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DISCERNMENT OF STAKEHOLDERS OF MASS COMMUNICATION TOWARDS IMPACT OF PERSONALIZED ADAPTIVE LEARNING ON HOTS IN SMART LEARNING ENVIRONMENTS

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Discernment of Stakeholders of Mass Communication towards Impact of Personalized Adaptive Learning on HOTS in Smart Learning Environments

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Abstract

The evolution of artificial intelligence has revolutionized the learning world and changed the fabric of societies. They have greatly impacted healthcare, agriculture, the economy, and transportation. Education is not immunized either. Due to this many intelligent technologies have gradually evolved like learner analytics, big data, IoT, and cloud computing which have made the learning

environment smart. In turn, these smart learning environments have catered to the specific needs of the learners according to their characteristics and provide real-time feedback on the assessed learning thereby tailoring the content accordingly. So this study employs a mixed-method research design for conducting the study by taking a sample of 160 students and 20 faculty members for the survey while 5 administrators of Mass Communication were interviewed for data collection. The results reveal that personalized adaptive learning positively impacts higher-order thinking skills and smart learning environments are discerned to impact education positively.

Keywords: Discernment, Personalized adaptive learning, HOTS, Smart learning environment

Introduction

The present-day traditional teaching cannot fulfill the needs of all the students that are designed with the consideration of "one fits all". No due care is given to learning styles and the pace of learning. So some students grasp the concepts well while some face difficulties in understanding them and may be more auditory and visual learners. This creates a huge learning disparity that leads to students dropping out of school. This issue has been raised by the World Bank report on education which showed concern about this widening gap (World Development Report, 2018).

In other sub-continents, AI is used for furthering the education system but in the Indian sub-continent, it is a necessity given to its low retention rates whose main culprit is the poor quality of education and poor learning outcomes. This is highlighted in the average performance of states, and union territories on various rounds of the National Achievement Survey (NAS) before 2017 over 60% of class 5 students scored below 50% across various subjects. It was found that the performance of the majority of the 31 states and union territories that were tested significantly deteriorated in NAS Cycle-4 versus Cycle-3. Poor learning outcomes were also reported in basic foundational skills. Notably, in rural areas, only 42.8% of class 5 students could read the text that was prescribed for class 2. The situation was even worse in arithmetic wherein only 26% of rural students could do class 5 arithmetic (NITI AYOG- National Strategy for AI discussion paper, 2018).

There is a huge interplay of factors that are obstacles to improving the quality of education such as multi-grade and multi-level classrooms, lack of interactive pedagogy, ineffective remedial instruction, and ineffective remedial instruction in addition to low adoption of existing technologies (NITI AYOG- National Strategy for AI discussion paper, 2018). Ineffective pedagogy is one of the root causes of poor learning outcomes that are mostly rote-learning based and lacks interaction between the teacher and the students. Remedial instruction wherever conducted lacks customization that is not as per the learners' learning level, abilities, and pace of learning (NITI AYOG in National Strategy for AI discussion paper, 2018).

Furthermore, there is a huge disparity in the adoption of technologies that is low in schools and it is largely due to untrained teachers in digital pedagogy despite the availability of ICT infrastructure as per the survey conducted by Cross Square Foundation, EdTech Adoption (2018). In the survey, 83% of the teachers used computers. But the use was limited primarily to audio or

video display, or student practice. Meanwhile, merely 41% used technology for tracking student data and 27% for participating in forums. This is a very common phenomenon in low-fee school segments (Cross Square Foundation, n.d.). But another pattern noticed was that trained teachers are considerably more reasonable to utilize technology in the classroom. 88% of trained instructors revealed utilizing accessible computers when contrasted with just 53% of untrained educators. Trained teachers were discovered to be almost twice as prone to report utilizing technology for correspondence purposes and online gathering participation (Economic Survey, 2016-17).

But the solution to this worrisome problem lies with personalized adaptive learning. So there is a need to increase awareness among teachers to use technology in their classrooms and train them to utilize it properly. It is not only teachers but all the stakeholders who should also be aware of the use of technology use in education. It is because if students are aware then it would be convenient for them to use while awareness of technology to administrative people would enable them to formulate necessary steps to encourage their use. This will lessen the learning gap that exists in Indian classrooms and improve the quality of education. In this series, effective pedagogy plays a prominent role that cannot be denied its importance. So no pedagogy could ever be better than the one that is customized to students' needs. Personalized adaptive learning is a pedagogy that caters to the needs of the learners. Personalized adaptive learning caters to the needs of the learners.

