Personalized Learning: Promising future?

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***Abstract*—The term personalized learning has proliferated over recent years especially with the advancement of several educational technologies, conceptual frameworks and mobile and wireless internet technologies. This paper investigates to identify most acceptable personalised learning paradigm for educators. A detailed literature review on various aspects of personalized learning is also presented. Eleven participants with moderate to highly-experienced in teaching across eight countries took part for this study. The data is collected via LinkedIn collaborative participation eliminating the possibility of bias towards a particular outcome. This provides both theoretical and empirical aspects of the topic in question. Interview data was analyzed using content analysis techniques to group issues raised by the participants into emerging themes. This paper concludes with acknowledging the necessity of good combination of teaching and technology for a successful personalized learning paradigm.**

Index terms — Personalized learning, e-learning, Customized learning; Individualized learning

I. Introduction

The basic premise of Personalized Learning (PL) is the belief that each student is unique and learns in different ways. It has been suggested that personalised learning is originated from Howard Gardners theory of multiple intelligences [1] [2]. Thus, the variables for personalised learning include individual pupils interests, their needs and abilities, and the identification of the best learning style for each pupil [3]. Personalized Learning strategies have a number of potential advantages over traditional learning methods and on-the-job training and they are consistent with constructivist learning theories [4], [5], which emphasize that learning is active and knowledge is built on top of own experiences.

It is the objective of this study, therefore, to present a coherent framework for an on-the-fly personalised learning and to provide the most acceptable personalised learning paradigm for educators and practitioners. This research was carried out using the platform of Higher Education Teaching and Learning (HETL), a LinkedIn discussion group. The goal of the discussion group, HETL is to improve educational outcomes in higher education by creating new knowledge and advancing the scholarship and practice of teaching and learning. HETL members represent all disciplines, functions, and levels within education. HETL is open to education professionals from all institutional types and missions. This diversity allows HETL to create a global perspective on teaching and learning. As such, the participants in this paper come from eight countries with moderate to highly-experienced in teaching and training. (see Appendix 1). Thus the study is a holistic overview of personalised learning with participation from real practitioners coupled with reference to current learning theory and state-of-the-art techniques that justify personalisied learning as a viable model.

The structure of the paper is as follows. Section 2 paints a picture of personalised learning against the views of educational policy coupled with the the findings of the classroom practitioners within the context of the existing learning theories. Section 3 highlights technological developments pertinent to this study. It summarises the developments in the areas of mobility, collaboration, game-based, context awareness and augmented reality. Section 4 presents a discussion of the implications of the framework and some remarks on future work, and then the conclusion is presented as Section 5.

II. Theory and Practice

Personalised Learning varies in definition in the contexts in which it is being applied today. In order to come to terms with both the theoretical and empirical aspects of PL, it is necessary to consider, to begin with, what has been written in the education policy documents as well as the approaches that educational institutes or teachers adopt in their practice. Personalized Learning is viewed by policy makers as shaping of students' learning activities and the curriculum/knowledge content that reflect the input and interests of students [6]. By this it is assumed that students can understand how they learn, own and drive their learning and are co-designers of the curriculum and their learning environment. It also implies that student learning needs, interests, and capability determine the pace of learning. This idea resonates with what practitioners seem to feel as one respondent remarks:

"By definition personalisation means wide diversity in the components that go into learning and how they are combined"

Another respondent remarks:

"Maybe personalisation has to come through how the student engages with content and the outcomes they produce from it rather than from the media through which knowledge and skills development is channelled."

In this environment, all the resources are made available for learning. They include teachers, parents, peers, technology, time, and learning spaces with the view that they will be used flexibly to meet individual student learning needs. It also, however, establishes the fact, as one respondent

rightly identifies, *"Personalised learning needs a degree of compromise and learner initiative which has too often been missing."*

It is, therefore, important that each learner realizes their individual characteristics and needs such as different prior knowledge, cognitive abilities and learning styles. These individual differences affect the learning processes and are the reason why some learners find it easy to learn in aparticular subject of study, whereas others find the same subject difficult [7].

