Kasetsart Journal of Social Sciences 42 (2021) 871–877

Kasetsart Journal of Social Sciences

journal homepage: http://kjss.kasetsart.org

Development of a process to change teachers' misconceptions in using portfolio for elementary school student assessment

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Article Info

Article history:
Received 9 July 2020
Revised 16 November 2020
Accepted 30 November 2020
Available online 3 December 2021

Keywords:
elementary school,
misconception,
portfolio

Abstract

The purposes of the present research were to develop a process to change teachers' misconceptions in using portfolio for elementary school student assessment, and to examine its effectiveness. Participants were divided into two subgroups, i.e., (1) the experimental group of 20 elementary school teachers who participated in the developed process, and (2) the control group of 20 elementary school teachers who did not. Research instruments were a questionnaire and a manual for changing teachers' misconceptions. Data were analyzed by using mean and standard deviation, and t-test. Results were as follows: (1) The developed process to change teachers' misconceptions consisted of four main steps, i.e., (1.1) self-analysis, (1.2) identification of the differences between the reasonable concepts and the pre-existing concepts, (1.3) understanding of the reasonable concepts, and (1.4) changing the misconceptions. Based on the experts' opinion, the quality of the components in the developed process was in a high to highest level. (2) Overall, teacher score on the concept of using portfolio after the participation in the developed process was statistically higher than that before the participation at the .01 level. Teachers who participated in the developed process had significantly higher score on the concept of using portfolio than those who did not participate at the .01 level.

Introduction

Portfolio has been widely used in various contexts. It has been used as a tool for assessing students' learning in classrooms. Moreover, it has been used in a large-scale assessment for accountability concern (e.g., Kentucky and Vermont statewide assessment) (Herman & Zuniga, 2020). In Thailand, student portfolio (an authentic assessment method) has been suggested to be more widely used in schools since the enactment of the National Education Act of 1999.

Student portfolio is a purposeful compilation of evidences reflecting students' learning processes and outcomes. Student portfolio could be used for formative assessment and summative evaluation. (Poowipadawat, 2001; Tangdhanakanond, Pitiyanuwat, & Archwamety, 2006a). In addition, portfolio process

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https://doi.org/10.34044/j.kjss.2021.42.4.22
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could enhance students' achievement (Chinnawong, 2000; Tangdhanakanond, Pitiyanuwat, & Archwamety, 2005; Tangdhanakanond, Pitiyanuwat, & Archwamety, 2006b), achievement motivation (Chinnawong, 2000), critical thinking (Koraneekid, 2007), self-directed learning (Elango, Jutti, & Lee, 2005; Tomkins & Quette-Frenette, 2010), self-regulated learning (Abrami, Venkatesh, Meyer, & Wade, 2013), and creative thinking (Sujarittanarugse, 2005). Moreover, portfolio process builds the opportunities for students to criticize themselves. Their learning strengths and weaknesses are identified (Tangdhanakanond, 2006; Priest & Robert, 1998 as cited in McMullan, 2006). Teachers can also communicate with parents about the development of students' learning and characteristics by using portfolio (Benson & Barnett, 1999; Tangdhanakanond, 2016).

Recently, Tangdhanakanond and Archwamety (2019) did an analysis of teachers' misconceptions in implementing student portfolio assessment in elementary schools in Thailand. It was revealed that there were misconceptions among teachers in relation to student portfolio assessment. Therefore, a plan for changing teachers' misconceptions in using portfolio for elementary school student assessment needed to be carried out.

Conceptual change has been widely implemented in the field of science education (e.g., Fulmer, 2013; Pimthong, et al., 2012), mathematics education (Samranin, 2010; Sujiva, 1994), health education (Johnson & Sinatra, 2013), teacher education (Ho, Watkins & Kelly, 2001), research methodology (Kaewfong, 2006), and quality assurance (Khong-ngam, 2009). However, research studies concerning conceptual change in using portfolio have not been found. A developed process for changing teachers' misconceptions in using portfolio assessment would be beneficial for organizations in charge of such a process.

