Trends on Technologies and Artificial Intelligence in Education for Personalized Learning: Systematic Literature Review

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Abstract

The continuous development of new technology and rapid advancement of Artificial Intelligence (AI) contribute to the improvement and enrichment of the teaching and learning process. AI technology promotes a flexible, customized, and effective learning environment, as well as improves other educational competencies via personalized learning. To create a personalized learning environment, AI collects, compiles, and interprets data from a variety of sources to create student learning profiles. However, a lack of information exists on incorporating AI technology into educational settings to promote teaching efficiency in Malaysia. AI technology helps to predict how well students will learn, so we can make content that is tailored to each person's goal and past success. To gain a better understanding of the concept and implementation of a personalized learning environment employing AI technology, a systematic literature review (SLR) was conducted to identify the trends of technologies and Artificial Intelligence in Education (AIEd) in promoting personalized learning. SLR has become the standard methodology for identifying answers by tracing the outcomes of past research by identifying and synthesising significant findings using systematic, transparent and repeatable techniques at each stage of the process. The literature search was performed in SCOPUS and Web of Sciences WoS) database and thirty-two articles from the years 2016 to 2022 were initially reviewed. From this number, 14 articles were included for analysis. Based on the findings, most learning elements, such as technology, teaching approach, teaching content can be adapted to each student's needs and learning intent in personalized learning. Personalised learning using AI is an approach that focuses on generating training to match the specific needs of each student such as in adaptive learning, online learning, MOOCs, and many other technologies. A few approaches on the other hand, appear to witness technological advancement as providing opportunities for individualised learning by applying analytical tools and algorithms to create automated adaptive learning activities and materials. The study of technologies for personalized learning in education in other nations has primarily concentrated on higher education, and it is advised that the scope of the research be expanded. In Malaysia. the implementation of these technologies in education should be bolstered. The research and practices reported in the study also show

how personalized learning was used and factors that made it work, thus the finding of this paper will guide other researchers to recognize various personal traits and the identification of appropriate technology trends and activities for further studies, as well as assist developers in the development of the personalized learning system and closely related to the adaptive learning systems.

Keywords: Personalized Learning, Artificial Intelligence in Education, AIEd, Educational Technology, Systematic Literature Review.

Introduction

Malaysia is now on the brink of what the World Economic Forum calls the Fourth Industrial Revolution (4IR). We are on the verge of a technological revolution that is fundamentally changing how we live, work, and communicate with each other. In Malaysia, AI in the fourth industrial revolution is a continuous extent convergence of new technologies along with the Internet of Things (IoT), Big Data Analytics, Augmented Reality, Cybersecurity, Simulation, Cloud Computing, Additive Manufacturing, System Integration, and Advanced Material (Ministry of International Trade and Industry, 2018).

AI is used in a wide range of applications and software for speech therapy, learning, planning, and problem-solving and is a must in many other technology industries, including the education field. Technology advancement in AI changes education radically and improves the skills needed to succeed in classrooms and workplaces. AIEd has grown as an interdisciplinary field from technology into a learning instruction context. Building future-ready education systems require consistent delivery of 21st-century curricula and free education for all (World Economy Forum, 2020).

The Malaysian Education Blueprint Plan (PPPM) 2013-2025 under Shift 7: Leverage ICT to scale up quality learning across Malaysia aims to maximize the use of ICT for self-directed learning to expand access to high-quality teaching (Ministry of Education Malaysia, 2013). The ICT Transformation Plan, Ministry of Education Malaysia (2019-2023) also supports PPPM in setting innovative, dynamic, and high-performing workforce targets for advancement in 21st-century education and pioneering the use of technology in line with digital capabilities to drive the educational agenda (Ministry of Education Malaysia, 2018).

The ongoing development of new technology and the rapid advancement of AI information and technologies will lead to the enhancement and enrichment of education methods. Technology has the potential to be a tremendous weapon for equality as well as to bridge gaps for those who have the least (Duncan, 2016). Exposure to the required content through technology facilities can also improve the quality of learning for students, as this will provide exposure to instructional materials and other tools for teaching and learning. The study that had been conducted by Adedokun-Shittu and Shittu (2015) showed that there is a significant impact of technology on students and their learning and teaching and learning styles.

However, this expectation is rarely applied effectively in the 21st-century classroom as technology develops appropriately in Malaysia. While the advantages of technology in other careers are calculated by comparing the results with the expected results, the use of technology by teachers is rarely linked to learning outcomes designed to facilitate students learning (Ertmer & Leftwich, 2011). Technology integration in teaching and learning is a vital

component of the ever-changing modern world. While emerging media is becoming increasingly common in schools and universities, scholars and educators continue to face challenges to identify strategies to improve their impact on students' learning (Normadhia et al., 2019).