Personalized learning can involve different levels in the educational process, including personalization of the curriculum, the courses, as well as the support provided within the courses. Furthermore, personalized learning can take place in traditional (face-to-face) learning settings as well as in technology-enhanced learning settings. In traditional approach, personalized learning requires a small number of learners per teacher. The small number of learners makes it possible for teachers to tailor their lessons, activities, and support, respectively. This gives learners more choices in the curriculum programs, allows parental involvement in education (if learners are children), affords student-driven learning, and involves learners in the decision making processes. A respondent remarks:

"I've taught at multiple levels so one example of personalized instruction is for high school math. Within a whole group plan for objective setting, methodology and evaluation on a topic, knowing intimately the progress of each student, and understanding achievement expectations of student and family, I extended or contracted requirements for each student individually or in small groups."

The advantage of technology, however, is that students can use the content and be the experts with their teacher. They can become experts on specific content areas, technology, and create content. Personalising learning challenges us to think about what new resources may be needed to support learning, and how learners can access these - including resources that have not traditionally been thought of as part of the education system. But one has to be mindful of the limitations too as one of the respondents identifies:

An app which is ideal for one learner will be loathed by another and no institution has the resources to provide a different one for every single student or parade them in front of people until they pick one they like.

In spite of such limitations, much progress has been made in meeting the individual requirements of learners with the advancement of several educational technologies coupled with mobile and wireless internet technologies. The next section highlights some of the developments pertinent to the study.

III. TECHNOLOGY-ENHANCED PERSONALISED LEARNING

The use of technology in education opened up new possibilities for providing personalized learning to learners and significantly enhanced the potential of personalized learning. Through the development and usage of learning systems, large numbers of learners in a class have been able to use and benefit from personalized learning as evident in literature [8].

In most of these studies, an intelligent learning system is able to identify the characteristics of individual learners such as prior knowledge, learning styles, cognitive abilities, learning interests, learning goals and motivation [9] from the feedback collected from the individuals. The knowledge thus realized allows the system for imparting personalized learning [10]. In addition, the system is able to monitor individual behaviour and their actions for further honing its knowledge of the individual.

Another aspect where technology has been able to facilitate personalized learning is the individualization of curriculums. Such a curriculum is the result of the system considering various factors of learners in order to generate the most suitable curricula as well as the best sequence of learning items for each learner.

Most of the current research on personalized learning is strongly related to technology-enhanced learning, enabling learning systems to provide personalized learning which otherwise is not feasible given the traditional classroom constraints. One of the participants of the current study remarks saying: *"If I wouldn't use and point the students into the direction of quality sources online or in books ... I wouldn't be able to free up enough time to personalize their processes ... if they wouldn't ask each other for advice or tips through Facebook and answer those before I have to (I do check if the right advice or tips are given) ... again I wouldn't have enough time to really engage with the students in that very personal way ... so in that sense technology does help."*

On the other hand, a significant body of research is underway into integrating more complex aspects of personalized learning such as user modeling into learning systems. Such systems are knowledge-based systems that simulate the behaviour of human teachers [11] with a view to provide an experience similar to personal tutoring without human intervention. It typically provides a problem-solving environment, in which students are given many opportunities to practice their skills.

Based on the learner-activity, the system collects information about the students actions to establish and maintain a student model to adapt the instructional actions to the skills and abilities of each individual student. Mostly the adaptation is done in terms of providing feedback, selecting or generating problems at the right level of complexity, or deciding topic to be taught. One such system is Thermo-Tutor, designed as a complement to traditional courses with lots of problem solving opportunities for students utilizing the concepts learnt in lectures [12]. Students can select problems to work on, and submit their solutions to be checked whenever they want.

Yet again, the practitioners feel the necessity of learner becoming the owner of their learning. One of the respondents says: *"Personalised learning requires a developed sense of taking responsibility for one's learning and a recognition that it takes effort on the part of you as a student rather than the expectation which endured too long that institutions*

would analyse you so well that what they provided to you was perfect for you, nothing superfluous, delivered at precisely the right time and so on."

Some of the practical constraints notwithstanding, it is identified that personalized learning with other pedagogical models such as mobile learning, ubiquitous learning, game-based learning, collaborative learning etc. has high potential to enhance the respective model by improving the learning progress and outcome of learners as outlined below.