Literature Review

It was found from related literature that there are four main steps in a portfolio process. These include: planning, collecting student's works, selecting and reflecting on them, and revising/evaluating them (Epstein, 2001; Moonkum, 2000; Pearson Education Development Group, 2001; Poowipadawat, 2001).

Arumugham (2019) did a qualitative study on teachers' understanding of portfolio assessment. It was revealed that teachers understood portfolios as students' work collections, as feedback tools, and as teaching, learning and grading tools. Tangdhanakanond and Wongwanich (2015) revealed that Thai teachers had partial knowledge and lack of deep understanding in implementing student portfolio assessment. Kornketkamon (2001) found that teachers had some difficulties in using portfolio to assess students' learning, especially in supervising students to organize their works in the portfolios, reflecting on the selected works, as well as improving and evaluating the works in the portfolios. Tangdhanakanond and Archwamety (2019) did an analysis of teachers' misconceptions in implementing student portfolio assessment in elementary schools in Thailand. It was revealed that overall, teachers had misconceptions in nine concepts.

Most conceptual change approaches and models (e.g., Posner et al's (1982) theory of change; She's (2004) dual situated learning model) focus on changing students' cognitive domain. Gregoire (2003) proposed the Cognitive-Affective Model of Conceptual Change that additionally focuses on changing students' affective domain (e.g. changing motivation). However, Tangdhanakanond and Wongwanich (2012) revealed that teachers already had positive attitude (affective domain) towards the use of student portfolio assessment. Therefore, in this study, a process designed to change teachers' misconceptions only focused on students' cognitive domain change. Accordingly, only Posner's theory of change and She's dual situated learning model were employed as the frameworks for developing process to change teachers' misconceptions in using portfolio for elementary school student assessment in this study.

The conceptual change approaches and models in the related literature reviewed so far only propose the essential broad concepts needed to be applied in practice. They do not propose the specific process or steps. Therefore, the purposes of the present research were (1) to develop a ready-to-apply process to change teachers' misconceptions in using portfolio for elementary school student assessment, and (2) to examine the effectiveness of the developed process to change teachers' misconceptions.

Methodology

Participants

Participants were 40 elementary school teachers in one of the public schools in Thailand selected by a volunteer sampling. They were randomly divided into two subgroups, i.e., (1) the experimental group of 20 elementary school teachers who participated in the developed process, and (2) the control group of 20 elementary school teachers who did not participate in the developed process. The experimental group consisted of

2 Thai language teachers, 4 mathematics teachers, 2 science teachers, 2 social study teachers, 3 health education teachers, 1 art teacher, 1 career and technology teacher, and 5 English language teachers. Their teaching experience ranged from one to 16 years. The control group consisted of 3 Thai language teachers, 4 mathematics teachers, 3 science teachers, 3 social study teachers, 3 health education teachers, 1 art teacher, 1 career and technology teacher, and 2 English language teachers. Their teaching experience ranged from one to 28 years.

Instrument

In this research, the researchers developed a process to change teachers' misconceptions in using portfolio for elementary school student assessment. To begin with, literature related to conceptual change was examined to find common steps essential to the process for changing teachers' misconceptions in using portfolio assessment. Subsequently, a manual for changing teachers' misconceptions in using portfolio for elementary school student assessment was developed. Five experts in portfolio assessment were selected to examine the quality of the components in the manual. The other research instrument was a questionnaire. Five experts in portfolio assessment were consulted on teachers' possible misconceptions in implementing student portfolio assessment. There were two parts in the questionnaire. The first part contained demographic information (teaching experience, grade and subjects taught). The second part analyzed teachers' misconceptions in implementing student portfolio assessment. Twenty-eight statements about student portfolio assessment were presented in the questionnaire. Teachers were asked to rate how well they understood the statements on a five-point scale (1 = strongly disagree; 5 = strongly agree) twenty statements were on the "principles" of portfolio assessment and eight were on the "utilization" of the results from portfolio assessment. The reliability of this questionnaire was 0.96 as determined by Cronbach's alpha coefficient**.**