A smart learning environment aids in achieving the purposes of personalized adaptive learning pedagogy to the stakeholders. It is an intelligent tool that makes the learning environment smart which tracks the learning process along with recognizing learning scenarios, spreads awareness about the physical environment, enables connectivity among the learning communities, performs the adaptive function, and also enables natural interaction (Huang et al., 2013; Zhu et al., 2016). Thus, giving the learners more flexibility in addition to effectiveness, adaptation, engagement, motivation, and feedback (Spector, 2014). Hence, smart learning environments (SLE) should be capable of providing effective personalized and adaptive learning.

It is a type of technology upgraded discovering that not just backings data movement and control of resource use, yet additionally effectively gives essential learning guidance, supportive tools, and help-seeking conduct at the right time furthermore, in the right structure (Hwang, 2014). Additionally, SLE helps provide smart education thus reducing the cognitive load, and also enabling sense-making education as well as ontological construction among the students (Zhu, Yu and Riezebos, 2016). A smart learning environment allows the students adaptation to the learning process by triggering an action (Burgos et al., 2007), embracing personalization of the learning as per the learner characteristics (Kurilovas et al., 2014), and learning analytics tracks students' work and keep a check on their progress, and by visualizing the data feeds the results back to the students (Mangaroska and Giannakos, 2018).

In disseminating the benefits of adaptive learning and making the learning environment smart, AI plays a prominent role. The advent of AI allowed human beings to apply it in diverse areas such as healthcare, in infrastructure development (NITI AYOG in National Strategy for AI discussion paper). Education could not remain immune from its influence either. So a variety of AI

technologies have found their place in vast educational subfields, for instance, personalized e-learning environments (Chen, 2008), intelligent learning style detection (García et al., 2007), and adaptive item-based learning (Wauters et al., 2010). Hence, as science and technology developed rapidly, AIeL not only played a critical role in the improvement of student performance but also provided personalized learning experiences that were not constrained by geographic factors (Chang and Hwang, 2018b; Liu et al., 2019). Scholars have interpreted AI as a system that thinks rationally and behaves reasonably or similarly to humans (Kok et al., 2009). Accordingly, several frequently adopted technologies that are used to simulate human intelligence, such as neural networks, expert systems, deep learning, symbolic machine learning, speech recognition, image recognition, natural language processing, and statistical analysis, can be categorized as AI technologies (Lu et al., 2018).

AI can solve the issues related to access and quality that pervades the Indian education sector by not only augmenting and amplifying the learning experiences through the use of personalized learning, automating and expediting administrative tasks but also predicting the student's needs by providing interventions that aid in lowering the dropouts or recommend vocational training for them (NITI AYOG in National Strategy for AI Discussion paper, 2018). So when AI was implemented into the classrooms they made the classrooms smart. These kinds of smart learning environments have a lot of avenues to be explored further. So smart learning emerged as a new paradigm, whose foundation lies in smart devices and intelligent technologies (Lee et al., 2014; Kim et al., 2011).

So it can be said that the present era has witnessed a boom in technological developments that are gradually changing the fabric of society. These technological advancements are unprecedented in history and will continue to encompass endless activities and many changes are visible around the imperceptible world. These changes lead to the fifth scientific research paradigm (Zhu and Shen, 2013). Artificial Intelligence (AI) was the result of this revolution.

Related work

In recent decennia, there has been an increase in the use of technology. At the same time the use of smart devices like sensors, and trackers is also on the rise. This has led to some new terminologies such as smart education, data analytics, IoT, Big data, and cloud computing (Picciano, 2012). All this became possible due to the evolution of AI.

Artificial intelligence in e-learning is in the nascent stage and there is a need for more cross-scholastic research (NITI AYOG in National Strategy for AI discussion paper, 2018). Even AI's powerful education models and learning methodologies can be applied to distinguish student styles, inclinations, and the key variables that affect learning outcomes and security. In this way, to address student's needs at the focal point of the new century, contemplating and growing more appropriate AIeL methodologies and models remains a theme deserving of broad research (Tang, Chang and Hwang, 2021). With the portability of cell phones, students can unreservedly peruse reading material, perform activities, and gather information. Simultaneously, the AI learning framework offers learning direction and the necessary auxiliary course books (Liu et al., 2019); consequently essentially further developing learning adequacy. Besides, an expanding number of

AI programs have been incorporated into e-learning conditions (Chassignol et al., 2018). Such an AIeL framework is reasonable for understudies with various information levels or individual attributes. But in the past decades, many AI-related educational programs have been launched globally for various application domains, such as science and mathematics education (Colchester et al., 2017; Hwang, 2003; Kok et al., 2009). But no such studies were found in Mass Communication and Journalism.