A. Mobility

The use of mobile wireless devices afford personalized learning while on the move [13] and the rise of these technologies provide positive pedagogical affordances. As Klopfer and Squire [14] summarized, portability, social interactivity, context, and individuality are frequently cited affordances of mobile learning out of which portability is the factor that makes other technological attributes such as individuality and interactivity possible. The first generation of truly portable information has been integrated with many functions in small, portable electronic devices [15]. Recent technological innovations in social networking due to the rise of Web 2.0 have made mobile devices more dynamic and pervasive and as a result promise more personalized content and also learning across contexts [16]. Brown [17] summarized several definitions and terms and identified mobile learning as an extension of personalized e-learning. Peters [15] also stated that it was a subset of e-learning, a step toward making the educational process just in time, just enough and just for me.

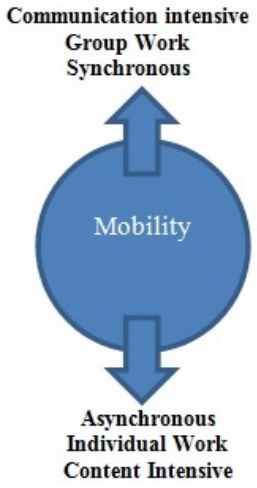

Fig. 1. Mobility Affordances

Above all, this mobility enables personalised learning in formal and informal settings by decreasing the dependence on fixed locations for work and study, and consequently change the way we work and learn [15]. As indicated by Fig 1, mobile technology has two personalizable attributes: (1) to increase an individuals organizational skills and self-regulative (or self-directed) learning ability, and (2) communication, collaboration, and knowledge construction. This shows that, students can consume and create information both collectively and individually [18].

B. Collaboration

Research findings in recent years provide compelling evidence of the importance of encouraging student control over the learning process as a whole [19]. The socially based tools and technologies of the Web 2.0 movement are capable of supporting informal conversation, reflexive dialogue and collaborative content generation, enabling access to a wide raft of ideas and representations. Some of these tools have been found to shift control to the learner, through promoting learner agency, autonomy and engagement in social networks that straddle multiple real and virtual learning spaces independent of physical, geographic, institutional and organisational boundaries. However, in order for self-regulated learning to come to fruition, students need not only to be able to choose and personalise what tools and content are available, but also to have access to the necessary scaffolding to support their learning. Following is an example from one of the respondents:

"For some strong students on or above grade level in a failing urban school, I used education psychology and Web 2.0 instructional technology to stretch performance. Best students led small online groups, were available for questions, checked answers for class practice while focusing on homework. Average students got large online group instruction on methods to meet objectives, joined smaller groups for practice, and learned the procedures checking answers and asking best students questions along the way, in lieu of teacher availability. I had no teacher aides at all. Poor students had steps explained while working through sample text problems with written discussion available. Alternate methods might be shown the slower students with more tangible materials and hands on teaching."

C. Game-based

Increasing interest in game-based learning established great opportunities for learning material personalization. Game-based personalized learning is consistent with constructivist learning theories [4], which emphasize that learning is active and knowledge is built on top of own experiences. Personalised games include tolerance and encouragement of risk within a safe environment [20], thus promoting and encouraging experimentation instead of passive learning [21] [22]. They can support personalized learning that is active, experiential, situation based, problem and inquiry-based, and they provide immediate feedback. They also involve communities of practice which provide collaborative support to learners [23]. Evidence for their efficacy as educational tools is growing with a growing number of research studies finding improved rates of personalized learning and retention for serious games compared with more traditional learning methods [24] [25] [26]. One of the respondents testifies thus:

"Accelerated students were assigned computer exercises/games to practice with minimal explanation and received students who finished early for extension of concepts on computer under peer supervision. Alternative class support tasks were selected by students for the week to include textbook distribution, forms distribution, other routine tasks the group required. Grades including test results, classwork/homework production and related notes were posted

weekly anonymously. My classes composed of students from grade level to primary school ability level were rated tops in achievement for many years. Even special ed students achieved remarkable results prompting many questions of me from their other teachers."

