

Designing Project-Based Learning (PjBL) Activities for Art and Design E-Portfolio Using Fuzzy Delphi Method as a Decision Making

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Abstract

The present article's is to propose the Fuzzy Delphi as a method of decision making in designing Project-based Learning (PjBL) activities for art and design courses. In this study, 22 experts in Project-based learning involved in the in-depth interview and online responses to reach the validity and conformability of the themes and elements. The experts participated in this study involves local and international perspectives that contribute to the best idea and practices by their respective institution. The selection of decision-making will reflect the e-Portfolio users which purposely design for art and design courses. As arise in this study, the Fuzzy Delphi will determine the best practices of the pedagogical strategy to be infused in e-Portfolio system. The project-based learning activity is proposed to ensure the learners can gradually develop a higher order thinking skills with the activities equivalent to their capability and ability to complete the task given.

Keyword: Project-based learning, learning strategy, learning activity, higher order thinking skills, art and design, fuzzy Delphi, e-learning and e-portfolio

1. Introduction

In 21st century skills, project-based learning is one of the significant approach in teaching and learning. Project-based learning or PjBL is moving away from the traditional practices and focus on the individual strength and capability. Therefore, PjBL in holistic view to incorporate students with real-context, authenticity and complexity surround the learning nature.

In so many years, behaviorism was dominance as a fundamental in instructional design then has been dispute by the proponent of constructivism theory which promoting a different view on constructing knowledge and understanding (Wills, 1998). Instructional design based constructivist principles are underlying the learning domain involving ill-structured problem. Students are encouraging to explore and discover a large amount of an evidence or information rather than single-piece of an answer.

Bringing real-context and technology using PjBL approach, students are encouraged to become autonomous and take responsible for their own learning. The difference of PjBL than others involves students to participate with the research process, solving the problem and communicating the solutions. Therefore, Malaysia Ministry of Education has stated in Project-based Learning Blueprint (2006) that this process will reflect to the human modalities that have active construction of knowledge, skills and meaning to find the purpose in their studies.

2. Literature Review

2.1 Designing Project-based Learning (PjBL) Activities

The adoption of a Project-based Learning (PjBL) into e-Portfolio, it seems like will be benefit the learners. It will involve the actual creation of the course content, learning materials and assessment. These learning strategies need to be aligned with specific learning goals and able to develop higher order thinking skills among learners in higher education institution.

Based on National Higher Education Strategic Plan 2020 and its Malaysia Education Blueprint 2013-2025, the Malaysian government has signaled its direction and strategies to educational reform in improving its quality of educational standards and outcomes in line with many other countries (Trilling & Fadel, 2009). The

Director-General of Malaysian Education has stated and indicated that the vital focus of the ministry is on student's higher order thinking skills. The implicit meaning of the statement also pointed at learning and assessment as an agent of change to improve and facilitate higher order thinking skills. At this juncture, Project-based learning is so significantly for new direction to equip and prepare learners with higher order thinking skills. Due to that reason, educators face a huge challenge in facilitating an appropriate strategy and activities of higher order thinking skills (Brandt, 2010).

In designing a project-based learning activities need three criteria to be fulfills 1) the activities should have tested student's metacognitive skills, 2) the students must perceive it as personally meaningful and 3) metacognitive skills and meaningful project fulfills an educational purpose. It's also supported by Savery and Duffy (1995) was concluded there are interconnection between human cognitive and educational settings to stimulate and evolves learning far beyond the context. In Malaysia context, based on PjBL conceptual blueprint, the ideal education setting should infuse:

- a. Meaningful-the curriculum emphasizes the active construction of meaning to enable students to find the purpose on their studies.
- b. Reflective-The curriculum fosters in student's skills and attitudes of reflection to enable them to think critically, creatively and affirmatively
- c. Holistic-The curriculum given appropriate emphasis to all significant aspects of growth and all types of human intelligence, helping students to see the connections between the subjects.
- d. Goal-based-The curriculum focuses on significant goals to develop skills, knowledge and lifelong learning.
- e. Open-Ended-The curriculum is open for revision and continued refinement.
- f. Metacognitive skills-The curriculum is able to infused varied skills such mathematic, scientific, research, and social skills
- g. Social Responsible-The curriculum develops in students a sense of social responsible towards their awareness, sensitivity, obligation and needs as a citizen.
- h. Technological-The curriculum uses technology to support teaching and learning.

This blueprint will give the author the idea and guideline to infuse before the actual design embedded into the e-Portfolio system. In arts and design context, this course has been implemented projects as a routine in assessing their coursework. It's aligned with the needs of assessment provided by Malaysia Qualification Accreditation (2012) or known as MQA as a manual in assessing students in higher education institution especially for art and design courses. Hence, the portfolio becomes a compulsory item in assessment which to store, reflect and show learners evidence of learning. The e-Portfolio will have acquired them to communicate with the ideas by doing collecting, displaying, articulating and evaluating the projects or tasks. The customize PjBL design activity should be align with the national blueprint and policy to ensure this model can be expanding to others. Thus, this study provides an experts agreement to validate the PjBL design activities within learning process.