Procedure

The pretest-posttest control group design was employed in this study. The questionnaires were distributed to the 40 elementary school teachers (20 teachers in the experimental group and 20 teachers in the control group) to get baseline data. The baseline data of teachers' misconceptions in both groups revealed that overall, teachers in both groups had a misconception in using portfolio assessment. They also had misconceptions both in the principle aspect and the utilization aspect. There was no significant difference on the misconception scores between teachers in the two groups ($p > .05$). Subsequently, the developed process to change teachers' misconceptions in using portfolio was implemented for one semester. The questionnaires were then distributed to the teachers in both groups again. A computed mean less than 3.50 in the misconception analysis was interpreted as misconception (Waedramae, 2004).

Paired sample t-test was employed to compare the experimental group's mean score of misconceptions before and after they participated in the developed process. In addition, independent-sample t-test was also used to compare mean score of misconceptions between the experimental and control groups.

Results and Discussion

A Process to Change Teachers' Misconceptions in Using Portfolio for Elementary School Student Assessment

The following four steps were implemented:

Step 1: Self-analysis. (four to six hours) The teachers' misconceptions are identified by a questionnaire and reported to each teacher. Then, teachers are asked to reflect on what they should adjust or change. They are also asked to write down the possible advantages for themselves and for their students.

Step 2: Identification of the differences between the reasonable concepts and the pre-existing concepts. (four to six hours) The reasonable concepts about the use of portfolio for student assessment are first presented to the teachers--followed by their pre-existing concepts. Then, they are asked to identify the inconsistencies between those two concepts in group discussion.

Step 3: Understanding of the reasonable concepts. (four to six hours) The correct concepts of portfolio assessment are transmitted to teachers via workshop where the activities in each essential step of the portfolio assessment are also shared. Then, a discussion session is held among teachers to share their experiences about problems, obstacles and solutions in using portfolio.

Step 4: Changing the misconceptions. (beginning to the end of the semester). Teachers are asked to redesign their own portfolio process and the activities in each step of the portfolio assessment. Finally, teachers' misconceptions in using portfolio assessment are analyzed again by using the same questionnaire.

The manual for changing teachers' misconceptions in using portfolio for elementary school student assessment

was subsequently produced. The experts' ratings of the appropriateness of the purpose, principle, and activities in each step of the developed process were at the highest level (M = 5.00, M = 5.00, *and* M = 4.80, respectively), whereas the appropriateness of the length of time of the process was at the high level (M = 4.40).

The above developed process was aligned with Posner et al. (1982)'s theory of conceptual change and She (2004)'s dual situated learning model. Posner et al. (1982) indicated that the conceptual change is completed when learners have dissatisfaction with their current conceptions and find a new conception to be intelligible, plausible, and fruitful. The first and the second step of the developed process had the activities that make teachers realize their misconceptions and make them dissatisfied with their prior conception. Besides, the activities in the third step help teachers to have a desire for correct conceptions in using portfolio to assess students' learning. Moreover, the second step of the developed process was also aligned with She (2004)'s dual situated learning model that emphasizes making teachers perceive the discrepancies between the correct and the prior concepts.

The Effectiveness of the Developed Process to Change Teachers' Misconceptions in Using Portfolio for Elementary School Student Assessment.

As shown in Table 1**,** teachers in the experimental group had misconceptions (i.e., a rating of < 3.50) in using portfolio before they participated in the developed process (overall M = 3.08, principles aspect M = 3.03, and utilization aspect M = 3.19). In contrast, they had correct concepts after they participated (overall M = 4.12, principles aspect M = 4.12, and utilization aspect M = 4.13). In the item-by-item analysis, however, the only concept that teachers in the experimental group still had misconception after the participation was Item 1.11--"Portfolio must only be used in a course that assigns students to create learning products" (M = 3.45). That might be because teachers who plan to use portfolio assessment in their course usually designed course activities that required their students to create some artifacts. They did not realize that portfolio could also be used in any courses that allow students to take a learning log or other kinds of students' thinking records. However, in contrast, Arumugham (2019) found that teachers used a portfolio as a proof of students' learning achievement and learning process.

