

Triggers in PBL Using Animations and Graphics to Enhance Self-Directed Learning Readiness among TVET Students

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Abstract

Self-directed learning skills required to help students strengthen their knowledge and build new understanding, appreciation and reflecting on their thinking processes. Students can control their own learning, responsible on managing and evaluate their learning. The purpose of this study is to investigate whether the use of animation can increase self-directed learning readiness in problem-based learning among polytechnic student in Malaysia. To achieve this purpose, this study comparing the finding from problem-based learning using animation with those in problem-based learning using text and images. Problem-solving process were being repeated to help students interpret engineering drawings work steps correctly and accurately. The instrument used is the Self-Directed Learning Readiness Scale (SDLRS) developed by Fisher, King & Tague (2001). Consequently, the findings of this study imply that animation can be an effective medium to present authentic situation in order to enhance self-directed learning readiness among student. The results showed significant differences in mean scores post-test of self-directed learning readiness among the students enrolled in problem-based learning using text and images with the group of students who attended problem-based learning using animation after effects of pre-test mean score is controlled. Therefore, the effects of animation modes have a positive impact on increasing self-directed learning readiness must be in Font Size 8, in the Bottom, First Page, and Left Side

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1. Introduction

Engineering Drawing is one of the elective courses offered to all students enrolled in of civil engineering, electrical engineering or mechanical engineering. According [1] Engineering Drawing integrated as geometric drawing combined with all fields of engineering. This subject develop more professional skills in engineering drawing. In addition, self-directed learning skills required to help

students strengthen their knowledge and build new understanding, appreciation and reflecting on their thinking processes[2] Students can control their own learning, responsible for managing and evaluating their learning with a friend or lecturer [3]. Individuals who engage in self-directed learning processes take their own initiative either through the help of others or build their own learning needs and learning goals. This research need to choose a suitable media or medium to retrieve

information and need to select appropriate learning strategies to support teaching method Engineering Drawing.

Self-directed learning readiness relates to the method of problem-based learning [4]. Self-directed learning is also often associated with problem-based learning theory in which the interaction occurs along with learning process [5] Self-directed learning need students to solve problems and this method can improve students' intrinsic motivation [6]. Through self-directed learning, students should be able to choose the time, learning methods and can determine their own learning goals efficiently [7]. When students have high self-directed readiness, they were able to solve the problem through information that have to be explore. Active learning will happen if students participate in the process of Problem-Based Learning (PBL) and build their learning strategies [8, 9]. In addition, employers are more likely to employ people who are capable of displaying their self-directed learning skill with combination of technical skills and personal skills in industry [10, 11]. These features are needed in all sectors of employment in Malaysia.

Problem-based learning is a learning method using real problems that are relevant and meaningful as the focus

in the learning process [12]. Problem-based learning is considered as a method of teaching and learning based on the concept of knowledge, understanding and experience [1] Problem-based learning is one of the most typical instructional strategies that reflect the constructivist learning approach. In this study, the problem usually consist of a description of design and drawing a engineering product. In this study, the problem usually consist of a description of design and drawing a engineering product. Each situation needs explanation to promote active learning among students. The task for each group is to discuss the problem which is presented in animation mode and text with images mode. In the process of problem-based learning, students will be given a situation and they are required to solve the problem by seeking information from books, journals, internet and other media. In this case, the lecturers also act as facilitators to the students. References [13] states that the problem-based learning as a philosophy for a new curriculum. This means that lecturers are no longer acting as a source of knowledge or reference by students. But students gain their knowledge and information from other sources.

