

Development of Engineering Drawing Teacher Creativity Teaching Practice Construct

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ABSTRACT

Teachers play an important role in ensuring that teaching and learning become more meaningful in an effort to produce human capital with knowledge, integrity, creative and innovative thinking in line with the development of the world today. This study was conducted due to the importance of creativity in teaching as well as the need for a guide and reference for creative teaching practices, particularly for Engineering Drawing (ED) subjects based on identified research problems. This study aims to identify the constructs and subconstructs of Teacher Teaching Creativity ED. Accordingly, a fully qualitative method through expert interviews was used. A total of four experts with specific expertise and experience in the field of ED teaching were appointed to participate in semi-structured interviews. Interview findings were analysed using the saturated data analysis method. Subsequently, the Fuzzy Delphi Method (FDM) was also employed to obtain expert agreement on the list of constructs that had been identified. Three experts were appointed to carry out the FDM process. The findings of the study indicate that there are five main constructs that need to be given attention in practicing creativity in the teaching of Engineering Drawing teachers, namely, planning creative teaching and learning, guiding, managing, developing a creative community as well as evaluating and assessing. It is hoped that these obtained constructs can be used as a reference to continue the study of developing a framework for teachers' teaching creativity as a reference and guide in practicing creative teaching in the future.

Contribution/Originality: This study contributes to the existing literature about the constructs needed to practice creativity in teaching. It revolves around how teachers play an important role in using and applying creativity through the activities of planning lessons, guiding, managing learning, developing a creative community, and conducting assessment in teaching and learning.

1. Introduction

The development and transformation of the world of education today demands that teachers are always ready to accept changes in various aspects along with education in the era of industrial revolution 4.0 (Ahmad Saifudin & Hamzah, 2021). Accordingly, teachers must be aware and play an active and creative role through the practice of creativity in planning, implementing and reflecting on teaching and learning (Samsudin et al., 2013; Aizat et al., 2018). In addition to that, teachers also need to take into account all current needs comprehensively to ensure the effectiveness of teaching and learning. Accordingly, effective teaching is the main thing in transforming education and subsequently increasing student success (Abu & Eu, 2014; KPM, 2011; Nazirah, 2017). Therefore, the effectiveness of teachers' teaching and learning is very meaningful in producing human capital that has knowledge, integrity, creative and innovative thinking and further equips students with 21st Century skills (Apak & Taat, 2018).

1.1. Research Problems

However, there are still some problems in the implementation of creativity practices in teacher teaching that require attention, especially in Malaysia. This is due to the main challenge in completing the 21st Century skills which requires teachers to master the knowledge and creativity skills in teaching and then implement them in the teaching and learning process. The Covid-19 pandemic is also one of the main challenges in the world of education that requires teachers to be physically and mentally prepared (Zawiah, 2020) and requires teachers to use a variety of methods and strategies to ensure active student involvement and influence the effectiveness of teacher teaching (Rohaila et al., 2019). Based on the problems identified referring to previous studies and literature studies, it was found that there is still a problem on teachers' lack of understanding of creativity practices in teaching (Henry & Mahamod, 2021; Huang & Iksan, 2019; Yunos, 2015). Due to the lack of exposure to aspects of creativity and thinking critical in teacher teaching (Raja Abdullah & Daud, 2018). The study also found that teachers' failure to use appropriate teaching approaches and strategies is also an obstacle in implementing creative teaching (Ruhizan et al. (2012), Normiati and Abdul Said (2019), Rusdin's (2018) study also found failure to plan and implement teaching strategies that are natural to teachers' teaching. Finally, the preliminary study conducted found that 55% of the respondents involved had never received exposure to the implementation of creativity practices in teacher teaching and 100% of respondents agreed that a teacher's creativity practice guide should be created to be used as a reference in ED teaching and learning at school. The findings of the preliminary study are in line with the focused study conducted on ED subjects that have been done by (Ruhizan et al. (2012) and Zaki et al., (2013) which is the need for research related to creativity in teacher teaching through the teacher's perspective is needed so that teachers can understand and improve the quality of their teaching.

1.2. Research Objectives

The objective of this study is to identify the construct of Teacher Teaching Creativity Practices through document analysis, past studies and expert interviews. It is also to ensure that the Creativity Practice Construct of Engineering Drawing Teaching has high reliability using the Fuzzy Delphi technique.

