Authentic assessment strategies in problem based learning

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Problem-based learning (PBL) uses real world problems and tasks as the initiative objective in constructing knowledge and enhancing learning experience. This paper looks into authentic assessment strategies in problem-based learning using an interactive multimedia project as a subject of investigation. Through the use of a range of authentic assessments like process assessment which contains of process assessment (consists of students' *self reflection*, *peer's evaluation and task completion reports*); content assessment (consists of *pretest* and *posttest*); together with portfolio assessment, this paper outlined strategies that have worked, as well as those that have not in a PBL setting. The collective data showed positive feedback towards learning tasks including problem solving skills, team collaboration and knowledge enhancement.

Keywords: problem-based learning (PBL), authentic assessments

Introduction

Computer based courses offered in the Faculty of Creative Multimedia, Multimedia University have been using student centred and problem–based curriculum for teaching and learning. With the usage of ICT and authentic assessment on students' learning, lecturers and tutors facilitate the learning process while engaging student in real-world task, enabling the students to work in collaboration with each other in constructing knowledge, fostering communication and enhancing self-directed learning skill.

Like most PBL courses, these courses present students with complex, open-ended project and tasks that require integration of knowledge and skills in their problem solving. Contrary to conventional learning, PBL construct knowledge in a flexible environment and is action oriented (Moursund, 1999). In PBL, the lecturers and tutors acts only as a facilitator, a resource guide or a consultant in encouraging students' participation, providing resources and advice to students as they carry out their research to collect and analyze information, make discoveries, and report their findings. (Aspy, Aspy & Quimby, 1993).

Students take responsibility for their own learning as PBL encourages students to identify their learning needs and determine the resources they will need to use to accomplish their tasks (Bridges & Hallinger, 1991). PBL also encourages collaborative and cooperative learning among students and their peers; students play the key role in encouraging learning in this collaborative setting (Neo, 2003).

As the curriculum content in PBL is authentic and resembles the real-world setting, evaluation for students' work turn into authentic assessment which measure their performance and learning of the authentic content (Moursund, 1999). As students are responsible for their own learning in PBL setting, students learn self-reflection where they become proficient in assessing their own progression in learning and also peer-assessment on how to effectively provide constructive feedback to their peers (Moursund, 1999).

In assessing PBL, authentic assessment seems as a more appropriate means to assess learning compared to traditional assessments such as norm-reference and standardised testing that assesses recall of factual content knowledge (Torrance, 1995; Herington & Herington, 1998, Ward & Lee, 2002). Authentic assessment utilizes performance samples or learning activities that encourage students to use higher-order thinking skills. Wiggins (1990) compared the difference between traditional and authentic assessment, and stresses that assessment is authentic if it is realistic and requires that students use knowledge obtained in many ways. Herrington and Herrington (1998) have defined seven essential characteristics of authentic assessment in categories of context, the student's role, authentic activity and indicators as list in Table 1.

Authentic assessment are generally categorised into Performance Assessment, Portfolio Assessment and Reflection and Self-Assessment (Hart, 1994; Phillips, 2005). Performance Assessments test students' ability to apply acquired knowledge and skills in a variety of authentic contexts and work collaboratively

to solve complex problems. Portfolio Assessment involves developing a portfolio that documents learning over time which in this study include and not limited to: journal entries; peer reviews; artwork, diagrams, charts, graphs; multimedia presentation; group reports; student notes and outlines; rough drafts and polished writing (Hart, 1994; Ward & Lee, 2002). Reflection and Self-Assessment requires students reflect and evaluate their own participation, learning progress, and products which are essential component of autonomous learning (Hart, 1994).

Table 1: Herrington and Herrington's (1998) essential elements of authentic assessment

Categories	Criteria
Context	Requires fidelity of context to reflect the conditions under which the performance will occur (rather than contrived, artificial or de-contextualised conditions)
Student's role	Requires students to be effective performers with acquired knowledge, and to craft polished, performances or products Requires significant student time and effort in collaboration with others
Authentic activity	Involves complex, ill structured challenges that require judgments, and a full array of tasks Requires the assessment to be seamlessly integrated with the activity
Indicators	Provides multiple indicators of learning Achieves validity and reliability with appropriate criteria for scoring varied products

Designing an authentic assessment strategy

Glasgow (1996) categorizes assessment strategies into three areas of content, process, and outcome. Content deals with the knowledge students acquire, while process focuses on the students' ability to apply knowledge and skill in problem-solving. Outcome assessments whereas involve the products students design that shows their combination of content and new applications of knowledge, in this case the creation of a multimedia application.

