THE EFFECTS OF GROUP-BASED PERSONALIZED ONLINE TEACHING ON LEARNERS' COMMUNITY OF INQUIRY AND ACHIEVEMENT OF A COURSE

Dr. Baris SEZER

ORCID: 0000-0003-0695-0819
Department of Medical Education and Informatics
Hacettepe University
Ankara, TURKIYE

Received: 07/06/2023 **Accepted**: 14/09/2023

ABSTRACT

The aim is to investigate the effects of delivering group-based personalized teaching via an electronic performance support system (EPSS) in an online medical informatics course on medical students' academic achievement and community of inquiry levels. The basic working principle of EPSS is to provide the most appropriate teaching methods to the educator, according to the students' variables and learning outcomes. The research design of this study involved a quasi-experimental pretest-posttest design with a control group and the qualitative research method of answers to follow-up questions. While the students in the experimental group were taught various teaching approaches (flipped classroom, brain storming, case-based learning, debate and think-pair-share), the students in the control group were taught directly by online lessons according to direct instruction method. It was seen that the experimental procedure had a positive effect on both the academic achievement and community of inquiry levels of the experimental group compared to the control group. Besides, students in the experimental group reported that the lessons were more effective when they were enjoyable, motivating, focused on discussion and research, and were taught through cases. The group personalized teaching method used in this study could be a guide for future studies.

Keywords: Online learning, improving classroom teaching, learning communities, teaching strategies.

INTRODUCTION

One of the situations that education should deal with is mostly that a uniform education has been given to students, although they are completely different from each other (preliminary knowledge, needs, interests, etc.). From a historical point of view, two main approaches have been used in solving this fundamental problem: (1) creating homogeneous classes by selecting students (grouping, monitoring, identifying, etc.), and (2) creating heterogeneous classes with different students without any selection, and then arranging the teaching environment/resources according to the various characteristics of the individuals (Bernacki et al., 2021). The first approach is very difficult to implement, as student profiles/variables are very diverse and constantly changing. The second option, "personalization", has become one of the main goals for educators with technology accompanied by integration of computer/data and learning sciences (Basham et al., 2016).

The concept of personalized education, which emerged for the first time in the laboratory school project by Dewey in 1896, was defined as a situation in which the learning environment (presentation, exam, course material, teaching method, etc.) is arranged in line with students' personal information (individual characteristics, interests, needs, etc.) (Xie et al., 2019). Although the concepts of "personalized teaching" and "adaptive teaching" are different from each other in the literature, they are often seen to be used interchangeably (Li et al., 2021). In adaptive learning, teaching activities can be applied according to the academic performance of the students without defining any personal characteristics/preferences. However, in personalized teaching, teaching is performed according to the individual characteristics, without any adaptation regarding the on-going progress of individuals in a task or situation.

It is observed that personalized education has a positive effect on many variables in every field of study, when the research studies in the literature are examined in general. Systematic review studies revealed that personalized education was effective on the variables of performance, perception, satisfaction, engagement, motivation, enjoyment, attendance and interest (Bernacki et al., 2021). However, it has been reported that most of these studies were carried out in short intervention periods and generally provided high-level technology-enhanced personalized education. The development of technology and accompanying technology-enhanced teaching can facilitate personalized teaching (Hernandez-Cardenas et al., 2022; Lim et al., 2020). Recently, data on individuals have been collected with learning analytics, artificial intelligence (AI), virtual reality and wearable technologies, and fully-personalized teaching situations are designed according to these data (Hernandez Cardenas et al., 2022; Lim et al., 2020). However, these situations bring about very complicated processes and are difficult to implement. Basically, it was reported that the hardest of these implementation difficulties are the existence of multivariate student profiles and the cost/workforce (Tan, 2021). We carried out this study with the idea of providing optimal group-based personalization, in order to reduce the limitation of this situation.

As e-learning environments, especially synchronous teaching, have been more extensively used during and after the Covid-19, it has been seen that these learning environments were uniform and educator centered, as in traditional teaching environments (Turnbull et al., 2021). The realization of effective learning in online environments is closely related to the community of inquiry (CoI) of the learners (Lee et al., 2021; Mr, 2021). In this context, "the model of community of inquiry" is an effective model that guides e-learning environments in order to create collaborative and constructivist deep content with online presence elements (Garrison et al., 1999). It has been reported that more successful learning and performances were realized in online learning environments where various student-centered approaches were used (Lee et al., 2021). Educators need to be supported to enable the use of these various teaching activities on the basis of personalized teaching. In this respect, EPSSs have the potential to provide instant support to educators on duty (Cakir & Tuzun, 2003). In this study, EPSS with a database of various educational activities was further developed, and its effects on providing personalized teaching in the online environment were evaluated.