Nevertheless, there is lacking information on incorporating technology and AI into education to promote personalized learning for teaching efficiency in Malaysia. Therefore, the study was conducted to review and highlight recent primary research that has been discussed in journal publications from the year 2015 to 2022 addressing the technology, features, and trends of a personalized learning environment that can more efficiently integrate AI into Malaysia's educational system. It is a hope that students will be able to access a broad range of content that is more engaging and interactive. They will also be able to learn some lessons at their own pace with teachers acting as facilitators rather than direct content providers. They will enjoy greater personalization of their educational experience known as personalized learning. With appropriate data and technology, this personalized learning can be utilized in Malaysia for the implementation of adaptive learning in the future.

Literature Review

The term AI has been applied to most computer programs and systems to perform more complex tasks than ordinary computer programs (McCarthy, 2007). Innovation in AI has evolved and changed the way we live, work, and communicate with one another (Netexplo, 2019). AI capabilities are now widely used in so many areas such as automation, information processing, national security, e-commerce, medical, entertainment, and education.

With the rapid development of AI technology in recent years, using AI in education has become more and more apparent. The emergence of these innovative technologies on teaching and learning methods is extremely beneficial in the classroom and significant (Shafie, 2019; Huang, 2021) as it enables teachers to access more current information, which improves their teaching as its attractive, easy, relevant, interactive and give learning experiences more effectively (Huang, 2021). With these advantages, teachers should be able to successfully integrate digital technologies into the teaching and learning process and derivative technological opportunities (Bozkurt et al., 2021).

For more than three decades, academic research on AIEd has made significant progress toward adopting a larger and more complex learning paradigm that enables successful teaching and learning (Luckin, at al., 2016). One of the importance of AIEd is that it promotes personalized teaching and learning. AI-driven, step-by-step personalized instructional and dialogue systems, smart agents in game-based learning, AI-supported exploratory learning, chatbots, student writing analysis to AI-friendly tutors are all part of AIEd (Holmes et al., 2019) where AI offers each learner their own tailored learning companion (Chaudhri et al, 2013.

Personalized learning can provide immersive learning experiences and intelligent learning tracking to help students improve their learning ability and efficiency according to students' needs and learning situations (Dishon, 2017). Learning in the AI era will be student-centered, with students taking the lead in learning activities (Chang and Lu, 2019) and creating their unique learning pathways (Chaudhri et al., 2013). It is designed to enable each student's academic performance by evaluating individual students' learning needs, interests, and goals

and then creating learning experiences that meet the needs of individual learners or groups of learners (Southgate et al., 2019).

These learning plans are based on the intelligent teaching system, autonomous learning content, learning progress organization, and participating in group cooperative learning (Walkington & Bernacki, 2020). It contributes to the developing field of learning analytics by assessing the quality of curricular resources, as well as adaptive learning and recommendation engines. It focuses on student behavior, achievement, and learning preferences to tailor the learning environment or assignment (Kakish, 2018). This personalized learning is an instructional approach that aims to tailor learning plans for each student's unique strengths, needs, skills, and based on what they know and how they learn best.

Methodology

To understand the concept and implementation of a personalized learning environment through the technology of AI in deeper, we conducted a literature review using Systematic Literature Review (SLR). The SLR attempts to comprehensively identify and synthesize relevant findings using organized, transparent, and repeatable procedures at each step in the process and became the standard methodology used to find solutions by tracing the results of previous research (Shaffril et al., 2020). The problems encountered in the SLR are referred to as research questions that keep the review focused. The research questions defined for this study is:

> **What are the current trends of activities and technology of Artificial Intelligent for Personalized Learning in Education?**

To get a comprehensive result, the literature search was performed in the most reputable and coverage journal article collections SCOPUS and Web of Science (WoS) database (Singh et al., 2021) that was published from 2016 to 2021. To answer that research question, we tracked published research results in that databases using specific search strings. The search string used in finding the appropriate literature is shown in Table 1.