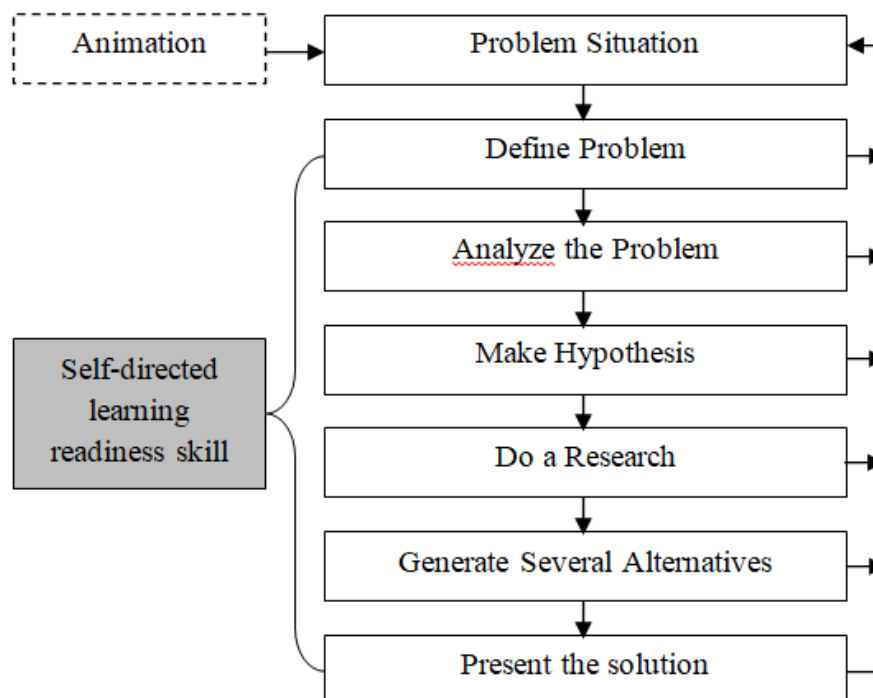


Figure 1 : Problem-Based Learning Model

Self-directed learning is applied in the problem-based learning method so that student will be able to build a more meaningful experience. In addition, problem-based learning helps students achieve specific learning to make them competent and capable. Students are also able to identify their strengths and weaknesses and also can work

effectively in groups.

Problem-based learning is a teaching and learning process that simultaneously builds problem-solving strategies and the basic areas of knowledge and skills which students play an active role in problem solving[14]. Problem situations describe a phenomena shown in

storytelling as ill structured problems. Therefore, students can find a variety of solutions to the problem. Problems are selected based on the actual situation and adapted to the criteria in learning objectives. Problem-based learning makes students more responsible, independent and active for their own learning. They will realize that in problem-based learning, they need to have better understanding and solve the problem exist [15].

Problem Based Learning

Figure 1 shows the seven steps in the problem-based learning. Problem-Based Learning Model Fogarty (1997) is applied in this study as a systematic problem-solving process and the problem will be seen repeatedly.

Corresponding to the Figure 1, the students will present their storytelling with a problem situation displayed in animation. Figure 2(a) shows a short video of animation display on the e-Engineering Drawing blog. The issue of problem is real situation and ill structured problem [16]. Presentation using animation help students to improve their understanding before solve the problem.

For the next step, students will define the of problem based on existing information, prior knowledge and experience. Definition the problem will change throughout

the process until the step of PBL finish. Figure 2(b) shows the question student should answer using website Poll Everywhere. In a step to collect information, students will use prior knowledge and experience. Figure 2(c) show FILA table which is used to facilitate in gathering information of students and their plan for the next solution. FILA offer four separate columns that need to be filled by students of a 'fact', an 'Idea', a 'learning issues' and a 'source needed'. The next step, in Figure 2(d) students will do a research to find the solution. They need to explore the information through books, journals, websites and notes. Information and ideas are shared with the others members of the group using Wikipedia. Facilitators also give an extra opinion and information to help student seek the idea. Figure 2(e), students need to generate a suitable alternative to the solution of the problem. After that, the students will make the final decision and present the solutions to support their findings.

Self- Directed Learning

Self-directed learning is a process of learning individual's ability to plan and manage their own learning [20].

