Using a Personalized Learning Application to Teach High School Students

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Doi: 10.21608/ajahs.2024.365891

استلام البحث ٢٠٢٤ / ٥ / ٢١
قبول البحث ٢٠٢٤/ ٦ /٦

Alnafea, Seham S. & Filimban, Ghadeer Z. (2024). Using a Personalized Learning Application to Teach High School Students. ***The Arab Journal of Literature and Human Studies***, The Arab Institute for Education, Science and Letters, Egypt,8(32), 659-692.

http://ajahs.journals.ekb.eg

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Abstract:

Saudi Arabia has undergone development in recent years in many terms, both economically and educationally. Economic development has led to the aspiration for advancing human capital and train skilled professionals. Ambitious educational objectives for the country have been set as well based on the use of modern technology. Using applications for personalized learning in high schools is a core element in the process of creating an innovative, flexible and adaptive educational system. Therefore, following the global educational trends, Saudi Arabia has been showing the continuous commitment to innovative educational methods and technologies. They have been pursuing a constant aim to provide Saudi high school students with basic knowledge as well as to develop their individual abilities to be ready to participate effectively in the global society and economy.

المستخلص:

شهدت المملكة العربية السعودية في السنوات الأخيرة تطوراً على العديد من النواحي، اقتصادياً وتعليمياً. وقد أدت التنمية الاقتصادية إلى التطلع إلى تطوير رأس المال البشري وتدريب المهنيين المهرة. كما تم تحديد الأهداف التعليمية الطموحة للبلاد بناءً على استخدام التكنولوجيا الحديثة. يعد استخدام تطبيقات التعلم الشخصي في المدارس الثانوية عنصرًا أساسيًا في عملية إنشاء نظام تعليمي مبتكر ومرن وقابل للتكيف. ولذلك، وفي أعقاب الاتجاهات التعليمية العالمية، أظهرت المملكة العربية السعودية الالتزام المستمر بأساليب وتقنيات التعليم المبتكرة. لقد كانوا يسعون لتحقيق هدف ثابت لتزويد طلاب المدارس الثانوية السعوديين بالمعرفة الأساسية بالإضافة إلى تطوير قدراتهم الفردية ليكونوا مستعدين للمشاركة بفعالية في المجتمع والاقتصاد العالمي.

Personalized learning is not a novelty. The underlying ideas can be found in the writings of philosophers since the times of antiquity. The ancestors of personalization of education are Aristotle, Locke, Rousseau, Dewey, and many others.

ISSN : 2537-0421 eISSN : 2537-043X

Theoretical development and the application of personalized learning dates back to the first half of the 20th century and was an idea about optimal conditions for individual development and socialization of the personality of each student. Personalized learning, while not a novelty, is an innovation. It is the process of changing the characteristics of the educational system, the process of searching for technologies and methods of personalized learning, their development, implementation in the educational process and creative rethinking. Modifying learning activities using personalized learning is still ongoing and suggests that personalized learning is an innovation. These days, it has been an inexplicable aspect of Saudi education to utilize personalized mobile applications in the teaching and learning processes. Furthermore, this tendency highlights the country's desire to modernize the education system and be ready to face the challenges and demands of modern students. Some examples of applications used in Saudi Arabia high schools include teaching languages, mathematics, personalized training. There are mobile applications that provide students with interactive English language learning opportunities. Students are provided with the opportunity to learn English in an interactive way and developing a set of communication skills. There are also applications focused on math studying that provide unique methods of teaching. In that way, students are able to learn complex mathematical concepts, solve problems and receive feedback. Mathematical concepts can be easily understood and studied in a playful way. For example, Khan Academy provides educational videos, lessons and exercises and depicts a personalized approach to learning. Therefore, students are presented with individualized learning opportunities. Modern times create more complicated challenges. With digital technologies, teachers can more quickly test students' work and grades, allowing them to focus on other aspects of learning. On

ISSN : ***2537-0421*** **eISSN :** ***2537-043X***

the training platforms, there are tests with automatic answer checking. The student can, at a convenient time, pass such a test, learn the results and understand the errors.

Introduction

These days, technologies have been actively penetrating the field of education at the same time providing unique opportunities for personalized learning. In Saudi Arabia, the personalized learning applications have been widely adopted as a key aspect of the educational system, especially in the context of high school. Widely considered to be a good way to meet the individual educational needs of high school students, personalized learning provides them with the opportunity to develop skills and deepen the knowledge based on the level of preparation and interests. Therefore, exploring the importance of using apps for personalized learning in Saudi high schools would be an essential area as well as studying of the principles of their effective implementation (Alenezi, 2023).

Modern educational landscape depicts personalized learning as increasingly relevant, particularly in the Saudi Arabian context. A vast progress in the sphere of technologies allows for the creation of applications that might be adapting to each student's level of knowledge and their needs (Alhramelah & Al-Shahrani, 2020). Hence, a unique educational experience is to be created. Among the core benefits of using apps for personalized learning, one may find the ability to individualize learning for each student. In this way, teachers will be able to accommodate the diverse backgrounds coupled with learning rates and characteristics of their students. When high school students end up choosing a future career field, personalized learning is a technique to dive deeper and more meaningfully into the subjects related to potential careers (Alyami, 2014).

Personalized learning applications also promote student autonomy and responsibility. Students can choose topics,

ISSN : 2537-0421 eISSN : 2537-043X

learning materials and pace of learning according to their own interests and temperament. This personalized approach fosters self-regulation skills in high school students, which is an important aspect of preparing them for their future independent lives and professional careers.