Table 1: Search strings from Scopus and Web of Science

SCOPUS	TITLE-ABS-KEY(("personal* learn*" OR "adaptive learn*") AND ("technolog*") AND ("artificial intelligen*") AND ("education*" OR "learn*"))	282 results
(inclusive criteria)	TITLE-ABS-KEY((("personal* learn*" OR "adaptive learn*") AND ("technolog*") AND ("artificial intelligen*") AND ("education*" OR "learn*"))) AND (LIMIT-TO (PUBYEAR,2022) OR LIMIT-TO (PUBYEAR,2021) OR LIMIT-TO (PUBYEAR,2020) OR LIMIT-TO (PUBYEAR,2019) OR LIMIT-TO (PUBYEAR,2018) OR LIMIT-TO (PUBYEAR,2017) OR LIMIT-TO (PUBYEAR,2016)) AND (LIMIT-TO (DOCTYPE,"ar")) AND (LIMIT-TO (SUBJAREA,"SOCI")) AND (LIMIT-TO (LANGUAGE,"English"))	19 articles
Web of Science	TS=(("personal* learn*" OR "adaptive learn*") AND ("technolog*") AND ("artificial intelligen*") AND ("education*" OR "learn*"))	126 results
(inclusive criteria)	TS=(("personal* learn*" OR "adaptive learn*") AND ("technolog*") AND ("artificial intelligen*") AND ("education*" OR "learn*")) Refined by: PUBLICATION YEARS: (2022 OR 2021 OR 2020 OR 2019 OR 2018 OR 2017 OR 2016) AND RESEARCH AREAS: (EDUCATION EDUCATIONAL RESEARCH OR SOCIAL SCIENCES OTHER TOPICS) AND LANGUAGES: (ENGLISH) AND DOCUMENT TYPES: (ARTICLE) Timespan: All years. Indexes: SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, BKCI-S, BKCI-SSH, ESCI.	13 articles

The literature search was performed in the SCOPUS and Web of Science (WoS) search. The initial search came out with 282 articles from SCOPUS and 126 articles from WoS. However, 376 articles were removed by automation tools provided in the database that were based on inclusive criteria:

1. All studies published between 2016 and 2022
2. All studies are in social science and educational technology.
3. All selected studies had to be peer-reviewed articles.
4. All selected studies are written in the English language.

To make the process more relevant and optimum with the subject, eligibility criteria were set for the most relevant research to the issues and trends of technology and AI for personalized learning. 32 records were screened and 17 records were removed based on excluding criteria:

1. Duplicate record studies
2. Unretrieved record studies
3. A systematic review studies
4. Unrelated studies

Final 14 studies from the year 2016 to 2022 were analyzed. Analysis and quality process of systematic literature review (SLR) shown in Figure 1 through the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement template, that is used to explain the overall process of selected and rejected articles for the study. PRISMA statement helps the researcher to analyze and improve the results of review papers and facilitate transparent and complete reporting of systematic reviews (Page et al., 2020).

Identification of studies via databases

| Identification | Records identified from Scopus and WoS:

Databases (n = 408) | Records removed *before the screening*:

Records marked as ineligible by automation tools (n = 376) |

Records screened (n = 32) → Records excluded Duplicate records removed

Reports sought for retrieval (n = 26) → Reports not retrieved (n = 5)

Reports assessed for eligibility (n = 21) → Reports excluded:
Reason 1: Reviewed Paper (n = 6)
Reason 2 : Not related to the field of study (n = 1)

Studies included in the review (n = 14)

