

Application of an Electronic Problem-Based Learning System in Undergraduate Medical Education Program

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Abstract

Objective: The objective of this article is to introduce the e-PBL application experience of a medical faculty in undergraduate medical education program.

Materials and methods: The special software for e-PBL application was developed and experienced. The application of e-PBL was carried out in the last two blocks of the Phase 3 program. During the last two blocks, third year students participated in the synchronized e-PBL sessions in small groups. After two years' pilot studies, E-PBL was applied to all third-year students during the Multisystem and Life Cycle blocks in the years, 2015 and 2016. Students engaged in the phases of PBL steps, orally and in written forms. Sessions were student-centered and tutors only undertook the duty of assessment by monitoring the groups externally and making use of the session records and reports.

Results: During the first year application, in light of students' and tutors' feedbacks, external motivation sources were identified to be crucial for effective sessions. During the second year application, performance of the groups increased compared to the first year through the implementation of summative assessment criteria and there was a decrease in technical problems.

Conclusion: Considering the advantages and restrictions of e-PBL application, a plan was made to carry out the same synthesis blocks at the end of the third year program for consecutive years.

Keywords: Education; Medical; Problem-based learning (PBL); e-learning

Introduction

Dokuz Eylul Faculty of Medicine has been implementing PBL curriculum for the first three years of undergraduate program since 1997-98 academic year [1]. Problem-based Learning (PBL) is a student-centered active method based on activation of prior knowledge, identification of learning needs, self-study of learning issues, and elaboration and discussion of knowledge in the process of solving health problems. During the PBL sessions, the role of the tutor is to facilitate and guide learning without contributing directly to the solution of the problem and to ask questions to explore and stimulate students' thinking [2,3].

It is known that the use of education technology and electronic learning applications have become increasingly widespread for education and assessment activities, they have also been integrated to PBL sessions, electronic applications increase the interest and motivation of students and promote learning, in this context, in medical education [4-6]. Recently, upon the increase in need for tutors in parallel with the increase in number of students, alternative searches have started to ease the educator's load. Considering that the students can make use of information technologies, the educator's load becomes easier; a student-centered electronic PBL (e-PBL) application in which students competent in PBL can steer themselves was planned at the end of third year of the educational program. The developed e-PBL application was not developed as an alternative to the classical face-to-face PBL sessions which are applied in the educational program during the first 3 years. It was planned as a transition model between the pre-clinically applied PBL and Task-based Learning programs which are applied in the clinical years.

Rationale and expected advantages of the e-PBL application can be summarized as:

- Promoting PBLs by audiovisual materials and making their scenarios more realistic and attractive, sharing information and enriching discussion;

- Providing the students with experience about making use of information technologies;
- Increasing their experiences about learning responsibilities and accessing information;
- Improving decision making and management skills due to undertaking group discussion leader responsibility respectively;
- Objective assessment of the performances by tutors due to recording and reporting verbal and written participation;
- The need for a fewer number of tutors.

The purpose of this article is to share the experiences regarding e-PBL applications which are implemented in the undergraduate education program of Dokuz Eylul Faculty of Medicine.

Materials and Methods

Application method

Students completed the written and verbal forms in the sessions in accordance with the PBL steps by logging in on the internet from their location simultaneously, with the small groups. There, they determined

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the learning objectives in line with their learning requirements and discussed them at the beginning of the next session. In the first year, the group size was determined as nine persons each, and it was determined as seven persons each in the second year so as to facilitate the active participation of the students. At the end of the last sessions of the scenarios, each student prepared a concept map and summarized the key concepts, with cause-and-effect relationship. At each session, one student was randomly as the group discussion leader by the system. Proceeding to the next phase/question at the session could only be possible as a result of the votes steered by the group discussion leader.

Sessions are planned as totally student-centered. The tutors do not have the function of participating in the session and asking questions. Tutors are responsible for monitoring and evaluating the four groups (28 students). Tutors are able to simultaneously monitor the written and verbal participations of the students during the session and/or make use of the participation records and report following the sessions and make assessments about the students' performance. The records of the verbal and written participations of the students are made into reports by the system. The reports include statistical data, such as each student's contribution to the hypotheses/objectives on scenario basis, written and verbal contribution, participation in the votes and the concept map which is individually prepared at the end of the scenario.

The e-PBL application related visuals are presented in Figures 1 and 2.

Technical properties

The e-PBL platform was basically operated through PHP support on Apache web server. In order to increase data safety of the information, SSL security certificate which provides 128/256-bit encryption was used. In order to provide a synchronous flow of the multimedia contents, asynchronous JavaScript and XML and HTML5 technologies were used. While the real-time flow of the data was managed by PHP and AJAX, WebRCT application programming interface which comes with HTML5 was particularly used for audio communication. The data was stored in MySQL relational databases. The system had two different modes for both live conference communication and press to talk.

