The Future of Education: Considerations on Technology and Peer Interaction in Facilitating the Learning Process for a Personalised Education

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Abstract
The Covid-19 pandemic led to an increase of technological usage into the educational process, at every level and it can be seen as a paradigm shift due to rapid changes. This paper gives a literature review on how technology helps and can bring self determination in students. While designing the next educational system we should strive to create an environment where students can find and cultivate their abilities, considering the theory of self-determination [1]. We should aim towards a system that can set growth goals in accordance with students' needs, and assure that the goals and aims are considered personally important. This paper wants to give an overview of these technology supported learning strategies and their effect, the current literature in the field, learning outcomes, student personalities and conscientiousness. Technology led to a more personalised education, thus systemic changes in the process might appear. Developing self-determination skills is vital for students in their future abilities and interactions. Personalised outcomes should come from complex peer interactions in the classroom and outside, which include negotiations that lead to understandings [2]. The present educational systems develop abilities, but we should also consider developing capabilities. All these strategies of peer to peer interactions, personalised educational technology are student focused, contributing to their learning independence, satisfying the need for autonomy.

Keywords: self-determination theory, educational technologies, personalised learning, educational systems, feedback.

1. Introduction
This paper offers an analysis over the characteristics of future learning, and trends for personalised learning as an outcome, using technology. New skills should be implemented to learners (pupils and students) to provide continuous sets of abilities for future societal upskilling, job market and social inclusion.

The notion of self-determination was noted and introduced by Ryan and Deci in their work in the year of 1985, a book entitled "*Self Determination and Intrinsic Motivation in Human Behaviour*". The syntagm self-determination speaks about a person's own ability to manage one's self, to make confident choices, and to think on their own [3]. Within self-determination theory (SDT) were identified three basic psychological needs: autonomy, competence, and relatedness [4], [5].

Personalised learning has been seen as a normal practice in the last years (2001-2022), from 2010 with a clear ascending trend [6],[7].

Technology is involved in the educational process, in initial phases of a lesson, such as linking old and new content, providing information [8] and especially in assessment [9] and feedback [10].

Alamri and his collaborators [11] brought up the importance of SDT and its connection to technology based learning in the paper termed "*The study is Using personalised learning as an instructional approach to motivate learners in online higher education: Learner self-determination and intrinsic motivation"* to engage students and stimulate their interest and cognitive and affective functioning [12].

Linked with the emerging technologies, the role of teachers is changing. Thus, from information providers and educational support givers, it shifts towards an educational guidance together with emotional support, through a cyber world, full of information and less human interaction [13]. So technology based personalised learning is also a stimulus towards an enhanced student-centred approach in education [14].

Various studies have shown that intrinsic motivation adds value to the *"engagement and optimal learning in different educational contexts*" [15]. While analysing how personalised learning should be implemented, it is essential to consider variables such as the pupils interests and abilities to identify the best learning style for each one of them [16].

As indicated in literature, the development of learning systems has meant a growing number of pupils which have been able to make use of personalised learning [17]. The integration of new technologies has the ability to enhance the effect of these methods. The usage of these innovative tools is giving us a valuable element to enable learning, namely the motivation. For instance, "*students using technological means familiar to them, can approach abstract concepts, like exploring with greater interest the new knowledge* [18].

Peer to peer interactions are a part of the educational process and their elimination from this process should be avoided, in the context of blended learning, as peer education is a complement, not a substitute for teacher-delivered education [19].

2. Objectives

Based on the self-determination theory of Ryan and Deci [4], [5], and the multiple ways of how technology can help to engage students [11], this paper gives a literature review on how technology helps and can bring self determination in students. It has the following objectives:

- to identity where technology can be implemented with good results in the educational process;
- to clarify how technology-enhanced instructional activities support student evaluation and feedback to promote self-determination based learning;
- to pinpoint the dynamics among factors that interfere and shape technology based personalised learning.