2. Research Methods

This study uses a fully qualitative method to identify the construction of the teaching creativity of ED teachers. The method used is expert interviews. Semi-structured interviews were used and the findings were analysed using saturated data analysis to analyse the findings from the interview. A checklist in the form of a construct questionnaire and construct dimensions were made to obtain construct approval from three appointed experts. At the same time, the Fuzzy Delphi method was used to obtain expert consensus on the list of constructs and the identified construct dimensions.

The Fuzzy Delphi calculation method used in this study aims to find the degree of agreement on the theme or construct being studied. The sample used for the semi-structured interview is among the Excellent Engineering Drawing Teachers in the State of Johor who have extensive expertise and experience in the field of ED. Apart from that, three experts on construct agreement and construct dimensions are composed of a Senior Lecturer of the Technical and Vocational Education Department of the Faculty of Social Sciences and Humanities of a local university, an Assistant Director of the Curriculum Development Division, Malaysia Education Ministry (MoE) and a DG52 Excellent Teacher who has extensive expertise and experience in ED lessons. Four experts who were interviewed in the first step also answered the questionnaire. Table 1 shows the selection of the number of experts involved refers to [Creswell and Clark \(2011\)](#), which is usually a qualitative study for exploratory mix-methods, the number of samples of four to ten people is sufficient as interview respondents.

Table 1: Selection of consensus experts for construct agreement and construct dimensions

Type of agreement	Deal expert	Institution / Organization	Number of Experts
Construct Consent and construct dimensions	Senior lecturer	Public University	1
	Assistant Director	Curriculum Development Division, MoE	1
	Excellent teacher	KPM Middle School	2

The seven-point linguistic scale used in the questionnaire consists of strongly disagree, strongly disagree, disagree, not sure, agree, strongly agree and strongly agree. According to [Ridhuan and Nurulrabihah \(2021\)](#), the use of a higher number of scales allows more precise and accurate data to be obtained. Table 2 shows the seven-point Linguistic scale table used in the construction of the questionnaire to obtain expert agreement and consensus.

Next the use of Formula that has been set is used to determine the average value of Fuzzy Delphi. The following is the formula used to obtain the average value of expert agreement.

$$d(m,n) = (m_1 - n_1)^2 + (m_2 - n_2)^2 + (m_3 - n_3)^2$$

Figure 1 shows the two processes used in the Fuzzy Delphi technique for the purpose of obtaining construct elements of Engineering Drawing Teachers' Creativity Teaching Practice based on expert interviews and expert agreement to obtain the validity of agreement on construct elements. Figure 1 shows the process steps involved in the Fuzzy Delphi process used in this study.

Table 2: Seven Point Fuzzy Delphi Linguistic Scale

Linguistic Variables	Likert Scale	Fuzzy Scale			
Strongly disagree	1	0.0	0.0	0.1	
Moderately disagree	2	0.0	0.1	0.3	
Slightly disagree	3	0.1	0.3	0.5	
Neutral	4	0.3	0.5	0.7	
Slightly agree	5	0.5	0.7	0.9	
Moderately agree	6	0.7	0.9	1.0	
Strongly agree	7	0.9	1.0	1.0	

Figure 1: Steps in the Delphi Fuzzy Technique Process

First step

1. Interviewing three experts who are excellent teachers of engineering drawings
2. Interview findings are used to form themes to produce questionnaire instruments to obtain expert agreement or consensus

Second Step

1. The questionnaire will be answered by six experts including three experts who are involved in the initial staged interviews
2. The findings of the questionnaire will be analyzed using the Fuzzy Delphi method to obtain the validity of the agreement from six experts in determining the appropriateness of the creativity practice construct of ED teachers

3. Research findings

The findings of this study are in line with the objectives and answer the set research questions. Phased qualitative data collection, data findings are obtained through the process of document analysis, previous studies and semi-structured interviews with experts. The data obtained through a qualitative approach was analysed using thematic analysis and saturated data analysis for the purpose of producing the ED-TCTP construct.

3.1. Identifying the ED-TCTP Construct

The results of the analysis of research findings that have been carried out based on document analysis and expert interviews in the field of Engineering Drawing have found that creative teaching practices are a catalyst for the effectiveness of teaching and learning as well as student achievement. However, due to the absence of any specific studies conducted related to creativity practices in ED teaching, the researcher has taken into

account the suitability of the teaching practices listed in the studies and documents referred to, according to the suitability and needs of ED teaching and learning. Therefore, an analysis has been done on the views of experts recorded based on their opinions and their agreement on the Creative Practices of Teaching ED Subjects that are compatible with the culture and educational patterns in Malaysia.