Application experience

Software studies and pilot studies were actualized in the two-year period. In the Multisystem and Life Cycle blocks between March-May 2015 and March-May 2016, the application was implemented on all third-year students (N:298, N:328) after being approved by the local ethics committee.

The students were provided two hours information about the e-PBL application in the computer laboratory. In the first years' introductory program, some of the students expressed their concern about the e-PBL replacing classical face-to-face PBL sessions and uttered their anxieties about whether they would be commonly applied in the educational program. They stated that the questions of the tutors are of importance in the determination of the relevance of the discussion and appropriate learning objectives. They stated that if no tutor was available, they could experience problems in a totally student-centered application. Since the e-PBL was applied at the end of third year program, the students were informed that they were expected to synthesize the previously learned biological, social and behavioral objectives to eliminate their anxieties and the expected advantages of the e-PBL application were explained.

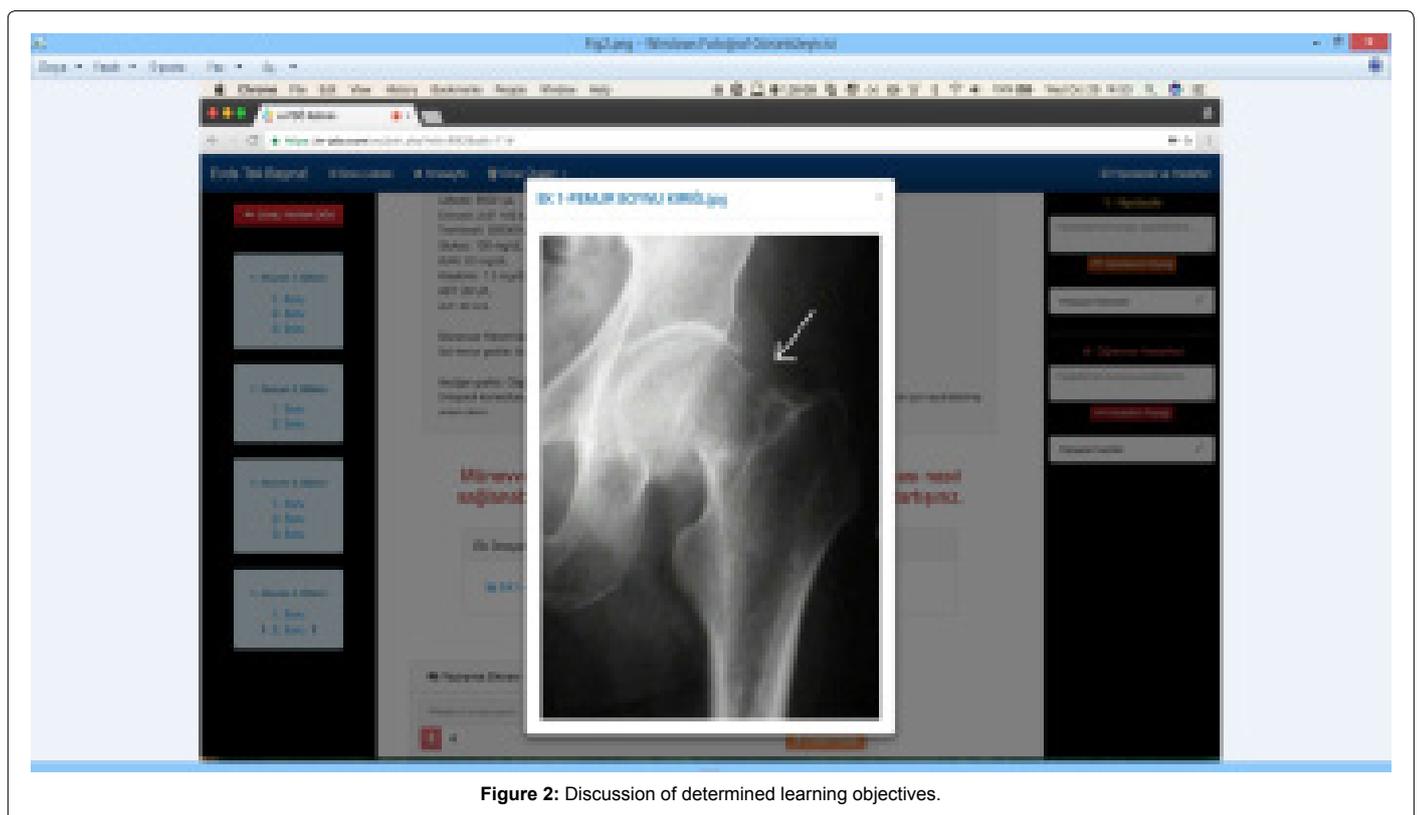
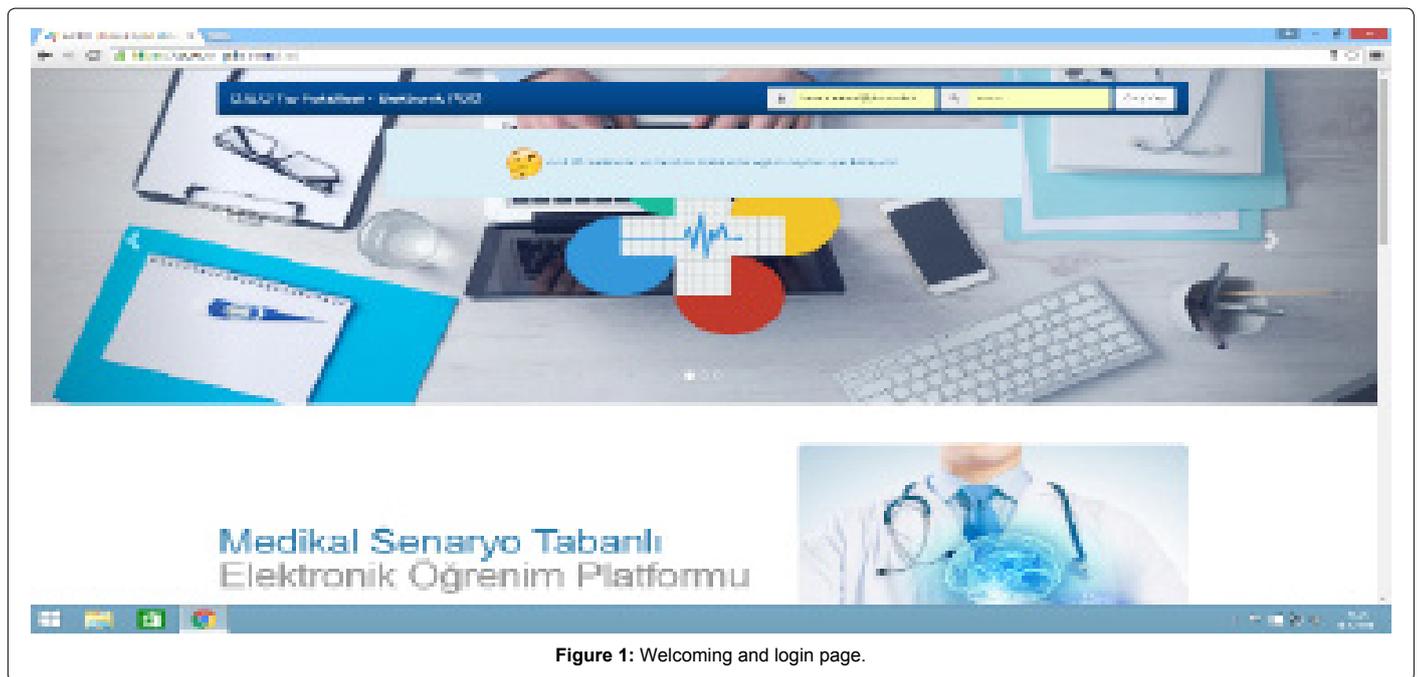
E-PBL was applied in seven scenarios each of which has two/three sessions. As in previous PBL blocks, there were lectures and practices in the number and content which does not prevent the independent

study process of the students in the weekly program. The students implemented the session through the experience they gained in the PBL sessions in the first three years and the facilitator status of the group discussion leader. The performance of the groups was evaluated by the tutors by synchronously monitoring the sessions and/or making use of the participation report. When it was applied in the first year, it was found that the students recorded progress in the determination of the learning objectives, and in their written and verbal participation in the sessions, but they could not reach the depth of discussion as in the classical face-to-face PBL sessions; also, some dysfunctional students inhibited the discussion process at the sessions. In the written feedbacks, there were statements indicating the failure of some group members to actively participate in the sessions, this affected the group performance negatively. There were some students who stated that the tutor's impossibility to actively participate in the sessions and the assessments which are only formative, negatively affected their motivations and the quality of the discussion. When students were reminded that the content and continuity behaviors were observed by the tutors, positive adjustments were observed in group performances. Since the importance of external motivation was also experienced in addition to internal motivation, non-active participation of the tutors in the sessions was thought to be beneficial for the following year, but they were involved in the process by making summative assessments. The assessment criteria were redefined to include: "physical participation of the student, continued participation in the session, hypothesis determination, learning objective determination, written contribution, verbal contribution, contextual quality of the contributions, material sharing, concept map formation, overall motivation" parameters. These were announced to the students in the introduction of the second year's program. It was stated that the scores to be received from e-PBL would be included in the PBL scores average of the other blocks.

