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Determining e-Portfolio Elements in Learning Process Using Fuzzy Delphi Analysis

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Abstract

The present article introduces the Fuzzy Delphi method results obtained in the study on determining e-Portfolio elements in learning process for art and design context. This method bases on qualified experts that assure the validity of the collected information. In particular, the confirmation of elements is based on experts' opinion and consensus. The consensus survey constructed based on the emergent themes the experts raised from the conducted interview. For this purpose about 23 experts in instructional technology involved in the interview and responses the survey. As resulted, the Fuzzy Delphi will interpret the decision making made by experts based on priority as a guideline to the best practices and mechanism of implementing e-Portfolio as methodological tool.

Keywords: Fuzzy Delphi method, art and design, e-Portfolio, teaching and learning

1. Introduction

Constructivism paradigm emphasizes on the individual in constructing their own knowledge. Knowledge and skills growth based on the subject changes and the modification of learning context. Students use e-Portfolio is to demonstrate their concept, understanding and skills required to fulfill the learning outcome. Respectively, the uses of e-Portfolio are to improve students' learning, develop a personalities, growth and autonomy in learning in art and design courses.

Commonly, art and design assessment practice implemented evidence-based to prove learning process during the course. Therefore, art and design current interest is using e-Portfolios of students has been driven by the Malaysian Qualification Accreditation (MQA) as a standard practices. Hence, methods of student learning and assessment have to be clear, consistent, effective, reliable and in line with current practices and must clearly support the achievement of learning outcomes (COPPA 2008).

The MQA has been a benchmark for the proportion of learning and assessment, which can be adapted by art and design program in higher education institution. Curriculum Affairs Unit of Universiti Teknologi MARA (2010) has reported that 40-70% of continuous assessment is the common practice being used and implemented in many faculties. They were also applying the use of portfolio as a mechanism of evidence-based assessment to access students' performance and competencies.

The e-Portfolio is seems useful not only as a learning tool but also useful as an archive of learning. The building of content knowledge and skills was documented as a preferal for future references. At the end of the day, the students will be equipped with a specific learning domain that enable them to a professional or expert in respective area. This paper establishes the e-Portfolio elements to improve teaching and learning process.

1.1 E-Portfolio Learning Process

The e-Portfolio derives from so many researchers opinion, which is a process to develop and access personal and professional activities. The main difference between traditional and e-portfolio is the ease to publish contents and evidence in electronic format.

The use of e-portfolio is promoting a students to be a learner-centered and authentic (Read & Cafolla, 1999). This process allows students to have opportunities to reflect upon their learning and instructor to provide the feedback (Ahn, 2004). Hence, the usefulness of e-portfolio is able to assess students competences in the terms of

evaluating this new method's as efficiency formative tool. The students have to prove certain set of skills involves, problem-solving, critical thinking, reflective learning, analyzing and synthesizing (Clark & Eynon 2009; Chin-Hung, 2013).

So far, some researchers such (Lynch & Purnawarman, 2004: Beck et al., 2005; Klenowski et al., 2007), have found 2 factors that show the importance of e-portfolio elements could become a support tool for teaching and learning. The factors describes, as: 1) It enhances learning through a domain of learning and 2) The alignment of academic course outcome with a specific standard of teaching, learning and assessment.

What is so significant about evidence-based that putting in learning process together with the e-Portfolio? The e-Portfolio were designed based on the structure that driven by the philosophical and pedagogical goals. The alignment of instructional objective emphasized students processes, articulated and judgment learning through their reflective practice as so called as evidence-based. The establishment of reflective practice that helps students accumulate the knowledge to constructs meaningful learning such to test their beliefs, intentions and actions.

Every constructs of meaningful learning engages with the inquiry into what they have learned by researching and identifying the context or body of knowledge and skills. Students were able to create content, reflect, collaborate and communicate on their creative process to demonstrate the art-making process. The diagnostic of learner competencies that based on e-Portfolio learning process allows students to understand their strength, weakness and opportunity to improve their standard and quality from time to time.

On the other hand, it has been identified a gap, there hardly exist any publication with empirical result showing the elements related to art and design of this methodological tool. Therefore, this paper provides the experts to confirm and validate the elements of e-portfolio within teaching and learning of students' competences. In the following sections, we will describe the experts defining the element of e-portfolio as a learning process focused on art and design context.

2. Methodology

2.1 Participant

Fuzzy Delphi Method (FDM) was derived to solve the problem of traditional Delphi method (Ishikawa et al., 1993). This method bases on group thinking of the qualified experts that assures the validity of the collected information. The first phase of data collection involved semi-structured interview with seven (7) experts in e-Portfolio based in the different universities. The interview protocol was prepared beforehand.