3.2. Data Findings of Expert Interviews on Construct Formation and Construct Dimensions of Drawing Teacher Creativity Teaching Practice (ED-TCTP)

Expert interview sessions were used to reinforce findings from document analysis. According to [Yunus \(2015\)](#), an expert is a person who is very knowledgeable in the field they are engaged in or skilled in a certain field. [Walker et al. \(2000\)](#) stated that the credibility factor is important in determining experts. Meanwhile, [Baker et al. \(2006\)](#) explained that apart from the required credibility, the knowledge and experience factors of a person are two very important criteria used to explain and clarify the definition of an expert. As a result of this interview process, the researcher has successfully identified the elements contained in each construct through the findings of semi-structured interviews that have been conducted with two ED Outstanding Teachers. In addition, through this semi-structured interview, the researcher was able to identify hidden practices practiced by experts to obtain information about ED-TCTP.

Based on excerpts from interviews with experts in the ED field displayed in the table below, elements of ED teachers' latent teaching creativity practices have been identified towards the effectiveness of teaching and learning. [Table 3](#) shows a summary of the findings of interviews with respondents involved in the creative practice of teaching ED teachers. The findings of the study show that both experts state that the practice of creativity in teaching is necessary to achieve the effectiveness of teaching and learning. Based on the results of the interviews that have been conducted, it shows compatibility and parallels with the findings obtained from the document analysis conducted by the previous researchers.

Table 3: Summary of expert interview findings

Reference	Excerpts from Face-to-face Interviews	Theme	Sub Theme
R1-ST05, SK03	Elements of creativity practice in ED teaching depends on the teacher's creativity skills. For me, if we want to be creative in our teaching, we need to plan our teaching creatively, if we have planned it well, then we need to implement our teaching as best as possible.	ED Teacher's teaching creativity practice	Creative TL planning
	Also take into account things such as our ability to manage and implement the TL process creatively and optimally.		Manage TL
	The current development of the education world which is concerned with 21st century teaching requires us to be facilitators in TL to create a more attractive and effective TL.		Teaching and learning guide
	In addition, for me the culture of creativity is not only among teachers but it needs to involve the formation of groups to form an effective		

	relationship with each other and most importantly the objectives of teaching and learning are achieved.		
	Too much practice of creativity in teaching actually. But when it's planned and implemented... teachers also need to have the knowledge and skills to evaluate and assess. The evaluation and assessment must be carried out according to the correct, systematic procedure and according to the latest developments, which is to apply HOTS.		Creative community
			Evaluation and assessment
Reference	Excerpts from Face-to-face Interviews	Theme	Sub Theme
R2-ST05 SK03	There are actually many creativity practices that can be practiced by Engineering Drawing teachers. Based on what I practice, to be creative we need to have good knowledge and experience in the subject. When we understand and are skilled with various teaching strategies and methods, we are able to plan our teaching well.	ED Teacher's teaching creativity practice	Creative TL planning
	Teachers actually have to understand the phases and the TL process well. Anything starts with good planning. Because in planning these various elements we have to take into account. After that, our planning needs to be appropriate for the subject and the students as well.		Manage TL
	Next, the implementation of TL is also very important, teachers need to be smart in managing TL, use various teaching resources, be proficient in using BBM, ICT in managing and implementing TL. In addition to that we also need to act as facilitators and guides by ensuring that students are actively involved in TL.		Teaching and learning guide
	Teachers who are creative can also carry out evaluation and assessment with various methods and ways. But don't forget to follow the procedure and be systematic. After that, try to construct questions that are suitable for KBAT that students can answer with various answers..... Even if this ED is already HOTS.....		Evaluation and assessment
	Besides that, create a close relationship with the students... after all the ED students are all teenagers.... they really feel appreciated if we are close to them... if we are close to them, understand them of course they are more interested with what we teach and don't forget that clear and effective communication is also important. If you follow my experience... I will bring my ED students once in the design club... so		Relationships and communication

