E-portfolio assessment model on collaborative problem solving (CPS) learning based on digital learning environment

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Abstract. The 21st Century Skill is the knowledge and skills needed to deal with the problems of the 21st century. This study uses the concept of 21st century skills published by The University of Melbourne in the KSAVE framework (Knowledge, Skills, Attitudes, Values, Ethics). The KSAVE framework illustrates that collaborative problem-solving (CPS) lessons, and learning through a digital network are the glue of 21st century skills. Learning CPS is a glue for the achievement of critical thinking skills, problem solving, decision-making and collaboration. While learning through a digital network is a combination of information literacy skills, ICT literacy, personal responsibility, and social responsibility. This study aims to create an e-Portfolio assessment model on CPS learning based on learning through a digital network in the form of Moodle learning management system (LMS). The development of the "e-Portfolio Assessment Model" uses the correlation method between the learning outcome that is to be achieved in CPS learning. Learning outcomes include knowledge, collaboration performance, and skills. The results of the implementation show that the e-Portfolio can provide a report on the CPS learning process properly.

1. Introduction

21st century skills are the skills and knowledge needed to deal with 21st century problems [1]. Some views about 21st century skills are stated based on the results of various research institutions (P21, EnGauge, ATC21S, NETS / ISTE, EU, and OECD), regarding what competencies and expertise humans must possess in the era of globalization. This research uses 21st century skill concept published by The University of Melbourne in the KSAVE (Knowledge, Skills, Attitudes, Values, Ethics) framework [2]. KSAVE Framework illustrates that collaborative problem-solving learning (CPS) based on learning through a digital network is the 21st century proficiency glue (Griffin and Care, 2015) [1]. CPS learning is an adhesive for critical thinking, problem solving, decision-making and collaboration achievement skills [3]. While the digital learning environment is a combination of information literacy skills, ICT literacy, personal responsibility, and social responsibility [2].

Evaluation CPS learning is done by evaluate the learning process of students as individuals and as part of a group [1]. Portfolio assessment is suitable to figure the learning process of students both individuals and part of groups in CPS learning. E-portfolio is the result, that created by learners as a collection of digital artefacts that articulate experience, achievement and learning [4]. The main purpose of e-portfolios is to gather evidence to measure, calculate, and determine targets - such as in individual learning notes and programs or to encourage ongoing processes and reflection, which are more often in the context of higher and sustainable education, but now it is occurs in education and school further. However, different conditions are not used, and may be a different starting point on the way to the e-portfolio.

The propose of this research is create e-Portfolio assessment model on CPS learning based on learning through a digital network in learning management system (LMS) form, Moodle 2.5. e-Portfolio is a digital portfolio to record the student’s learning process and student’s learning performance which is used as an evidence of collection learning process data electronically in LMS. e-Portfolio aims to show the results of the student learning process in terms of Knowledge, Skills, Attitudes, Values, Ethics.
Based on the KSAVE framework. The results of the e-Portfolio model implementation in Database subject - Computer Science Study Program - University of Education Indonesia, can represent the results of the student learning process in terms of Knowledge, Skills, Attitudes, Values, Ethics well.

1.1. 21st Century Skills
Based on the AERA conference in Griffin and Care (2004), four competencies that must be had by students in the 21st century on learning process are ways of thinking (Ways of Thinking), ways of working (Ways of working), tools for working and living in the world (Living in the World) that have just emerged as a result of technology. These skills recognized as an important thing for adjusting to the influence of the technology on life, learning and work. [1]

The way of thinking is conception by adding the creativity and innovation, critical thinking, problem solving and learning to learn and metacognition development. The ways of working is conception by including communication, collaboration, team work. Tools for working is including information and ICT. Living in the world is including change of interest on local citizen and global citizen, living aspect, career development and personal dan social responsibilities. All of these concept is KSEVE (Knowledge, Skills Attitudes, Value and Ethnic). Hence the way of learning and teaching has to be considered for development of assessment strategy that is focusing on these skills.

![KSAVE Framework for 21st Century learning](image)

To illustrate the linkages and relationships of ten 21st century skills based on the KSAVE framework are to link to problem-solving collaborative learning, and learning through a digital network [2]. Problem-solving collaborative learning is a combination of critical thinking skills, problem solving, decision-making and collaboration. Collaborative problem-solving (CPS) as an activity between two or more people working together to contribute knowledge, skills, materials, and a series of cognitive thoughts including gathering information, analyzing information, formulating hypotheses, and testing the hypothesis [3]. While the ability to learn through a digital network is a combination of information literacy skills, ICT literacy, personal responsibility, and social responsibility [2]. The ability of a digital network learning through illustrates how individuals can learn through social media, and how they work together switch from individual consumers and information producers to collaborative contributors to developing social capital and group intellectual capital. In the ATC21S problem-solving collaborative project and learning through a digital network is measured by developing algorithms that monitor, and record types of activities, communication by students as they work together to solve problems. Design
data collection process to monitor how students learn by human to human (H2H) interaction in digital network-based learning [2].