BACKGROUND

Electronic Performance Support System

EPSS is defined as "integrated electronic environments to provide instant and easy information, suggestions and experience for individuals in order to increase their performance" (Sezer, 2021). The most important features of these systems are that they can be used during the education process and in education environment and that they present appropriate information clearly (Ugur-Erdogmus & Cagiltay, 2019). Basically, there are four components that should be included in an EPSS. These are databases, teaching systems, consultant systems and auxiliary tools (McKay & Wager, 2007). These systems, which are generally developed as mid-level (Sezer, 2021) and high-level (Lizdas et al., 2017) according to the level of complexity (programming, AI integration, etc.), have been seen that they are very effective in gaining knowledge/skills.

EPSS has been developed and used for many educational design processes and for educational designers. Many systems, the first example of which is GAIDA developed in 1994, have been very effective for the automation of educational design and material development (Askar, 2018; Wang et al., 2007; Ugur-Erdogmus & Cagiltay, 2019). The basis of this success is the amount, type, timing and presentation of the needed information to individuals in the right environment. However, performance in these studies is generally focused on a single product (lesson plan, course material, etc.). In this study, we rather focused on the teaching process and tried to provide a group personalized teaching environment. The most important advantages of the EPSS developed in this research are the following; it is prepared in a short time at low cost, does not require high technology skills for use, provides pedagogical support to educators about educational activities and has the potential to be used for a wide audience.

Community of Inquiry Framework

The model was developed to support higher education and was comprised of three elements. These elements are *social, cognitive and teaching presence* (Garrison et al., 1999). Evaluation of the effectiveness of the developed e-learning systems is suggested to be made according to this model (Almasi & Chang, 2020; Horzum, 2015; Karaoglan-Yilmaz, 2020; Tan, 2021). The research conducted by Korkmaz and Toraman (2020) with 1016 educators during the COVID-19 period reported that effective teaching could not be realized due to problems like the technology literacy level of the educators, the interaction problem in online environments, low motivation of the students, monotonous lecturing etc. Similarly, it was determined that students did not attend courses, their cognitive/teaching/social presence levels decreased in synchronous courses and engagement of students was not fully achieved during and after the COVID-19 period (Almasi & Chang, 2020; Chung et al., 2020). In this direction, it is recommended to provide the most basic level of faculty development programs, educator training and material/method diversity (Amir et al., 2020; Tan, 2021). In e-learning environments, it is argued that it is important to create situations enabling student-student and student-educator interaction, problem-based discussion activities and opportunities for students to cooperate (Almasi & Chang, 2020; Lee et al., 2021; Tan, 2021).

Rational and Research Hypotheses

This study aimed to use the teaching methods that are most suitable for the students' individual characteristics, especially in online education, based on the requirements mentioned above. Since there are individual differences among students, the determination of the most basic variables that should be addressed in personalized education with educational science experts was the first step. In this way, the use of the most appropriate educational methods for the student community consisting of a heterogeneous group was discussed which would create a more effective and efficient group personalized teaching situation. An EPSS designed by the author (Sezer & Simsek, 2018), which can be used by educators to provide effective educational environments, was implemented and evaluated for the first time during an academic term within the scope of medical informatics course. This study is a first for the use EPSS, which has a wide range of applications, to support personalized teaching.

In this study, it was aimed to investigate the effects of delivering group-based personalized teaching via an electronic performance support system (EPSS) in an online medical informatics course on medical students' academic achievement and community of inquiry levels. In this context, the following hypotheses were formed:

Hypothesis 1. (H1): Academic achievement scores of the students in the intervention group who applied personalized teaching will be higher than the control group.

Hypothesis 2. (H2): Community of inquiry levels of the students in the intervention group who applied personalized teaching will be higher than the control group.

METHOD

The research design of this study involves a quasi-experimental pre-test-posttest design with a control group and the qualitative research method of answers to follow-up questions. The effect of personalized education on students' academic success and CoI levels were investigated in this study. Personalized teaching methods with online synchronous EPSS support were applied to the experimental group, while synchronously online teaching with the traditional lecture method was used in the control group.

Participants

The study group consisted of 120 (male= 54, female= 66) second-year students studying in two different fields in Hacettepe University Faculty of Medicine and taking the "Medical Informatics" course. The difference between academic achievement and CoI pre-test scores of both groups was not statistically significant ($p>.05$). This showed that both groups were equivalent in terms of CoI levels and academic achievement before the experiment (see Table 1). Accordingly, the study was carried out by the same educator in two groups. Both the experimental group (female= 34, male= 26) and control group (female= 32, male= 28) consisted of 60 students. All participants gave their written and verbal informed consent.