The issue raised from PBL is to provide an authentic assessment strategy. This learning space requires support in collaboration and communication among the students as a medium to exchange ideas, conduct discussion and put hands together. Students research, document, do peer's feedback, design, learn various authoring tools for acquiring, manipulating, and communicating information in order to solve the problems and challenges given to them.

The scope of the study was confined to 53 students (N=53) taking Interactive Multimedia course, from Multimedia University. These students were not equipped with design and multimedia knowledge as they came from management or information technology background. Content assessment (consists of pretest and posttest) were conducted to pin point the students' knowledge gain in design and multimedia theories. A total of 10% is given to both tests (5% to each test).

Students then formed 11 teams (T1-T11) of four or five members (TM) of their desired choice. A Team Leader (TL) was elected from every team. Each team was to output a PC-based multimedia application demonstrating understanding and applying knowledge of design theories and techniques learnt in the lectures with the theme "Malaysian Culture" within a 14-week time frame. The content of the application was entirely the team's decision. At this stage, the instructors clearly define the standards and expectations of the application outcome and briefed the students of the criteria in assessing students' work. Throughout the assessment process, students were reminded again on the assessment criteria so not to lose focus. Authentic assessment is most successful when students know what the instructors expect. (Pearson Education Development Group, 2007)

The challenges behind this project was not limited to deal with team members who have multiple abilities, varied learning styles, and diverse backgrounds, but also problem solving strategies at different stages of the design. The maximum project grade (60%) goes to final portfolio assessment base on the criteria set by the facilitator which include the delivery of the final work, functionality and interactivity of the application, entertainment value, presentation skills and final submissions. This portfolio assessment made way in determining the PBL outcomes.

Process assessment which consists of self reflection and peer's assessment was designed to track the PBL process. Two sets of assessment forms were structured separately for each TL and TMs. The main objectives for these assessment activities were to determine the authentic learning experience, the prevailing attitudes of students towards PBL and the students' response to the ways this PBL would be supporting their learning process. A schedule with dates and times to collect the assessment forms was planned accordingly to match the multimedia project's program as George and Cowan (1999) found that a schedule or checklist will aid observation, focus attention, and lead the students to make records in appropriate form, which can be readily and comparably summarized and analyzed. These assessments activity were seen important as it determines the grades for team progress, team work and problem solving skills. This process assessment contributed to 30% of the students' total project marks.

Process assessment: Self reflection reports

Each TM was given a set of *Self Reflection Report* to fill up. These assessment forms were distributed to the students every alternate week to report their daily progress and development of the project. A column was prepared to allow TM to jot down problems encountered during the project execution so to highlight the issues during group discussion. The self reflection report permitted students to produce evidence of their task accomplishments. The nature of this assessment activity engaged meaningful and authentic problems; it involved students assuming responsibility for self-evaluation, thus encourage a factual and honest assessment report.

Subsequently, the assessment reports were compiled and submitted to their respective TL. Upon evaluation, TLs were to provide a status report for each task assigned e.g. "*Task completed", "Task on hold", or "Task in progress*". The task status and the problem and solution columns highlighted were meant to bring awareness to the TLs so to bring up the matter during their group discussion.

Process assessment: Peer's evaluation reports

Since this project entirely relied on students' self-exploration, the TLs were given the responsibility to monitor their TMs' explorations and guide the direction of their inquiries. In the Peer's evaluation reports, TLs oversaw their TM's report and summarized their progress according to their individual tasks. TLs submitted both the *Peer's Evaluation Report* and the *Self Reflection Report* to the facilitator. This data collection activity (as illustrated in Figure 1) was repeated until the completion of the project.
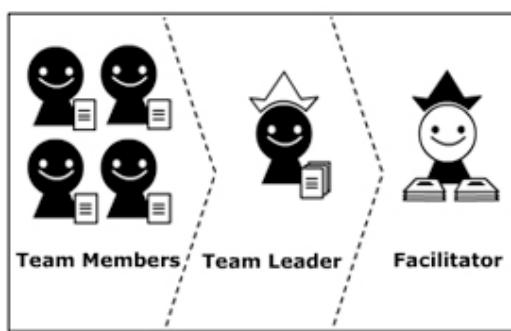

