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Niu, Shuanghong Jenny

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Multiple Users' Experiences of an AI-Aided Educational Platform for Teaching and Learning



Shuanghong Jenny Niu, Xiaoqing Li, and Jiutong Luo

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1 Introduction

Currently artificial intelligence (AI) has attracted enormous attention in the media and in public discussion. AI has had a huge impact on societies, organizations, work, and education. Applying AI in learning and education has a long history, going back to at least the 1960s (Minsky and Papert 1968). Driven by the fast advancement of AI technologies, many new ways and possibilities were found to apply AI in education and in supporting students' learning. How to use AI technologies to better support teaching and learning has become one of the main developments in the educational field.

S. J. Niu
University of Helsinki, Helsinki, Finland
e-mail: Jenny.niu@helsinki.fi

X. Li · J. Luo (✉)
Beijing Normal University, Beijing, China

There have been several common AI-associated themes widely used in education, such as robot teachers, intelligent tutoring systems (ITS), massive online learning courses (MOOCs), etc. (Stone et al. 2016). These applications have been widely used in education throughout the world. A typical scenario of these applications is a student working with a digital device to solve or learn domain-level knowledge (e.g., VanLehn 2006). However, this kind of use case does not sufficiently reflect the recent development in practices and theories of education, such as the learning of skills and competencies, students' motivation and agency, the importance of social interaction, and the active role of learners. Additionally, compared to unified "one-size-fits-all" courses, there is an urgent requirement for individualized and/or various ways of teaching and learning based on students' needs and strengths. Therefore, both students and teachers are in need of better personalized support and social interactive learning environments in AI-aided platforms in learning and teaching.

Furthermore, there is also a major concern how to utilize the available educational resources to benefit more schools, especially schools in less advanced areas. The fast development in information communication and AI technology creates possibilities to provide high-quality educational resources to a large number of schools. In this way more students and schools can have a chance to access high-quality educational resources even in less advanced or less developed areas. The current educational platform should be created by using AI technology to meet these needs.

The purpose of this study is to investigate the experiences of students, teachers, and principals in using an AI-aided educational platform and their suggestions for future platform development. This chapter consists of sections of the background, methodology, findings, discussions, learning, and recommendations.

2 Study Background and Research Questions

AI technology has been widely used in many fields, as well as in learning and education. Lorenz and Saslow (2019) refer to AI as "the scientific pursuit of teaching machines to think like humans, or more simply, the automation of cognitive processes." Lorenz and Saslow (2019) consider machine learning (ML) to be a subdiscipline of AI. Renz and Hilbig (2020) state that ML consists of "data and learning algorithms that are fed into a software program able to create patterns, summaries, or conclusions about certain phenomena." Renz and Hilbig (2020) believe that "ML is only possible if big datasets are available." Gartner (2012) defines big data as "high-volume, high-velocity, and high-variety information assets that demand cost-effective, innovative forms of information processing for enhanced insight and decision making." ML and big data are the basic conditions for AI-supported applications or platforms. In the last few decades, the use of AI, especially ML and big data with educational methods, has grown rapidly in AI tutoring system (ITS). This enables ITS to provide customized tutoring functions based on learners' needs (Keleş et al. 2009).

Many studies (e.g., Baker and Inventado 2014; Fischer et al. 2020) show that ML, LA, big data, and educational data mining (EDM) have been important tools for personalized learning and assessment tools in the current use of AI in education (AIED). Several researchers (e.g., Labarthe et al. 2018; Renz et al. 2020) point out that AIED, LA, and EDM are the essential concepts of technology-enhanced learning by using available digital data and the results of analyzing the data to provide more options and improve the quality of education. The main applications of AIED are to provide intelligent agents and tutors services through AI-supported platforms (Alexander et al. 2019; Labarthe et al. 2018; Renz et al. 2020).