This closely follows the paradigm of personalized learning applications providing continuous monitoring of each student's academic performance and progress (Alenezi, 2023). This system can enable teachers and parents to track individual achievements and difficulties effectively. As a result, students' needs can be responded quickly and adjusted to the curriculum. Equally important is the idea that personalized learning using apps contributes to creating a more motivating and interesting learning surrounding. When high school students are able to choose their learning materials and methods, they become more actively involved in the learning process. Consequently, increased motivation and interest can be observed.

All in all, the implementation of personalized learning applications in Saudi Arabian high schools represents a promising direction for the modern educational system. This innovative approach meets the needs of diverse students and contributes to the development of active, motivated and independent individuals who are ready for the challenges of the modern world.

Background

What is known about the historical context of use of personalized learning applications in Saudi Arabian high schools can be traced in the broader trends of education and technology in the country. Since the beginning of the 21st century, Saudi Arabia has been actively modernizing its educational system. At the same time, the importance of preparing the next generation for the challenges of globalization and the digital age is being addressed vastly (Allmnakrah, et al., 2019).

ISSN : ***2537-0421*** **eISSN :** ***2537-043X***

In 2005, the Royal Education Project initiative was launched with an aim of improving the quality of education in the country. The project embraced a range of activities to introduce new technologies in the educational process, including high schools. There was also a financial support from the government. At that time, institutions began to incorporate modern technology into curricula and prioritizing the interactive and personalized approaches.

The following years highlighted Saudi Arabia working actively on the development of information and communication technologies in education. In addition, an integral part of strategy involved the projects focused on digitalizing learning materials, creating online resources and digital libraries. Hence, a wider access to educational resources was granted, and the quality of learning improved (Alyami, 2014).

Saudi Arabia's economic development incorporated the desire to develop human capital and train skilled professionals. The new economic strategy presented in Vision 2030 sets ambitious educational objectives for the country, including the use of modern technology to train a highly skilled workforce. In this context, the use of applications for personalized learning in high schools can be considered a key element in the process of creating an innovative, flexible and adaptive educational system. Taking into account the global educational trends, Saudi Arabia is committed to innovative educational methods and technologies and aims to provide its high school students with basic knowledge as well as developing their individual abilities to be ready to participate effectively in the global society and economy.

E-Learning Platforms

The Royal Education Project has developed and implemented e-learning platforms such as Edmodo. This platform provides students with access to digital learning

ISSN : *2537-0421* eISSN : *2537-043X*

materials, interactive lessons and assignments. Students can choose their own subjects, interact with teachers and fellow students in a virtual environment, which promotes personalization of learning. Some schools in Saudi Arabia implement adaptive learning programs that use artificial intelligence (Alhramelah & Al-Shahrani, 2020). For instance, there is a system that automatically analyzes a student's progress and can offer personalized learning materials, which will match student's level of knowledge.

Virtual laboratories are introduced for studying science and math. Those applications can provide the opportunity for conducting experiments in a virtual environment. In this way, students' interest becomes activated and they can apply theoretical knowledge in practice. What is more, educational games contribute to a higher level of engagement and development of critical thinking. Apart of that, educational institutions in Saudi Arabia make extensive use of interactive online courses provided by such platforms as Coursera, edX and others. High school students make a choice of courses based on their interests and are granted an exceptional chance of expanding educational opportunities beyond standard curricula (Alyami, 2014).

To conclude, these examples are to demonstrate how the use of personalized learning applications in Saudi Arabian high schools have been adjusted to become an integral part of the educational process. More importantly, they are enriching the student experience and providing a personalized approach to learning.

Significance of the Study

Employing the educational platforms in Saudi Arabia has been gaining an important strategic role within modernizing the educational system and preparing young people for the demands and challenges of the modern world. Recent methods focus on

ISSN : ***2537-0421*** **eISSN :** ***2537-043X***

overcoming the problems by proposing different schemes for determining several key factors that can emphasize the importance of implementing educational applications.

First of all, there is a high level of contribution to the digital transformation of education. By this, it is meant that educational platforms and apps play a critical role in the digital transformation of Saudi Arabia's educational system. When the latest technology in the learning process is introduced, there is a high level of support given to the creation of an educational environment that will correspond to the current trends and needs of learners. Furthermore, educational learning applications provide the opportunity for personalized learning, which is of the utmost importance in the high school environment (Alhramelah & Al-Shahrani, 2020). Students are provided with an opportunity to choose the level of difficulty of assignments, subjects, and the pace of learning based on their temperament.

Secondly, this process has a wide applicability in developing information literacy and digital skills. To be more specific, the introduction of educational applications helps develop information skills in a digital environment. This yields a significant aspect of preparing for modern labor market, where digital literacy is a prerequisite for a successful career. Besides, the personalized apps enhance the global accessibility to education. Educational platforms grant access to studying regardless of a student's location. It is especially crucial for students in remote or sparsely populated regions, where access to high-quality education may be limited (Elyas & Picard, 2010).