Additionally, India is a developing country, and scarcity of resources is a common phenomenon. Sometimes there are not adequate teachers, some other times there is a lack of quality teachers. This can be overcome by personalized adaptive learning as in personalized adaptive learning students can learn at their pace without any constraints of geography and location. They can also get immediate feedback about their learning and they are free to progress at their pace without compromising their learning styles as all these things are taken care of by AI. But leveraging AI in Indian classrooms is a challenging task. There is less awareness about AI in India. So to harness the good of AI requires a lot of research that is still in its infancy in the country (NITI AYOG-National strategy for AI discussion paper, 2018). Furthermore, data handling is of utmost concern as AI heavily feeds on data so privacy and security are obstacles to its implementation. Bridging digital divides remains a challenge that needs to be sorted out (NITI AYOG-National strategy for AI discussion paper, 2018). Additionally, it can potentially solve access and quality issues that are too obviously observed in the Indian education sector.

AI can curtail the problems that persist in the Indian education system. The problems that are there are due to either scarcity of resources, or poor quality of teaching (NITI AYOG-National strategy for AI discussion paper, 2018). In this regard, data analytics, IoT, and cloud computing have enabled the customization of learning according to the needs of the learners (Picciano, 2012). This customization of learning as per one's own needs is called personalized adaptive learning (Peng, Ma and Spector, 2019). This pedagogy that is there due to the use of smart devices for learning or customizing learning has emerged as a new tool in the recent decennia (Peng, Ma and Spector, 2019). The emerging technologies have made personalized learning a bit more adaptive, and adaptive learning a bit more personalized. So combining these two a new pedagogy emerged called personalized adaptive learning (PAL). It is a new research paradigm (Zhu and Shen, 2013). So when constructing PAL four aspects must be considered such as learner’s profile, competency-based progression, personal learning, and flexible learning environments (Peng, Ma and Spector, 2019). The core elements of such pedagogy are individual characteristics, individual performance, personal development, and adaptive adjustment (Peng, Ma and Spector, 2019). The emerging pedagogy also provides real-time monitoring of learners’ differences and changes in individual traits, individual performance, and personal development.

Personalized adaptive learning came into existence with the rise in big data technologies that changed the whole fabric of society. More and more data were generated at high speeds that not only spawned Data-Intensive science but also lead to the fourth scientific research paradigm (Hey et al., 2009). The technologies like cloud computing, learning analytics, and big data that focus on the way the learning data is captured, analyzed, and aimed at improving learning and

teaching, sustain the development of personalized as well as adaptive learning (Mayer-Schönberger and Cukier, 2013; Picciano, 2012). It is because students are motivated to take ownership of their learning and make informed decisions by reflecting upon their learning in learner analytics research (Santos et al., 2012) that is the soul of personalized and adaptive learning.

The pedagogy that can develop among the learners' higher-order thinking skills is most beneficial. The present scenario demands from the learners to apply the knowledge learned in the classroom to real-world situations rather than cramming the concept. Higher order is such a skill that one cannot own by cramming the concepts but understanding and applying will do. The thinking activities that involve the higher hierarchy of Bloom's cognitive level are the higher-order thinking skills (HOTS). But later it was revised by Anderson and Krathwohl (2001) and proposed a new hierarchy that includes remembering, understanding, applying, analyzing, evaluating, and creating. Many scientists found it easier to understand and proposed it is referred to while developing a theory. When mental activities are involved in the thinking process to explore complex, reflective, and creative experiences to consciously achieve goals such as acquiring knowledge that is of analytical, synthesis, and evaluative thinking levels is called HOTS (Wardana, 2010). HOTS comprises three components, namely critical thinking skills, design thinking skills, and system thinking skills (Wang, and Wang, 2011). But a different categorization was proposed by Miri et al. (2007). According to them, HOTS includes three components such as critical thinking skills, systematic thinking skills, and creative thinking skills. Yet another definition was put forward by Lewis and Smith (1993) that is a bit elaborated one, according to which HOTS consists of critical thinking skills, problem-solving skills, decision-making skills, and creative thinking skills. So, most scholars have accepted critical thinking skills and creative thinking skills.