1.2. e-Portfolio for CPS Learning

There are various definitions of e-portfolio. On this research, refers to the emerging consensus that e-portfolio includes both products and processes: "E-portfolios are results, made by learners, a collection of digital artefacts that articulate experience, achievement and learning" [4].

The main propose of e-portfolio is collect the evidence to summative assessment, show the achievement, and record the improvement and specify the target. As in the record of achievement and individual learning plans or to maintain an ongoing process of personal development and reflective learning, it is more often experienced in the context of higher and sustainable education, but now also occurs in education and school further. However, these different approaches are not exclusive to each other, and may actually be a different starting point on the way to fully using the e-portfolio into the curriculum.

e-Portfolio Assessment Model on Collaborative Problem Solving (CPS) proposed in this study is illustrated in Figure 2 below. CPS learning assessors are taken based on student learning processes both as individual learning processes, or collaborative learning processes [5]. CPS learning aims to achieve individual skills (cognitive skills), the ability to work in groups (collaborative skills), and the interrelation of individual skills with groups.

![Diagram](image)

**Figure 2.** e-Portfolio of Assessment Model on Collaborative Problem Solving (CPS) [6].

The detail explanation for Figure 2 are as following: 1). Cognitive skills, propose to improve subject knowledge for each student as an individual. Performance assessment for CPS learning is done to capture the knowledge achievement for the learning subject; 2). Collaborative skills or affective skills, propose to improve student's affective skill individually or team. The performance assessment of CPD learning as a team is metacognitive factor is consisting sharing idea, negotiation ideas, regulating problem solving dan maintaining communication; 3). The link between cognitive skills dan collaborative skills is evaluated to assess the relation between the skill.

2. Methods

Development of the e-Portfolio Assessment Model based on the CPS learning framework in Figure 3 below [7]. e-Portfolio records CPS learning processes including knowledge, collaboration performance, and skills. The e-Portfolio Assessment Model applies the correlation method between knowledge,
collaboration performance, and skills. It is expected that this model can provide reports on CPS learning outcomes, and the linkages between the assessment components.

**Figure 3.** The Framework for e-Portfolio Assessment Model on CPS learning [7].

3. Result and Discussion
The assessment of e-portfolio on CPS learning model was conducted on learning process in Database subject in Computer Science Department, UPI. The CPS learning e-Portfolio model in Figure 4 serves as a dashboard for measuring CPS learning. The e-Portfolio on CPS learning model shows the learning process in the form of value of student model, knowledge, collaboration performance, and student skills.

**Figure 4.** Evaluation of e-Portfolio on CPS Learning.

In this case, this guide explores more, how e-portfolio able to this following: a). Improve the students’ self-understanding and the understanding to curricula; b). Involve and motivate the student, either individually or as apart of team or community; c). Personal learning; d). Promote the appropriate learning model to digital era; e). Promote reflective practice.
While some technical, cultural and pedagogical issues still need to be resolved, on this research using the case shows the benefits of learning from the use of e-portfolios. The most important of these is the ability to share develop ideas and receive quick feedback, thereby increasing the ability of students to understand concepts that were initially unknown, even frightening. When effectively embedded in practice, the dialogical functions usually found in e-portfolio systems can even support learning communities to improve the performance of both individuals and teams.

People gain self-knowledge through exploring aspects of their learning and broader life experiences. Such narratives about self are easily updated online, developing from time to time to provide a learning journey that involves each student. In addition, the use of e-portfolios can produce many skills that students need to effectively navigate their way through the complex demands of the information age. Through e-portfolio development, collaboration and selection skills, even a sense of audience, can be obtained.

4. Conclusion
The following discussion and conclusions are obtained as the result of the research: 1). CPS learning is one of the 21st century learning models. CPS learning assessors are taken based on the student learning process both the learning process as individuals, or the collaborative learning process; 2). The e-Portfolio assessment model for CPS learning is based on learning through a digital network. e-Portfolio or also known as digital portfolio is a collection of electronic evidence compiled and managed by users, usually on the Web; 3). The CPS learning portfolio model can show the learning process in the form of value of student model, knowledge, collaboration performance, and student skills; 4). The results of the case study of the implementation of the e-portfolio assessment model have a positive impact on learning, namely: improving self-understanding and curriculum, involvement and motivating students, both individually and as part of the practice community, personalizing learning, supporting learning models that are in accordance with the digital era, and promote reflective practice.

This research is still limited to the proposed e-Portfolio model on CPS learning based on learning through a digital network. Further research is needed to apply the e-portfolio model in CPS learning based on learning through a digital network.

5. References
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