Last but not least, the additional advantage of this method is preparing young people for adult life in the times of digital economy. In light of Saudi Arabia's Vision 2030 strategy to develop an oil-dependent economy, the use of educational platforms has been considered a vital tool to prepare youth for being knowledgeable, skilled, and independent within digital

ISSN : 2537-0421 eISSN : 2537-043X

economy era. By this, training highly skilled professionals in technology, innovation and entrepreneurship is meant. In addition, updating and upgrading educational methodologies takes place along with the above-mentioned idea (Allmnakrah, et al., 2019). The introduction of learning applications requires the revision of traditional teaching methods. What is more, it encourages teachers to be innovative and facilitates their constant updating of curricula and methodologies to be aligned with modern educational standards.

All in all, the use of personalized learning applications in Saudi Arabia complies with the national strategic educational and economic goals. As well, it provides students with the unprecedented tools to become active participants of the global educational environment and digital economy.

Research Questions

This study outlines the importance of using personalized learning applications in Saudi Arabia high schools. Several key questions can be addressed to better understand the effectiveness and implications of this technique. It is fundamental to note that the effectiveness of implementing educational platforms for personalized learning in high schools compared to traditional teaching methods should be analyzed to better understand what specific student outcomes and achievements can be observed. This relates to high school students' achievements, motivation, and skills development.

Another critical aspect is the way how educational platforms affect access to education, what the feedback from teachers and students is, and what obstacles or challenges may arise in the process. Besides, the extent to which educational platforms contribute to the development of digital literacy among high school students is under the focus of attention as well as their preparation for the demands of the digital economy.

ISSN : ***2537-0421*** **eISSN :** ***2537-043X***

Literature Review

Establishing why this topic is really important, it is essential to comprehend that at the heart of personalized learning, there is the understanding of the importance for a learner to be able to choose the most interesting or critical learning material for themselves. In addition, a learner should be able to determine or adjust the pace of learning their needs, i.e. to adapt learning to their needs and capabilities instead of following a certain fixed course structure. This understanding did not emerge at once, but went through a number of transformations (Ambele, 2022).

Several studies show that the basis of personalization ideas can be traced in the works of philosophers and educators from the 17th century. John Locke in his treatise in 1693 wrote about the need for a teacher to take into account the mood of a student and choose the moment when the student is tuned to learning and ready to respond and justified the need by the fact that students have different temperaments and properties of character, which must be taken into account when teaching (Bray & McClaskey, 2014).

Jean-Jacques Rousseau describes the ideas of natural learning and says that a child in learning should follow their inclinations. In the early 19th century, John Lancaster created a model of learning in which each discipline studied was divided into levels, and students were assigned to these levels before they began learning. In this case, a student could get to the advanced level for a writing course and to the elementary level for a math course. In this way, the teaching content was matched to a learners' knowledge and abilities (Bray & McClaskey, 2014).

Generally speaking, personalized learning is not a novelty, since the underlying ideas can be found in the writings of philosophers since the times of antiquity. The ancestors of

ISSN : 2537-0421 eISSN : 2537-043X

personalization of education are Aristotle, Locke, Rousseau, Dewey, and many others. The beginning of theoretical development and the application of personalized learning dates back to the first half of the 20th century. Personalized learning in the version proposed by the American educator, H. Parkhurst, aimed to create optimal conditions for individual development and socialization of the personality of each student (Bray & McClaskey, 2014).

This was realized in the following way: the student was asked to choose the subjects he was going to study, to determine the pace of their development. Although this approach to education has worked relatively well in practice, it has been poorly and fragmented around the world. The main obstacle was that full-fledged personalized education is expensive and requires a team of highly skilled professionals. One teacher should have about three or five learners. The advent of digital technologies in the field of education has radically changed the situation, and in the early 21st century, teachers again turned to the ideas of personalized learning (Makhambetova et al., 2021).

Personalized learning, while not a novelty, is an innovation. Based on the ideas of personalized learning, it is the process of changing the characteristics of the educational system, the process of searching for technologies and methods of personalized learning, their development, implementation in the educational process and creative rethinking. Modifying learning activities using personalized learning is still ongoing and suggests that personalized learning is an innovation. Thus, it is connected with the process of finding educational technologies that implement the basic ideas of personalized learning. The analysis of learning technologies adequate to the fundamental principles of personalized learning must begin with the identification of the main features of personalized learning (Buckley, 2006). The leading attribute of personalization is the

ISSN : ***2537-0421*** **eISSN :** ***2537-043X***

subjective position of the student. Personalization of education implies that the student becomes the main subject of education. The main function of the teacher is a kind of delegation to the student of the function of subjectivity, the position of the subject of own education (Ambele, 2022).

Speaking about personalized learning, individualized learning, and adaptive learning based on the roles played by an educator and a learner, in individualized and adaptive learning, the educator makes choices based on his vision of the needs, interests, abilities and limitations of the student. At the same time, in personalized learning, the learner manages their own learning, correlates learning with interests, talents, hobbies and desires, actively participates in the design of learning and determines goals and indicators of success, that is, actively involved in all components of learning.

A few researchers have noted the active role of the student. For example, two ways of personalizing learning have been identified: personalization for a learner, in which learning is adapted to a learner by a teacher, and personalization by a learner themselves, in which a learner builds their own learning (Makhambetova et al., 2021).

Based on these traits, it is possible to determine the technological content of personalized learning. Depending on its characteristics, the technologies can be divided into the following groups. The first one will constitute the technologies that allow students to define their own learning goals. This group can include technology design and contextual competence training. Besides, a person can also predict their professional future on the basis of formation of competences of self-education, professional-personal development and self-actualization of cognitive abilities (Bray & McClaskey, 2014).