Structure and Algorithm of the System

The system was designed by five educational technology specialists (faculty members), and the validation of these processes was provided by the opinions and suggestions of 16 faculty members at the national level. There are 44 educational activities (methods, techniques, approaches, etc.) in the database of this EPSS, which was previously designed by the author (Sezer & Simsek, 2018) and further developed for the first time in the present study. The basic operation of the system relies on the variables of learning outcomes (Bloom's taxonomy) (Krathwohl, 2002), and student variables that affect the "achievement", "participation", and "performance" of the students. In this context, "technology self-efficacy, academic self-efficacy, course-related task value, and prior knowledge" determined students' variables by the experts.

To prepare the database related to the educational activities, first, the variables that affect the "achievement", "participation" and "performance" of the students were determined. With the consensus of the experts, "online technology self-efficacy, academic self-efficacy, course-related task value, and prior knowledge" variables were included in the system's structure. Secondly, the definition and stages of 44 selected activities (flipped classroom, brain storming, anchored learning, spaced learning, etc.) in the database were prepared. Then, to prepare "matching algorithm", the suitability levels of 44 activity-student variables were also rated by experts via 5 (highly suitable) to 1 (not suitable at all) (see Figure 1). More detailed information on these stages can be found in the author's previous study (Sezer & Simsek, 2018).

	Accelerated Learning	Anchored Learning	Authentic Project	Best Choice Debate	Buddy System	Book Report	Brainstorming
2. Student Variables							
2.1. Self-efficacy regarding course							
Low	4	1	1	1	4	1	1
High	5	5	5	5	5	5	5

Figure 1. Sample figure for student variable–activity (self-efficacy regarding the course) suitability

An example of the developed system is shown in Figure 2; after 'Low-Medium-High' selections are made according to the results of the student variables, the educational outcomes of the relevant course are marked according to Bloom's taxonomy, and the most appropriate activities for the related group are listed with the 'FIND' button. The educator can access basic information about these activities (and more detailed information/examples, if preferred) step-by-step by choosing the desired activity/activities.