HOTS are very critical to a student's growth. The development of HOTS is a very complicated and multidimensional challenge in education. Problem-solving is one of the most significant HOT skills and a very essential skill for a student. If a student owns it he exercises the meta-cognitive level as problem-solving is an act of meta-cognition. So, the learning environment plays a predominant level in acquiring HOTS in a student. Some of the favorable environments are those that can be created by utilizing the Problem-based Learning (PBL) models (Duch, Groh and Allen, 2001; Amador, Miles, and Peters, 2006; Barell, 2006; Barret and Moore, 2010). Similarly, the pedagogy that is used to teach also promotes HOTS development. So they are also very crucial.

Providing smart pedagogy that is suited to one's needs requires a smart learning environment that is created by the use of smart devices and intelligent technologies (Peng, Ma and Spector, 2019). The SLE is very realistic so students can easily transfer the knowledge. In such environments, learning can be carried out ubiquitously anytime, anywhere without any limitations of time and space, or environments (Hwang et al., 2008).

Synthesizing all, SLE makes education smart with the use of smart devices. And education cannot be made smart without the smart pedagogy that is specially designed and tailored to learners' specific styles, and needs, and based on the pattern of interaction with the environment. So

personalized adaptive learning caters to the needs of the learners thus allowing them to develop their higher-order thinking skills that are so very crucial to develop the overall persona of the learner and enabling the learner to lead a satisfactory life while solving the problems of their lives in creative ways and critically by taking valuable decisions.

Although a lot of studies have been done on personalized adaptive learning where many of the researchers have proposed their model of learning, some have highlighted the benefits of adopting personalized adaptive learning, while others have used it in the context of Learning Management Systems (LMS). Smart learning environments have also been described similarly but none have explored the impact of personalized adaptive learning on higher-order thinking skills in the context of smart learning environments (SLE). So that is a void that remains to be explored. Even more, all the studies that have been conducted have their locus mostly on engineering education but no studies were found that have been conducted on undergraduate students of Mass Communication. So this study was taken up to understand the discernment of Mass Communication stakeholders towards the impact of personalized adaptive learning on higher-order thinking skills in smart learning environments.

Objectives in the study

a. To know the discernment of students and teachers towards the impact of personalized adaptive learning enabled by AI on higher-order thinking skills in the smart learning environment.
b. To know the discernment of administrators towards the impact of smart learning environments on education.

Methodology

A mixed-method research design was followed in which the data is collected into two parts:

a. Discernment of students and teachers towards the impact of personalized adaptive learning enabled by AI on higher-order thinking skills in the smart learning environment. For this, a questionnaire was used for data collection.
b. Discernment of administrators towards the impact of smart learning environments on education. The data was collected through an unstructured interview.

Sample of the study

The target population in the study was Undergraduate students, teachers, and administrators of Mass Communication in Greater Noida, Uttar Pradesh. 250 Under Graduate students and 50 teachers were contacted. Out of which 160 students, 20 faculty responded. So 160 students, 20 faculty, and 5 administrators were taken as the sample that included both males and females and was selected randomly.

Instrument used

Questionnaires were prepared to consist of five question types for collecting data from both students and teachers respectively. The instrument was prepared based on the definition of HOTS by Lewis and Smith (1999). An unstructured interview was carried out to gather information from administrators about the impact of a smart learning environment on higher-order thinking skills. The question asked was “Does a smart learning environment have any effect on education?”

Results and discussion

The survey was conducted in June 2021 in Greater Noida; 160 responses were received from undergraduate (UG) students and 20 faculties of Mass Communication out of 250 students and 50 faculties. The survey form was closed after having obtained responses from 180 participants in total including both the students and faculty members. This yielded response rates of about 60%. The results obtained are tabulated here in Table 1.

Table 1

Discernment of teachers and students towards the impact of PAL on HOTS in smart learning environments

	According to Teacher				
Response	Customization enables analyzing the learning situation well	Personalized adaptive learning promotes critical thinking	Personalized Adaptive learning does not promote decision-making	Personalized adaptive learning encourages creative thinking	Personalized adaptive learning does not promote problem-solving
Yes	70%	64%	13%	87%	7%
No	5%	10%	76%	3%	73%
Can't say	25%	26%	11%	10%	20%
	According To Students				
Response	Customization enables analyzing the learning situation well	Personalized adaptive learning promotes critical thinking	Personalized Adaptive learning does not promote decision-making	Personalized adaptive learning encourages creative thinking	Personalized adaptive learning does not promote problem-solving.
Yes	67.50%	75.00%	17.50%	81.25%	19.75%
No	7.10%	9.25%	72.83%	8.00%	62.50%
Can't say	25.40%	15.75%	9.67%	10.75%	17.75%

By having a closer look, it can be observed that on the question of "customization enables analyzing the learning situation well", 70% of faculty and 67.50% of students agreed. This shows clearly that customization in adaptive learning increases the analysis of learning situations. The reason the question "personalized adaptive learning promotes critical thinking" was added was to know the discernment of both the stakeholders to produce the final results. The maximum percentage of students and faculty accepted that PAL boosts critical thinking and around an equal percentage of both stakeholders agreed to some extent (Table 1).