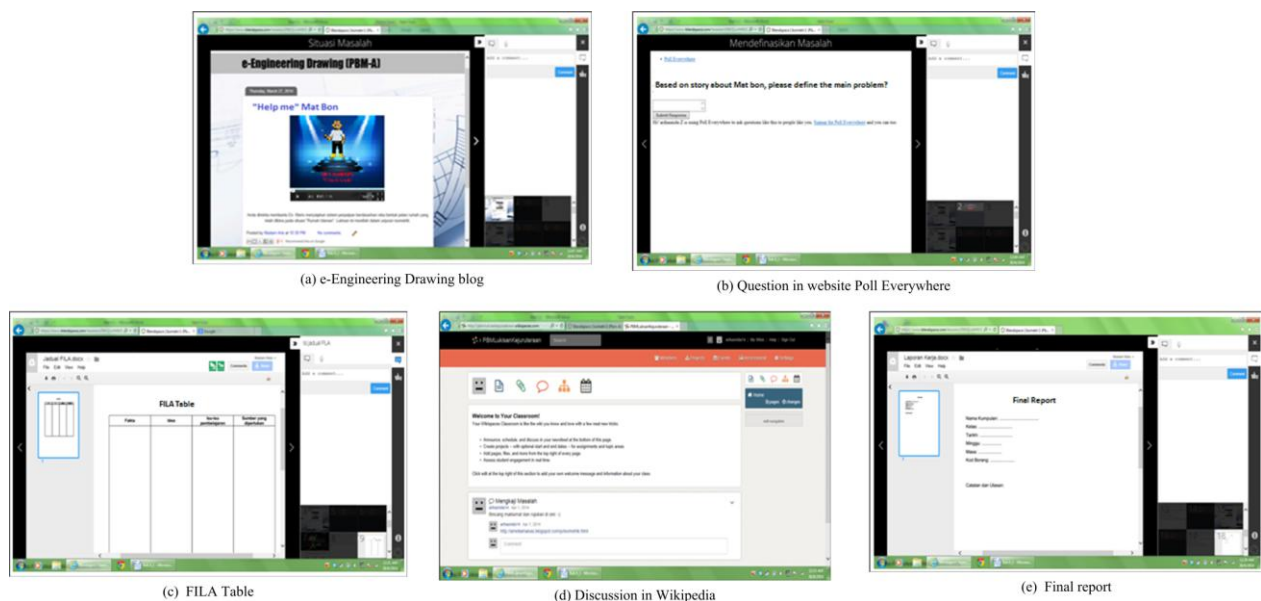


Figure 2: Partially Content of e-Engineering Drawing blog

[17] described self-study as a personal property owned by some of the students that affect their attitudes towards responsibility for their own learning. Another definition is a form of education in which students have the main responsibility for planning, conducting and evaluating their own learning experiences [18]. Self-directed learning gain during a process of PBL from peer discussions, collaboration between team members, access to information, research and development, and working through the workbook

Self-directed learning concept should be understood as individual learning methods. That means students need to identify the learning needs of a properly managing learning resources and skills to evaluate the results regardless of the place or the distance [19]. In fact, in the Self-directed learning, all decisions and how to communicate with external sources depends on the student's own. To encourage students in self-directed learning, this study designs a good animation for the student to gain motivation. In self-directed learning,

motivation is an important element and lecturers need to guide and control the learning process [20].

Students have different levels of ability and willingness to accept responsibility for themselves. Self-directed learning is a process that involves a series of inter-related activities to present the problem. This process in which individuals take the initiative, with or without the help of others, diagnosing their learning needs, formulating their learning goals, identifying the source of the information and materials for learning, choosing and implementing appropriate learning strategies, and assess learning outcomes.

Problem Presentation Using Animation

This study have integrated these animation storyline based on principles underlying the Cognitive theory of multimedia learning [18].

a) Modality principle- Students can learn better if there is an animation with audio along with the text. PBL-A is based on the use of animated elements and associated audio.

b) Redundancies principles -Students can learn better if there is an animation with audio along with text. This increases the cognitive load when combined together. The researcher did not incorporate animation, audio and text to avoid confusion during the intervention.