	when we give them tasks that involve design and design activities, they have a variety of ideas for them tell them that sometimes they can create concepts themselves using their own understanding.		Creative community
Reference R3-ST05 SK03	Excerpts from Face-to-face Interviews Creativity is something that needs to be practiced and is very important throughout the TL process for me to be creative in TL there needs to be a good plan throughout the TL process... but sometimes it appears accidentally... that is unexpected... especially when we want to give understanding and want to make it easier for the children to understand what we want to convey. Before that, teachers have to clearly understand what they want to convey, what techniques we want to use in TL.	Theme	Sub Theme
	to ensure that the TL process runs smoothly, besides we focus on the topics and topics that will be presented... the teacher needs to take into account the needs and level of the students, what Teaching Aids are needed... sometimes these weak students need more attention and an easier approach to convey a concept. Especially the titles that are difficult to understand.	ED Teacher's teaching creativity practice	Creative TL planning
	for ED subjects, students need visualization skills to answer questions or solve ED questions. Students need to be taught and trained how to visualize well starting from easy questions to difficult questions. Teachers also need to be skilled and creative in using a variety of teaching aids that are appropriate in addition to generating interest in students.....		Manage TL
	To achieve the goals of 21st century teaching, teachers do not only teach... teachers need to know our responsibilities as guides and facilitators... various activities can be used to ensure that students become more responsible and active in TL...		Teaching and learning guide
	not only the TL presentation needs to be creative, coursework assessment, tests, assessments, exams also need to be taken seriously. The implementation of PBS, for example, requires a smart and creative teacher to organize, plan a schedule to attract the interest of students to complete well. It also requires intelligent planning in adapting school-based assessment to the topics and requirements of the syllabus. In order to make an assessment, it is necessary to use various methods in accordance with the needs of ED Middle School Standard Curriculum (MSSC) itself.		Evaluation and assessment

	the relationship between students and teachers needs to be on the right track. Students really like us to care... sometimes when they can't solve a problem, they get a bad ED result... I can see they are down... we shouldn't let them... take their heart... not all our students can score well... boys really don't like to be compared... have to give n take... can be angry... then persuade them back, tell them what they are and why they need to be reprimanded and angry... my experience as a teacher... is very undeniable... closeness making students more interested in our subject.		Relationships and communication
	To make students better understand and remember a concept, I like to do problem-solving activities in groups that involve brainstorming, discussion and presentation... especially for topics that are quite difficult... I see the truth when we do activities like this... various- the kind of creative ideas that we see they can exist and produce. This is also one of the ways we can do to create a culture of creativity among students.		Creative community
Reference R4-ST05 SK03	Excerpts from Face-to-face Interviews ED teachers need to be sensitive to any changes and developments in the world of education. Creativity starts with the teacher himself... The teacher needs to stand out as a creative individual who knows and is a master in all subject content.	Theme ED Teacher's teaching creativity practice	Sub Theme Creative personality
	every action and activity that will be carried out must be organized and planned creatively, carefully and well. So, in the planning process you have to take into account the factors of the topic that will be taught and adapt it to the students.		Creative TL planning
	to ensure that TL runs smoothly and in an orderly manner. Teachers need to manage wisely and ensure that all students are ready and focused to receive the teacher's teaching. In this process, any unexpected things need to be dealt with creatively.		Manage TL
	Teachers also need to make the teaching objectives that are set achievable during the teaching and learning period.		
	I really agree with maximizing the use of the student-centered method even though it takes a long time but gives its own meaning to the students. They explore some information or concept and the role of the teacher is to guide them. In my opinion, through this method, the		Teaching and learning guide

understanding is easily stored and remembered by students. That's why teachers need to plan well to adapt to appropriate teaching methods and techniques.

.....The planned activities also need to be implemented by getting used to creative activities in groups for the purpose of generating ideas in solving problems related to Engineering Drawings. The more group activities are carried out, the more creative and up-to-date ideas can be discussed and shared between the students.

Creative
community

.....Assessment can be done at any time but consistently and purposefully using various methods and means. In addition to that, for me the important thing is to reflect on a test or assessment is very important to ensure that students understand and master the methods and techniques to solve problems clearly.

Evaluation and
assessment

.....A good relationship between teachers and students is very important to create comfort during teaching and learning. Teachers need to be able to communicate in a creative and effective way and be able to control their emotions.

Relationships
and
communication

The findings of the interview analysis conducted show that all four experts stated that the practice of teacher teaching creativity is necessary for an ED teacher to ensure the effectiveness of TL. Based on the interview, it was also found that the experts who were interviewed had listed almost the same views. Teaching creativity practices that are often done and expressed can be summarized as follows: (i) planning creative TL; (ii) guiding TL (iii) managing TL; (iv) develop a creative community; and (v) make evaluations and assessments. Table 4 shows the findings of the interview analysis for the ED-TCTP construct.