There are numerous studies on the system design and functions of AI-supported ITS. In a systematic overview of 57 papers related to ITS (Mousavinasab et al. 2021), researchers found that the major factors examined in those papers were applied AI techniques, the purpose of AI techniques, learners' characteristics, educational fields, evaluation, and user interface of ITS. However, there is fewer research investigating the multiple users' experiences. In this study, we will introduce the AI-aided Smart Learning Partner (SLP), which is designed as an ITS with AI technology to support teaching and learning at schools. The SLP educational platform adopts a number of AI technologies, and its design uses a number of pedagogical and learning theories. The aim of this study is to investigate multiple users' experiences of using SLP which support teaching and learning at schools. We can learn from these cases, and the learning can be used for future development. In this case study, we focus on the students, teachers, and the school principal's self-reported experiences using the AI-aided SLP. The research questions are the following:

1. In what ways does the AI-aided SLP platform assist students in their learning? What are students' self-reported experiences of using this platform?
2. In what ways does the AI-aided SLP platform assist the teachers and the principal in their work at school? What are the teachers' and the principal's self-reported experiences of using this platform?
3. What can we learn from the students', teachers', and the school principal's self-reported experiences for further development of AI-aided educational platforms?

In the next section, this AI-aided SLP educational platform will be presented. The methodology will also be described, followed by the main findings from this case study. Finally, the conclusions and recommendations are given.

3 Description of the AI-Aided SLP Educational Platform

In this section, we will explore the purpose, design structure, functions, and the current uses of the SLP platform. The case description is based on the materials, documents, and articles as well as interviews from the platform designing and developing team.

This AI-aided SLP educational platform has been developed by the Advanced Innovation Center for Future Education at Beijing Normal University. It can be easily accessed by students and teachers using any smart device, such as computers, iPads, and mobile phones. According to the data from the platform retrieved on 1st of June 2021, there were over 200 schools that were using SLP in five different provinces in China. Over 20,000 teachers and more than 250,000 students have used the platform. To have a better understanding of the SLP platform, we conducted in-depth interviews with four SLP platform designers, developers, and researchers. Additionally, we also investigated 35 documents (platform descriptions, PowerPoint presentation slides, journal articles, user experience reports, etc.) which gave detailed descriptions of the platform. We sought to identify the main purposes, major functions, and ways to support the students' learning in the SLP platform from the developers' perspectives.

Based on the interviews with the designers and developers of SLP, we identified two main purposes for creating the AI-aided SLP educational platform. One purpose is to expand possible ways of teaching and learning, especially providing additional resources for students' self-study, and for individualized teaching and learning. Another purpose is to provide more educational resources to schools, especially to bring high-quality educational resources to schools located in less advanced locations. This includes exurban or rural areas that have fewer teachers and lack high-quality educational resources. As one of the SLP platform designers stated in an interview:

We intend to use AI and ICT technology to provide more possibilities to students and teachers. On the one hand, we strive to build a database with high quality educational assessment tools and resources created by the best teachers and educators. These high-quality educational materials can be utilized by any Chinese schools regardless of their locations. On the other hand, students' real inputs are collected and analyzed to construct individual students' learning reports that include several dimensions, such as knowledge and competencies, strengths, and weaknesses, learning paths and learning progress . . . these kinds of learning reports can be used either by teachers or students for the students' further development.

Technically, this SLP platform adopts machine learning techniques to build the student model, especially the knowledge-tracing model for estimating the individual students' knowledge proficiency at the concept level (Chen et al. 2018). Furthermore, the specifically designed algorithms have been deployed to recommend the multimodal learning resources. Graph convolutional network models have been designed to grade both text-answer math questions and formula-answer questions (Tan et al. 2020). In addition, a cognitive graph is used to support the learner's self-awareness and reflective thinking, which consists of a proper form of knowledge representation and the individual learner's cognitive status (Pian et al. 2019). Recently, the SLP research team has attempted to adopt explainable AI techniques to better support and interpret different decisions made by the platform (Lu et al. 2020). Besides the desktop and mobile version, the SLP educational platform also provides the robot version. Lu et al. (2018) state that the robot version "provides the personalized learner-robot interaction services by leveraging on the

latest techniques, typically including the conversational agent, question-answering system and emotion recognition.” (pp. 447).

This SLP platform is intended as a learning assistant at school (Lu et al. 2018). The platform provides different levels of resources which satisfy different learners' needs and competency levels. It also periodically gives positive feedback when learners make progress in their learning topics or tasks. The platform enhances learners' relatedness to the platform through a conversational agent which can chat with the learners. All the assessment tools are built on Bloom's learning pyramid at various levels (Bloom 1956). The learning reports show the students' learning capabilities in remembering, understanding, applying, analyzing, evaluating, and creating. An adaptive learning cognitive map model (Wan and Yu 2020) is also applied in this platform. The platform continuously adjusts appropriate learning resources and recommendations with learning contents, learning activities, learning paths, and learning partners to the learners based on the learners' knowledge structure and cognitive state. Therefore, this platform has used several learning theories to increase learners' motivation, active role and agency, progressive learning, and competencies when using the platform.