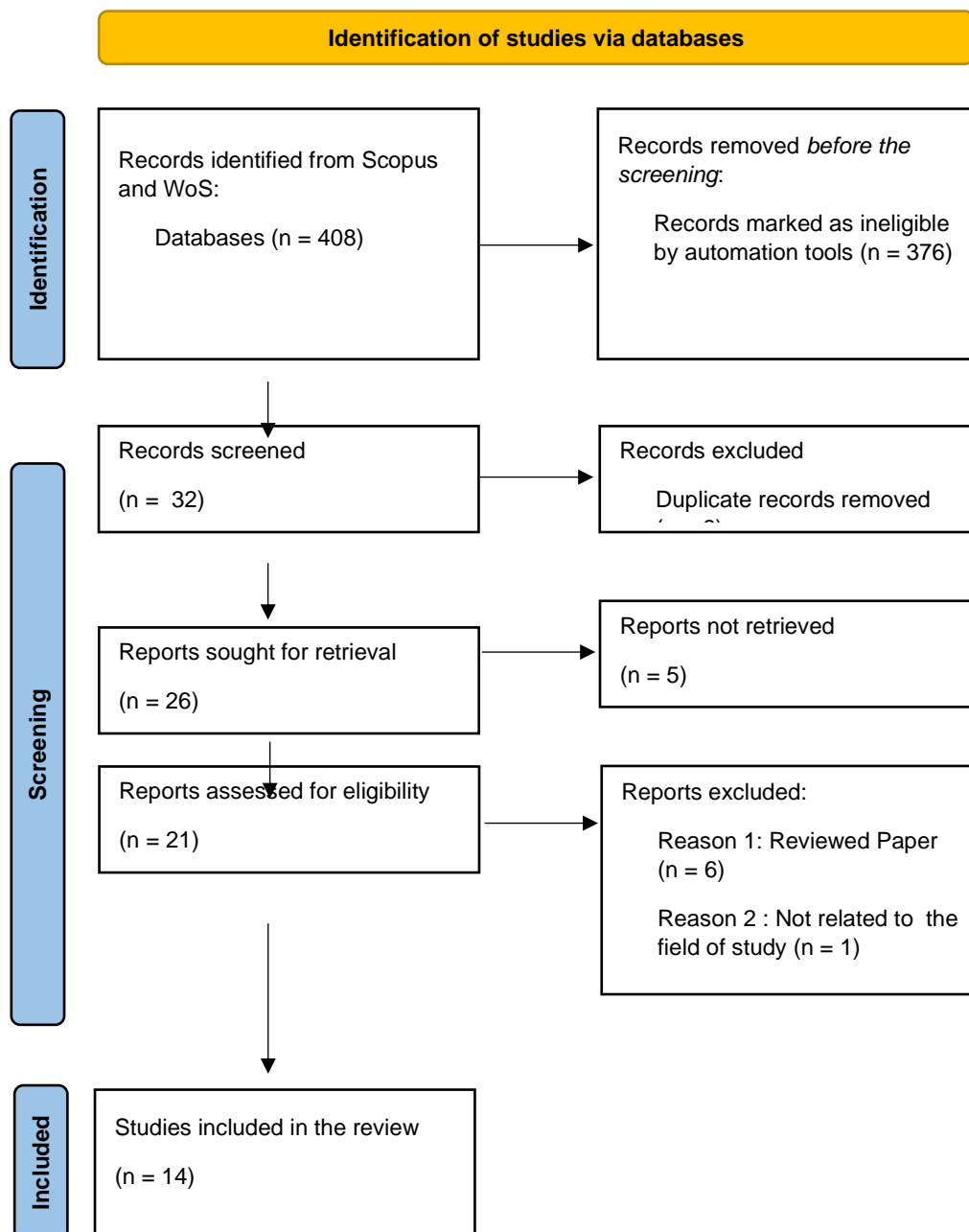*Figure 1: Adapted from Page, M. J. et al. The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. http://www.prisma-statement.org/*

Result and Finding

The findings from the results of a systematic literature review show that 14 studies have been successfully identified related to the issues and trends of technology and ai for personalized learning in education. A summary of that finding is presented below in table 2.

Table 2: Previous Issues and Trends of Activities on Technology and Artificial Intelligence for Personalized Learning in Education.

	AUTHOR AND YEAR	**TECHNOLOGY DISCUSSED**	**FOCUS GROUP**	**ISSUES AND TRENDS OF ACTIVITIES**
1	Loeckx (2016)	**MOOCS, GAMIFICATION, ADAPTIVE LEARNING, AND INTELLIGENT TUTORING SYSTEM**	**EDUCATION FIELD**	Discussion on MOOCs and other learning and teaching technologies accordingly disturbing established boundaries between formal and informal learning, public and for-profit education, teachers and learners, and between software and teaching practices.
2	Heffernan et al (2016)	**ONLINE LEARNING AND ADAPTIVE LEARNING.**	**HIGHER EDUCATION**	Examine the modest steps of ASSISTments (a popular online learning Platform) to accommodate learning technologies by crowdsourcing contributions from teachers and students with explanations, feedback, and other pedagogical interactions.
3	Isaías (2018)	**ONLINE LEARNING, LEARNING MANAGEMENT SYSTEM,** Adaptive Learning, Artificial Intelligence, Mobile Technology, MOOCs, Virtual Reality, Augmented Reality, Gamification, and Internet of Things.	**HIGHER EDUCATION**	Propose a model for the selection and adoption of emerging learning technologies to enhance learning. Each of these five characteristics, 1) personalized, 2) ubiquitous, 3) collaborative, 4) lifelong and 5) authentic is said to be attained by the model.

| 4 | Lippert et al (2019) | **INTELLIGENT TUTORING SYSTEMS.** | Higher Education and School Level | Describe the design of multiple conversational agents (computerized talking heads or embodied animated avatars) within the framework of intelligent tutoring systems by developing three programs: (1) Instruction with Deep-level Reasoning questions In Vicarious Environments (iDRIVE), (2) Center for the Study of Adult Literacy (CSAL), and (3) AutoTutor Operation ARA/ARIES. |