Based on [21], the research suggested the use of multimedia, including animations, to teach difficult subjects such as Engineering Drawing will allow students to access the new learning in PBL. Thus, designing the animation should be plan correctly, as the animation can assist students in constructing and understanding the complex problem in PBL. The storyline of animation is designed to satisfy the following criteria:

- Include scientifically accurate information while presenting a the situation of problem based on curriculum of Engineering Drawing course.
- Help the students to improve intrinsic motivation. Motivation also increases self-directed learning readiness among students.
- Help redirect and focus students' attention in certain topics are related with real situations.
- Allow students to interact directly with animation video and freely explore the content of PBL.
- Stimulate recall of prior knowledge and transfer the concept to solve the problem.

2. Methodology

The purpose of this study is to investigate whether or not the use of animation can increase self-directed learning readiness in problem-based learning among polytechnic student in Malaysia. In this study, the selected design is quasi-experimental study in the form of pre-test and post-test of the two treatment groups. PBL group through trigger in animation mode is called PBL-A and the others group PBL through problems in the mode of text and

images storytelling is called PBL-G. Furthermore, these two groups will took a post-test II to identify the retention of PBL-A and PBL.

Table i: Intervention

Group	Intervention		
PBL-G	O_1	x_1	O_2 O_3
PBL-A	O_1	x_2	O_2 O_3

x_1 = PBL-G, x_2 = PBL-A, O_1 = Pre Test, O_2 = Post Test I, O_3 = Post Test II

Purposive sampling are used in this study. 68 Engineering students from polytechnic in Malaysia are selected. These study only focused on the Isometric Projection topic and this experiment only took three months. The instrument used to measure self-directed learning readiness instrument adapted from Self-Directed Learning Readiness Scale (SDLRS) developed by [12]. SDLRS instrument widely used in the field of Technical and Vocational Education to measure students' self-directed learning readiness in the fields of engineering [22].[23] build each item with a brief and use simple language. SDLRS instrument consists of 40 items and has a three constructs of self-management (item 13), the determination to learn (12 items) and self-control (item 15). Likert scale used is from 1 (strongly disagree) to 5 (strongly agree). The coefficient of reliability for the entire item is 0.94 while the coefficient of reliability for each construct is self-management (0.87), the determination to learn (0.86) and self-control (0.88).

3. Results and Discussion

Refer to Table ii and Figure 3, the findings of the analysis of the PBL-G found that post-test mean score ($M = 146.88$, $SD = 23.108$) were relatively higher than the pre-test mean score ($M = 124.09$, $SD = 20.593$).

Table ii: Descriptive Analysis

	Pre-test	Pos-test I	Pos-test II
N	32	32	32
Mean	124.09	146.88	160.47
Standard deviation	20.593	23.108	11.311
Minimum	82	107	136
Maximum	167	200	180

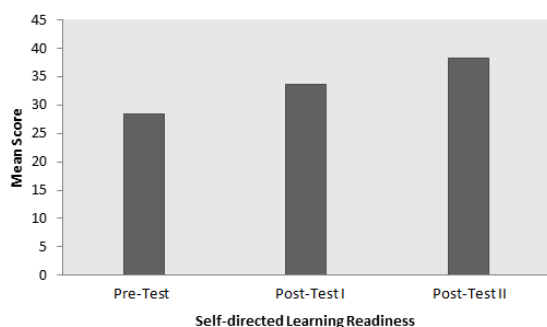


Figure 3: Self -directed Learning Readiness (Pre – Test)

Refer to Table iii and Figure 9, available post-test mean score of the PBL-A ($M = 162.64$, $SD = 10.810$) were relatively higher than the pre-test mean score ($M = 138.31$, $SD = 17.942$).