Figure 1: Data collection activity

Process assessment: The task completion reports

The *Task Completion Report* had the similar layout as *Self Reflection Report* except that students were to wrap up the final development of their projects and report the way they manage their remaining delegated tasks in the final week. TLs were to ensure that every given task was completed as scheduled. This *Task Completion Report* and all the other reports were in line with Oliver and Herrington's (2003) position that students' feedbacks were primary quality indicators to assessing and monitoring the teaching and learning process.

Overall observations

The problem-based multimedia project started out with TMs negotiating tasks according to their capabilities. Followed by TLs delegated tasks and planned out their team's deadlines and schedules. Data collection is divided into three stages: the beginning of the project, the middle of the project and the end of the project.

The beginning of the project

It was reported that all TMs played their roles and attentively filled up the self reflection reports. T3 and T7 passionately brainstormed ideas and concept for their topic; T1, T3, T5, T6, and T10 industriously gathered resources for their selected area; T4, T5, T7, T8, T9 and T11 thoroughly planned out the project goals, project milestones, software platforms, TM's roles and responsibilities. Throughout the semester, responses obtained from all teams' reports went on smoothly with full participation except for T2 and T11. This is due to lack of project commitments and communication in both teams together with negligence in TL to follow up with the assessment activity.

In the meantime, TMs' progress are monitored and reported to be in line with the planned schedules by other TLs. T3, T4, T11 were reported as being behind schedule due to the TLs' high demands on the project. Quality control was strictly applied on members' project output. However TMs willingly sacrificed their time for resource gathering and redoing unsatisfied output.

The middle of the project

Majority of the teams were functioning well, some teams reported enjoyment working on this project. T1, T3, T4, T6, T7, T8 and T9 have actively participated in process assessment activity. Through their reports, it is observed that TMs frequently in contact with their TL. Whereas TLs persistently carried out progress check on tasks segregated to their TMs. However, unavoidable problems encountered at this stage were technical problems, personal problems during the video shoot, and difficulties in conducting meetings. During this stage, TMs realized the need for discussion in order to come out with a solution. Communications between the TMs gradually improved at this stage. Aware of the time limitation, all teams pushed themselves harder towards work completion.

On the other hand, problems were observed in T2 and T8. T2 slacked off in team progress as TL abandoned the team development and lied about her involvements. There is no sign of improvement until the facilitator call up for urgent group meeting. Consultation and advices were given to improve the situation. As time went by, the situation of T2 had perked up with TLs learning to fairly plan out tasks and overcome communication barrier within the team. Almost all team members cooperated according to the planned milestones and managed to accomplish the given tasks on time. On the other hand, one TM was reported missing and could not be contacted in Team 8. This indicated undefined goals and negligence from the TL as well as TMs towards their team's unity and responsibility.

The end of the project

At this stage, detailed reports were received from all teams except for T2, T5, and T8. Reports indicated that most TMs tied good bonds with their TLs. T1 has shown the greatest motivation of among the teams. TL of T1 reported good communication with her TMs, and hence able to handle their project well. On the contrary, problems encountered by T2 were due to lack of leadership skill and a sense of responsibility in their TL. Consequently the TMs lacked the motivation to actively participate in this project. They were far left behind compared to other teams. Constant progress check on allocated tasks was practiced by all other TLs.

Findings and Discussions

Process assessment findings

The core of the process assessment was to ignite problem solving skills within the students in an authentic setting. Problems were inclusive of project obstacles and challenges, non achievable milestones and missions; conflicts, miscommunication and punctuality issues among the TMs; and lastly task delegations, responsibilities and leadership issues by the TLs.
Details of the team progress towards the multimedia project in this PBL setting were observed through this process assessment.