5	Alsobhi & Alyoubi (2019)	E-Learning and Learning Management System (Dyslexia Adaptive E-Learning Management System (DAELMS)	**HIGHER EDUCATION (SPECIAL NEEDS STUDENTS)**	Describe an adaptive e-learning system called dyslexia adaptive e-learning management system (DAELMS) to adapt to students' learning styles and dyslexia type.
6	Kazimzade et al (2019)	Adaptive Learning and Assistive Technology (AT)	**EDUCATION FIELD**	Discussion on possible directions for combining Artificial Intelligence in Education (AIED) and inclusive educational technologies and some emerging practices.
7	Picciano (2019)	**ONLINE LEARNING, ADAPTIVE LEARNING, CLOUD COMPUTING AND MOOCS.**	**HIGHER EDUCATION**	Exploring the potential of online and adaptive learning to change the traditional roles in colleges and universities to the point that many educators will reconsider their purposes as teachers, researchers, and administrators.
8	Krechetov & Romanenk (2020)	**ADAPTIVE LEARNING, E-LEARNING AND MOOCS.**	**HIGHER EDUCATION**	**PROPOSE A GENETIC ALGORITHM TO EXPLOIT ADAPTIVE LEARNING TECHNOLOGY AND TECHNIQUE BY DESIGNING A FEW VERSIONS OF SOFTWARE ARCHITECTURE BY UTILIZING VARIOUS TECHNOLOGIES, PROGRAMMING LANGUAGES, AND SERVERS.**
9	Kashive et al (2021)	**E-LEARNING.**	Education Field	Discussion on the perception of the users concerning the role of artificial intelligence (AI) in enhancing personal learning profile (PLP), personal learning network (PLN), and personal learning environment (PLE) and their effect on the perceived ease of use, perceived effectiveness and perceived usefulness for enhancing the overall attitude and satisfaction of the e-learning.

10	Pence (2020)	Artificial Intelligence, Mobile Computing Cloud Computing, **3D PRINTING, VIRTUAL REALITY, AND AUGMENTED REALITY.**	**HIGHER EDUCATION (CHEMISTRY FIELD)**	Discussion on new technologies that focus more on individual experience than a group activity and the challenges to develop social skills by integrating social constructivism with these types of technological advances.
11	Lorenzo et al (2021)	**ARTIFICIAL INTELLIGENCE, ADAPTIVE TECHNOLOGY, AUGMENTATION TECHNOLOGY, DIGITAL IMMERSIVE**	**EDUCATION FIELD**	Discussion on theoretical reflections and recommendations for implementing smart **LEARNING SPACES IN SCHOOLS.**
12	Qushem et al (2021)	MOOCs, Artificial intelligence, Gamification, learning management systems, mobile applications, augmented reality, virtual reality	**EDUCATION FIELD**	Discussion on personalized or precision education (PE) to the integration of multimodal technologies to tailor individuals' learning experiences based on their preferences and needs.
13	Harati et al (2021)	Artificial Intelligence, Adaptive Learning (Assessment **AND LEARNING IN KNOWLEDGE SPACES (ALEKS) SYSTEM)**	**HIGHER EDUCATION**	Discussion on the results of administering the newly developed Adaptive Self-regulated Learning Questionnaire (ASRQ) in an adaptive learning course equipped with the ALEKS (Assessment and Learning in Knowledge Spaces) system to the amount of Self-regulated Learning Skills (SRL) score.
14	Reiss (2021)	**ARTIFICIAL INTELLIGENCE**	**EDUCATION FIELD**	Discussion on the practicalities of AI in education and ethical issues it raises.

Discussion

Years of Publication

The systematic review results have shown that the number of publications related to technology and AI for personalized learning in education is becoming more common in study and practice from 2019 onwards. However, no articles were found for 2022 due to a database search made in early January 2022.

Focused Group of Study

Most studies are focused on higher education level, some are general in the education field, and only one study was found at the school level, which has been done by Lippert et al (2019) on Intelligent Tutoring Systems (ITS). Recent years have also witnessed technology and AI for personalized learning initiatives for special needs students. The development of the Dyslexia Adaptive E-learning Management System (DAELMS) has been discussed by (Alsobhi and Alyoubi, 2019). Overall, the findings show that technology and AI are fit for personalized learning and are more widely used in various educational settings.

Common Terms and Technology Discussed

To discover the most frequently used terms and discussed topics, a word cloud is used, as seen in Figure 2 and Figure 3. Word clouds are quantities visualizations that refer to graphical representations of data that include counts of textual characters, attributes, or sequences. Data visualization is a simple and efficient way to communicate information. It can be used for compelling storytelling, identifying trends, recognizing patterns, attracting audience awareness, and presenting summary representations of different data types (Conner et al., 2019).