This platform in its block diagram has two modules (see Fig. 1). One is the *data aggregation module* which refers to how the data are collected and managed in the platform. It can construct a personalized knowledge graph according to the students' personal assessment results and the interaction data. Another is the *human-machine (learner-machine) interaction module*. It is mainly in charge of how the human interacts with the platform. These two modules establish the block diagram of this SLP platform.

The data aggregation part in this SLP platform continuously collects educational data and resources, including the data on students' learning. The continuously evolving educational data are based on existing and new educational data and resources, the continuous data collection from students, and continuous inputs from educational experts and resources. Also worth mentioning is the fact that the students' data is not limited to the knowledge-level learning and assessment information in different subjects; it also includes students' core literacy related to these subjects, such as their math literacy and reading literacy. All the students' data can be utilized to better serve the students' learning and development. This provides the foundations of *big data* for the AI-aided SLP platform. The platform incorporates uses of *learning analytics*, *machine learning*, and *educational data mining*.

The human-machine interaction part in this SLP platform continuously interacts with the users. The platform provides various *assessment tools* which can be used by students and teachers. Based on the assessment results, data are analyzed and *learning reports* are provided to the users. The platform then sends *resource recommendations* to the users based on the users' learning reports. The platform uses AI technology to build visualizations of the students' learning progress diagram and the students' learning competencies level module, as well as students' strengths and weaknesses. Based on these data, the platform provides information and suggestions to students for *learning enhancement*.

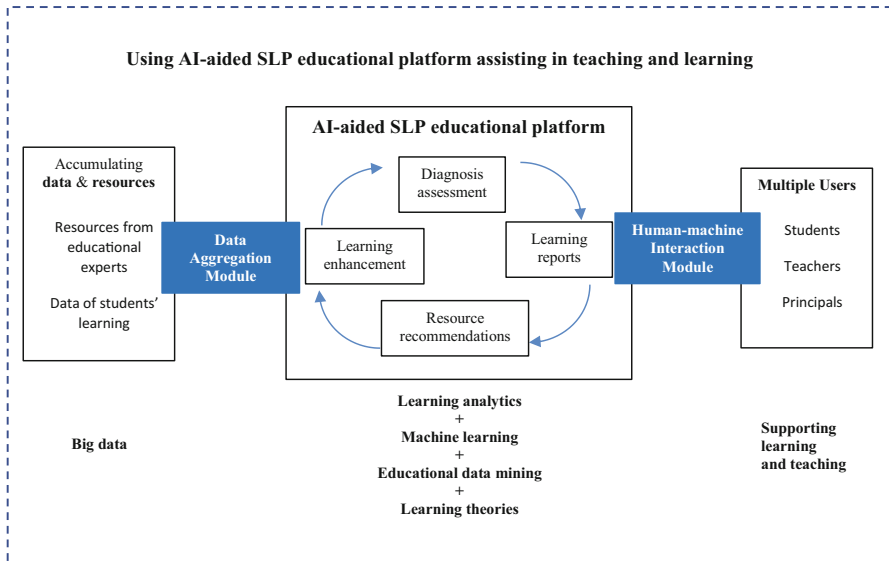


Fig. 1 Design structure of the AI-aided SLP platform

We identified four major functions of the SLP platform. The first function is to provide various assessment tools and tests for teaching and learning purposes. Students can access the tools in the platform to carry out self-diagnosis assessment whenever they want, while teachers can use the tools to do diagnosis assessment to assess the students' learning level or learning outcomes (Chen et al. 2018). Teachers gain a good overview of the learning situation of all students as well as individual students to provide appropriate teaching and individualized teaching for the students. The second function is to produce various learning analytical reports with instant feedback as well as learning progress over time. Students can get reports on their learning situation as well as their learning progress over a long period. The report can also show the students what they are good at and what they need to work on to improve themselves. Teachers can get reports on individual students' learning as well as the whole class's learning situations. In this way teachers can better plan their teaching and courses to suit their individual students' needs as well as the whole class situation. Principals have access to the overview report of the whole school teaching and learning situation, so that they can provide better support and resources for teachers and students. The third function of the platform is to provide recommendations and suggestions to the students and teachers. Students receive recommendations from the platform to improve their learning. Teachers also receive suggestions from the platform for their teaching to better support their students' needs. The fourth function of the platform is to provide a resource pool with various micro lectures. The teachers can use these micro lectures as part of their teaching. Students can watch these micro lectures according to their interests or based on the recommendations from the teachers or from the platform. All these four functions

from this AI-aided SLP platform provide many options and possibilities for teaching and learning at schools to better support the students' learning.