D. Context awareness

With the evoluation of mobile technology there is a growing interest about context-aware learning by many researchers over the last decade. The studies of Hwang et al [27] cover context-aware learning activities such as the ones represented mindtools, concept map and an algorithm used for planning personalized learning paths. For instance a context-aware English vocabulary learning application [28] considers three internal and external contexts of learners including learners location, leisure learning time (i.e. time of day) and individual abilities. The aim of this is to increase the learners interests in language learning and enhance their ability and performance in using and practicing the language with people. For example, Christmas vocabulary is displayed to the student when the date is 25 December, and food/drinks vocabulary is displayed to the student if they are in a restaurant. The CLUE knowledge-awareness application [29] enables collaborative learning between learners. It makes use of two community contexts the learner and other learners surrounding them in order to facilitate the learning process. The application is particularly aimed at distance learners for helping them to identify the nearest learners and what they know about different subjects/topics. This information is geographically displayed in a knowledge awareness map to enable them to seek help from one another and to find collaborative peers to learn/study with. An adaptive personalised recommendation model for recommending Sharable Courseware Object Reference Model (SCORM)-compliant learning objects from online learning object repositories was constructed by Wang et al. [30]. The learners intention and preferences are considered for selecting relevant learning objects to them. SCORM (2003) is an international standard proposed by advanced distributed learning initiative (ADL) for solving the problems of sharing and reusing learning materials in different and incompatible formats of web-based learning systems.

E. Augmented Reality(AR)

AR uses a calculated field position and camera angle to impose a layer of virtual objects over the real-world background [31]. Learners can immerse themselves in the combined virtual and real-world scenes as well as interact with the virtual objects and access relevant information[32]. AR systems can be designed to provide students with personalized scaffolding and support and help them construct personal knowledge as they observe and experience real-world contexts [33] [34]. In recent years, AR has been applied to learning environments in an attempt to overcome drawbacks associated with traditional teaching environments. Some of these technologies have been shown to improve learning outcomes and learning motivation. The goal of many such systems is to provide learners with a friendly, interactive interface and rich, engaging media to stimulate intrinsic motivation and learning performance. The key advantages of AR in personalized learning include the following: (1) it helps stimulate learning intention through pursuing outdoor learning objectives, (2) AR technology provides learners with contextual information related to the outdoor learning environment, and (3) it enhances learner retention of teaching contents easily with the situated learning strategy [35].

Both Android and iPhone support AR in navigation features, providing users with personalized location-specific information. Images have a stronger impact on memory than text, thus layering supplementary images and information over the real world environment in the AR environment can promote knowledge retention [36].

Liarokapis et al. [37] proposed an interactive Multimedia Augmented Reality Interface for E-learning system and developed a user-friendly interface to explore the potential of AR in instruction by superimposing virtual multimedia content information in an AR tabletop environment. Matcha and Awang Rambli [38] investigated the potential of AR spaces to supply communication cues and promote collaboration in learning environments. Their empirical results indicated that AR techniques have significant potential to serve as a shared medium in personalized collaborative learning.

IV. DISCUSSION

From the perspectives of the educationists and also considering the current technological developments in the field, the paradigm of personalised learning can be interpreted as a continuum from teacher to students as well as individualized to participatory (see Fig. 2). Many such operational definitions have influenced its evolution. According to a respondent *"Personalized learning is really learner-centered learning where each of us are learners and at time even students are the teachers. If it is designed on research validated principles of learning, motivation, and development – how it is delivered is secondary. It is not about technology – that is merely one of many tools that may be needed in some cultures and contexts."*

However, for this study, personalised learning is regarded as a single continuum from teacher-mediated to technology driven personalized learning. Viewing it as a two-by-two matrix or distinct clusters makes the model more perplexing due to the complex interrelations of variables. Nevertheless, when personalised learning is used to fill a psychological gap between teacher and learner, it still requires a structure and dialogue.

Due to recent developments of emerging communication technologies, learning structures are built not only by the teacher or instructional designer but also by collective learners; and dialogue is also formed not only between the teacher and learners, but also among the learners themselves. Working in wikis is an example of how learners build structure through dialogue [39]. Regarding dual types of dialogue, Moore [40] already mentioned that a new form of dialogue called inter-learner dialogue can make knowledge creation possible for variety of learning styles. Structure and dialogue, previously defined as being under the instructors control, have evolved into something that learners can also form. Due to this, every definition regarding personalised learning must now include the interaction among learners. It

is, therefore, necessary to define the dialogue and structure that influence personalised learning as the only interactions that take place between the instructor and learners and to exclude the interactions among learners. Any kind of dialogue and structure built by learners alone should be discussed in a different dimension. Such a new dimension connotes 'individual versus collective (or social)' activities by considering the importance of the social aspects of learning as well as newer forms of social technologies. This idea was formed by the influence of cultural-historical activity theory that Kang and Gyorke [41] proposed.