Figure 1 shows that five commonly used terms that can be applied in a wide range of contexts on trends of activities and technology of Artificial Intelligent for Personalized Learning are (1) learning, (2) education, (3) technology, (4) students and (5) systems.
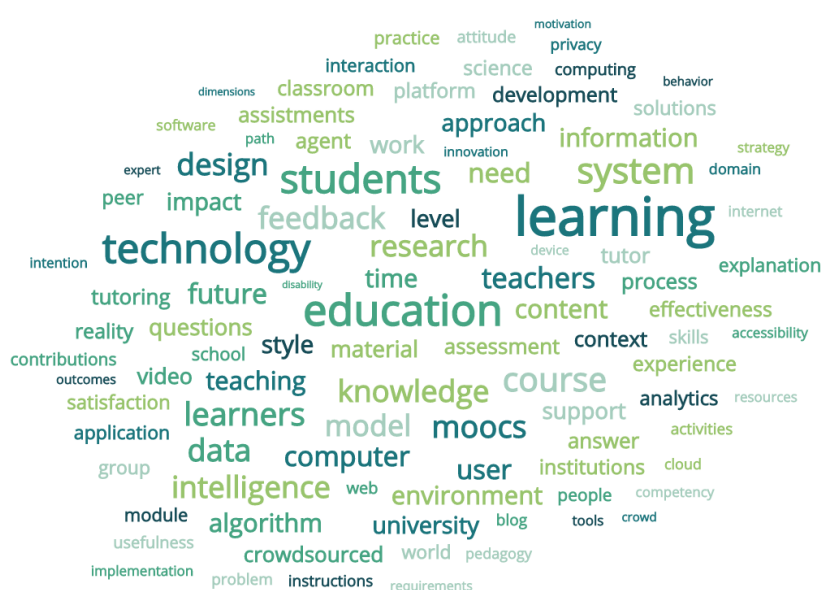

Figure 2: Word cloud generated from 14 articles on common terms discussed

While Figure 3 shows that three commonly discussed technology in selected articles is (1) adaptive learning, (2) online learning, and (3) MOOCs.
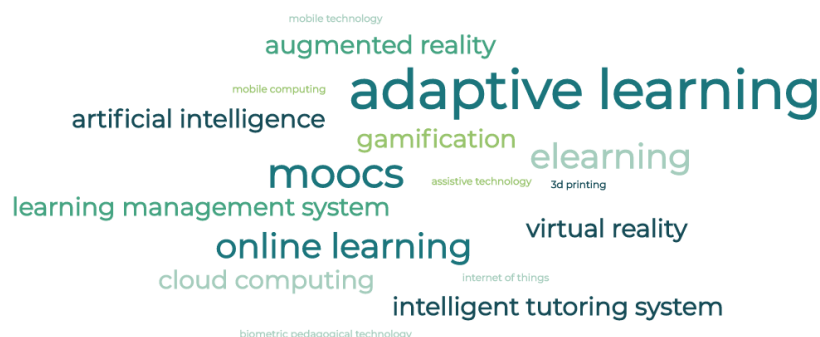

Figure 3: Word cloud generated from 14 articles on common technologies discussed

The Trend of Activities and Technologies for Personalized Learning
Personalized learning is an instructional approach that tailors learning to students' needs, capabilities and interests. According to Patrick et al. (2013), personalized learning means adapting learning to the interests, strengths, and requirements of each learner. This approach encourages learners to be flexible in their learning and gives them control over how, what, when, and where they learn.

Teachers have used various activities to practice personalized learning, but technology can provide the education field with a new experience for better achievement. Technology has been crucial in addressing student variability and facilitating individualized learning progress. Students can easily adapt learning materials to meet their needs using digital tools to aid in information processing and demonstrate their understanding in their distinctive way. They have complete control over the learning materials at their own pace and convenience. AI algorithms can be used to deliver a more personalized instruction (Isaias, 2018) that will help to predict learning outcomes tailor the material to each learner's goals and previous performance. Without artificial intelligence technologies, personalization at scale could be difficult (Kazimzade et al., 2019).

Based on the results of findings, Krechetov and Romanenko (2020); Kashive et al (2020); Lippert et al (2019); Alsobhi et al (2019); Harati et al (2021) have researched the system developed by themselves namely Adaptive learning system, E-learning system, Intelligent Tutoring System (Instruction with Deep-level Reasoning questions In Vicarious Environments (iDRIVE), Center for the Study of Adult Literacy (CSAL), AutoTutor Operation ARA/ARIES), Dyslexia Adaptive E-Learning Management System (DAELMS) and Adaptive Self-regulated Learning Questionnaire (ASRQ)) that meet personalized learning experiences.

Krechetov and Romanenko (2020) proposed a solution for mapping optimal individualized learning paths for students enrolled in online courses, using the ratio of course completion knowledge to course time spent as an optimality criterion. This optimization problem is solved using a genetic algorithm. The proposed technology is implemented in practice by a set of

tools for extending the adaptive learning capabilities of distance learning systems and a module for operating the genetic algorithm.