4 Methodology

The school in this case study is in an exurban area near Beijing, China. The school has been using the SLP platform since 2017. The main users were the principal as well as the students and teachers who were from grade 7 to grade 9 with students from 13 to 15 years. In-depth interviews were conducted with two students, two teachers, and one principal. A questionnaire with background information and six open-ended questions were collected on paper from seventh to ninth grade classes. The students could either voluntarily reply to the questionnaire or choose not to. Fifteen fully supplied responses were received. The participants in this study is shown in Table 1.

The background information included gender, grade or teaching position, as well as how many years they have used the platform. We made comprehensive interviews with students, teachers, and the principal at schools to investigate their experience of using the AI-aided SLP platform. We strove to understand and obtain their best experiences, challenges, and suggestions for this AI-aided SLP platform. We also sought to identify the major functions in the SLP used by students, teachers, and the principal at this school.

The questions in the questionnaire were almost the same as those used in the semi-constructed interviews. The main questions were:

1. Based on your experience of using the SLP platform, can you tell us your overall experience of using the SLP platform?
2. How did the platform support you in your study (or in your work)? Please give some concrete examples.

Table 1 Participants in this study

Participants	Gender	User information	How many years was the SLP platform used by the user? (Until 1st of June 2021)
Students (interview)	2 girls	7th–9th grade students	1–3 years
Students (Questionnaire in paper)	5 boys, 10 girls		
Teachers (interview)	2 female	Math teacher, physics teacher	Over 3 years
Principal (interview)	1 female	Principal	Over 3 years

3. Did the platform introduce any changes in your study (or in your work)? If the answer is yes, please share with us the kind of changes you had after you have used the platform.
4. What were the best experiences that you had when using the platform? Please share some concrete examples.
5. What challenges did you have when using the platform? Please share some concrete examples.
6. Would you like to share your wishes or suggestions for further improvement of the platform to better help you in your studies (or in your work)?
7. Based on our discussion, is there anything else you would like to share with us concerning your experience of using the platform? (This question was only used in the interview).

All participants in the interviews and questionnaire responses participated voluntarily. The participants were informed about their confidentiality and the possibility of withdrawing from the study at any time. All their personal information was removed, and it was not possible to identify the participants. All the interview data were voice recorded and transcribed.

The qualitative data analysis used content analysis to identify the key information. Two experienced researchers analyzed the qualitative data using content analysis. They also discussed the data analysis to achieve a synthesis in the data interpretation. The data analysis revealed the major ways in which the SLP platform assisted teaching and learning at the school, such as diagnosis assessments, student learning analytical reports, and accessing micro lecture resources and learning enhancement. We strove to identify how these aspects assisted in teaching and learning at the school by looking into the students', teachers', and the principal's self-reported experiences. Additionally, we aimed to identify the major challenges and further improvements in these kinds of learning platforms.

5 Findings

In this section, we present the main findings based on the multiple users' perspectives of students, teachers, and the principal and their experiences in using this platform.

5.1 *Students' Self-Reported Experiences*

The majority of student participants stated that the *main functions* they used in the SLP platform were self-assessment, checking the reports of their learning, and studying the micro lectures (online teaching videos). These functions helped them in the following ways: providing new ways and possibilities for learning and additional

learning resources; recognizing the weak parts and mistakes they made in their study and specific areas which needed to be improved; receiving recommendations and suggestions from the platform or from teachers; and consolidating student learning. Several students stated the following in their answers:

(It) provides more learning resources, such as the micro lectures (online videos) . . . (Students 1, 2, 9, 10, 12, 16, 17)

(It) helps me to see which parts I am not good at, and provides suggestions for making improvements. (Students 2, 3, 4, 7, 9, 13, 15, 16, 17)

(It) helps me to reinforce and consolidate my learning . . . (Students 5, 6, 7, 8, 11, 12, 16, 17)

Later, we asked the students *what kinds of changes* they had experienced since using the SLP platform. Almost all the students stated that using the SLP platform changed their ways of learning in the following ways: broadening their thinking, building habits of self-assessment, becoming more active in learning, becoming more self-disciplined, making their own study plans and being able to follow the plans, finding their own ways of learning, improving their study, etc. Some students also stated that their learning motivation increased after they had used the platform to assist their learning:

