

# CAPBLAT Development and Testing: Computer-Assisted Assessment Tool for Problem Based Learning

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**Abstract**—Recent years, Computer-Assisted Assessment (CAA) has become increasingly important in education. This is indicated by many researches that focused on the development of computer-based assessment tool to help assess performances of students from various disciplines. This study contributes to education area with the research on the development of innovative computer-based tool for Problem-Based Learning (PBL) assessment. A web-based assessment tool, named CAPBLAT, has been developed. The tool incorporates some methods of PBL assessment process which framed within “Problem-Based Learning Assessment Framework”. The tool has been created for evaluating students’ achievements on the PBL approach. This paper presents the development and user acceptance test of the CAPBLAT. The study utilizes the tool within two PBL classes as a medium for testing in the duration of one semester. A total of forty students participated in the testing of the tool. During the study, questionnaires were administered to students. The results concerning the assessment tool acceptance demonstrate that students showed positive feedback and accepted the usage of CAPBLAT for the PBL assessment process. It is also proved that the use of CAA in PBL gives advantages for both of lecturers and students by providing them with detailed formative feedback on their learning achievements compared to conventional assessment. It also reduces lecturer’s tedious load by automating parts of the task of marking students’ work.

**Keywords**—Computer-Assisted Assessment, Problem-Based Learning, peer-assessment, self-assessment.

## I. INTRODUCTION

The use of Computer-Assisted Assessment (CAA) in education has increased substantially in recent years. This is because most of the task of delivering course content, supporting both student learning and assessment can be applied by using computers[1-3]. According to Bull (2004), using computers to perform assessment is more contentious than using them to deliver content and to support student learning. CAA offers a number of advantages over traditional paper-based assessment, including the providing highly effective instant feedback, which students may take tests at any time and lecturer is free from manual marking [3].

The interest in developing CAA also has increased in recent years, several of computer-based assessments have been developed for use in education area. There is a need to develop assessment tools which are easy to use and can provide the necessary information that can help lecturers to improve students’ learning ability, performance and to help assess on students’ performances. *First*, this paper presents development of a computer-assisted problem-based learning assessment tool (called with CAPBLAT) which is designed to assist lecturers in conducting the PBL teaching method and assess students’ learning progress. The tool could also reduce lecturer’s tedious load by automating parts of the task of marking students’ work[4].

CAPBLAT has been specifically created to design and undertake computer-based assessment that conducted under PBL approach. Hence, the tool incorporates some methods of PBL assessment process which is framed within the “Problem-Based Learning Assessment Framework, called PBLAsF”. This framework consists of seven PBL assessment methods [5], which are Peer-assessment, Self-assessment, Group-presentation, Individual-activities, Group-report assessment, pre-test and post-test assessment. Then the framework was applied to the tool that encompasses the use of computer (CAPBLAT) which will assist lecturers for assessing their students’ achievements during PBL process. The tool also facilitates students to review and assess their peers’ contribution, to identify whether he/she worked well or not during learning process.

CAPBLAT has been developed by ensuring that it is easy to use. The process of developing CAPBLAT went through successive phases in an orderly way, some of the phases are tool design, programming, and tool testing [6]. For the intent that CAPBLAT can be used properly by lecturers or other educators to undertake computer assisted assessment. *Secondly*, this paper also presents user acceptance test of the CAPBLAT. Forty students were involved for the testing, and to know whether the targets of the testing match with the expected objective, the research conducted technology acceptance test against the tool, the activity was performed after completing the tool testing.