Research by Lippert et al. (2019) has shown that the developed system, Conversational Intelligent Tutoring Systems (CITS) and multi-agent CITS (MACITS) thru the iDRIVE system have been successfully implemented as multi-agent designs to facilitate learning in multiple pedagogical for collaborative problem solving (CPS) and virtual environments. To help hundreds of thousands of students master content, learn strategies, think critically and write effectively is the hope.

According to Qushem et al (2021), personalized or precision education (PE) techniques could leverage the instructional potential of educational platforms and tools by facilitating students' knowledge acquisition and skill development. The use of multimodal technologies (e.g., MOOCs, serious games, artificial intelligence, learning management systems, mobile applications, augmented/virtual reality, and classroom technologies) to tailor individuals' learning experiences is examined. Positive outcomes were also identified in blended/face-to-face learning scenarios, revealing that the added value of PE extends beyond the online digital learning context, with multiple connections being discussed between the impact of PE on student efficacy, achievement, and well-being.

Kashive et al (2020) found that the personal learning profile (PLP), personal learning network (PLN), and personal learning environment (PLE) are all essential components of personalized education. The users' technology perceptions of AI's role in enhancing personalized learning have also been captured in the study. Meanwhile, Loeckx (2016) discusses MOOCs and other computerized learning technology. According to the study, changing roles and economies of degrees, courses, and teaching, as well as increasingly scalable personal learning experiences, automated technology may have a significant organizational impact on institutions.

The Technologies and Potentials
The current generation of digital natives is very comfortable with technology. Today's students are technologically savvy, and the pervasive presence of technology in their lives has fostered a new participatory culture among today's and future generations of learners (Loeckx, 2016).

There are numerous approaches to individualized learning. At the same time, some approaches appear to view technological innovation as enabling personalized learning by utilizing analytical tools and algorithms to provide automated adaptive learning tasks and contents. The conceptions view educational technology as a collection of tools that assist teachers in tailoring their teaching methods to the needs of individual students and allowing for student choice while monitoring student progress and providing scaffolds and feedback. The application of AI in education has enabled the complete integration of teaching and learning and the possibility of reforming teaching and learning (Huang, 2021). The article discusses the application of artificial intelligence in education, including adaptive learning, teacher evaluation, and virtual classrooms.

Meanwhile, Isaas (2018) developed a model for selecting and adopting emerging learning technologies to enhance learning. According to the model, each of these five characteristics,

(1) personalized, (2) ubiquitous, (3) collaborative, (4) lifelong, and (5) authentic, must be facilitated by the use of appropriate technologies: adaptive learning technologies, artificial intelligence, mobile technology, social technology, massive open online courses, virtual and augmented reality, gamification, and the Internet of Things.

Pence's (2020) study on How Should Chemistry Educators Respond to the Next Generation of Technology Change demonstrated that new educational technologies described a greater emphasis on individual experience than on group activities. Educators will need to reconcile social constructivism with these technological advancements.

According to Picciano (2019), colleges and universities have been open to changing and adapting to new technologies that may benefit their students. These changes are most effectively implemented through meticulously planned and developed projects, programs, initiatives, and collaboration with private companies that can contribute financial resources and expertise to the issues that AI will inevitably bring.

Lorenzo (2021) describes that evolved technology can assist in the creation of smart learning environments. The classrooms will consist of several intelligent learning spaces that will eventually incorporate some level of artificial intelligence. Such platforms will require the construction of a well-conceived pedagogical framework and the integration of such artificial intelligence tools into the pedagogical matrix. They must be developed ethically to provide students with individualized self-access and interconnections that facilitate interaction with one another.

This contribution discusses possible directions for integrating AIED and inclusive educational technologies and highlights some emerging practices. There is a need for heightened awareness of potential biases when developing learning systems and training algorithms using appropriate data sets (Kazimzade et al., 2019). In the near- to medium-term future, AI has the potential to enhance student learning and supplement the work of (human) teachers without dispensing them. AI should increasingly enable traditional learning divides such as 'school versus home' to be straddled (Reiss, 2021).

Adaptive Learning
Adaptive learning is a methodology for determining a student's level of knowledge and learning styles and adapting materials, tasks, and delivery methods to meet the needs of learning process participants. To aid students' learning, adaptive learning attempts to incorporate all aspects of testing, teaching, learning, and practice into the adaptive learning system (Van Der Vorst & Jelicic, 2019).

When there is no direct access to in-person instructors, adaptive learning, as a new form of online learning, can focus on the needs of each learner and assist them with their learning process by adapting learning materials based on their knowledge level and personalizing their learning path (Harati et al., 2021).