Context-competence training is a process during which the subject and social content of future professional activity of

ISSN : 2537-0421 eISSN : 2537-043X

students is consistently modeled. Contextual and competency training creates conditions for the meaningful development of the content of future professional activity depending on personal professional plans. In addition, there is also a group of technologies that provide a choice of pace and level of learning material. An inverted class is a technology that assumes that the main absorption of new material by students takes place at home, and classroom time is allocated to tasks, exercises, laboratory and practical research, individual consultations of the teacher (Ambele, 2022).

The format of individual consultations with the teacher helps the learner avoid frustration and fear of not understanding the new material. It also allows the teacher to see the progress of each individual. The student acquires knowledge when they are comfortable, learns the material at their own pace, can watch video or listen to audio as much as they see fit, make a pause for the outline or simple perception of new information. Apart from that, there are more additional sources for self-training: Internet resources, dictionaries, etc. An important advantage of this technology is that it does not require expensive technical devices.

Another group includes technologies that ensure the construction of personalized learning trajectory. Developing it requires the support of a tutor, as the student is not always competent in the field of educational opportunities and resources. The tutor performs the function of navigator and creates conditions for real individualization of the learning process. Tutor's role is similar to that of a coach: an athlete does everything themselves, and a coach, interested in everything that happens to the athlete and possessing experience and unconditional professionalism, observes from the outside and helps to move in the right direction.

ISSN : ***2537-0421*** **eISSN :** ***2537-043X***

Tutor is a consultant, motivator, organizer of joint activity of participants of educational process, creator of comfortable psychological conditions and navigator of changes of the student. Without imposing their ideas how to act helps to find the most effective development trajectory. In practice, the individualization of the learning trajectory is manifested in a fragmented way, mainly in the form of project activities of schoolchildren, as well as in the opportunities to study individual subjects at the basic or profile level. In vocational education, some variability in the trajectory of study depending on the capabilities and interests of students is manifested in the performance of course and diploma works and projects. The possibility of full implementation of personalized training is provided by the individual curriculum provided for in the educational legislation (Buckley, 2006). But it should be noted that in reality this is not a very common practice. It is significant that the construction of an individual educational trajectory more often occurs spontaneously, outside of the official system of mass education, through the use of online courses posted on digital educational platforms. The digital platform as a space for building and implementing a personalized educational trajectory contains the necessary resources (educational materials, evaluation tools, etc.) for the realization of educational goals, taking into account the individual needs of the student (Makhambetova et al., 2021).

In addition to technologies in which individual features of personalized learning are manifested, some cross-cutting technologies can be distinguished. Such technologies include, inter alia, practical-oriented cases and project method. Practical-oriented cases are characterized by a large degree of variability and uncertainty. The execution of the tasks of cases provides independent analysis of problem situations, the proposal and verification of hypotheses, determination of the sequence of

ISSN : 2537-0421 eISSN : 2537-043X

training actions. Generalization of results and drawing of conclusions is carried out with participation of tutor or moderator of educational process (Ambele, 2022).

Project method is a learning system in which students acquire knowledge and skills in the process of planning and execution of progressively more complex practical tasks called projects. It is based on the concept of pragmatic pedagogy and becomes the end-to-end personalized learning technology, provided that the choice of the problem, work planning, execution and evaluation of the project is carried out by the student himself, which does not exclude support from a tutor. In the case that the student's subjectivity is manifested only at certain stages of the project, the design method relates only to one of the features of personalized learning.

To summarize, the following conclusions can be drawn. Firstly, personalized education is not a novelty, but the process of its implementation in modern conditions has signs of innovation. Modification of education for the purpose of its personalization consists in the search for new and selection of already existing forms and methods that provide independent determination of the student's goal of learning, their choice of the pace and level of learning material, and building an individual learning path. Secondly, the arsenal of personalized education includes modern educational technologies, which are grouped according to the characteristics of personalized learning: self-definition of the student's learning goal (foresight design, context-competence training), choosing the pace and level of learning material, building individual learning trajectory (individual curriculum, online courses). Finally, it is possible to allocate some through-technologies, in which all the features of personalized training aggregate (Bray & McClaskey, 2014).

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Learners and Personalized Learning

Today, there are at least three approaches to respond flexibly to the characteristics and needs of the learner. These approaches are personalized learning (personalization), individualized learning and adaptive learning. Often these terms are used synonymously or as close synonyms. At the same time, there is not yet a common understanding of the term personalized learning, and the definitions used by learning theorists and practitioners seem to be very vague. Thus, personalized learning is defined as learning, in the process of which the personalization of learners is carried out in the community of learners and in the community of teachers. This is a way of designing and implementing the educational process, in which a student is the subject of learning activities (Ambele, 2022).

Adaptive learning is a type of learning, in which the pace of learning and approach to learning are optimized for the needs of each student. Learning objectives, approaches and learning content (and the sequence in which it is presented) may vary according to the needs of learners. In addition, learning activities are meaningful and relevant to learners, based on learners' interests and often initiated by learners themselves, as defined in the U.S. National Education Technology Plan Update (2017).

As the Glossary of Education Reform notes, a number of educational organizations include blended learning in the concept of personalized learning. Amanda Morin provides an equally vague definition. Personalized learning is an approach to learning that aims to tailor instruction to each student's strengths, needs, skills, and interests. Each student is given a learning plan that is based on what they know and how they learn best.

