Key Goals

John is a mature student who has severe anxiety and is an expert computer user who often spends much time interacting with his mobile device. Due to anxiety, he requires a personal support worker to accompany him to lectures. With the support worker always present for all study groups, John is not too comfortable and prefers group meetings where he can collaborate with his peers virtually. For this, he does not require the help of his support worker.

Daily Tasks

John attends classes twice a week at the university and spends another day accessing the online learning environment where he completes and submits his assignments. As John is in his final year of the master's program, he also has a lot of group work.

John finds that the learning environment used for his courses does not meet his need to be able to synchronously collaborate with his peers on assignments. He wants the learning environment to incorporate educational Apps including social media that will facilitate group communication and collaboration.

Fig. 1. The persona of John Smith, a student with severe anxiety

4.2 Using Ontologies to Model the Learner and Educational Apps

We earlier discussed how personalization could be achieved to meet the needs of learners and discussed the use of ontologies to provide personalization. The advantage of ontologies we said, was the ability for machines and humans to communicate well and understand each other.

Also, we pointed out that ontologies could be used to represent the user as well as represent various components of the learning environment. Figure 2 presents an example of how John Smith's profile which contains vital information about him that could be used to provide him personalized educational Apps and could be modeled using an ontology presented using the Friend of a Friend (FOAF) vocabulary.

John's profile contains information such as his first name, family or last name, his gender, the username for logging into the learning environment or App, his email address, the type, and severity of his disability. The ontology also stores information about his learning goals and his preferred medium of achieving this goal. In his case, John wants to be able to collaborate with his peers to submit their assignment on time, but he also prefers to be able to do this collaboration online so that he can fully participate free from the anxiety and sometimes the feelings of intimidation that is associated with him being present with others in the same physical room. Also, he wants to be more independent in his study and to avoid episodes of panic attacks.

```
:rdf: type       foaf:Person
:personDetails          "firstname, family_name, gender, username, password, mbox";
:person_concept hasfirstName: "John";
:person_concept hasfamily_name: "Smith";
:person_concept hasGender: "Male";
:person_concept hasuserName: "jsmith";
:person_concept hasmbox: "jsmith10@uOttawa.ca";
:person_concept hasDisability: "Anxiety";
:person_concept hasDisabilityDegree: "severe";

:rdf: type               foaf:LearningGoals
:learningGoals           "Collaborative learning with peers";

:rdf: type               foaf:LearningResource
:studyMedium                "classroom, social media, virtual environment";
: studyMedium _ prefersMedium: "social media";
: studyMedium   prefersMedium: "virtual environment";
```

Fig. 2. Sample ontology-based profile data set for John Smith

4.3 Emerging Problems and Issues with Social Media

Before we conclude however we need to also consider some potentially harmful aspects of social media as not all you read is true on media sites. Once to get published was hard, you either had to go through scientific reviewers and/or editors to publish. Indeed, you often had to establish your technical background to be considered as a suitable source of copy. This leads into the whole issue of Fake News and its sad associate Fake Science. What we are told is true and a scientific fact is now a part of the problem. You only must look at the many stories that circulated during the recent health crisis to see an example of this (Hoa and Basu, 2020).

Traditionally there are professional standards and checks and balances established. A teacher has a well-defined role, and it is often policed by professional organizations or government Agencies[1] where a teacher's legal right to teach may be removed. Teachers go through training for that professional vocation. In many locations the curriculum is already specified and the ability for the individual deliverer to go off message or into their own realm is limited. Again, this is limited when there are set learning outcomes and national exams at the end that limit educational deliverers going off-piste.

[1] E.g., https://www.gov.uk/government/organisations/teaching-regulation-agency

Not everyone out there is nice. This might involve inappropriate behavior in the teacher-learner relationship. The internet also contains some darker more sinister agents who engage in trolling, harassment, social games, career building at the sake of others, or sexual motivated behaviors. For this reason, we must think about how best to deploy social media within our context. The obvious solution is to do so in a controlled environment where content is reviewed and checked, interactions monitored, and standards and understood terms of references for use policed are enforced. Such facilities are already in many places like MOOCs or other social extensions to existing VLEs within established learning institutions. It is now common practice of broadcasters and others who wish to extend their media provision into social media to do so in a moderated form (e.g., BBC Have Your Say (HYS)). So, whilst we must be aware of the potential pitfalls and dangers that we are faced with here there are already very well-established measures to protect and support learners.

This does not mean that social media interaction has exclusively to stay within the confines of an in-house MOOC for example. The use of other popular social media platforms may increase the motivational hook to learning and collaborating on a particular course. This might involve having their own dedicated use of 3rd party social media platforms, for example lecturers/professors or universities having their own YouTube channel(s). However, if third parties are used it will be necessary to be clear where trusted sources come from and what are the clear rules of interaction. This is something educators need to be aware of and many are doing anyway. Since whether they are formally part of a course or not, modern users will use them anyway, so necessitates consideration.

5 Conclusion

In this paper it has been argued that learning environments should be designed for all users and how being minded of users with disability from the outset can better inform the design of educational Apps that allow for social and collaborative learning. We have argued for the importance of flexibility, so that users are able to personalize their learning experience. For students with disabilities, we have argued for a disability-aware approach for all users. We have also discussed delivery modes and techniques to achieve delivery. Above more conventional techniques, we have discussed the role of the semantic web with ontologies for personalization and have argued about the role social media should take alongside more standard learning methods.

This is not to say that all is necessarily good in the world of social networking. The teacher/tutor's role is a very important one and there always runs the risks that this relationship might become inappropriate given the nature of interacting using social media.

All learning environments and social computing leave an increased user footprint in their wake. Our very use of online learning and social media means that we are contributing, knowingly or not, to Big Data. This in turn leads to the possible deployment of deep learning analytics (e.g., Schmidhuber, 2015; Bengio, et al., 2015) where we use machine learning to look for undiscovered knowledge in patterns of engagement and

interaction within our e-learning experiences. This can be in terms of classification of Big Data or in terms of pattern analysis and discovery. Linking such data mining of e-learning data and social media learning would present a possible future development.

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