(Using this platform) changed my way of learning . . . (Students 1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 12, 13, 14, 15, 1, 17)

I became more active in my learning, my interests in studying increased, my thinking ability increased, I found my own ways of learning which are better than before . . . (Student 8)

My learning motivation has increased (Student 6)

When we asked the students what their *best experiences* were when using the SLP platform, the most mentioned was receiving feedback/suggestions/reports, especially instant feedback. Several students also mentioned that they liked the visualized diagram reports. The second most mentioned best experience was having the possibility of watching the online micro lectures and online videos at any time. They stated the following:

Receiving *instant* feedback/results (Students 4, 11, 8, 13, 16)

Receiving feedback/suggestions/reports (Students 1, 2, 4, 7, 8, 9, 10, 11, 12, 13, 16)

I can receive instant feedback after the exams, and I also get an analytical report of my learning, for example my weak parts, and I also received suggestions from the platform and teachers. (Student 11)

. . . watching the micro lecture (online videos) . . . (Students 3, 4, 5, 6, 13, 16)

When we asked the students what the *challenges* were when using the platform and invited their suggestions for further improvements, they stated that the challenges were a slow network or long response times from the platform or not being familiar with how to use some of the SLP functions. The students wished to have better connections and shorter response times from the platform, more user-friendly interface in the platform, and more resources in the platform, such as more

Table 2 Students' self-reported experiences of using the SLP platform

Key analysis categories	Responses from students
<i>Functions in SLP that helped the students' learning</i>	Self-diagnosis Feedbacks Suggestions and recommendations for further development Learning analysis reports Resources (e.g., micro lectures)
<i>Changes after using SLP</i>	New ways of learning More active Increased motivation
<i>Best experiences</i>	Instant feedback Learning analytical reports Micro lectures
<i>Challenges</i>	Slow internet connection Long connecting time from platform Some functions in SLP are not so clear
<i>Suggestions for further development</i>	Better connection Faster connecting time from platform More learning resources (e.g., micro lectures) User-friendly interface Online interaction and studying together with student peers

micro lectures and learning materials. Two students also suggested the possibility of having pairs or groups studying with peer students or chat functions with peer students.

The overall student self-reported experiences of using the SLP platform are summarized in Table 2. Based on the students' self-reported experiences of using the SLP platform, the overall experiences are very positive. Almost all students have stated that this platform assisted their learning and even changed their ways of learning. Students appreciated the feedback, reports, and suggestions and the available platform learning resources. Having said that, platform improvements were still needed, such as optimizing response time, user-friendly interface, and more learning resources. One interviewed student summarized her overall opinion about the platform:

This platform is like another teacher who can help me in my learning. (Student 16)

5.2 Teachers' and Principal's Self-Reported Experiences

We interviewed one math teacher, one physics teacher, and the principal from our case study school. In this section, we will discuss the self-reported experiences from teachers and the principal concerning *how this platform assisted in their work*.

Both subject teachers described this platform as a tool that assisted their teaching. The teachers used diagnosis assessment and generated reports to identify the students' weak points, key points, and individual needs in the students' learning. Based on the information and on analyzing reports, the teachers were able to provide individualized teaching to the students as well as adjust the teaching progress and pedagogical methods based on students' different needs. The teachers often used two major functions in the platform. One was the examination/test with auto-marking for diagnosis as well as for homework. The other was the platform-generated analysis reports of the individual students' learning as well as the overall situation of the whole class students' learning. As the math teacher stated in the interview:

(this platform) can provide accurate students' learning analytical reports as well as recommendations for students' improvement. This helps to provide individualized teaching based on students' needs . . . I like very much the 'instant' feedback/report from the system. I can see the students' learning reports right away after the exams . . .

When discussing *what changes* were experienced by the teachers after using the platform in their work, the teachers said that they could have a clearer picture of the students' learning needs and the overall learning situation in the class. One teacher also stated that their work became easier since they did not need to do marking when students took exams from the platform. Another teacher added that she felt the changes in her students, whether they were more advanced students or those who had learning difficulties, started when they did self-assessment and self-analysis of their own learning. Teachers also felt that their role had changed as more facilitators and students became more active learners when using the resources (micro lectures and tests) in the platform. The math teacher summarized that he was greatly impressed by:

. . . the platform's strong analysis capabilities which generated the students' learning reports. And this helps a great deal by providing individualized teaching and learning.