## II. TERMS IN THE STUDY

### • PBLAsF

Problem-Based Learning Assessment Framework (PBLAsF) is a framework of PBL assessment to provide a holistic approach for assessing students' process skills such as communication skill, problem-solving abilities and team-work skill. The aim of PBLAsF is to assist lecturers to assess their students in PBL approach. The framework (see Figure 1) consist several methods of PBL assessment; the methods have been selected based on the study on PBL assessment and

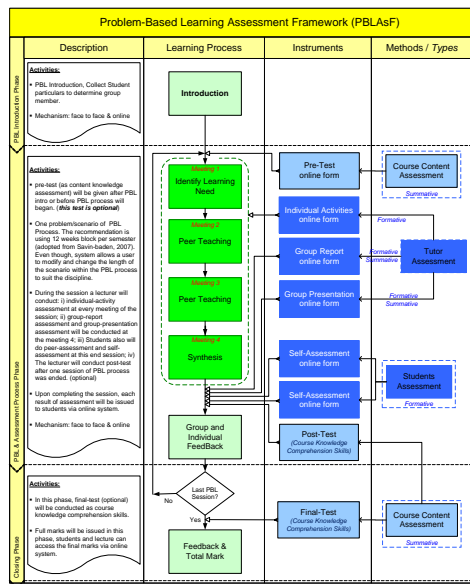


Fig. 1. PBLAsF

the survey among the practitioners[5]. The selected methods are: Peer-Assessment, Self-Assessment, Individual-Activity Assessment, Group-Report Assessment, Group-Presentation Assessment, Pre-test, and Post-test/Final-test. In the next step this framework was used as requirement for developing the CAPBLAT.

### • CAPBLAT

Computer-Assisted Problem-Based Learning Assessment Tool (CAPBLAT) is a computer-based assessment tool for assessing students' progress in PBL approach. The purpose of CAPBLAT development is to provide a computer-based tool for PBL assessment in order to assist lecturers who conduct PBL teaching method and effectively assess students learning progress and provide the students with detailed and specific feedback. The CAPBLAT was developed based on the PBLAsF as a proof of concept to verify the framework.

Main features of CAPBLAT are: i) Tutor assessment (Individual-activity assessment, Group-report assessment, Group-presentation assessment), ii) Student's assessment (Peer-assessment, Self-assessment), iii) Subject content assessment (pre-test, post-test, final test), and iv) Auto generated and manually generated group members.

## III. RESEARCH DESIGN

According to Figure 2, the research focuses on the development of CAPBLAT, which the tool development consists of four processes. During this phase, designing a Business Process Diagram (BPD) to define a "to-be" business process was modeled using a tool called Business Process

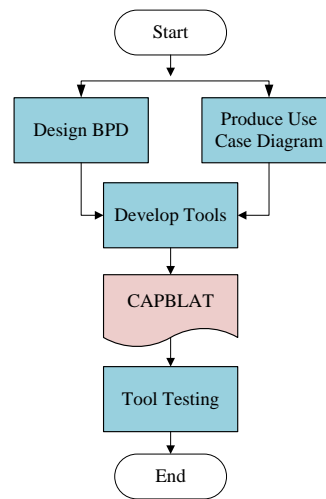


Fig. 2. Research Design.

Modeling Notation (BPMN). The BPD design helps to construct a use case diagram in order to capture user requirement utilizing the UML use case diagrams. Use case diagram was designed to develop the CAPBLAT. Then the research proceeds with user acceptance test of the CAPBLAT. The tool testing was carried out in two PBL classrooms in the duration of one semester.

### • Research Participants

There were 40 students from two classes who used the CAPBLAT in this research. All students involved were registered in second semester and this activity was their first attempt in PBL Online assessment. The testing conducted throughout their class activity with the duration of one semester.

To know whether the targets of the tool testing match with the expected objective, the research conducted technology acceptance test against the tool. The activity was performed after completing the tool testing by distributing a questionnaire. The participants were the same people involved in tool testing. The detailed procedure of technology acceptance will be discussed in next section (see the testing of CAPBLAT).

## IV. CAPBLAT DEVELOPMENT

Tool development is the process of developing software through successive phases in an orderly way. This process includes not only the actual writing of code but also the preparation of requirements, the design of what is to be coded, and confirmation that what is developed has met objectives [6].