Excellent case
Upon assessing students' progress, it was observed that T4's TL attentively followed up with the TMs' progress as the team's vision is to complete the project earlier than the submission date. T4 stressed the need of having discussion to solve uncertainties. They constantly meet up to guide each other with problems, following up with each others' progress, give feedback and positively accept comments to

improvise their design work. Additionally the TL of T4 and T7 practiced a "receive and reward" strategy by giving compliments to members for being diligent, helpful, active, creative, responsible and efficient at different stages. These compliments became the driving force to uplift the team's spirit in creating a fun, interactive, informative and entertaining multimedia application. TMs actively played their roles and demonstrated high efficiency in the project. It was reported that both T3 and T4 opted for online conferencing when group meeting was affected by the haze and the mid-term break.

Apart from that, T3 took extra initiative in solving their technical problem for the project. They took the effort to attend additional classes aside from this course just to learn the creative Flash buttons' technique. It was reported that, "The process of searching through info was an exciting experience".

Similarly, a positive working attitude was observed in T7's *Self Reflection Reports*. It was noted that T7's pre-authoring stage took longer than needed due to difficulties in obtaining information that caused a cramped schedule during project execution. On top of that, due to their lack of knowledge and skill to construct the project's interface, TMs ended up spending more time to pick up the skills. However, positive thinking and teamwork prevail as the resulting multimedia application showed a remarkably well-designed outcome.

The process assessment activity also observed that PBL was in practiced at the early stage. T8 which confronted challenges using new authoring tools managed to overcome the problems with the help of senior students, and reference to online tutorials. The resulting project outcome was assessed to be well designed with good application of space, colour and composition. T1 ran into problems writing functioning code with the application testing returning error messages. Their persistence and determination kept them going after many attempt of trials for bugs and irregularities. The TMs felt a sense of achievement when the problems were finally solved. To them, it was an impressive and amazing knowledge enhancement through PBL.

Improving case
Cooperation was reported to be well-cultivated in T6. Data has shown high productivity and efficiency in completing scheduled tasks. Based on the 5th assessment, a lot of last minute work was reported due to lack of resources. TMs were reported to be in a state of panic while rushing to complete their tasks. However, they managed to complete their tasks accordingly and reported them as flawless.

Realizing their lack of design knowledge, T9 and T10 actively interacted with their TMs in seeking opinion for their design progress, fine-tuning the design contents and compiling the work as a piece. Besides that, T10 took the initiative to use past years' projects as reference and set up several bench marks for their own project.

Problem case
A contrast to T2, low level of team collaboration and motivation was reported with only two active members involved in the project. Additionally the TL was reported to be missing in action in the midst of the project. Consequently, the resulting project and learning outcome was poor as the team's goals were not achieved as planned. However, T2's members managed to identify their faults and determined not to commit the same mistakes in upcoming opportunities. With that, not only PBL has provided hands on experience to these TMs but also has raised awareness towards the right attitudes in confronting future challenges.

Likewise to T11, progress was less impressive with members not giving hand to the TL in running the project. Furthermore, the project did not progress as scheduled due to time constraints and distance issues. Additionally, technical issues such as scripting errors in their application have caused poor performance during the final presentation. However, the TMs were determined to fix the problems and modified their application at the very final stage. The team managed to identify and corrected the faulty areas in their application (i.e., all video clips had to be converted into proper file format and these resources were to be compiled and locate together in the same folder). As a result, their final product outcome showed a completed project, with no scripting errors, but mediocre in project quality. To wrap up, even though this group did not enjoy a delightful journey in delivering their given tasks as a team, however PBL has given them an opportunity to experience and identify these problems prior to joining the actual workforce. With that, it served as a reminder to the TMs to change their attitude to a good team player in the future work settings.

Content assessment: Pretest and posttest

Content assessment which consists of pretest and posttest were adopted as additional measuring tool to evaluate the knowledge enhancement base on PBL.
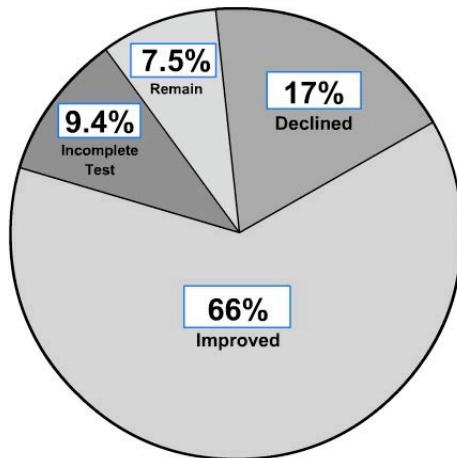

Figure 2: Pre-test and post-test score comparison (N=53 students)

As depicted in Figure 2, majority of students have shown knowledge enhancement in terms of multimedia knowledge (N=35 students, or 66%).