3. Methodology

Delphi Technique has been widely used in education, especially in anticipation of the future, this method has its drawbacks. Among the weaknesses of the Delphi method (Siraj, 2008), 1) Reliability of the data depends on expertise; if the researcher fails to deliver real experts mean the study will lose credibility, 2) Experiments are repeated on a sample and this will cause boredom to the sample, 3) A small number of experts are not able to resolve all the issues studied and 4) Less chance of getting a response from the emotional aspect.

To solve the problem of ambiguity in the consensus of experts, researchers from many countries have created new methods. Murray, T. J., Pipino, L. L & Gigch (1985) suggested the application of Fuzzy Delphi Method Theory into semantic variables used to solve the problem of ambiguity in the Delphi Technique. Fuzzy Delphi Method was adopted to illuminate the problems of conventional technique (Rahman & Siraj, 2013; Glumac, Han, Smeets, & Schaefer, 2011; Ishikawa, Amagasa, Tamizawa, Totsuta, & Mieno, 1993; Siraj, 2012).

The Fuzzy theory was introduced to improve time-consumption and solving the fuzziness of common understanding in experts' opinions (Hwang & Lin, 1987; Noorderhaben, 1995). The Ishikawa works used the maximum-minimum method together with cumulative frequency distribution and fuzzy scoring to gather the expert opinions into fuzzy numbers. The experts' interval value was then used to derive the fuzzy numbers resulting in the analysis. This data analysis was based on an experts thinking and voice that persuade the validity of the accumulated information.

Hsu, H., & Chen (1996) proposed a fuzzy aggregate equation. By using this similarity function, the similarity between experts can be collected and fuzzy numbers can be built directly into each expert to determine the degree of agreement between experts. Then the coefficient of consensus is employed to get value assessment fuzzy numbers for all experts. If the degree of agreement is too low among experts, then the questionnaire must be administered again for the second cycles. The advantages of Fuzzy Delphi Method are; 1) saves time, 2) save costs, 3) reduce the total number of surveys, questionnaires increase the recovery rate, 4) unlimited access of expert's opinions and voice, ensure completeness and consistency of opinion and 5) taking into account the ambiguity that cannot be avoided during the study. This method does not misinterpreted initial expert opinion and gives their real reactions. Further is the following steps of Fuzzy Delphi Method (Azlan, Amin, & Norazah, 2015):

a) Round One (1): Issues and Interview Protocol

The first phase of data collection involved in-depth interviews with seven (7) experts in project-based learning in the different universities. The emerging themes and elements established from the experts were used to develop the "Project-based Learning Questionnaire".

b) Round Two (2): Developing and Distribution of Consensus Survey

The "Project-based Learning Questionnaire" is to gain the consensus made up based on the themes given by the experts. Experts were required to indicate their agreement with the statements given. For this purpose of round 2, about n=16 experts in project-based learning involved and responses the survey.

c) Round Three (3): Fuzzy Delphi Data Analysis

The FDM comprises of two result indicator to make a decision. First, each expert's responses are converted into triangular fuzzy numbers to identify their stand for each statement. Next, the defuzzification process was conducted to determine the value reflecting the respondents' degree of consensus. At the end of the data analysis, one framework was designed to enable the author to proceed with the development process.

4. Findings and Discussion

This constructs involved thirteen (13) items representing designing project-based learning activity as described below. Here are the threshold (d) values, expert consensus percentage and defuzzification by items can be referred to Table 1 and Table 2.

Table 1. Threshold values (d), expert consensus percentage and defuzzification by designing project-based learning activity items

| Expert | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|------------------------|--|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| Items $d \leq 0.2$ | 0.115 | 0.115 | 0.208 | 0.204 | 0.149 | 0.136 | 0.136 | 0.153 | 0.153 | 0.204 | 0.191 | 0.170 | 0.153 |
| Construct $d \leq 0.2$ | 0.160 | | | | | | | | | | | | |
| % $d \leq 0.2$ | 100 | 100 | 92 | 83 | 100 | 100 | 100 | 92 | 92 | 92 | 83 | 83 | 92 |
| | Expert Group Consensus Percentage % $d \leq 0.2$ (93%) | | | | | | | | | | | | |
| Defuzzy | 0.750 | 0.750 | 0.683 | 0.700 | 0.717 | 0.733 | 0.733 | 0.733 | 0.733 | 0.667 | 0.650 | 0.667 | 0.700 |

Table 1 shows the design of project-based learning activity in which items 1, 2, 5, 6, 7, 8, 9, 11, 12 and 13 had the consensus among experts with threshold score ≤ 0.2 . It described that the items met the experts' agreement and consensus. As reported in items 3, 4 and 10, they exceeded the threshold value (d) = 0.2. However, the second rule in fuzzy Delphi was accepted in which the percentage of expert consensus was more than 75% experts agreed. For this construct, the overall consensus stated 93% experts agreed. The defuzzification showed each item reached above α -cut = 0.5.