3. Prior Work

With technology making its way into the classroom, its effectiveness in aiding the learning process and its effects on education are considered future research topics.

This study looks at SDT [4], [1], and its relationship with technology based learning applications that help education providers to engage students [11]. It gives a literature examination of educational technologies that support the development of the psychological aspects needed to implement SDT in students, especially autonomy.

Ultimately, the use of technology is destined to enhance students' motivation, engagement in the topic, and satisfaction, factors identified by monitoring learning progress and characteristics [20]. For the long road, building community capacity is a desirable outcome, conducted naturally in a future personalised learning.

There are various factors that interfere and shape technology based personalised learning and educational activities. Some of the extrinsic factors are: technological developments in education applied to different educational systems, resistance to change in administration and educational institutions**,** human resource - teachers trained to use digital skills. Intrinsic factors that influence technology based personalised learning and educational processes are: prior knowledge, cognitive abilities, learning interests and affinity, learning goals and motivation [11].

3.1. Types of technology based personalised learning and SDT

While seeking to personalise education using technology, blended learning has been widely used. Blended learning is a learning model that combines online and face-to-face interaction, but it can require further training for teachers [18].

Besides blended learning, AI assisted learning (like Smart Content, Intelligent Tutoring Systems, Virtual Facilitators and Learning Environments) [21]**,** traditional face to face classroom learning assisted by technology [22], and interdisciplinary or transdisciplinary approaches were applied by educational providers [15], [23]. In the last years, due to pandemics, previous types of technology assisted education and learning were tested and took a leap of faith to be widely used.

Technology is used in the learning process, through intelligent tutoring systems, mobile devices, AR applications. More technological strategies used in the educational process are: gamified learning, digital field trips, integrating social media, students feedback, digital content creation, shared online classroom calendar, incorporation of video and multimedia into lessons and presentations [21], [24].

Artificial machine learning has the ability to adapt, recognise and extrapolate new patterns. Thus, its incremental use in tailoring education using SDT is valid.

For online learning, relevant curriculum, interaction with instructors, interaction between students, personalised online discussion boards, and personalised learning (PL) as an instructional approach in an online learning environment [25], [26].

3.2. Assessment

The basis of educational assessment is represented by testing. In order to place educational assessment, and specifically testing, in the context of an educational system, considerations on the effects and the information obtained in the process.

Two fundamental types of assessment are: the formative one and the summative one. In literature, both of them are mentioned to be assisted by digital technologies in order to retrieve better results from students [27]. Regarding continuous assessment, it has been concluded that formative tests can have an amplifying effect on the learning process [28]. Technology helps assessment providers to readily implement formative assessment.

3.3. Feedback

Feedback represents an influencing factor of learning. A possible definition of feedback, present in literature is: "*information with which a learner can confirm, add to, overwrite, tune, or restructure information in memory, whether that information is domain knowledge, metacognitive knowledge, beliefs about self and tasks, or cognitive tactics and strategies*" [29]. This learner-centred definition indicates the aspect of highly-personalising the given feedback. Research suggests that feedback needs to be able to work at four levels: task level (the level of task fulfilment), process level (techniques required to fulfil the tasks), self-regulation level and self level (personal evaluation of the learner) [30]. Employing technology assures that a highly-personalised feedback, which satisfies the four levels of function can be readily given. Computer-based feedback delivers flexible individualised feedback on a large scale, which comes in opposition with physical, person-delivered feedback [33]. Computer-based feedback can be adapted using statistics of how the learner scored during testing, in order to reach a maximal level of tailoring of the feedback, given that the testing process is designed according to this directive. Furthermore, research suggests that computer-mediated and computer-generated feedback environments stimulate feedback-seeking behaviour [31].