Bray and McClaskey (2014) is very successful in separating personalized learning, individualization of learning, and adaptation of learning based on the roles of teacher and

ISSN : 2537-0421 eISSN : 2537-043X

student. The author emphasizes that in individualized and adaptive learning, a teacher makes choices based on their vision of students' needs, interests, abilities, and limitations, while in personalized learning, the student manages their own learning, relates it to interests, talents, hobbies, and desires, actively participates in the design and determines goals and indicators of success (benchmarks), i.e. the student is actively involved in all components of learning (Bray & McClaskey, 2014).

The authors also highlight the differences in assessment in these approaches. First of all, individualization assesses learning. Summative assessment is based on grades and requires testing to identify what students know and what they do not know. With personalization, there is assessment of learning (Shemshack & Spector, 2020). Teachers create conditions and opportunities for students to set their own goals, monitor progress, and reflect. In this case, assessment is skill-based. It might be assumed that the authors believe that individualization of learning assesses students' results in mastering the material defined by the teacher, while personalization of learning is more about teaching to learn and the students' sense of progress (Makhambetova et al., 2021).

The Teach to One model is implemented in a high school math course in the United States. This model uses algorithms to create a daily schedule of lessons, determine what students have learned, and select activities and lessons for students. For students, this model allows more flexibility in choosing the pace of learning. For example, an able student can study material that is scheduled to be studied at a later time, and once a learner realizes that they have mastered the material, they do a quiz to demonstrate knowledge. As well, the material is not offered to study or practice with the rest of the class. Thus, the student has the opportunity to manage the content of their learning and demonstrate their knowledge (Oates, 2018).

ISSN : ***2537-0421*** **eISSN :** ***2537-043X***

Levels of Autonomy Model means that in literacy lessons, each student operates at one of four levels of autonomy. At level one, students receive instructions that tell them where and what tasks to perform. By level four, students have almost complete freedom to choose where they want to study, including the hallways of the school, and the flexibility to choose assignments. There is also a model for selecting research topics. Each teacher develops their own curriculum and students select the research questions. School keeps records for each student, noting their strengths, needs, motivation, goals, and progress on a regular and frequent basis. This information helps teachers make decisions that have a positive impact on learning. Learner's profile also helps a learner to keep track of their progress. It enables them, teacher and parents to realize that a change in methodology or learning goals needs to be made before learner's progress deteriorates and to make appropriate changes.

Following the Personalized Learning Trajectory Model, the school helps a student develop a learning trajectory that responds or adapts based on the student's progress, motivation, and goals. For example, a learner's timetable is based on weekly updates on their academic progress and interests. Each student has their own unique schedule that incorporates several teaching methods, which may include project-based learning in microgroups, independent work on specific skills or complex assignments, or one-on-one instruction with a teacher. A personalized learning pathway allows students to develop different skills at different rates. Teachers carefully monitor student progress and provide support to avoid falling behind the class (Ambele, 2022).

Based on the competency model, the school assesses students regularly to show progress towards specific targets. The system clearly shows learners what they need to master. These competencies include specific skills, knowledge and attitudes,

ISSN : 2537-0421 eISSN : 2537-043X

for example, developing resilience. Leaners have a choice of how and when they demonstrate mastery of the competencies. The focus is not on successful completion of a test paper, but on continuous learning and regular opportunities to demonstrate knowledge.

Flexible Learning Environment Model means that the learning environment adapts based on the conditions in which students learn best. The adaptation of the learning environment includes the physical environment in the classroom, the organization of the school day and the distribution of the teacher's workload. Teachers' use of time and resources is more difficult to change, but this type of design thinking can help students define their learning environment. Hence, all the models described assume a certain control of student choice on the part of the teacher, that is, in each of the models there is a set of elements of personalized learning, but these elements are combined with elements of individualization.

A transformative model of learning personalization puts students at the center of the system and invites them to use a set of inclinations to engage and learn. In other words, personalized learning is a generic term that can refer to many practices, each designed to accelerate learning by adapting it to the needs and skills of individuals in the process of fulfilling curriculum requirements. The scope of personalized learning (as currently understood) should expand, allowing students to explore and develop their own passions and interests. One of its goals should be to reveal the extent of the pupils' aspirations, which will enhance their possible involvement in the economy and in society as a whole. The purpose of learning is to attract students to passion and a growing sense of purpose, to teach them the critical skills needed for career and citizenship, and to inspire them to do everything possible to make the world a better place (Makhambetova et al., 2021).

ISSN : ***2537-0421*** **eISSN :** ***2537-043X***

It is essential not to miss this goal, however. Even the students of privileged schools can suppress their interests, because their innermost desires remain captive to the practicality of what is called success. Similarly, students born into low-income or socially disadvantaged families can suppress their aspirations because their teachers find them impossible. Increasing willingness to get higher education and build careers often creates new obstacles for students when faced with their future. The way to help students develop the intellectual and social strength of character that everyone needs in today's world is to strive for continuous learning and success through individual experience.

Personalized learning is a learner-centred educational model that enables learners to pursue goals, explore problems, find solutions, exhibit curiosity and create representations. There are four characteristic determinants of personalized learning, each of which can be used as a filter to study existing classroom practices or create new ones. It's motivation, co-creation, social building and self-discovery (Shemshack & Spector, 2020).