Table iii: Description of the mean, standard deviation, minimum and maximum

	Pre-test	Pos-test I	Pos-test II
N	36	36	36
Mean	138.31	162.64	164.47
Standard deviation	17.942	10.810	8.759
Minimum	105	140	145
Maximum	180	185	182

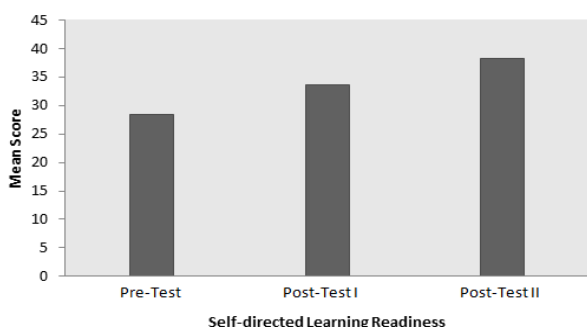


Figure 4: Self Directed Learning Readiness (Post –Test)

The results of this study show that there are differences between PBL-A and PBL-G. This study showed that students' self-directed learning readiness had increased when following the treatment in the PBL-A. The use of animation will enhance the delivery process to ensure it is delivered. It also allows something rather difficult to explain with words or static images more easily and effectively [24]. Entertainment elements should be inserted in the process of teaching and learning to raise motivation and help them to improve their ability to plan and manage

their own learning [20]. PBL-A in teaching and learning process provides self-directed learning platform better. It allows students to do research, learn with the group study, access information and identify the learning outcomes. Students will have the ability to take responsibility for themselves after going through the process in PBL until the step finish. Reference [20] considers it as a process in which individuals take the initiative, with or without the help of others, diagnosing their learning needs, formulating learning goals, identifying the source of the information and materials for learning, choosing and implementing appropriate learning strategies. Each student in the treatment group will go through the same stages of training the ability to control self-directed learning. In this study, all activities will be implemented in a weekly series. The findings also show that students are always given the opportunity to improve self-directed learning readiness more effectively.

Table iv: One-way ANCOVA to test means score self-directed learning readiness

Source	Sum Sq.	df	Mean Square	F	Sig .
Corrected Model	4302.61 ^a	2	2151.309	6.80	0.002
Intercept	36840.09	1	36840.09	116.52	0.000
Pre. Visual	92.731	1	92.731	0.29	0.590
Group	4114.10	1	4114.104	13.01	0.001
Error	20551.07	65	316.170		
Total	1663207.00	68			
Corrected Total	24853.691	67			

Through one-way ANCOVA analysis, the impact of PBL applied to the values on the mean post-test advanced visualization skills can be determined. Results of this analysis are shown in Table v. The results of one-way ANCOVA analysis on the data of this study demonstrate the value of $F = 13.012$, the mean square error = 4114,104 and $p < 0.05$.

The findings of this study show that there are differences between PBL-A and PBL-G. This results in Table iv shows that students' self-directed learning readiness had increased when following the treatment in the PBL-A. Reference [25] found that intrinsic motivation had affected students' self-directed learning readiness. They found that students' motivation and application of PBL as a catalyst to increase self-directed learning readiness. Animation throughout the process of PBL will be able to create a situation of effective learning and improve the student's motivation because they will be able to interact in a fun way [26]. The narrative in problems presentation with the story of Mat Bon provide added value in implementing motivation in learning through PBL. Mat Bon expression, movement and attitude contribute to the

fun storytelling and use to convey the message of learning.

This finding is also consistent with a study by [27] which describes the influence of motivation in the animation being the main driver of revenue and an increase in self-directed learning readiness. It is also supported by a study, [28] showed an increase in self-directed learning readiness due to two main factors, namely intrinsic motivation and attitude of the student's responsibility to solve the problem of learning. The animated Mat Bon story showed plumbing skills without explaining the true picture happened if the piping system was not designed accurately. The assertion problem in the animated elements is capable of generating motivation compared to the use of images [29]. In this study, the animation process in storytelling problems is more effective in providing information to assist students in planning the problem solving process in PBL more regularly. Furthermore, the application of PBL in Model Fogarty (1997) helps students redefine the problem every step in PBL.