Before the second year's application, some fulfilled studies on solving the experienced problems are presented below:

- Measures were taken against the problems that might originate from user error in the software (preventing recurrent messages of the users who press buttons too many times to enter their inputs, and so on).
- The interface which was used in the first year's application was improved, writing area was expanded, and the hypotheses were made visible by being listed in a separate field.
- A press-to-talk application was added to the system to record verbal communication.
- Vocabulary restriction was provided so as to prevent long text sharing that inhibits the discussion process.
- Problems experienced in the first year about recording and controlling concept maps were eliminated.
- The system server was moved from the Faculty to the University information processing center so as to eliminate the problems experienced at the beginning of the application in the second year, and the intensity and the slow-downs experienced due to the internet infrastructure were eliminated.

In the second year's application, it was found that the qualitative and quantitative participation of the students in the sessions improved when compared to the previous year in parallel with the development of the infrastructure, there was a minimization of the communicative and technical problems and the identification of the summative assessment criteria.



It was stated that the use of multimedia content in the PBL applications made the scenarios more realistic and increased the motivation and interest of the students [7]. In e-PBL application, radiology and pathology materials including photos, videos, audiovisual materials, and so on that were presented in scenarios and shared by the students increased the interest, and enriched the sessions and the discussion.

Introductory activities were recommended for introducing the group members in the online sessions [8]. Due to the negative feedbacks of the students about the absence of an introductory activity in the first year, introductory/warm-up module was added in the second year's application so that the group can get to know each other.

Students did not experience any problems in applying the steps in the sessions because they gained experience in PBL in the previous years.

Since the biological learning objectives in the Multisystem block, and the social, behavioral, forensic medicine and ethical learning objectives in the Life Cycle block intended to synthesize the gains acquired in the previous years, absence of tutors' questions and deficiency in directing did not create a significant disadvantage in terms of the gains of the students. However, by taking into account the restriction of the depth of discussion observed in e-PBL application when compared to the face-to-face PBLs, it was concluded that the students would experience difficulties in reaching the learning objectives to be met for the first time and might be restricted from gaining the advantages of PBL. In the e-PBL application, it was observed that tutors were able to assess the four groups. A fewer number of tutors were required.

Results

In the results of the theoretical exams made at the end of the Multisystem and Life Cycle Blocks, possible differences between the years when e-PBL was applied and the previous years were analysed. It was determined that the three years' average for the period when classical face-to-face PBL was applied was 78.6, while the two years' average for the period when e-PBL was applied was 77.8 out of 100.

Discussion

Students evaluated the efficiency of the group discussion, balanced sharing of the participation between the group members, quality of the information shared, quality of the scenario and the technical infrastructure of e-PBL application parameters with a five-point scale at the end of each scenario. It was found that the feedback scores were below the median value at the sessions with technical problems originating from the infrastructure, and the scores relatively rose at the sessions without difficulties, thanks to the measures taken throughout the process. It was found that the feedback score averages given to all parameters progressed at medium values every two years.

Upon examining the written feedbacks of the students, it was found that there were those who stated that e-PBL applications were successful; as well as those who stated that they were not as efficient as the face-to-face classical PBL sessions, that not all of the group members made active contribution, and that they had worries that they would become widespread by replacing other PBLs. The above-defined enhancements were made in the system in the second year in line with the first year's experiences and feedbacks.

Conclusion

Within the scope of the electronically implemented PBL applications in medical education, there are examples indicating that sharing learning material supporting classical face-to-face PBLs, online discussion platforms following the PBL sessions, clinical reasoning applications in which students are able to participate in at different times individually or in groups and multimedia scenarios, virtual patients are integrated to PBL sessions [4,7,9-13]. In Dokuz Eylul Faculty of Medicine model, all of the steps in the classical PBL format were electronically actualized by the students in synchronized e-PBL sessions. It was found that the e-PBL application which was developed

in the light of the experiences acquired in two years gave the students the gains anticipated at the beginning of the implementation, eased the educator's load and did not pose a difference in theoretical assessments. However, it is considered that it will be appropriate to continue with e-PBL for only the synthesis blocks at the end of the third year program since group communication and richness in discussion observed at e-PBL sessions were more restricted when compared to face-to-face classical PBL sessions supported by tutors' questions and directions.

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