### A. Functional Requirement

The tool developed was based on the PBL Assessment framework (PBLAsF) which was explained in Section 3. The fundamental thing that needs to be emphasized on the development phase is functional requirements, which aim to capture the intended behavior of the CAPBLAT. This behavior may be expressed as services, tasks or functions the system is required to perform the CAPBLAT. Business Process Diagram (BPD) and Use cases were used to capture functional requirements.

The BPD design helps to construct a use case diagram in order to capture user requirement utilizing the UML use case diagram[7]. With BPD, the researcher can understand how users work together and identify functions needed by the tool. The following BPD (Figure 3) has been created based on the description of the framework (PBLAsF).

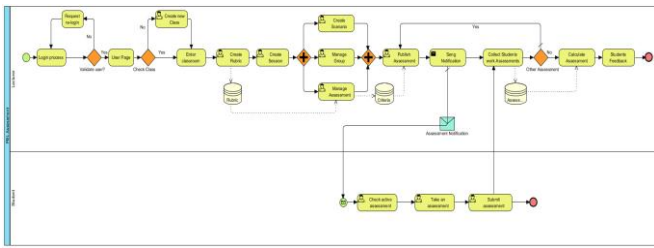


Fig. 3. Business Process Diagram (BPD) for CAPBLAT



Fig. 5. User Interface of The Lecturer Page

On the other side, the use case diagrams are used to gather the requirements of a system, including internal and external influences. The purposes of producing use case diagrams are: - to gather requirements of software; - to get an outside view of software; and - to identify external and internal factors influencing the software. Visual-Paradigm modeling for UML software has been selected to produce the use case diagrams.

The identified use cases diagram based on the framework and based on the BPD was depicted in the figure 4:

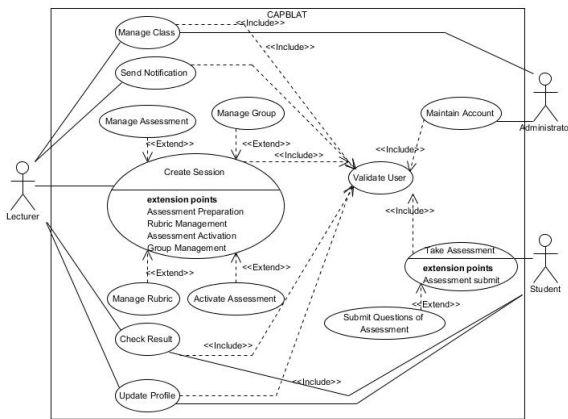


Fig. 4. Use Case Diagram for CAPBLAT

**B. User Interface Design**

Interface design is the process of defining how the system will interact with external entities (e.g., lecturers, students, other systems). According to Dennis, Wixon, et.al(2012)[7], the goal of interface design is to create a pleasant appearance of a system so that it would make easy for the user to interact with the system in a clear manner. In this section, the discussion focused on the design of user interfaces. For designing the user interface of CAPBLAT, the research pay attention to three principles from mechanisms of the user interface design as suggested by Dennis and Wixom (2012)[7], which are, navigation mechanism, input mechanism, and output mechanism.

The Figures 4 is a samples of the CAPBLAT’ user interface design.

**C. The Testing of CAPBLAT**

**Procedure**

Before the commencement of the PBL class, an introduction of PBL was given to the students. We also hosted a presentation of the use of CAPBLAT for the students, by means of a demonstration in the classroom. Then students were compulsory using the CAPBLAT for their PBL class.

During the PBL session of one semester, students presented three problems as a trigger for their work tasks in their respective groups. Each group members were encouraged to share and discuss their work on the dedicated online forum that has been provided during the program. At the end of each problem, students were required to fill the online form for their peers and their own performance. Upon completing the session, a questionnaire has been distributed to all students for the purpose of technology acceptance test against the tool.