The emerging themes identified form the interviewers were used for develop the "E-Portfolio Consensus Survey". Second phase, the "E-Portfolio Consensus Survey" is to get the agreement based on the themes given by the experts. The consensus survey will be using the 5 point Likert scale anchored in strongly disagree and strongly agree. Experts will be required to indicate the extent of their agreement with the statements given. It will be constructed based on the emergent themes the experts raised from the conducted interview in the previous phase. For this purpose about 16 experts in instructional technology involved and responses the survey.

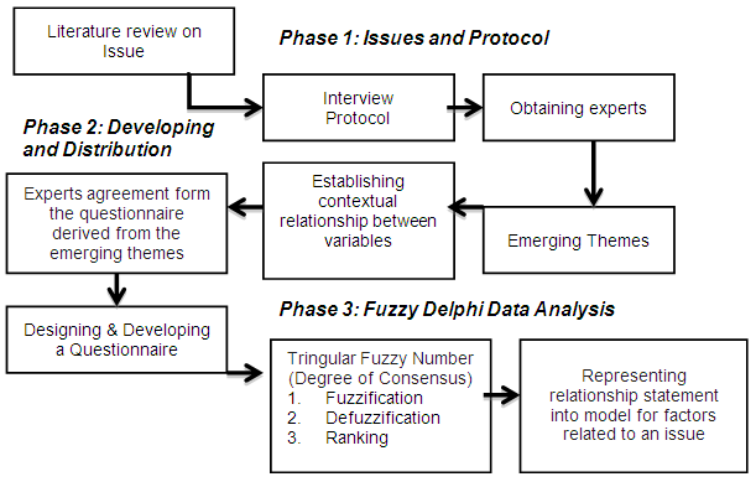

Figure 1. Fuzzy Delphi method

2.2 Data Analysis

Step 1: Assume that *K* experts are invited to determine the importance of the evaluation criteria and the ratings of alternatives with respect to various criteria using variables (Table 1).

Step 2: Convert the variables into triangular fuzzy numbers as suggested in Tables 1. Let fuzzy numbers be the rating of alternative *i* with respect to criteria $\varpi_j^k$and be the jth criteria weight of the kth expert for *i*=1, … , *m,* *j*=1,..., n, *k*=1, ..., *K*. and $r_{ij} \equiv \frac{1}{k}\left(\pm\, r_{ij} r_{2ij} \pm\, r_{kij}\right)$

Table 1. Variable for the importance weight of criteria

Variable	Fuzzy Scale
Strongly disagree	(0.0, 0.1, 0.2)
Disagree	(0.1, 0.2, 0.4)
Not Sure	(0.2, 0.4, 0.6)
Agree	(0.4, 0.6, 0.8)
Strongly Agree	(0.6, 0.8, 1.0)

Step 3:For each expert, use the vertex method to compute the distance between the average ~rij and r_{ij} and the distance between the average $\varpi_{ij}$and ϖ_j^k, *k* =1, K (Chen, 2000). The distance between two fuzzy numbers $\tilde{m} = (m1, m2, m3)$ and$\tilde{n} = (n1, n2, n3)$is computed by,

$$d(\tilde{m}\tilde{n}) = \sqrt{\frac{1}{k}\left[(m1 - n1)\dot{2} + (m2 - n2)\dot{2} + (m3 - m3)\dot{2}\right]}$$

Cheng and Lin (2002) suggested, if the distance between the average and expert's evaluation data is less than the threshold value of 0.2, then all experts are considered to have achieved a consensus. Furthermore, among those *m* x *n* ratings of alternatives and n criteria weights, if the percentage of achieving a group consensus is greater than 75% (Chu, 2008; Murry & Hammons, 1995) then proceed to step 4; or otherwise, the second round of survey is required.

Step 4: Aggregate the fuzzy evaluations by,

$$\tilde{A}\begin{vmatrix}\widetilde{A1}\\ \widetilde{A2}\\ \vdots\\ \widetilde{Am}\end{vmatrix} \text{ where } \tilde{A}r_{i1} \text{ X } w_1 + r_{i2} \text{ X } w_2 + \cdots\cdots\cdots wr_{in} \text{ x } w_n$$

$i \quad = 1, 2, \ldots\ldots, m$

Step 5: For each alternative option, the fuzzy evaluation

$\tilde{A} = (ai1, ai2, ai3)\ is\ defuzzified\ by$

$\tilde{A} = \frac{1}{4}ai1 + 2ai2 + 2ai3$

The ranking order of alternative options can be determined according to the values of ai

3. Findings and Discussion

Table 2 show that the e-Portfolio as a learning tool has consensus among expert with threshold score below then 0.2. This finding shows that the findings are suited to first rules with threshold score (d) ≤ 0.2. Second rules in Fuzzy Delphi also accepted whereas percentage consensus of expert more than 75% expert agreed.