In the conversations that followed, we also discussed the challenges the teachers had encountered and their wishes for further platform improvements. In some comments from the teachers interviewed, one desired platform feature was that the teachers wished to add their teaching materials or teaching videos to the platform:

There are difficulties in adding the special math symbols to the platform. (Math teacher)

It is difficult to add some course information and contents in paper format to the platform. (Physics teacher)

One teacher stated that the current functions were enough to assist her teaching. However, another teacher indicated that it would be good if some PowerPoint slides in the micro lectures could be downloaded so that she could modify and use them in her course.

The principal from this case study school participated in the project from the very beginning in order to implement the SLP platform at the school. She stated that the best function she used was the reports of the students' learning. From these reports she could see the overall picture of the teachers' teaching as well as the students'

learning. It became easier to identify which class was doing better, which teachers taught more effectively, and what were the improvement areas needed in teaching and learning. As the principal stated in her interview:

As a principal, I need to know the overall situation of teaching and learning at my school. From the reports generated from the SLP platform, I can have a good picture of how well the students have learned, which is also reflected in how well the teachers have taught in that class. And I can also see the changes over time. This helped me to pay attention to which parts needed to be improved . . .

The principal also felt that using the platform had brought some changes to the school:

The teachers' ICT competency has increased. There was more collaboration between ICT teachers and other teachers. Teachers were using the resources in the platform to improve their teaching . . . I also noticed that students became more active in their learning, and it changed their way of learning and thinking, as the students started to carry out more self-assessment.

Based on the teachers' self-reported experiences, the platform assisted their work in providing individualized teaching based on their students' needs. Overall, they were satisfied with the functions in the platform, although further development could be explored for specific subjects or needs. The principal also felt that the platform was useful in her work and would improve the teaching and learning in her school. The diagnosis assessment, platform generated reports, and the micro-lecture resources were beneficial, though the principal wished to have more varied tests and examinations and more micro-lecture resources in the platform. The overall student self-reported experiences of using the SLP platform is summarized in Table 3.

6 Discussion and Learning from This Case Study

In this section, we discuss the main findings and what we learned from this case study.

Based on the self-reported experience from students, teachers, and the principal, the findings demonstrate that this SLP platform can provide additional assistance for teaching and learning at schools (Lu et al. 2018). The following five major forms of learning were found.

6.1 Major Functions Favored by Students and Teachers

The following functions in the AI-aided SLP platform are important for teaching and learning: assessment tools, analytical reports, recommendations for further learning, and educational resources.

Table 3 Teachers' and the principal's self-reported experiences of using the SLP platform

Key analysis categories	Responses from teachers and the principal
<i>Functions in SLP that helped the teachers' and the principal's work</i>	Diagnosis assessment and generated students' learning analysis reports Suggestions and recommendations to improve students' learning Assessment tools for students' homework with platform auto-marking Using the micro lectures in teaching
<i>Changes after using SLP</i>	Teachers' work became easier, assisted by auto-marking, assessment tools, and micro lecture resources from the platform Teachers' role gradually became facilitators when students became more active in their learning using the resources from the platform Teachers were better able to provide individualized teaching based on the students' learning analysis reports from the platform Teachers' ICT competencies were increased
<i>Best experiences</i>	Instant feedback Analytical reports of students' learning Micro lectures
<i>Challenges</i>	Teachers had some difficulties in introducing materials or documents or teaching materials into the system
<i>Suggestions for further development</i>	Teachers felt that overall, they were satisfied with the current functions in the platform. It would be good if the teachers could download some teaching materials from the system so that they could make modifications in their teaching

From the teachers' point of view, teachers can better support the students' learning by obtaining more teaching resources and analytical reports of students' learning from big data, LA, and EDM in the platform. The resources from the platform for teachers include diagnostic assessment tools, homework assignments, micro lectures, etc. The teachers can see students' learning analytical reports with instant results and learning progress over a specific period. This function enables teachers to provide individualized teaching and learning for students. It also supports teachers in adjusting their teaching through making pedagogical decisions according to the students' needs.

From the students' point of view, students have more opportunities to be active in their learning. They can carry out self-diagnosis assessment of their own learning. Based on their learning analytical reports, they can gain recommendations for further development or actively seek resources for their learning.