Paired sample *t*-test was also employed to compare teachers in the experimental group's misconceptions before and after they participated in the developed process. The result is as shown in Table 1. Overall, teacher score on the concepts of using portfolio after the participation in the developed process was statistically higher than that before the participation (p < .01). This indicates that, as a whole, the developed process was effective. However, in the item-by-item analysis, there were two concepts that did not show statistically significant differences i.e., (1) the concept Item 1.12 that "It is not necessary that teachers plan the learning activities at the beginning of the courses" (p > .05), and (2) the concept Item 1.17 that "Scoring criteria or rubrics for evaluating the products in portfolios should be provided at the beginning of the courses" (p > .05). That might be because teachers already knew these two concepts before they participated in the developed process as shown by the values of Means. Therefore, no statistical difference was found.

In addition, independent-sample t-test was used to compare teachers' misconceptions between teachers who had participated in the developed process (experimental group), and those who had not (control group). Table 1 shows that, overall, teachers who participated in the developed process significantly had higher score than those who did not participate (p < .01). This is also true with the principle aspect (p < .01) and the utilization aspect (p < .01).

An effect size was also calculated (Glass, McGaw & Smith, 1981; Light & Pillemer, 1984). Overall, the calculated effect size was 2.16 (principle aspect = 2.27 and utilization aspect = 1.59). These also indicate the effectiveness and the practicality of the developed process to change teachers' misconceptions in using portfolio for elementary school student assessment. The various activities of each step of the developed process provided teachers with an opportunity to analyze themselves and identify the differences between the reasonable concepts and their pre-existing concepts, which made them realize their misconceptions about their implementation of student learning portfolio. The developed process also allowed them to learn the correct concepts of the implementation of student portfolio assessment and enabled them to change their misconceptions in this regard. That made teachers really desire to change their misconceptions. Subsequently, they could finally do it, which is according to Posner et al. (1982)'s theory of conceptual change and She (2004)'s dual situated learning model as mentioned earlier. Besides, the developed process lasts only one semester which is quite an appropriate period of time for them to learn and change their misconceptions in this regard.

Table 1 Mean and Standard Deviation of Teachers' Score on the Concept of Using Portfolio for Elementary School Student Assessment by Teachers