**Data Collection**

A quantitative method was used to collect the data, which had been gathered via a questionnaire. The questionnaire was administered to students for the purposes of examining technology acceptance based on Technology Acceptance Model (TAM) by Davis[8].

Questions posed in the questionnaire were divided into two parts. In Part A, the questions were determined based on three factors, namely: Perceived Usefulness (PU), Perceived Ease of Use (PEU), and Attitude Towards Usage (ATU) with a total of 10 questions. The 5-point Likert scale from 5 for “strongly agree” to 1 for “strongly disagree” was used for the questions in Part A. Meanwhile, Part B consists of open-ended questions in which students are invited to provide comments and suggestions concerning the tool.

**Data Analysis**

The result (Table I) shows that average scores for each question of PU, PEU and ATU are all above 3,9 respectively. They range between “Agree” and “Strongly Agree”. The students generally agreed that CAPBLAT is useful, easy to use, and they have a positive attitude toward using it.

Responses to question Q1 indicated that 95 % of students were in agreement that the tool provides a comprehensive framework for PBL assessment by which to efficiently assess students' performances; while just 5% of them indicated a neutral position to this question. Responses to Q2 indicated that 92.5% of students showed their agreement that the tool is effective in assisting lecturers to assess their students by the PBL Method; while only 7.5% of them were shown as having a neutral attitude to this question. Regarding responses from other questions in factor PU (Q3-Q6), more than 75 % of students showed their agreement, while the remainder chose neutral and disagreement stances.

TABLE I. STATISTICS OF QUESTIONNAIRE QUESTIONS

Question	Percentage (%)					Mean
	SD	DA	N	A	SA	
<b>PU</b>						
Q1	0	0	5	57,5	37,5	4,33
Q2	0	0	7,5	42,5	50	4,33
Q3	0	5	10	32,5	52,5	4,33
Q4	0	2,5	20	55	22,5	3,98
Q5	0	2,5	20	55	22,5	4,35
Q6	0	2,5	20	55	22,5	4,45
<b>PEU</b>						
Q7	2,5	0	0	60	37,5	4,30
Q8	0	2,5	10	55	32,5	4,18
Q9	0	0	10	40	50	4,40
<b>ATU</b>						
Q10	0	2,5	15	45	37,5	4,18
Q11	0	2,5	20	55	22,5	4,20

1=SD: Strongly disagree, 2=DA: Disagree, 3=N: Neutral, 4=A: Agree, 5=SA: Strongly agree

According to the results of open-ended questions, it can be seen that most of the students gave positive comments on their experiences with using the tool. Some of the comments included: "the system is good and accessible. It is user-friendly and gives students continuous feedback on their progress throughout the course. Assessment is more reliable because each student was assessed by the lecturer, peers and even themselves".

### V. CONCLUSION

The use of CAA in education area has increased substantially in recent years. In order to contribute in education, the researchers developed CAPBLAT which this web-based assessment can be used by lecturers or other educators to undertake computer assisted assessment in PBL approach. The development of CAPBLAT based on the PBLAsF for assisting lecturers in PBL assessment, was considered successful. Since the CAPBLAT is a well-designed tool for assessment especially in PBL approach. The tool is also recommended for the use in others learning approach such as active learning approach, due to its features that were designed for multi-platform learning assessment.

This research has conducted tool testing and verification of the CAPBLAT. Tool testing is a process of evaluating a system based upon its behavior during execution. The activity has included User Acceptance Test to ensure that the tool meets the requirements and works as the user expected. The

activity also verified the framework which was embedded into the tool. Verification process was conducted to make sure the tool was built as per users' requirements.

CAPBLAT testing involved students using the CAPBLAT for the purpose of, specifically: reading the problem trigger, checking their progress, and assessing the online form for their peers and their own performance respectively. Reflecting upon the case study, the answers to the questionnaire as provided by the students showed very positive feedback on the use of the tool. The students were in agreement that CAPBLAT is useful, easy to use, and they displayed a positive attitude towards using it.

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