An obvious percentage gap, approximately 1/6 of the total sample size (17%; N=9 students) in comparison to students who showed knowledge declination with those who have improved. 7.5% (N=4 students) were in stagnant mode, showing neither improvement nor declination. Whereas 5 (or 9.4%) out of 53 students showed an incomplete testing, in that they had either participated in the pretest or posttest, but not both.

The results obtained from this assessment made way to a few conjectures. Large sum of knowledge enhancement demonstrated among the students has proven positive learning outcome based on PBL. Authentic assessment strategies played a major role on PBL as it enforces hands on experience and thus effectively aiding students in both knowledge and skill enhancements.

Diverse inferences were made on students who obtained poorer scores in posttest. PBL were unable to trigger their memory on theories taught and knowledge applied on multimedia project, hence did not seem to be helpful in enhancing these students' learning process. Another inference could be due to this group of students did not actively participate in problem solving activity and authentic assessment strategies. Therefore they were not able to register new knowledge into their memory.

Meanwhile, students who maintained their results in both tests showed no progression in PBL. Regrettably, the tests did not receive 100% participation due to a small group of students did not show up for either test.

Portfolio assessment: PBL outcome

Excellent projects
Project of T8 was assessed to be well designed and showed some level of sophistication. Good application of design theories such as colour distribution, space composition were being properly applied into the project.

Project outcome from T1 was proven to be interactive and entertaining. The TM claimed that not only they learn about the chosen subject matter, "Hang Tuah" (a famous Malay hero), they discovered improvements in terms of technicality, problem solving as well as knowledge.

TM of T4 created a fruitful product and authentic experience by creating a fun, interactive, informative and entertaining application. Good assessment was given to compliment their efforts contributed in this project.

Figure 3: Project snapshot for T8

**Figure 4: Project snapshot for T1**
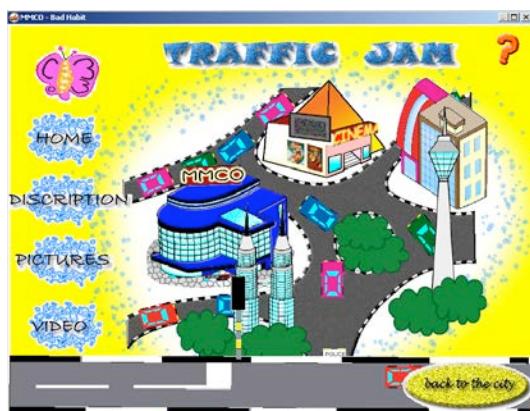
Figure 5: Project snapshot for T4
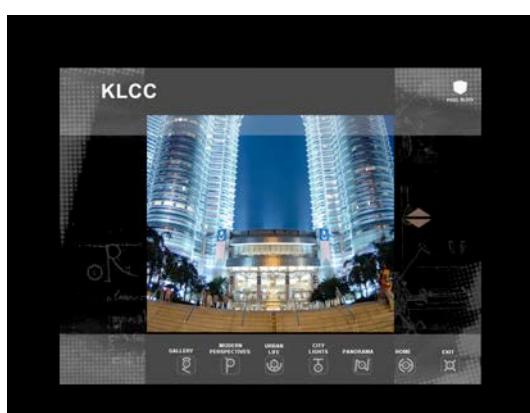
Figure 6: Project snapshot for T7

It was noted that T7 has showed a remarkably well-designed application, even though none of the TM had a strong design foundation. PBL was seen helpful in igniting knowledge enhancement.

Mediocre projects
Though T6 managed to complete their project accordingly, the resulting outcome showed a lack in technical sophistication.

With newly learnt skills, T5 manage to produce an interactive application with clear directions.

The project outcome for T9 and T3 were full of local, cultural, colourful and informative content.