Portfolio Concepts & Questionnaire Item	Experimental Group (n = 20)				t (before & after)	Control Group (n = 20)		t	Effect Size
	Before		After						
	M	*SD*	M	SD		*M*	*SD*		
1. Principles of Student Portfolio Assessment	3.03	0.28	4.12	0.39	10.28**	3.19	0.41	7.31**	2.27
Questionnaire item 1.1	1.95	0.69	3.75	0.85	9.00**	2.45	0.89	4.73**	1.46
Questionnaire item 1.2	3.05	0.95	4.20	0.70	5.51**	3.55	0.83	2.69*	0.78
Questionnaire item 1.3	3.20	0.77	4.40	0.60	6.44**	3.25	0.91	4.72**	1.26
Questionnaire item 1.4	2.70	0.66	3.50	1.28	2.71**	2.80	0.70	2.15*	1.00
Questionnaire item 1.5	2.85	1.14	3.95	0.76	4.07**	3.30	0.92	2.43*	0.71
Questionnaire item 1.6	2.90	0.91	4.20	0.52	5.64**	3.25	1.02	3.71**	0.93
Questionnaire item 1.7	3.15	0.93	4.05	0.61	3.76**	3.25	0.91	3.27**	0.88
Questionnaire item 1.8	3.50	1.10	4.60	0.60	4.59**	3.30	0.98	5.07**	1.33
Questionnaire item 1.9	3.95	0.76	4.40	0.51	2.44*	3.35	0.88	4.65**	1.19
Questionnaire item 1.10	2.10	0.85	3.95	0.83	7.00**	2.75	1.02	4.09**	1.08
Questionnaire item 1.11	2.05	0.60	3.45	1.05	4.50**	2.40	0.88	3.42**	1.19
Questionnaire item 1.12	3.55	0.89	3.80	1.06	0.87	3.10	0.85	2.31*	0.82
Questionnaire item 1.13	3.05	1.28	4.25	0.72	4.19**	3.50	0.95	2.83**	0.79
Questionnaire item 1.14	1.95	0.83	3.65	0.88	7.03**	2.35	1.04	4.28**	1.25
Questionnaire item 1.15	2.80	0.83	4.30	0.57	8.11**	3.60	0.75	3.31**	0.93
Questionnaire item 1.16	4.00	0.65	4.40	0.50	2.18*	3.60	0.75	3.95**	1.07
Questionnaire item 1.17	4.25	0.72	4.45	0.51	1.17	3.75	0.91	3.00**	0.77
Questionnaire item 1.18	3.90	0.72	4.30	0.57	2.99**	3.50	0.83	3.56**	0.96
Questionnaire item 1.19	3.30	1.38	4.45	0.51	3.61**	3.30	0.87	5.12**	1.32
Questionnaire item 1.20	2.40	1.05	4.30	0.57	7.29**	3.50	0.89	3.39**	0.90
2. Utilization of the Results from Student Portfolio Assessment	3.19	0.33	4.13	0.56	6.96**	3.13	0.63	5.37**	1.59
Questionnaire item 2.1	2.65	0.93	3.90	0.97	4.08**	3.00	0.86	3.11**	1.05
Questionnaire item 2.2	2.65	0.93	3.95	0.95	4.47**	2.95	1.15	3.01**	0.87
Questionnaire item 2.3	3.35	0.99	4.40	0.60	4.70**	3.60	0.94	3.21**	0.85
Questionnaire item 2.4	3.35	0.75	4.15	0.49	4.66**	3.45	0.95	2.94**	0.74
Questionnaire item 2.5	3.75	0.64	4.30	0.66	3.58**	3.15	1.04	4.18**	1.11
Questionnaire item 2.6	3.85	0.59	4.30	0.57	3.33**	3.05	0.95	5.06**	1.32
Questionnaire item 2.7	3.25	0.79	4.10	1.02	3.22**	3.15	0.93	3.07**	1.02
Questionnaire item 2.8	2.70	1.03	3.95	1.00	3.39**	2.65	0.93	4.25**	1.40
Total	3.08	0.20	4.12	0.40	11.37**	3.30	0.38	6.70**	2.16

Conclusion and Recommendation

The developed process to change teachers' misconceptions in using portfolio assessment (consisting of 4 steps, i.e., (1) self-analysis; (2) identification of the differences between the reasonable concepts and the pre-existing concepts; (3) understanding of the reasonable concepts; and (4) changing the misconceptions) would have direct implications for sectors and personnel involved in conducting conceptual change of elementary school teachers in the use of student portfolio assessment. Further implication is that teachers would be able to implement each step of student portfolio assessment correctly and more properly. This study also found that the developed process is effective in changing teachers' misconceptions in using portfolio. The implications of teachers' conceptual change for the consequential change of student learning, should be studied in further research. This study only involved elementary school teachers. It is recommended that further research be conducted with both middle and high school teachers.

Finally, note that the present study has contributed to the knowledge base in educational research, particularly, in the area of educational assessment. The knowledge involves (1) "know how" to use the 4-step developed process to change teachers' misunderstandings in using portfolio, and (2) "know that" this process is effective.

Conflict of Interest

There is no conflict of interest.

Acknowledgments

This study was supported by the TRF Research Career Development Grant, Thailand Research Fund (TRF) (RSA5880029) and Chulalongkorn University.

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