Learning design: reflective video as self-control in project learning for physics teacher candidates

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Abstract. This research aims to: 1) Identification of activity steps in project learning that can be recorded by video to facilitate formative assessment, and 2) Design a Self-Regulated Project Based Learning (SRPjBL) model to improve competences of Indonesian physics teacher candidates. The research method is done through two phases: 1) Study of literatures on video recording advantages in PjBL, and 2) Propose SRPjBL model to improve competences of physics teacher candidates through video recording based evaluation. The results show that the main phase of project learning is the inquiry activities to create new products. The activities are as follows: Problems challenging, preparing, planning, performing, and Evaluating. The process in each activity is integrated with self-regulation to improve competences of teacher candidates. Competencies are as follows: professional, pedagogic, personal, and social. Assessment of activities and products is easier by video documentation. In the future, this model can be used to explore competences of professional, pedagogy, and social of physics teacher candidates.

1. Introduction
The main challenge for teacher candidates in the 21st century is the knowledge of technology in learning. Meanwhile, they must solve the problem of heterogeneous student characteristics, difficult and complex subject matter, higher learning process standard, and are required to explore students’ skills in high-order thinking [1], innovation [2], and communication and collaboration [3]. Therefore, universities should be able to apply variations of appropriate learning models to improve the professional, pedagogy, personal, and social competence of teacher candidates. The project-based learning model for heterogeneous learners has been proposed by Musa, F [3] to train the competences of teacher candidates. This model has been predicted to improve the competences of teacher candidates. The resulting impacts are improving: HOTS, problem solving, collaboration, social, and communication. Meanwhile, the assessment of physic teacher candidates’ performance in each project-based learning process can be effected using video club [4]. The ‘human-tech’ relationship of the 21st century is not mechanistic-mechanical. However, it is a communicative interaction that demands high-order thinking (HOT). One of them is the quality of video recording technology. Technological developments make it easier for people to take advantage of video recording tools. In fact, every Android-based Smartphone has been installed video recording app. This app is ready for use by anyone, anytime, and anywhere because it is always taken and used. In educational institutions, educators use video as learning media such as videotaped offline [5] and online lecture videos [6].
However, it is still rarely used to assess the learning process especially for teacher candidates. In Europe, this video app has been applied to assess the learning process. Delen, E. [7] has found that the effectiveness of the evaluation of the learning process by video in southern Texas; video club on west coast U.S [4]; videotaped in German [8]; and streaming video in England [9]. Learning models with 'collaborative approaches' require video recorders to control and evaluate the learning progress of each learner especially for teacher candidates. Learning models that require technology are models of 'scientific approach'. One of them is PjBL. English M. C [10] has divided the PjBL process into three phases as follows: Problem launch, guided inquiry, and conclusion (Fig. 1).

![Figure 1. Strategy for evaluation of PjBL phases using video](image)

Each phase is controlled by self-regulation and evaluated formatively. Yoo [11] proposes that self-performance evaluations using videotapes have a positive impact to improve students' skill competency. Therefore, the purpose of this study is as follows:

a) Studying research since 2003-2016 related to PjBL evaluation models using video recording,

b) Propose the design of SRPjBL model integrated by video recording evaluation to improve the competences of physics teacher candidates.

2. Experimental Methods

The research method for designing SRBPL model is divided into two phases as follows:

**Phase I:** Review the literature on video-based evaluation models to control the main steps of project learning. The stages are as follows: First, review the research since 2003-2016 regarding the role of video as an assessment in PjBL found from Google-scholar with keywords: "Evaluation for PjBL using video" and "Assessment of project-based learning using video". Second, analyzing reflective videos as a self-assessment in the PjBL processes [12].

**Phase II:** Propose the design of self-regulation based project learning to improve the competence of Physics teacher candidates. Project performance assessments and controls are evaluated through reflective videos created during project completion.

3. Results

Previous studies that have taken advantage of video for formative evaluation in each of the PjBL phases are shown in Table 1 as follows.

The research results found in accordance with the keywords are as follows: Dop-pelt, Y.[13];[14], Gülbahar [15]; Macias [16], Frank [17]; Land [18], Ardaiz [19], Smith, S. [12]. These reports are involved because they are the main references of various researches. Technology issues are the most frequent cases of project topics for learners from 2003-2016.