This study was supported by [30] in his study that found the use of animation in PBL helped students to manage their learning more consistently. This is because students are more easily understood the steps to resolve the problem compared to conventional methods of learning. The most important function in the process of PBL is to improve students' self-directed readiness, improve the quality of curriculum and teaching strategies[31]. In this study, the design of PBL compiles steps systematic problem solving. Problem situations in animation seen repeatedly showed a positive effect in improving student learning plans. The use of animation in the PBL online can provide a platform that seeks to stimulate active learning, encourage intrinsic motivation and student-centered strategies [17]. Animation storyline in this study also encourages curiosity of students and enhances students' understanding in finding a solution [29].

Table v: One-way ANCOVA to test mean score self-directed learning readiness

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	2862.000a	2	1431.000	12.234	0.000
Intercept	37226.688	1	37226.688	318.271	0.000
Pre_visualization	82.441	1	82.441	0.705	0.404
Group	2820.789	1	2820.789	24.116	0.000
Error	7602.750	65	116.965		
Total	1912599.000	68			
Corrected Total	10464.750	67			

Through one-way ANCOVA analysis, the impact of PBL applied to the values on the mean post-test advanced visualization skills can be determined. Results of this analysis are shown in Table v. The results of one-way ANCOVA analysis on the data of this study demonstrate the value of $F = 24.116$, the mean square error = 2820,789 and $p < 0.05$.

A study conducted by [32] in line with the findings of

this study revealed that the use of animation to transform learning styles to improve their self-directed learning skills. The implication, students can improve their memory while learning to master each level. The animation of Mat Bon story help student to gain better knowledge and provided long term memory [33]. This animation will be able to assisted students to control the progress and seek new knowledge freely. Therefore, this animation elements enable students to be independent and enhance their self-directed learning readiness. Reference [32] found that the use of animation in teaching aids gave positive reception of students in the classroom. In addition, the animation will also expedite the process of understanding in learning over the use of graphics alone. Integration of animation with PBL encourages self-directed learning readiness.

The findings are also consistent with studies conducted by [28] which found they there was a positive change each time the student went through learning sessions using interactive multimedia materials using animation. Studies performed by them can enhance the ability of self-directed learning readiness. This creates a learning environment more attractive and able to convey the message of storytelling problems effectively [33]. PBL online approach also helps students to develop new knowledge and improve their ability to explain the solution to the problems of Mat Bon story [31]. The use of animation also trigger students' motivation and build a sense of responsibility for their own learning [34]. This is a relevant approach to foster students' desire to learn independently and increase the resilience in facing the challenges they face.

4. Conclusion

The findings of this study imply that animation can be an effective medium to present authentic situation in order to enhance self-directed learning readiness among student. The results showed significant differences in mean scores post-test of self-directed learning readiness among the students enrolled in problem-based learning using text and images with the group of students who attended problem-based learning using animation after the effects of pre-test mean score is controlled. Therefore, the effects of animation modes have a positive impact on increasing self-directed learning readiness.

Students will continue to build new knowledge from information obtained by the students' existing knowledge [16].PBL-A helps students improve self-directed learning readiness better. Presentation of problems using animation enable students to explore their own solutions at the same time they are responsible of their own learning. PBL provides a platform for the latest learning methods appropriate for collaboration between students and lecturers to inject a sense of interest and develop ideas based on online discussion. This gives the students the opportunity to actively interact among lecturers and other students. Indirectly, students will explore the information

correctly in cyberspace. This method also provides significant implications for changes in students' attitudes towards self-directed learning.

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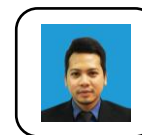
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