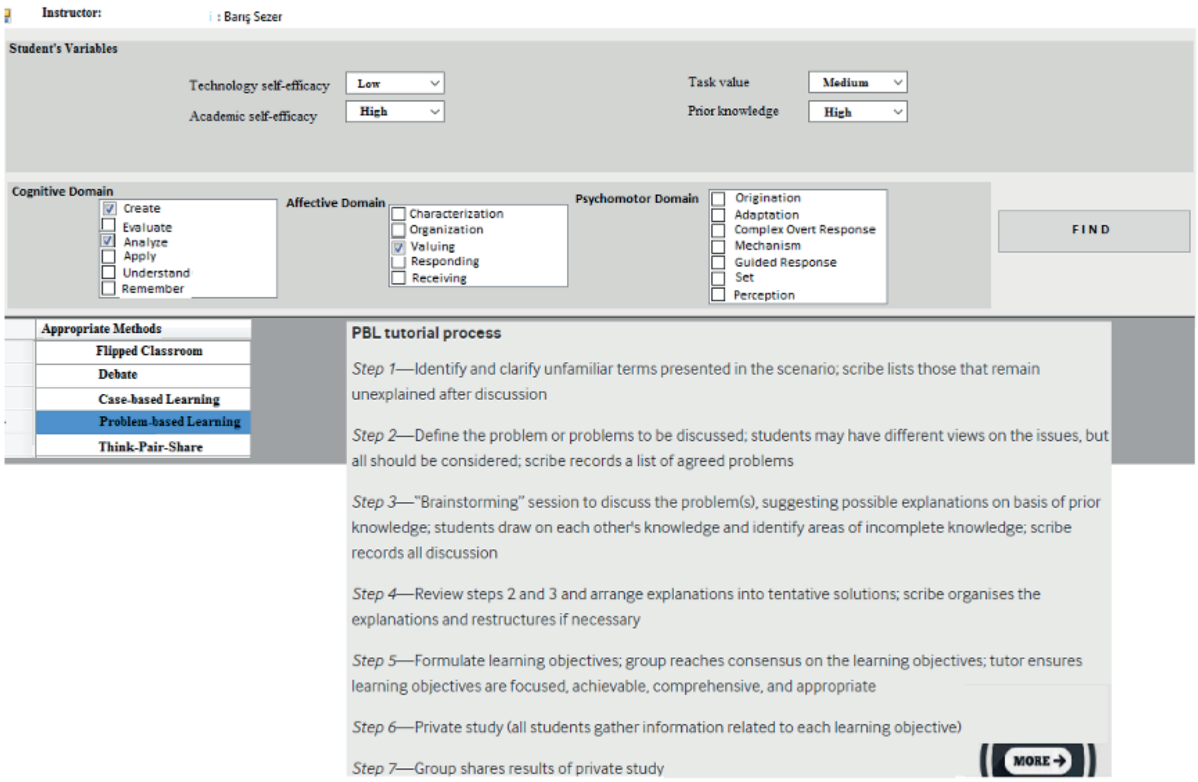

Figure 2. Sample figure of the developed EPSS

In line with the data obtained from the measurement tools, the system suggested 'flipped classroom, brain storming, case-based learning, debate and think-pair-share' activities based on the scores of the experimental group students on "online technology self-efficacy, academic self-efficacy, task value for the course, prior knowledge" scores (the scores obtained from the scales/tests reported in the data collection tools section were entered into the system as input, therefore detailed information on these values were not given in the findings section) and lecture outcomes that could change every week. The lessons were carried out synchronously over Zoom by using these teaching activities according to the weekly lecture (12 weeks in total) outcomes with the experimental group during an academic term, within the scope of the study. On the other hand, the lessons (12 weeks in total) were carried out synchronously over Zoom based on the direct instruction method with the control group.

Data Collection Tools

Online Technologies Self-efficacy Perception Scale

This scale was developed by Miltiadou and Yu (2000) and was adapted to Turkish in 2009 (Horzum and Cakir, 2009). The scale consisted of 29 items (lowest score= 29, highest score= 116) and four sub-scales (Asynchronous interaction I, Asynchronous interaction II, Synchronous interaction and Internet competencies). Evaluations related to the scale were coded as "Low-Medium-High" in order to define "online technology self-efficacy" scores in EPSS, only for the experimental group students.

Task Value for the Course

"The Motivated Strategies for Learning Questionnaire (MSLQ)" developed by Pintrich et al. (1993) was used for task value. The motivation section of MSLQ consists of 6 sub-dimensions: "self-efficacy, test anxiety, intrinsic goal orientation, extrinsic goal orientation, control belief, and task value". Pintrich et al. (1993) stated that the scale could be used in different disciplines and all or individual dimensions of the scale could be included, depending on the purpose of the research. Adaptation of the scale to Turkish was done by

Buyukozturk et al. (2004). The 6-item "task value" sub-dimension (lowest score= 6, highest score= 42) in the motivation section of the related scale was used within the scope of this research. Evaluations related to the scale were coded as "Low-Medium-High" in order to define "task value" scores in EPSS, only for the experimental group students.

Academic Self-efficacy Scale

The scale was developed by Jerusalem and Schwarzer (1992) and was adapted to Turkish in 2007 (Yilmaz, Gurcay and Ekici, 2007). The scale, which has a one-dimensional structure, consists of a total of 7 items (lowest score= 7, highest score= 28). Evaluations related to the scale were coded as "Low-Medium-High" in order to define "academic self-efficacy" scores in EPSS, only for the experimental group students.

Community of Inquiry Scale (CoIS)

This scale was developed by Arbaugh et al. (2008) and adapted to Turkish in 2012 (Ozturk, 2012). The scale was used in the present study to determine students' community of inquiry levels. The scale consists of 34 items (lowest score= 34, highest score= 136) and three sub-scales in total. The high score obtained indicated higher level of community of inquiry of the students.

Academic Achievement Test

The test, consisting of 20 questions, was developed by the author. There are various question forms in this test, and the maximum total score that can be taken is 100. A specification table was prepared and used to ensure scope validity during the validation process. In addition, for validity and reliability of the test, evaluation criteria were developed, and the opinions of field experts and second-year students were taken before administering the test. Before the experimental procedure, this test was applied to 20 second-year students who were not included in the study group. To determine the reliability of the test, Kuder-Richardson Formula 20 (KR-20) was applied and 0.88 was obtained in the pre-test and 0.87 in the post-test.

Feedback Form

Feedback form, which was developed by the author to facilitate the interpretation of the qualitative data, consists of three questions. The interview with the students were held online, and one week after course program.

Data Analysis

The data were analyzed with descriptive statistical techniques, chi-square and t-test. Cohen's d effect size was calculated if there was a significant difference in the performed t-test. As a general recommendation for the effect size, Cohen states that if the d value is less than 0.2, the effect size can be defined as weak, if it is between 0.5-0.8 the effect size is medium, and if it is greater than 0.8 the effect size can be defined as strong (Cohen, 1988). Qualitative data obtained from the feedback form were analyzed by two educators and was coded under three themes, using content analysis.