The first defining feature is motivation, which means participation and involvement of the student in *what* and *how* in the early stages of learning. Instead of being passengers in the educational trip, which was identified by teachers, students become its valuable participants, make the curriculum plan and are ready to get behind the wheel. Personalized learning encourages students to understand not only the power of their ideas, but also how these ideas can change and evolve through the influence of others' ideas (Shemshack & Spector, 2020).

The second defining characteristic is joint creation. In personalized learning, students work with a teacher to develop a problem or idea, clarify what is being measured, present the outcome or effectiveness of learning (assessment), outline an action plan that will lead to a response and relevant desired

ISSN : 2537-0421 eISSN : 2537-043X

outcomes (training activities). Thanks to regular joint creativity, which implies individual training, students acquire and build their innovative and creative muscles.

The third defining characteristic of personalized learning is social construction. Students generate ideas through relationships with others when they theorize and explore something to achieve common learning goals. Here, the topic can be referred to the social construction of knowledge, an idea that people learn through dialogue, discussion based on each other's opinions. Teaching students how these processes take place helps them to learn and change or transform new information. The real strength is the feeling that they are not alone, the camaraderie that comes from working together to change, to create a model or a prototype. For students, the experience of individual pieces of knowledge, ideas, and actions combined into a larger and better whole can be transformative and even magical (Makhambetova et al., 2021).

The other defining attribute of personalized learning is self-knowledge, the process of children understanding themselves as learners. They reflect on the development of ideas, skills, knowledge and achievements, and it helps them to imagine what can happen next, and what they can do next, explore and create further.

As a result, the question arises: how is individualization and differentiation different from personalized learning? Thinking about the four characteristic features of personalized learning, some educators may associate them with other learning models, often wrongly called personalized. Individualization, like personalized learning, allows training to take place at any time and anywhere. Individualized learning is personalized because it is a way to use the efficiency of the technique of adjusting tasks and learning pace according to the needs of the student. Using a mixed approach to learning, students can do part

ISSN : ***2537-0421*** **eISSN :** ***2537-043X***

of the work themselves, using various technologies: jointly create projects, work in a group. A significant difference is not how much they do outside school. Rather, it is a question of how motivated they are for the work they do.

The personalized learning model involves students in the design and development of the tasks they are involved in. Involvement is not measured by how quickly the student learns the learning material; it depends on how relevant, interesting and worthy they find the material. The role of the teacher is to work with students, hone their skills and pass on knowledge, help students confirm their knowledge and skills in genuine, complex and challenging undertakings (Oates, 2018).

Class differentiation covers all students with their range of skills, readiness levels and areas of interest. In this model, teachers begin by requiring students to designate or select the range of learning they prefer. It is a form that can be confused with a personalized learning model because of situations in which students can choose resources or topics to study (content differentiation), how to explore or develop an idea, in particular with individualization and differentiation. While these models are somewhat reminiscent of personalized learning, there are significant differences, especially with regard to the nature of the assignments and the level of control over the learning process. Unlike differentiation, a personalized learning model gives students access to shaping what they do and how they are involved in learning. From the beginning to the end of the training, they have more rights to develop ideas, research, analysis, refine and present the results to the true audience (Shemshack & Spector, 2020).

This is a difficult job for students. How can teachers equip their students for this task? If students are to achieve a higher level of thinking and learning efficiency, they must be able to develop and demonstrate a much richer set of skills and

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inclinations than measured in narrowly defined tests, which are so common today. Most standard-based tests measure academic knowledge and report on its comparative level. While this is important, students need to develop the skills needed to implement projects where the outcome is less obvious. They must develop mind habits that guide their strategic abilities and enhance their ingenuity and ability to solve complex problems. Habit is something that is done automatically, without much involvement of consciousness. The list of sixteen mind habits corresponds to the modern view of intelligence, which discards conventional theories based on ability and replaces them with growth thinking. These habits are often called soft skills or non-cognitive (Oates, 2018).

Since teachers and students develop the free skills of the mind, they do not always have to remind themselves of what habit they need in a given situation. As with any habit, practice increases the likelihood that a person will use it without a reminder. First of all, pupils and teachers «persist» before uncertainty. People who have adopted mind habits as a way to think about life situations are more aware of the skills that affect their success. Similarly, schools that embrace the habits of the mind as part of their vision become learning communities, where all participants like students, teachers, administrators, parents act consciously and with understanding.

Personalized learning through mind habits promotes a holistic approach to studying. Personalized learning is the organizational structure that pedagogy needs today: a structure that requires students to use the explicit thinking reflected in mind habits. Moving in this direction requires that teachers and students think differently and take on a new learning process. Let’s look at the four key shifts in thinking that characterize personalized learning with mind habits. A well-designed curriculum developed by the teacher ensures that there is a

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consistent set of goals and assessments that each student receives. Personalized learning means that students must take responsibility for it by jointly creating their tasks, projects and evaluations. This promotes self-government and shows the intention to continue working to achieve the desired performance (Shemshack & Spector, 2020).

Students develop specialized knowledge and interdisciplinary skills. The more is learnt about personalized learning achievements, the more we understand that the specific goals of each subject, while important, are not enough if students are expected to develop confidently in modern society. For example, instead of reading about what an engineer does and answering simple questions about the role of an engineer, students can use critical thinking and problem solving to include imagination, as well as to create and innovate, direct engineering process combined with its arts courses. Subject learning and dispositional thinking are complementary rather than competing goals. When school teaching teams include mind habits as a target component of practice, they recognize that teaching thinking is as important as transferring knowledge.