Figure 7: Project snapshot for T6

Figure 8: Project snapshot for T5

Figure 9: Project snapshot for T9
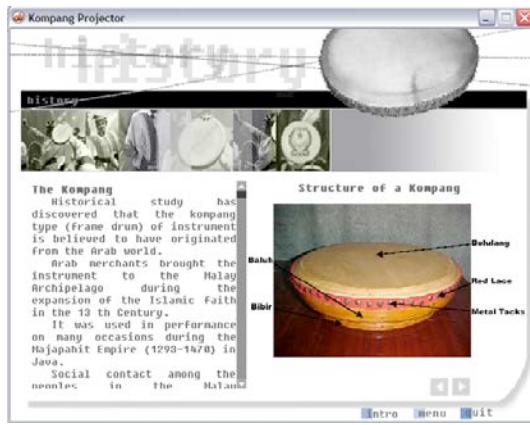
Figure 10: Project snapshot for T3

Inadequate projects
The resulting product outcome for T10 has showed poor design application and barely maximizes the usage of multimedia tools.
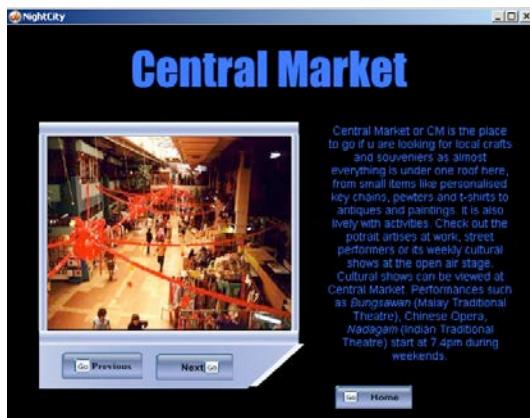
Figure 11: Project snapshot for T10

The final product of T2 was assessed as meagre in quality. The team's goal was not achieved as planned, and theories learnt were not fully utilized. Application constantly returned with errors and takes up a lot of time for loading.

Figure 12: Project snapshot for T2

Likewise, T11 product outcome was not impressive as well. However they manage to show a complete project without scripting errors, but with minimal design theories applied.
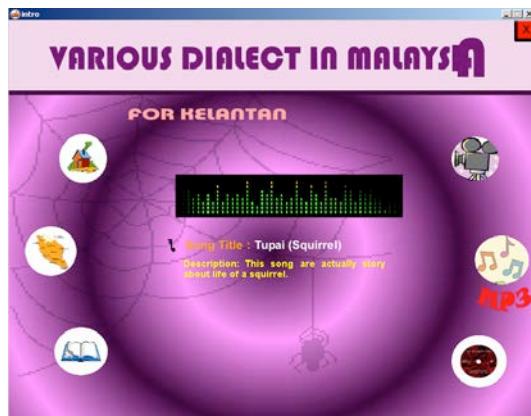
Figure 13: Project snapshot for T11

Conclusion

These authentic assessment strategies were instilled to promote a more student-centred approach to problem based learning. Students played a larger role in learning where each of them was responsible for their own learning. In this PBL setting, students constructed and shared knowledge between peers, involved in active learning and went through various form of knowledge evaluation techniques. Meanwhile, instructors played the role of the facilitator, probing and guiding students to group processes and also additional resources.

The authentic assessment strategies have shown to benefit the students. Through these assessments, students' problem solving skills related to real-world issues and high-level understanding were assessed and evaluated. As shown in the results, although some teams were unable to achieve the learning outcome, through authentic assessments, students' became aware of their mistakes especially in areas of communication and knowledge sharing, and so learnt not to repeat the mistake in the future.

Process asessment which contains of *Self Reflection*, *Peer's Evaluation* and *Task Completion Reports* allowed the students in identifying one's own progress and deficiencies, making them independent learners. Content assessment served as a measuring tool to evaluate students' knowledge gain, together with the ability to understand and apply knowledge learned from this PBL setting. And lastly, portfolio assessment enabled students to not only see the final learning outcome but to track their learning progress, achievement and growth with the documentation done in various forms.

All in all, implementation of authentic assessment strategies is seen as a tedious process to evaluate students' learning, a more efficient authentic assessment strategy is needed to maximize future research in PBL.

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