FINDINGS

The study involved 120 voluntary students. The experimental and control groups did not differ according to age, gender, academic achievement and CoI levels before the experimental procedure (see Table 1). The introductory information of the students in the study group is given in Table 1.

Table 1. Demographic characteristics of participants

		Experimental (n= 60)	Control (n= 60)	Test statistics p value
Gender	Female Male	34 (51.5) 26 (48.1)	32 (48.5) 28 (51.9)	x2: .135 p: .714*
Age	Mean	19.13± 0.91	19.31±.89	t: -1.114 p: .268**
Academic Achievement	Mean	41.65± 9.45	42.95±9.01	t: -.771 p: .442**
CoI	Mean	67.95± 11,56	68.88±11.91	t: -.435 p: .664**

*Chi-square test, ** The independent sample t test

In order to test the hypotheses of the present study, pretest and posttest mean scores were compared between groups (experimental and control), t-test was used in independent samples and intergroup comparisons in paired samples. The results of the analyses are given in Table 2.

Table 2. Distribution of pre-test and post-test values of measurement tools with respect to experimental and control groups

		Experimental	Control	
		Mean± SD	Mean± SD	Test statistics p value*
CoI	Pre-test	67.95± 11.56	68.88± 11.91	t: -.435 p: 0.664
	Post-test	96.23± 15.74	76.06± 17.84	t: 6.564 p: 0.00
	Test statistics p value**	t: -11.401 p: 0.00	t: -2.533 p: 0.14	
Academic achievement	Pre-test	41.65± 9.45	42.95± 9.01	t: -771 p: 0.442
	Post-test	86.31± 9.22	75.41± 17.76	t: 4.219 p: 0.00
	Test statistics p value**	t: -23.977 p: .000	t: -13.737 p: .000	

*Independent sample t test, **paired sample t test

While the CoI pre-test post-test measurements of the experimental group (t:-11.401; p=0.00) showed a statistically significant difference, the control group (t:-2.533; p=0.14) did not show a statistically significant difference. A statistically significant difference was found between the post-test measurements regarding the CoI levels of the experimental and control groups (t: 6.564; p=0.00). In the effect size analysis of the resulting difference, Cohen's d value was determined as 0.51 and it was found to have a moderate effect.

A statistically significant difference was found between the academic achievement pre-test post-test measurements of the experimental group (t:-23.977; p=0.00) and the pretest-posttest measurements of the control group (t:-13.737; p=0.00). A statistically significant difference was also found between the post-test measurements of the experimental and control groups in terms of academic achievement variable (t: 4.219; p=0.00). In the effect size analysis of the resulting difference, Cohen's d value was determined to be 0.77 and indicated a medium-high level effect.

A focus group interview was conducted with 54 students (6 students did not participate) in the experimental group, in order to get the opinions on the personalized teaching. The interview was held in a one round in the classroom during the last course hour. In this interview, a discussion was conducted with the students using the brainstorming technique regarding the personalized teaching method by the educator, and at the end of this discussion, the feedback form was distributed to the students. Data collected from 54 students were subjected to content analysis. The meaningful data were determined, coded by two educators and the draft themes were identified. The codes obtained according to these draft themes were rearranged and clarified. The findings obtained as a result of the content analysis are given in Table 3.

Table 3. Thematic codes

Category	Code	f
Positive aspect	Interaction in course	36
	Different education methods	33
	Having fun in course	27
	Motivating	23
	The need for face-to-face education	16
Negative aspect	Spending much time preparing before course	13
	Technical issues	5
Things to be Improved	Effective learning management system	12
	Artificial intelligence integration	9
	Integration with other courses	8

As could be observed from Table 3, most of the students were satisfied with personalized education. Students reported the positive aspects as, generally taking a more active role in synchronous lessons, coming to the lessons more motivated, use of various educational activities and case-based situations were more contributive. Sample student statements expressing this feeling are as follows:

> *Although our group wasn't small, we organized interactive Zoom sessions with both my friends and our educator. This way, I could actively participate in the lessons without being passive.*

> *While it wasn't quite the same as face to face education, the lessons were highly interactive. I completed this course with minimal boredom since various educational methods (problem-case based) were employed.*

> *Our educator frequently engaged us using various educational applications on our mobile devices. Consequently, I can confidently say that our motivation increased.*

On the other hand, as the negative aspects, students reported that they would like to take this course face-to-face, in which case much more effective learning would have taken place. They reported the reasons for this situation as especially the technical problems experienced from time to time and stated that they had to be exposed to the screen a long time. Sample student statements expressing this feeling are as follows:

> *Due to the demanding nature of the medical education program, we often found ourselves dedicating substantial time to course preparations outside of class. While it was informative, it posed time-related challenges.*

Zoom sessions were occasionally interrupted, and I encountered sound issues at times. I suspect these issues were related to my internet connection speed.