Feedback has been categorised in the literature and its effect on the learner studied. Our study of the current literature indicates that to reach maximal efficiency, a differentiated feedback system is to be developed, which will deliver an elaborated feedback (EF) to learners identified as to hold low prior knowledge of the content and knowledge of results (KR) or knowledge of correct response (KCR) feedback to learners identified as to hold high prior knowledge of the content [10], [32], [5], [33].

4. Approach

This paper wants to give an overview of these technology supported learning strategies and their effect, the current literature in the field, learning outcomes, student personalities and conscientiousness. To capture this literature research we used two main approaches, namely the SDT concept and technology assisted education. The first concept that we used was brought up by Ryan and Deci [1]. As for the second one, regarding technology based learning applications that help education providers to engage students, we focused on Alamri's study [11]. We present a literature examination of educational technologies that support the development of the psychological aspects needed to implement SDT in students, especially autonomy.

Ultimately, the use of technology is destined to enhance students' motivation, engagement in the topic, and satisfaction, factors identified by monitoring learning progress and characteristics [20]. For the long road, building community capacity is a desirable outcome, conducted naturally in a future personalised learning.

Technology led to a more personalised education, thus systemic changes in the process might appear. Developing self-determination skills is vital for students in their future abilities and interactions. Personalised outcomes should come from complex peer interactions in the classroom and outside, which include negotiations that lead to understandings [2].

Strategies like peer to peer interactions [19] and personalised educational technology are student focused, contributing to the learning independence, satisfying the need for autonomy [19]. Education is shaped like an organism that evolves together with technological developments and societal requirements, education reflets how society changes.

Various measures were taken by each country even before the COVID-19 pandemic. The Digital Education Action Plan (2018-2020) taken by the European Union, for example, aims to support the use of technology towards high-quality and inclusive digital education and training. It presents measures to help educational systems and institutions to look for opportunities offered by the digital era and to respond to the related challenges [34]. The plan has brought the question of AI in education to a transgovernmental level, together with 2021-2027 measures.

On the other side, we have to see to what degree we can extend technology based personalised learning involving self determination theory - SDT. Thus, an inevitable issue arises around the educational practitioners on how to take advantage of technological opportunities to further nurture students' interest and autonomy.

At the same time, using technology in education is not necessarily without any harm, as Kollias and Kikis stated, ”*technology is not an autonomous and revolutionary force which is inherently good*”, and moderation is required [35].

5. Results

Technology-enhanced instructional activities support student evaluation and feedback to promote self-determination based learning. Consequently, we have designed a diagram reflecting the role of technology in assessment and providing feedback (Fig. 1).

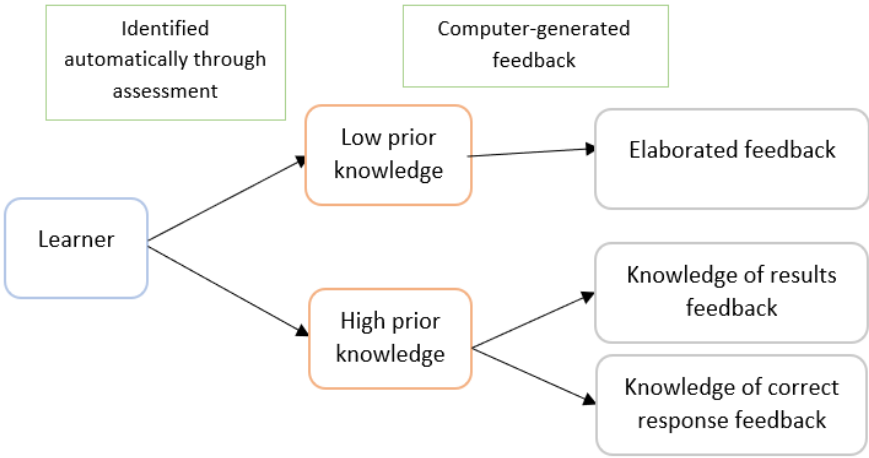

Fig. 1. Assessment and Feedback Relation with the Learner's Prior Knowledge

As a result of literature review, we have shown possible parts of the educational process, which can be assisted by technology. Although, we have to mention that prudence is advisable.