Saudi Arabia Applications

Currently, we are living in the era of rapidly developing technologies and increased attention to education. What is more importantly, Saudi Arabia has not been an exception in introduction of mobile applications in school curricula (Alhramelah & Al-Shahrani, 2020). This has been to demonstrate the country's desire to modernize the educational system, to be able to adapt to modern technological requirements, and increase the efficiency of teaching. Educational process in Saudi schools undoubtedly has had an impact on the quality of learning and development of students (Elyas & Picard, 2010). In recent years, mobile applications have become an integral part of education worldwide, which is a

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known fact. Being driven by the passion and challenge to modernization, many educational institutions in the country have been actively integrating mobile applications into the curriculum. For example, Saudi schools have been seeing the applications for teaching languages, mathematics, science and even personalized learning applications (Allmnakrah, et al., 2019).

These days, it has been an inexplicable aspect of Saudi education to utilize personalized mobile applications in the teaching and learning processes. Furthermore, this tendency highlights the country's desire to modernize the education system and be ready to face the challenges and demands of modern students. Below are some examples of applications used in Saudi Arabia high schools (Saudi Apps, 2023).

1. Teaching Languages.

There are mobile applications that provide students with interactive English language learning opportunities. To be more precise, those apps offer a wide variety of lessons, tests and games to add to the learning process in a funny and accessible manner. Students are provided with the opportunity to learn English in an interactive way and developing a set of communication skills. Several analyses have shown that the use of this type of application has been accompanied with an increase in students' interest in learning English along with improvement in their language skills.

2. Mathematics.

There are applications focused on math studying that provide unique methods of teaching. In that way, students are able to learn complex mathematical concepts, solve problems and receive feedback. Moreover, active participation is stimulated as well as academic performance gets improved. The core idea of these apps aims to make the study of mathematics interesting and exciting, and consists of structured lessons and game elements. Hence, mathematical concepts can be easily

ISSN : ***2537-0421*** **eISSN :** ***2537-043X***

understood and studied in a playful way. Following the results of the app usage in some schools, it is clear that performance in mathematics has improved and motivation level has increased.

3. Personalized Training.

Modern times create more complicated challenges. It has become a common thing that applications get adapted to the level of knowledge and needs of each student. For example, Khan Academy provides educational videos, lessons and exercises and depicts a personalized approach to learning. Therefore, students are presented with individualized learning opportunities. Learners have shown improved results, especially in areas where difficulties have previously arisen. All in all, this application has been designed to stimulate active participation of students in the learning process and provide a deeper understanding of the educational material.

Therefore, it can be clearly seen that the above-described examples are positive and especially significant in studying how the usage of a personalized learning application impacts teaching high school students in Saudi Arabia. First and foremost, accessibility is the number-one advantage (Shemshack & Spector, 2020). Mobile applications provide access to education in any place and at any time, which is particularly important in an active educational process and modern dynamic life of students. Using mobile applications in Saudi Arabia's education is an infrastructure, which requires not only quality applications, but also an appropriate technological base. Apart from that, it is critical not to forget about motivation and interactivity. Having interactive elements and instant feedback available in mobile applications is a great tool to stimulate learners' motivation and makes the learning process enjoyable (Alshawi & Alhomoud, 2016).

Secondly, there is personalization of learning coupled with the adaptation to the specifics of students. Personalized

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learning option provided by mobile applications helps each learner to study more effectively based on their individual needs (Alhramelah & Al-Shahrani, 2020). Previous studies have emphasized that the effects of mobile applications on students' academic performance highlight the positive impact on the level of knowledge and skills. For example, Saudi high schools using educational apps for teaching have shown statistically significant improvement in performance compared to those using traditional teaching methods (Elyas & Picard, 2010). Moreover, mobile applications adapt to the individual needs of students and allow each of them to learn at their own pace based on their personal interests. The analysis of the concept of adaptive learning using mobile applications delivers the possibility of personalizing learning, which will unarguably add to a more effective learning and individual development (Allmnakrah, et al., 2019).

Finally, game elements in learning applications make studying more fun. They are an integral part of motivation and encouragement that students get to further participate more actively. Studies have also portrayed that the use of mobile applications in education is frequently accompanied by improved academic performance. Nonetheless, despite positive aspects, there are challenges such as the need for equal access to technology, quality control of application content and data security (Shemshack & Spector, 2020).

To conclude, the use of personalized learning applications in Saudi Arabia high schools is a vital component of the educational process. This ensures adaptability, individualization, and improvement of the quality of learning (Alhramelah & Al-Shahrani, 2020). Even though the country encounters setbacks, it continuously integrates innovative methods into education. Hence, one might expect further improvements in the quality of education and development of high school learners (Alyami, 2014). In Saudi Arabia, the use of mobile applications

ISSN : ***2537-0421*** **eISSN :** ***2537-043X***

in education ranges from languages and mathematics to technology and arts. The approach is mainstreaming and responds to currently changing educational needs and ensuring access to learning at any time and anywhere.