Since I was attending the lessons on my mobile phone, I faced difficulties in simultaneously keeping up with the lectures and actively participating in the educational activities within the applications.

In the aspects that need to be developed, the students have requested that the variety of methods covered in this course should also be applied in other courses. In addition, students also expressed their requests to use artificial intelligence supported learning management system. It has been reported that this artificial intelligence support (adapted interface/exam/content) will make LMS more personalized. Sample student statements expressing this feeling are as follows:

The materials shared on the LMS for pre-class could have been more personalized. For instance, I would have preferred shorter videos. I also wish the LMS had personalized editing capability like this.

Interactive Zoom sessions should be a part of certain courses without a doubt, as they prevent boredom.

I already had prior knowledge of certain content, such as virtual patients. In such cases, higher-level materials could have been presented to me using a system like artificial intelligence.

DISCUSSION AND CONCLUSION

In this study, the effect of group personalized teaching provided by EPSS on the academic success and CoI levels of second-year students was investigated, and it was determined that personalized instruction applied to the experimental group had a positive and significant effect on both the academic achievement and community of inquiry levels of the students compared to the control group. Accordingly, the hypotheses of the research, H1 and H2, were accepted.

In the literature, it is observed that individually personalized instruction is usually carried out in small groups; however, computer-based adaptation/personalization studies are carried out in larger groups with the development of technology. In this study, optimal educational activities suitable for the group profile and course outcomes were used in order to provide group personalized teaching. There are many studies on the use of EPSS positively affects students' learning and performance (Martinez-Mediano & Losada, 2017; Mitchell, 2014; Sezer, 2021). This study, in which EPSS was used to support personalized teaching, is a first and sets an example for the variety of uses of EPSS.

Another positive situation experienced in the present study, was that the perception of presence in online environments, which was the main measured subject within the framework of CoI, was at a high level. Studies have revealed that students' CoI levels are highly correlated with their academic self-efficacy and course motivation (Shea & Bidjerano, 2010; Karaoglan-Yilmaz, 2020). It is suggested that the three components of CoI, cognitive, social and teaching presence, should be highly interrelated to each other, and a balanced online education should be designed by integrating these three components (Caskurlu et al., 2021). It is thought that the positive findings obtained in the present study are the result of using constructivist teaching approaches (problem-based learning, reflection, collaborative tasks, interactive lectures, discussion, etc.). It was reported that these teaching activities increase students' community of inquiry levels. (Horzum, 2015; Karaoglan-Yilmaz, 2020). These findings also reveal the necessity of using innovative educational techniques/applications, either online or offline, in which students are more active, instead of the traditional direct instruction method, in the 21st century.

Limitations

Only course outcomes and student variables were discussed in this study. Stronger personalization could be achieved by considering educator and learning environment variables.

Conclusion

In this study, the personalization part of a pre-designed EPSS was developed to provide personalized education and used in the online medical informatics course of students. The courses taught according to the educational methods/activities increased students' academic success in the medical informatics course and had a positive effect on their CoI levels. The group personalized teaching method used in this study could be a guide for future studies.

BIODATA and CONTACT ADDRESS of AUTHOR

Dr. Baris SEZER is an Associate Professor of Medical Education at Faculty of Medicine, Hacettepe University. Dr. Sezer gained his Ph.D. in Educational Technology at July, 2016. His academic interest areas are instructional design, technology integration, simulation and electronic performance support system, e-learning and use of internet in education. He has served as the principal investigator in a TUBITAK project on virtual patient development and has spent 4 months at the University of Florida to conduct studies within this field. He has over than many journal articles published in international indexes, book chapters and other national and international articles, papers submitted to international meetings.