Based on Table 1, the process of project learning proposed by English M.C [10] is divided into three phases. Phase I contains a trigger question that covers real issues. Phase II is an investigation activity to solve the problem. The Phases are Planning, Implementing, Reporting, and Evaluating. The last phase is concluding to reflect the product produced in the project. The weakness of this project model is not all experienced trainers to apply it. The reason is that it takes a long time and many instruments...
are used for each process. Bell, S. [20] has found that many skills are emerging and not measurable in every project activity. Alternatively Bell, S. [20] proposes an authentic assessment model. Since 2003-2016, researchers tend to use portfolios and observations to assess the process in learning. In fact, this method of assessment allows some meaningful assessment processes to be missed. Previous research has applied worker appraisal using video recording. However, in 2016 only done by Smith, S. [12] to record every process in PjBL.

Table1. Research reports related to using video for assessment

| Phases | Instruments of PjBL |
|--------|---------------------|
|        | Doppelt, Y. [13];[14] | Gülbahar [15]; Macias, J. A. [16] | Frank*, [17]; Land, [18]. | Smith, S. [12] | Ardaiz[19] |
| Problems | Technological project | Instructional Technology | Creative Thinking in Technology | Process of learning | Wikideas and Creativity |
| Guided inquiry (Planning, Implementing, Reporting, Evaluating) | Portfolios, observations, and interviews | E-portfolio | Portfolio | Reflective videos | Interviews, observations |

Sources of research reports using videos to assess the learning process especially for teacher candidates in PjBL are lacking. The advantage of this assessment is that teachers provide detailed assessments of PjBL activities that have been documented through the video. Therefore, educators become more flexible to use it because the video can be played anywhere and anytime. Teacher candidates are able to record every challenge experienced in real-time to solve problems. The results of Smith’s research become an answer to the problem of authenticity in PjBL which can be used as project in PjBL. Previously; Thomas [21] has provided an overview of the difficulty of determining the theme of problems in applying PjBL.

PjBL is a product-oriented learning. Therefore, assessment of learning outcomes tends to be based on product innovation. Smith [12] reveals that any meaningful process that has been experienced in creating a product is essential to be documented. A variety of meaningful experiences such as: learning between friends, social interaction, how to manage yourself, and others. This case can be illustrated like a billionaire. Some people may not consider it important how to become a billionaire. However, for the billionaire, the experience already possessed for success is very meaningful to share. Therefore, it can be used as a motivation for others. English, M. C [10] reveals that the motivation of learners arises from their sense of responsibility for a project work. Meanwhile, motivation will be the response of learners to manage themselves. The proposed SRPjBL model is expected to train and explore the competences of physics teacher candidates. The strategy as follows: The PBSRL model involves the ability of self-regulation as a result of the motivation of teacher candidates to complete the project. Self-regulatory skills are expected to train the competence of teacher candidates. The first competency is a professional that includes three domains (Figure. 2).

“Knowledge (Cognitive domains): “Remembering, understanding, applying, Analyzing, evaluating, and Creating, Anderson [22]. Affective domains: Receiving, Responding, Valuing, Organization, Characterization, Krathwohl, [23]. Psychomotor domains: Reflex movements, Fundamental movements, Perceptual abilities, Physical abilities, skilled movements, Non-discursive communication, Anita Harrow’s [24]”

Pedagogy competence is related to how to transfer the knowledge that has been mastered. Project learning is emphasized on communication skills in presenting the resulting product. Both professional and pedagogic competencies are expected to be trained at every stage of the project (guided inquiry).
As for self-regulation can be monitored based on personal and social indicators of teacher candidates. To facilitate assessment, activities in each of the major phase (guided inquiry) can be documented by the video. Lecturers are only to guide and direct teacher candidates to be completely independent and to feel owned by the project.

**Figure 2.** Design in SRPjBL model

4. **Conclusion**
SRPjBL is a learning model that supports the competences of teacher candidates in the 21st century. SRPjBL steps have been proposed to be proven in the future (Figure 2). The number of rubric for assessment can be anticipated through video documentation (Figure 1). Therefore, the assessment of processes in project and product quality is more flexible.

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