Results of the survey showed that a majority of participants rejected that PAL does not promote decision-making. This means that personalized adaptive learning influences motivates,

and pushes the HOTS of individuals who adopt personalized adaptive learning. Both the stakeholders assumed personalized adaptive learning to encourage creative thinking skills and supported the argument that PAL solves the problem of HOTS.

This study revealed that personalized/adaptive learning has always been an attractive topic in this field, and personalized data sources; for example, student preferences, learning achievements, profiles, and learning logs have become the main parameters for supporting personalized/adaptive learning. Personalized Adaptive learning broadly helps in motivating, influencing, and helping in creative thinking and problem-solving (Table 1).

Discernment of administrators on the impact of a smart learning environment on education.

5 administrators from the Department of Mass Communication and Media Studies, Sharda University were interviewed for knowing their discernments towards the impact of smart learning environments on education, and the results are presented here in Table 2. The qualitative data were analysed using NVIVO 12. The results were coded and categorized into broader themes. These broader themes later became part of the discussion.

Table 2

Themes and codes of the qualitative analysis

Raw codes	Broad themes synthesized from raw codes	Cluster of themes
Personalized learning Instant feedback Multimedia content Real-time e-learning Organization of content Improved retention rates Reduce abstraction Interactive Resources Self-sufficient	Features of smart learning environments	+*Characteristics of smart learning environment* Personalized learning Instant feedback Real time e-learning Improved retention rates Resources +*Content* Multimedia content Organization of content Interactive content Self-sufficient

Personalized content Positive effect Multimodal content Easy access Huge information available Improved education system Realistic education Caters needs of the learners Empowerment of teachers and students No barriers of space and time Optimization of learning Self-regulated Customized feedback	Effect of smart learning environments on education	+*Effects on education* Personalized content Multimodal content Positive effect Customized feedback Easy access Realistic education Improved education system No barriers of space and time +*Students* Caters needs of learners Self-regulated Optimization f learning
Facilitator/guide/mentor Creation of interactive learning environment Develop students' abilities/capabilities Search for multimedia resources Monitor and record students' progress Motivating students to strive for their goals Enable students to think creatively and critically	Roles of a teacher in smart learning environments	+*Teachers* Facilitators/guide/mentor Develop students' abilities/capabilities Creation of interactive learning environment Enable students to think creatively Motivation to students

There are unique features of smart learning environments that makes it a resilient learning environment as evident in Table 2. All the stakeholders stressed the significance of personalized learning that customizes the content according to the needs of the learners. Instant feedback in such environments is of high significance that provides a guidance to the students for their progress and keeps them on the track. Furthermore, availability of content in various form caters to the varying learning styles of the students.

Most administrators were considerate of the benefits of smart learning environments. They pointed out the reasons for their assertion that intelligent technologies make the environment more interactive, and multiple sensory channels are involved while learning in such an environment. Some also asserted that it is due to personalized experiences the smart learning environments provide that make them unique choices thus empowering both the faculty and the students.

The administrators consider teachers to be facilitators of learning in the smart learning environments instead of controllers of education. The classrooms are mostly of democratic set up. It is largely based on the constructivistic philosophy as propounded by Piaget and Bruner. The students remain active in such learning environments and take charge of their learning. The learning is mostly self-regulated and self-paced according to the need of the students. They are responsible for implementation and creation of such learning environment and optimize learning in such ecosystems. The teachers are the ones who monitor the progress of students and develop and search quality learning resources for them. The teachers also keeps the students motivated and enable them to think creatively and critically.