The factors that interfere and shape technology based personalised learning activities are extrinsic and intrinsic. Intrinsic factors play a major role when it comes to SDT as psychological needs that have an effect on motivation. Technology has its own part and its successful implementation relates with students' prior knowledge, cognitive abilities, learning interests and affinity, learning goals. Some relationships among factors that interfere and shape technology based personalised learning were identified, as shown in the second figure (Fig. 2).

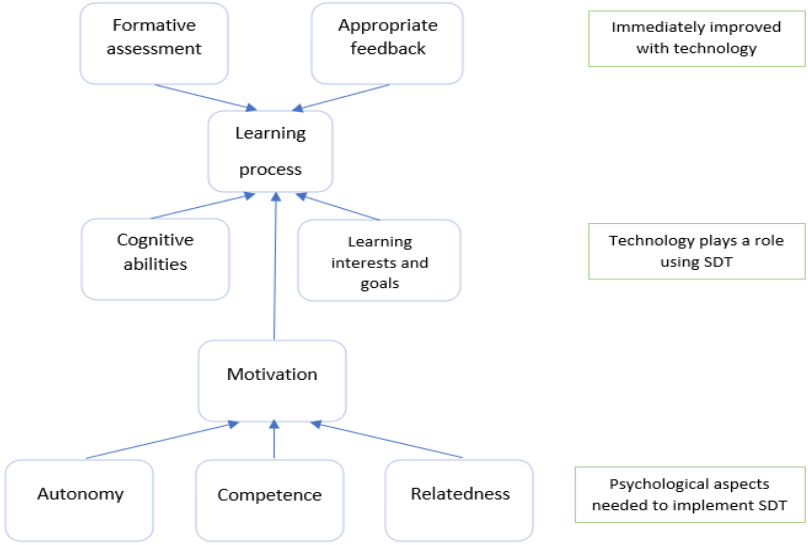

Fig 2. Relationship between technology and factors affecting the learning process including SDT principles

There is a need to clarify how far we can extend personalised learning based on technology related to SDT. Therefore, a question arises around educational providers about how to take advantage of technological developments to develop student interest and relatedness while advancing their competences.

6. Conclusions

While designing the future of education, it is clear that there is a need to create an environment where students relate to their background and educational technologies are helping them to find and cultivate their abilities, based on SDT.

In agreement with SDT's fundamental needs, autonomy, competence and relatedness, an educational system that is established in accordance with students' needs assures that the goals are considered personally important, so as to ensure the stimulation of motivation.

Technology has its own part and its successful implementation relates with students' prior knowledge, cognitive abilities, learning interests and affinity, learning goals. Utilising diverse technology-supported learning strategies (blended learning, AI assisted learning - such as smart content, intelligent tutoring systems, virtual facilitators and learning environments**,** traditional face to face classroom learning assisted by technology, and interdisciplinary or transdisciplinary approaches) combined with SDT core concepts, leads to a more personalised education.

Relationships among factors that interfere and shape technology based personalised learning were identified having a positive effect reflected upon learning outcomes, and they come from complex peer interactions in the classroom and outside of it. Developing self-determination skills is vital for students in their future abilities and interactions.

Personalisation of content and outcomes have a bigger impact on students' personal needs. Strategies of peer to peer interactions, personalised educational technology are student focused, contributing to their learning independence, satisfying the need for autonomy.

Sporadic empirical research has been conducted, and as a limitation of educational technologies usage, we have to see from an alternate point of view, that technology is not an autonomous, nor a revolutionary mean of approach. So, we should wonder what will happen when technology takes a social being out of its social environment.

This echoes the need for more extensive studies on this topic, to observe the long term impact on the future of education and how smart educational systems should be to overcome this switch.

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