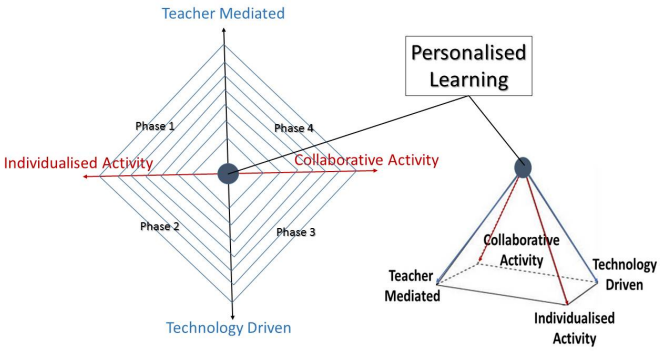

Fig. 2. Personalized Learning Paradigm

However, the role of the teacher is not diminished in any sense. As one respondent rightly points out, *"The real problem is using technology to do what teachers naturally do very well – connecting with their students, motivating them to learn in a variety of ways that fit their interests and skills, and being real partners in the learning journey. Teachers either know what technologies are best or they know their students do and use them as expert teachers when the class needs to learn from their peers."* As another respondent remarks, *"Learning is not like online grocery shopping and as we know even that is never perfect. An app which is ideal for one learner will be loathed by another and no institution has the resources to provide a different one for every single student or parade them in front of people until they pick one they like."*

On the other hand, there is this vice of technology misuse. For example, as one respondent points out, *"I see technology becoming the 'babysitter' for babies through adult learners – too many institutions encourage teachers to use the latest and greatest program while completing their mountains of accountability paperwork. There is misuse from students point of view as well as one respondent points out."*

Some say doing this is more work and adds more to their already overfull plate of responsibilities. However for those educators who have stayed the course and helped mentor whole systems in research-validated ways to create learner and learning-centred environments, personalization is a natural outgrowth, the jobs of teaching and learning are in fact easier because the responsibility is shared, and if students are allowed to establish classroom rules for what will and will not be used inappropriately in technology rich or poor environments – misuse of social media or other tools will disappear with peer pressure.

V. Conclusion

This study presents the data analysis from the reflections of the educationists on LinkedIn focus-group relating to the individual personalized learning perspectives. Based on the analysis, a personalized learning paradigm has been evolved. From the study it appears that personalised learning spaces, resources and environments to be developed, supported and created through systematic design as well as by inclusion of both instructor and learner perspectives. As online or Internet based learning is now the mode of learning for many students globally, it is important that students develop reasonably high levels of digital skills to enable them to negotiate, interact and access resources independently [42]. Also, as noted in many recent reports, the dispositions developed through engagement with Web 2.0 - i.e. communication skills, participation, networking, sharing - overlap with what are viewed as essential 21st-century learning and employability skills [43].

Nonetheless this study identifies the need for explicit scaffolding of essential skills for *"the total dependence on software is a barrier to implementing personalised learning - although the right type of software can support the process if it is facilitated through a developmental process of blended learning (i.e. both class-based and web-based)"*as one of the respondent remarks. The challenges for educators are complex and multifaceted, and include the provision of personalised learning experiences using suitable technologies that cultivate independent learning skills, while also scaffolding learner reflection and the development of generic competencies. As one respondent points out, *"There is also the issue of sense of ownership: that if academics are involved in something that it stops being cool."*

Another respondent remarks: *"We certainly need to alert students to the fact that socialising with friends is not learning and in fact eats into their time for learning."* Hence, the study proposes the necessity of good combination of teaching and technology for a successful personalized learning paradigm and that is continuously adapted for each individual learner.

Appendix

TABLE I. Participants' data

Participant	Expertise	Country
1	Faculty at FIDM	Concordia University
2	Founder Lifewide Education CiC	Betchworth, Surrey, United Kingdom
3	Learning Communities in Higher Education	Brussels Area, Belgium
4	Faculty Education Co-ordinator	Surrey, United Kingdom
5	Professor of Commerce	Bardhaman, India
6	Senior Research Scientist	Jacksonville, Florida Area Research
7	Education Researcher	San Francisco Bay Area Research
8	Education Management Consultant	University of Southern Denmark
9	Founder at Global Digital University	Istanbul, Turkey
10	Education Researcher	Charles Sturt University, Australia
11	Trainer and Lecturer	Massey University, New Zealand.

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