Learning Management System (LMS) Moodle provides various adaptive learning solutions that give administrators and teachers the tools they need to vary all stages of the learning process, from information delivery to assessment (Morze et al., 2021). The developed

adaptive learning management system, namely Dyslexia Adaptive E-Learning Management System (DAELMS), proves that when the system provides the user with learning materials that match their learning style or dyslexia type, it improves their learning outcomes (Alsobhi et al., 2019).

This adaptive learning system was also discussed in research that had been done by (Kazimzade, et al., 2019; Picciano, 2019; Harati et al., 2021). Meanwhile, Krechetov and Romanenko (2020) has proposed a genetic algorithm to exploit adaptive learning technology and technique to create an autonomous system of teacher-less learning as an effective student profiling tool in e-learning, providing teachers with extensive student performance analytics and allowing them to adjust individual learning paths.

According to Heffernan et al (2016), the incorporation of sound experimental design and crowdsourced content into adaptive learning systems can produce a large-scale systemic change for educational reform while also advancing the collaborative knowledge of those researching AIED.

Online Learning and E-Learning

In recent years, advanced technology has facilitated the emergence of online learning as a new mode of instruction. Without regard for time constraints, learners can access the online learning environment and study from anywhere using the Internet and various online learning platforms. This mode of learning enables greater adaptability in educational settings. The provision of online teaching materials or videos for learners to view is a common feature of various online learning platforms, which also combines the benefits of online learning without regard for time or location constraints (Hwang et al., 2021).

Heffernan et al (2016) conducted a study on existing online learning technologies, ASSISTments. They discovered that they have the potential to collect teacher- and learner-sourced contributions and rigorously test their effectiveness and that the implementation of adaptive learning platforms was heavily influenced by crowdsources known as the AIEd community. Utilizing crowdsourced knowledge will enable the AIED community to advance adaptive learning platforms. The majority of participants in the learning process agree that they benefit from knowledge acquisition regardless of the time, location, or device used. Among the benefits mentioned are the ability to revisit previously learned material multiple times, segment the material, and consume information via various educational materials (video, infographics, presentations, text, and quizzes, for example).

E-learning courses have grown in popularity to deliver knowledge to higher education institutions. Wikipedia has established itself as a necessary tool for students, and teachers are already utilizing E-textbooks and specialized apps (Loeckx, 2016). Numerous scholars believe that online learning benefits students' self-directed learning and recommend increasing guidance or introducing learning strategies to assist students in experiencing in-depth learning in an online learning environment.

Blended learning is an educational trend that enables the requirements above to be met. It has several advantages, including usability, consideration of individual abilities, additional materials, and activity monitoring. Although it incorporates both offline and online learning, the effectiveness of the e-learning courses used to implement it is critical (Morze, et al., 2021).

Massive Open Online Courses (MOOCs)

MOOCs have the potential to transform the educational industry completely. Digital natives, who are at ease with new technologies such as social media, mobile devices, cloud computing, and big data, find their style of living in deep conflict with the prevalent archaic way of teaching. MOOCs have transformed the way basic education is delivered, eradicating time and space constraints and transforming the contexts in which they are used (Krechetov & Romanenko, 2021)**.**

Isaias (2016) also mentioned that MOOCs are particularly advantageous in situations where there is widespread online enrolment (for example, a Stanford course on AI is reported to have attracted up to 150,000 enrolments); where there is a wide geographical diversity of students; and where students desire access to courses taught by prestigious higher education institutions.

On another finding, Loeckx (2016) stated the four pillars in society that provide the current drive and context in the MOOC movement which are, (1) technology, (2) culture, (3) society, and (4) economy. MOOCs' ultimate goal is to close this gap by providing affordable, democratic education to the masses. The digitalization of instruction, gamification, and the stringent need for massively scalable (and thus computerized) personal learning experiences are indeed presenting golden opportunities for Artificial Intelligence and Technology Enhanced Learning.

Conclusion

This paper summarizes the trend of a personalized learning environment, focusing on the characteristics, supporting technology, and applications built by AI for personalized learning. The findings also show how personalized learning was used and what factors made it work, as shown by the research and practices reported in the study. It will be challenging to develop teaching strategies that incorporate these technologies while also encouraging interpersonal participation to prepare students for the collaborative work environments that they will encounter in the modern workplace. In Malaysia, change is the watchword; as roles shift, classrooms are reinvented, and content becomes more accessible. The pervasiveness of learning technology and the selection and adoption of emerging learning technologies to enhance learning are at the heart of these changes. Thus, to remain competitive in the face of a new global economic challenge, Malaysia's education must change with the advancement of AI technology.

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