Table 2. Expert consensus about e-Portfolio elements based on threshold (d) value

Experts	ITEMS													
	a part of the course	aligned to specific standards	deep learning	authentic	evidence-based	Metacognitive skills	think critically	in-depth learning	reflect learning	think differently	quality	responsibility as owners.	purpose of doing things.	freedom to control the contents
1	0.2	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.4	0.1	0.2	0.1	0.1
2	0.1	0.1	0.1	0.2	0.2	0.2	0.4	0.1	0.1	0.2	0.1	0.1	0.1	0.1
3	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.2	0.2	0.2	0.2
4	0.2	0.2	0.2	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
5	0.1	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
6	0.2	0.2	0.2	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
7	0.1	0.1	0.1	0.2	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.2	0.1	0.1
8	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.2	0.1	0.7	0.4	0.7	0.7
9	0.2	0.2	0.2	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
10	0.2	0.2	0.2	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
11	0.2	0.2	0.2	0.1	0.2	0.2	0.2	0.1	0.4	0.1	0.1	1.0	0.4	0.2
12	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2
13	0.1	0.1	0.1	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
14	0.1	0.1	0.4	0.2	0.2	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.1	0.1
15	0.7	0.7	0.4	0.2	0.5	0.5	0.1	0.4	0.1	0.1	0.7	0.1	0.1	0.4
16	0.1	0.1	0.1	0.1	0.1	0.1	0.4	0.1	0.1	0.1	0.2	0.1	0.1	0.1

Table 3. E-Portfolio elements learning Ranking based on score

Items	Score/Value *Average of Fuzzy Number*	Ranking
a part of the course	0.663	11
aligned to specific standards	0.675	5
deep learning	0.663	10
authentic	0.713	2
evidence-based	0.725	1
metacognitive skills	0.713	2
think critically	0.650	12
in-depth learning	0.650	12
reflect learning	0.675	5
think from differently	0.663	7
quality	0.663	7
responsibility as owners.	0.679	4
purpose of doing things.	0.650	12
freedom to control the contents	0.663	7

Table 3 shows that evidence based had a highest with consensus expert score 0.725 and in depth learning score was a lowest score with 0.650.

Based on these findings, the elements of e-Porftolio in learning process consist:

Evidence-based (0.725) was agreed by an experts that it the main focused to have e-Portfolio as a support tool. The evidence-based will show the learner's learning track and progress during the learning process. The assessment will use evidence-based to measure the standard and quality of work based on standard rubric refer to respective subject or courses.

Kimball (2005) stated that the authentic is a process of reflection in action or the reiterative process of looking the past and future to meet the goal and expectation of their learning. Authentic (0.713) is a key feature of e-Portfolio which focuses on real-world and complex problems. The authentic learning develop a cognitive domain to think, solve and create by providing engaging activities and supported by a proper scaffolding.

The authentic task emphasized on the development of metacognitive skills (0.713). These skills allows learners concurrently to control, monitor and regulate a different level cognitive process (Flavell, 1979). Individual with a greater metacognitive skills are able to control, manage and make adjustment to their learning behaviour (Ford et al., 1998). At this juncture, this metacognitive skills leads to higher learning (Dresel & Haugwitz, 2008). Therefore, metacognitive skills is actually apart of national education plan in which every students are prepared and equipped with these ability.

By having e-Porftolio, the learners automatically become as an owners of the content. The ownership is a central in e-Portfolio system (Garret, 2011). The beauty of ownership elements where as the learners have a personal voice to share and reveal their experience based on the task given with peers. This social learning environment will give students more space and motivate them to always connect. This opportunity allows learner with instructor and peers have a reflective session (0.675) to share and express the idea and feedback. The best part of reflective learning is encourage and make them to think differently (0.663), critical thinking (0.650) and perform the best quality of work (0.663) align with the specific standard and outcome (0.675).

On the other hand, we believes that for the long-terms effect, the learners will gradually develop their in-depth learning (0.650) and give them a purpose doing things (0.650) not only to fulfill academic courses but also for future carrier as a professional.

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