Baris SEZER
Department of Medical Education and Informatics, Faculty of Medicine
Address: Hacettepe University, Faculty of Medicine, Department of Medical Education and Informatics, 06230, Ankara, Turkiye
Phone: +90 312 3052617
E-mail: barissezer@hacettepe.edu.tr

REFERENCES

Almasi, M., & Chang, Z. (2020). Investigating students' perceptions of cognitive presence in relation to learner performance in blended learning courses: A mixed-methods approach. Electronic Journal of e-Learning, 18(4), 324-336. https://doi.org/10.34190/EJEL.20.18.4.005

Amir, L. R., Tanti, I., Maharani, D. A., Wimardhani, Y .S., Julia, V., Sulijaya, B., & Puspitawati, R. (2020). Student perspective of classroom and distance learning during COVID-19 pandemic in the undergraduate dental study program universitas Indonesia. BMC Medical Education, 20(1), 1-8. https://doi.org/10.1186/s12909-020-02312-0

Askar, A. (2018). Mobile electronic performance support system as a learning and performance solution: A qualitative study examining usage, performance, and attitudes. Turkish Online Journal of Educational Technology, 17(2), 76-88. http://www.tojet.net/articles/v17i2/1728.pdf

Basham, J. D., Hall, T. E., Carter Jr, R. A., & Stahl, W. M. (2016). An operationalized understanding of personalized learning. Journal of Special Education Technology, 31(3), 126-136. https://doi.org/10.1177/0162643416660835

Bernacki, M. L., Greene, M. J., & Lobczowski, N. G. (2021). A systematic review of research on personalized learning: Personalized by whom, to what, how, and for what purpose(s)? Educational Psychology Review, 33(4), 1675-1715. https://doi.org/10.1007/s10648-021-09615-8

Buyukozturk, S., Akgun, O. E., Kahveci, O., & Demirel, F. (2004). Validity and reliability study of the Turkish form of the Motivated Strategies for Learning Questionnaire. Educational Sciences: Theory & Practice, 4(2), 207-239. https://toad.halileksi.net/sites/default/files/pdf/gudulenme-ve-ogrenme-stratejileri-olcegi-toad.pdf

Cakir, H., & Tuzun, H. (2003). Design and Development of an Internet-Based Electronic Performance Support System for Systemic Change in K-12 Settings. 2003 Annual Proceedings-Anaheim, Vol 2., pp. 67-72.https://citeseerx.ist.

Caskurlu, S., Richardson, J. C., Maeda, Y., & Kozan, K. (2021). The qualitative evidence behind the factors impacting online learning experiences as informed by the community of inquiry framework: A thematic synthesis. Computers & Education, 165(20), 104-111. https://doi.org/10.1016/j.compedu.2020.104111

Chang, J., & Lu, X. (2019). The study on students' participation in personalized learning under the background of artificial intelligence. Proceedings of 10th International Conference on Information Technology in Medicine and Education (pp. 555-558). IEEE. https://ieeexplore.ieee.org/iel7/8960968/8964637/08964718.pdf

Chung, E., Subramaniam, G., & Dass, L. C. (2020). Online learning readiness among university students in Malaysia amidst Covid-19. Asian Journal of University Education, 16(2), 45-58. https://doi.org/10.24191/ajue.v16i2.10294

Cohen, J. (1988). Statistical power analysis for the behavioral sciences. Hillsdale, NJ: Lawrence Erlbaum.

Garrison, D. R., Anderson, T., & Archer, W. (1999). Critical inquiry in a text-based environment: Computer conferencing in higher education. The Internet and Higher Education, 2(3), 87-105. https://doi.org/10.1016/S1096-7516(00)00016-6

Hernandez Cardenas, L. S., Castano, L., Cruz Guzman, C., & Nigenda Alvarez, J. P. (2022). Personalised learning model for academic leveling and improvement in higher education. Australasian Journal of Educational Technology, 38(2) 72–84. https://doi.org/10.14742/ajet.7084

Horzum, M. B. (2015). Interaction, structure, social presence, and satisfaction in online learning. Eurasian Journal of Mathematics, Science & Technology Education, 11(3), 505–512. https://doi.org/10.12973/eurasia.2014.1324a

Horzum, M. B., & Cakir, O. (2009). Validity and reliability study of the Turkish version of the online technologies selfeficacy scale. Educational Sciences: Theory & Practice, 9(3), 1327-1356. https://files.eric.ed.gov/fulltext/EJ858927.pdf

Karaoglan Yilmaz, F. G. (2020). Modeling different variables in flipped classrooms supported with learning analytics feedback. Journal of Information and Communication Technologies, 1(2), 78-94. https://dergipark.org.tr/en/download/article-file/1083612

Korkmaz, G. & Toraman, C. (2020). Are we ready for the post-COVID-19 educational practice? An investigation into what educators think as to online learning, International Journal of Technology in Education and Science, 4(4), 293-309. https://files.eric.ed.gov/fulltext/EJ1271308.pdf

Krathwohl, D. R. (2002). A revision of Bloom's taxonomy: An overview. Theory into practice, 41(4), 212-218. https://doi.org/10.1207/s15430421tip4104_2