Table 2. Items for designing project-based learning activity

| Items | Ranking |
|-----------------------------------|---------|
| 1 Set instructional objectives. | 1 |
| 2 Align instructional objectives. | 1 |

| Items | | Ranking |
|-------|---|---------|
| 6 | Use students' critical thinking skills to solve the problem. | 3 |
| 7 | Encourage students to be more creative in handling resources. | 3 |
| 8 | Make students suggest a decision to get a better result. | 3 |
| 9 | Encourage students to do hands-on activities. | 3 |
| 5 | Use students' analytical skill to solve the problem. | 7 |
| 4 | Design questions based on problems. | 8 |
| 13 | Improve students' communication skills. | 8 |
| 3 | Apply appropriate level of Bloom Taxonomy. | 10 |
| 10 | Show students examples of projects/tasks or assignment. | 11 |
| 12 | develop a teamwork spirit | 11 |
| 11 | Encourage students to be a leader. | 13 |

As have been mentioned, the item analysis explained the constructs which gained the consensus from the experts. The items were arranged according to priority and ranking-based. The instructional objective had the highest expert consensus score 0.750 and leadership had the lowest score 0.650. As reported, designing project-based learning started with the align and set of instructional objective to fit the purpose of learning outcome (0.750). Project-based learning is able to develop a critical thinking skills (0.733), creativity (0.733), and problem-solver (0.733) and encourage students to do hands-on activities (0.733). Students' are allows to use analytical skill to solve the problem (0.717) based on the question given (0.700). In addition, these approaches will improve communication skills (0.700) while the students having their presentation on subject matter given. The use of different level of Bloom Taxonomy will tested student's cognitive ability (0.683). Facilitator will show them with examples of works to set the standard and benchmark (0.667) to fulfill and meet the requirement of the task. The task is not focus on individual progress but also inculcate a teamwork spirit (0.667) and leadership (0.650) in their learning process.

As to conclude, the author was outlined the proposed of Six Principles of Designing Project-based Learning (PjBL) Activity with Project-based Learning Blueprint by Ministry of Education, Malaysia.

Table 3. Six principles of designing Project-based Learning (PjBL) activity

| Six Principles of Designing PjBL Activities | Learning Output | National blueprint | PjBL |
|---|--|------------------------------------|------|
| 1. Learning objectives | Using Bloom Taxonomy as a guide to measure learning outcome | Goal-Based/Open-Ended | |
| 2. Problem-focused | Plan question based on real-situation and authentic. Student involves in planning process | Meaningful | |
| 3. Hands-on activities | Activities that involves students; analytical skills, creativity, critical thinking, problem-solving and ICT skills due to prior task or assignment. | Metacognitive Skills/Technological | |
| 4. Reflect and Assess | Allows student to communicate with peers to reflect on their learning. Provide a diagnostic feedback | Reflective/Technological | |
| 5. Decision-Making | Allows student to make a decision-making based on findings. | Holistic | |
| 6. Leadership and teamwork skill. | Work as a unit and accomplish the task given by showing their capability as a leader and members. | Social Responsible | |

According to (MQA, 2010; Savery & Duffy, 1994) to design a project-based activity that tested learners higher order thinking skills should involve a goal-based/objectivity, meaningful, reflective, social responsible and holistic. The experts also agreed the elements of engaging learning with project-based learning consists; designing project-based learning started with the align and set of instructional objective to fit the purpose of learning outcome. Project-based learning is able to develop a critical thinking skills, creativity, and problem-solver and encourage students to do hands-on activities. Thus, learners' are allows to use an analytical skill to solve the problem based on the question given. In addition, this activity will improve a communication skills while the learners having their presentation on subject matter given. The use of different level of Bloom Taxonomy will tested students cognitive ability. Facilitator will show them with an examples of works to set the standard and benchmark to fulfill and meet the requirement of the task. The task is not focus on individual progress but also inculcate a teamwork spirit and leadership in their learning process.

5. Conclusion

The proposed Six Principles of Designing PjBL Activity is to ensure the facilitator is able to plan a proper teaching, learning and assessment. This principle helps instructor to design an effective teaching to deliver their content. The appropriate strategy in designing activity is the key essential to make sure PjBL can successfully implemented. However, the novelty of this principle is not only applicable for art and design courses but also can be adapted to any fields or courses in higher education institutions.

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