Technological Start-Ups in the Sphere of Education in Saudi Arabia

Modern educational landscape of Saudi Arabia strives to offer innovative solutions and personalized approaches to learning in high schools. Technological start-ups in Saudi education in 2023 have started comprising Artificial Intelligence (AI) integration, Virtual Reality (VR) and Augmented Reality (AR), and e-learning platforms. AI has been introduced in educational processes at a high level (Elyas & Picard, 2010). Personalized platforms are capable of adapting to the needs of each learner and concentrate their activities on creating unique educational plans and customized tasks. Businesses tend to experiment with VR and AR in order to establish immersive educational surroundings through various projects, like virtual tours or interactive AR-lessons. Electronic educational platforms offer an extensive variety of online resources, for instance, video tutorials or interactive quizzes (Allmnakrah, et al., 2019).

There might be some obstacles in implementing personalized learning apps in high schools. To be more precise, educational establishments can face the lack of infrastructure and access. Although technological progress has been rolling out in the 21st century, some areas of Saudi Arabia faced limited access to high-speed Internet and modern devices, which may limit the potential of educational technologies (Elyas & Picard, 2010). It is a known fact that educational advancements will create the need for qualified teachers and technicians. However, the demand for such personnel may exceed their current number. Apart from that, data security issues might create the risk of leakage of learners' personal data increases. Hence, this requires

ISSN : 2537-0421 eISSN : 2537-043X

strict security measures and compliance with data processing standards (Allmnakrah, et al., 2019).

In the future, creation of educational communities and online platforms to exchange experience between teachers and companies will promote learning and collaborative creativity. Besides, encouraging and supporting educational research to develop new technologies will undoubtedly stimulate innovations (Saudi Apps, 2023). If partnerships with educational institutions get launched, technologies will be better adapted to the needs of the educational environment. Saudi Arabia's educational technologies sector represent a dynamic and innovative sector that seeks to improve educational practices. Despite the challenges, the prospects for this sector promise to contribute significantly to the development of education in the country.

Conclusion

Trends all over the world show that the future of education lies in personalized learning, individual educational trajectories, educational environment, stimulating learning. Learning activities, driven by personal meaning and intrinsic motivation, which are subsequently reflected in the quality of learning, are impossible without the personalization of the subject. Therefore, the use of personalized approach is considered among the successful educational reforms of the next decade in relation to all levels of education.

Addressing the problems of education is important not only for meeting the educational needs of young people, aimed at acquiring demanded competencies to competently solve life problems, feel confident in a rapidly changing world, to meet the challenges of the 21st century, but it is necessary to meet the need of the economy for workers with qualitatively new characteristics, capable of solving complex professional problems and ready for innovation not only today, but also

ISSN : ***2537-0421*** **eISSN :** ***2537-043X***

tomorrow. Its neglect can lead to the inability of future graduates of educational organizations to adapt to life and profession, to realize their personal and professional potential in the context of digital challenges of reality and the future. Meanwhile, the difficulty of solving problems of personalized education hinders its development in mass practice.

The main obstacle is that a full-fledged personalized education requires the work of a whole team of high-quality specialists, certain resources of the educational organization: organizational, human resources, methodical, digital educational resources – everything that creates special conditions for independent implementation of the educational program and development of the student. The advent of digital technologies in the field of education radically changed the situation, and teachers and scientists again turned to the development and implementation of personalized educational trajectories of students, designed on the basis of their motivation to learn, positive attitudes, sustainability and self-fulfilment in future professional activities.

Another aspect of addressing personalized education is also important. The result of personalized education is not only self-realization of students in educational activities, but also the design of their forecasting of their social and professional future. Socio-economic conditions, the diversity of types of professional qualifications, as well as the individual characteristics of students generate a variety of potential paths of formation and career orientations. The choice from a variety of possible trajectories of development is possible by forecasting strategies for achieving the desired image of a professional future, implemented in a personalized trajectory of professional development of the student.

With digital technologies, teachers can create personalized learning programs, tailored to the level of

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knowledge and needs of students, and as a result, maximize the potential of each of them. Today there are many smart electronic textbooks and notebooks that make the learning process adaptive, when each student works with tasks and topics that correspond to their level of knowledge at the moment. As a student learns a specific topic, digital textbooks either open up new challenges for them to study and consolidate, or increase the complexity of tasks within the current one. Adaptive learning also helps with dealing with students with special needs. Experimental studies show that the use of technology increases the interest and success of such students. For example, teachers who used mobile applications and 3D modeling thus stimulated the interest of schoolchildren with HIA in computer science and engineering.

With digital technologies, teachers can more quickly test students' work and grades, allowing them to focus on other aspects of learning. On the training platforms, there are tests with automatic answer checking. The student can, at a convenient time, pass such a test, learn the results and understand the errors. Studies of the importance of feedback in learning show that instant feedback keeps a student's attention and interest intact, while a check that takes several days may reduce their interest in reviewing wrong answers.

Digital technology is not only good for school, but also good for school after a few years. In particular, the use of computers and access to online learning can have a positive impact on the student's educational trajectory for several years after school using technology. In addition, the use of computers can be an effective way to reduce the quality gap between rural and urban areas, as technology provides access to better educational resources, including for rural school students. In China, for example, a large-scale experiment was conducted to introduce computers into the educational process and to listen to

ISSN : ***2537-0421*** **eISSN :** ***2537-043X***

high-quality classes recorded by the country's best teachers for students from underdeveloped rural areas. The results showed that the students in the experimental group in the future stayed longer in school and demonstrated higher cognitive skills even ten years after becoming familiar with educational technologies. They earned higher wages in the labour market and were more likely to be employed in intellectual occupations.

ISSN : 2537-0421 eISSN : 2537-043X

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ISSN : *2537-0421* eISSN : *2537-043X*