Lee, R., Hoe Looi, K., Faulkner, M., & Neale, L. (2021). The moderating influence of environment factors in an extended community of inquiry model of e-learning. Asia Pacific Journal of Education, 41(1), 1-15. https://doi.org/10.1080/02188791.2020.1758032

Li, F., He, Y., & Xue, Q. (2021). Progress, challenges and countermeasures of adaptive learning. Educational Technology & Society, 24(3), 238-255. https://www.jstor.org/stable/27032868?seq=1

Lim, L.-A., Dawson, S., Gasevic, D., Joksimovic, S., Fudge, A., Pardo, A., & Gentili, S. (2020). Students' sense-making of personalised feedback based on learning analytics. Australasian Journal of Educational Technology, 36(6), 15–33. https://doi.org/10.14742/ajet.6370

Lizdas, D., Avari, K., Zimmerman, M., & Lampotang,S. (2017, August). An editor to create integrated tutors for a modular set of mixed reality simulators [Paper presentation]. Military Health System Research Symposium, Kissimmee FL. https://simulation.health.ufl.edu/technology-development/augmented-reality-mixed-simulation/ra-sim/abstracts-posters/%23prettyPhoto

Martin, S. M., Casey, J. R., & Kane, S. (2021). History of artificial intelligence and personalized learning. In S. M. Martin, J. R. Casey, & S. Kane (Eds.), Serious games in personalized learning (pp. 27-47). Routledge.

Martinez-Mediano, C., & Losada, N. R. (2017). Internet-based performance support systems in engineering education. IEEE Revista Iberoamericana de Tecnologias del Aprendizaje, 12(2), 86-93. https://ieeexplore.ieee.org/stamp/stamp.jsp?arnumber=7914728

McKay, J., & Wager, W. (2007). Electronic performance support systems: Visions and viewpoints. In R. A. Reiser, & J. V. Dempsey (Eds.), Trends and issues in instructional design and technology. (pp. 147-155). Merrill/Prentice Hall.

Mitchell, M. D. (2014). Effectiveness of electronic performance support system and training in a higher education setting [Doctoral dissertation, Capella University]. Digital Library. https://search.proquest.com/openview/b8fd77082542d8496fb06aa33e883c4a/1?pqorigsite=gscholar&cbl=18750&diss=y

Mr, A. W. (2021). Developing social presence in online learning among nurses: Exploration of the community of inquiry models domain of social using a qualitative descriptive design. Nurse Education in Practice, 52, 1-6. https://doi.org/10.1016/j.nepr.2021.103000

Ozturk, E. (2012). An adaptation of the community of inquiry index: The study of validity and reliability. Ilkogretim Online, 11(2), 408-422. https://dergipark.org.tr/en/download/article-file/90583

Sezer, B., & Simsek, N. (2018). Designing an electronic performance support system for technology-rich environments. Behaviour and Information Technology, 37(6), 596-606.

https://doi.org/10.1080/0144929X.2018.1469669

Sezer, B. (2021). Developing and investigating an electronic performance support system (EPSS) for academic performance. Australasian Journal of Educational Technology, 37(6), 88-101. https://doi.org/10.14742/ajet.6121

Somasundaram, M., Junaid, K. M., & Mangadu, S. (2020). Artificial intelligence (AI) enabled intelligent quality management system (IQMS) for personalized learning path. Procedia Computer Science, 172, 438-442. https://www.sciencedirect.com/science/article/pii/S1877050920314253

Tan, C. (2021). The impact of COVID-19 pandemic on student learning performance from the perspectives of community of inquiry. The International Journal of Business in Society. 21(6), 1215-1228. https://doi.org/10.1108/CG-09-2020-0419

Ugur-Erdogmus, F., & Cagiltay, K. (2019). Making novice instructional designers expert: Design and development of an electronic performance support system. Innovations in Education and Teaching International, 56(4), 470-480. https://doi.org/10.1080/14703297.2018.1453853

Wang, Q., Nieveen, N., & van den Akker, J. (2007). Designing a computer support system for multimedia curriculum development in Shanghai. Educational Technology Research and Development, 55, 275–295. https://doi.org/10.1007/s11423-006-9017-2

Xie, H., Chu, H. C., Hwang, G. J., & Wang, C. C. (2019). Trends and development in technology-enhanced adaptive/personalized learning: A systematic review of journal publications from 2007 to 2017. Computers & Education, 140, 103599. https://doi.org/10.1016/j.compedu.2019.103599

Yilmaz, M., Gurcay, D., & Ekici, G. (2007). Adaptation of the academic self-efficacy scale to Turkish, Hacettepe University Journal of Education, 33(1), 253-259. https://dergipark.org.tr/en/download/article-file/87651