Discussion of the results

Smart learning environments are the result of evolution of digital technologies and smart devices (Peng, Ma and Spector, 2019). They have literally transform the landscape of our lives. Most significantly these have altered the way we teach and learn (Goodyear and Retalis, 2010; Mor and Craft 2012). These smart devices have made it possible for the students to learn at their own pace with the content which is tailored according to the needs of the students as enunciated by (Hwang, 2015; Chang and Hwang, 2018b; Liu et al., 2019). The results of this study are inline with these results . The results of the study also reveal that the smart learning environments with multimedia content have the provision for personalized learning which provides instant feedback in real time which was supported by (Hwang, 2015; Zhu, et al. 2016). The organization of the content is such that it reduces abstraction, improves retention of learning and provides opportunities for inetreactivity thus allowing the students to learn at their own pace. This corroborates with the studies conducted by (Zhu, et al. 2016). Although few studies refute the arguments putforth in the present study and highlighted the challenges faced by the students. In this regard it was emphasized by certain investigators that the students who were used to instructive based-learning had difficulty managing the learning process (Abuhammad, 2020; Alqurshi, 2020; Kolcu, Kolcu, Demir and Gulle, 2020).

The administrators also strongly emphasized that smart learning environments positively impacts the education of the students. The user rich-media with seamless access to pertinent information (Hwang et al., 2008; Hwang, 2015; Singh and Hassan, 2017) caters to the needs of the learners thus optimizing the learning. Simultaneously, the personalized content that adapts to the learner interface and subject contents (Hwang, 2015; Singh and Hassan, 2017; Chang and Hwang, 2018b; Liu et al., 2019) that these learning environments provided are an added bonus with customized feedback (Zhu, et al. 2016; Hwang, 2015; Singh and Hassan, 2017). Thus making the learning of students more of self-regulated one where students learn at their own pace and convenience (Schilit et al. 1994; Chan et al. 2006; Hwang 2014; Hwang, 2015; Singh and Hassan, 2017). This further allows for transfer of knowledge and skills learned from one context to another seamlessly (Kinshuk, Chen, Cheng, and Chew, 2016). However, certain studies proclaimed that the difficulty in content in smart learning environments poses difficulty for the learners (Bora, 2003; Li, Wang and Zhang, 2020). Moreover, such ecosystems motivates a variety of learners by recognizing their competencies and capabilities, learning styles and the interests (Spector, 2014; Singh and Hassan,

2017). Such environments does not seem convenient to students only but also to the teachers. The teachers can easily design and plan their lessons with the focus on the needs of the students. It also makes it feasible for the teachers and students to retrieve huge information (Singh and Hassan, 2017) and resources of high quality thus helpful in improving the access and quality of education for all. However, the designing of such ecosystems that integrates is quite challenging.
smart learning to enable customized and self-regulated learning is a challenging task (Gros, 2016). Furthermore, there is a lack of physical interaction among the students despite the opportunities for collaboration and enagement in virtual space (Stecula, and Wolniak, 2022). Separation from the peers and distance learning have very limited interpersonal contacts (Alqurshi, 2020; Rutkowska et al. 2021). Moreover, the integration of and implementation of such environment is a bit tricky and requires proper training on the part of the teachers, however the teachers lack such training (Irvin et al., 2010). Henceforth, it can be concluded that although there are a few studies that contradict the results of the study but more studies support the findings of the study that the smart learning environments have a positive impact on education.
The administrators assumed the teachers to be keyplayers in the smart learning environments. The teachers according to the administrators are the facilitators of learning similar to the study conducted by Daouk et al. (2016). They are the ones who hold the responsibility of creation and designing of interactive content, search suitable multimedia resources and monitor and record student's progress in such environments. The teachers also shoulder the responsibility of motivating the students to strive for their learning goals and become problem-solvers as pointed out by Zhu, et al. (2016). However, the isolation from the colleagues in these ecosystems affects the quality of teaching adversely (Ionescu, Paschia, Gudanescu Nicolau, Stanescu, Neacsu Stancescu, Coman, and Uzlau, 2020). Published literature also suggests that teachers face several challenges when implementing mobile technology into the classrooms for teaching which includes innovative teaching methods, anxiety, and extended teaching roles (Jie and Sunze, 2021).

Conclusion

The emerging pedagogy of personalized adaptive learning caters to the specific learning needs, and styles of the learners. It provides real-time monitoring of the student's performance, and lacunae, and customizes the learning according to the needs of the learners when a learner interacts with smart learning environments through intelligent technologies such as learner analytics, IoT, Big data, and cloud computing. So this pedagogy can be leveraged in the Indian education system where there is a large disparity in learning gains either due to a lack of resources or poor teaching methods.

The study has certain limitations also. Due to a shortage of time, the sample size is small. So it is recommended that the study be conducted by taking a larger sample to get an exhaustive set of data and including other disciplines. Experimental research can also be conducted to compare the effectiveness of such emerging pedagogies.

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