6.2 New Ways and Possibilities in Learning and Teaching

AI-aided educational applications can provide new ways and possibilities in teaching and learning. In this case study, we can see that teachers can provide better personalized teaching based on the students' learning reports using diagnosis assessment. Additionally, teachers can use and select ready-made assessment items for students' homework or for both formative and summative assessments. Teachers can also use the micro lectures or other educational resources, such as teaching materials, in their courses.

This case study shows that students became more active in their learning. They can carry out self-assessment to become more aware of their strong and weak points in their learning. Moreover, they receive recommendations from the platform about how to enhance their learning and make improvements in their areas of difficulty. Students can also freely choose their interest areas to study from the large number of micro lectures available in the platform.

6.3 Positive Experiences and Changes

All students, teachers, and the principal in this study indicated that they have benefited from using the AI-aided SLP educational platform. The platform also introduced changes in teaching and learning at schools. Teachers said that their work became easier. The teachers' role gradually changed to become facilitators, and students became more active in their learning. Students' learning motivation also increased, and they stated that they found new ways and methods for their learning. Finally, the principal found that she could optimize and increase the level of proficiency in school planning and resource allocation.

6.4 The Importance of Learning Theories Applied in AIED Applications

Many current learning theories could be implemented in the design of the AI-aided educational platform. All the assessment tools were based on Bloom's learning pyramid (Bloom 1956) at various levels. The learning reports showed the students' learning capabilities in remembering, understanding, applying information, analyzing, evaluating, and creating. This matches our current expected learning outcomes from students. An adaptive learning cognitive map model was used in the SLP (Wan and Yu 2020).

6.5 *Continuous Improvements and the Social Nature of Learning*

This AI-aided SLP platform is a dynamic progressive system design. It continuously collects data from students as well as from teachers, which contribute to the big data, ML, and EDM. The platform becomes more intelligent with the continuous input data, and it also becomes more adaptive to the users' needs. It represents a continuously progressive improvement in the interactions between the SLP's AI and its human users. However, another important concern is the social aspects, which refer to the interactions among peer students through the platform. It is critical to know how to build a social supportive and collaborative learning community as well as to use the AI-aided platform to support students' learning. Students in this study wished to study together with other peer students and have more social interaction when using the SLP platform. Designers and developers for the educational platform need to think and rethink how to satisfy the students' social needs in the platform.

7 Conclusion and Recommendation

To conclude, the AI-aided SLP educational platform can be used as another tool to support better learning and teaching at school. Students can have more resources and options in their learning and become more active learners when they have various choices and receive instant feedback. Teachers have additional ready-made expert contents and assessment tools for their teaching. Teachers and principals can receive an instant view of all the students as well as individual students' learning situation and learning progress. This enables them to provide better teaching and individualized support for students. The teachers' role is also gradually shifting more to facilitators. This case study demonstrates that the AI-aided SLP educational platform did lead to positive effects and changes and assisted in teaching and learning at school.

Based on this case study, practical implications and recommendations were drawn concerning further development of this kind of AI-aided educational platform. First, to support better learning and teaching, the most favored functions were identified as the assessment tools, learning reports, online resources, and recommendations. Second, it was found that learning theories should be combined with AI technology. This enables positive experiences in teaching and learning. The students became more motivated and active in their learning. Teachers had more time and information to provide individualized learning, and the teachers' role gradually shifted to a more facilitative role. However, there were calls to expand the system to incorporate the social aspects of learning and make continuous improvement. Students wished to have social interactions with their student peers. Providing group learning and/or peer support and a learning community could become extremely valuable. The future new design features should respond to the

“social nature” of learning and consider how to synthesize the AI technology with social human learning needs to enhance its usefulness. Both students and teachers expressed the need for an easier-to-use and faster user interface. These factors can be taken into consideration in improved designs for AI-aided educational platforms. Additionally, rethinking is needed concerning ways in which the platform can help teachers save time and make their work easier. The platform should focus on refining the individualized services for each student, for example, more and better choices concerning micro lectures and online off-school support for their homework or when students face difficulties.

This case study was based on multiple users’ self-reported experiences in one school. Conducting further studies in a wider school population is suggested for future research. It is also worthwhile comparing the study results of this AI-aided SLP platform with other similar kinds of AI-aided educational platforms. More studies are needed concerning specific new design features to meet the needs from users and to enhance the usefulness of AI-aided educational platforms.

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