Table 4: Findings of the interview analysis of the Construction of Engineering Drawing Teaching Creativity Practice

Bill	Creativity Practice Construct	Expert 1	Expert 2	Expert 3	Expert 4
1.	Teacher Teaching	√	√	√	√
2.	Planning Creative TL	√	√	√	√
3.	Guiding TL	√	√	√	√
4.	Managing the environment	√	√	√	√
5.	Building a creative community	√	√	√	√

3.3. The ED-TCTP Construct List and Construct Dimensions

Against the 20 ED-TCTP indicators that have been identified and agreed upon by the panel and experts involved in this study, there are five subject teachers' creative teaching practice constructs that have been agreed upon, namely; (i) Planning teaching and

learning; (ii) guiding TL; (iii) Managing teaching and learning; (iv) develop a creative community; and (v) Evaluate and assess. The compilation of 15 ED-TCTP construct elements that have been agreed upon are shown in [Table 5](#), namely learning style, intelligence, lesson plans, TL strategies and methods, motivation, creative personality, mentors and facilitators, use of Teaching Aids, ICT, TL environment, TL implementation, relationship, communication, systematic and continuous as well as KBAT application. [Table 5](#) also shows the position of the elements of creativity practice listed based on the agreed ED-TCTP construct.

Table 5: The position of constructs and construct dimensions of creativity practice based on the ED-TCTP Construct

CONSTRUCT	CONSTRUCT DIMENSIONS
A. Planning creative teaching and learning	A1 Thinking style A2 Intelligence A3 Lesson plan A4 TL strategies and methods
B. Guiding TL	B1 Motivation B2 Creative personality B3 Guide and facilitator
C. Manage the TL environment	C1 Fuel consumption C2 Use of ICT C3 TL Environment C4 Implementation of TL
D. Build a creative community	D1 Relationship D2 Communication
E. Assess and Assess	E1 Systematic and continuous E2 HOTS Application

3.4. Fuzzy Delphi Analysis – Expert Agreement on Constructs and Construct Dimensions of AKPG-LK

Once the constructs and construct dimensions of the ED-TCTP measurement were identified, the researcher used the Fuzzy Delphi Index analysis method ([Cohen et al., 2018](#)) to obtain agreement on the list of constructs and construct dimensions identified. Fuzzy Delphi analysis aims to find the degree of agreement of the theme or construct being studied ([Azman, 2012](#)). This process involves the services of three experts consisting of a Senior Lecturer of the Faculty of Social Sciences and Humanities, Universiti Teknologi Malaysia (UTM), an Excellent Teacher of ED and an Education Officer consisting of the Assistant Director of the Curriculum Development Division of the MoE to evaluate each theme contained in the list of constructs and construct dimensions which is formed from the results of expert interviews and a review of theories, models and literature made. [Table 6](#) shows the agreement analysis of experts' assessment of the constructs and dimensions of the ED-TCTP constructs using Fuzzy Delphi analysis.

The findings shown in [Table 6](#) show that two of the four experts who were consulted to get theme agreement using Fuzzy Delphi analysis gave agreement (100%) to the 20 ED-TCTP construct indicators listed. While three experts agreed that 19 out of 20 indicators (95%) of agreement on the ED-TCTP construct theme. At this step, the researcher has obtained an expert group agreement of more than 75%, which is 97.86% of the average value of consensus agreement. Based on the results of the Kappa agreement value, there

are 20 ED-TCTP indicators that have been identified and agreed upon by the panel and experts involved in this study. The list of subject teacher creativity teaching practice constructs that have been agreed upon are planning teaching and learning, guiding teaching and learning, managing teaching and learning, developing a creative community and evaluating and assessing. Apart from that, there are 15 dimensions of creativity in the teaching of ED subjects that have been agreed upon, namely learning style, intelligence, lesson plans, TL strategies and methods, motivation, creative personality, guides and facilitators, use of Learning aids, Information and Communication Technology (ICT), Teaching and Learning (TL) environment, TL implementation, relationships, communication, systematic and continuous as well as Higher Order Thinking Skills (HOTS) application. Finally, the findings from the construct agreement and construct dimensions can be used by the researcher to continue the next research process, which is the construction of research instruments.

Table 6: Expert assessment agreement analysis of the constructs and dimensions of the ED-TCTP construct

BILL	CODE	CONSTRUCT/ CONSTRUCT DIMENSIONS	P1	P2	P3	P4	P5	P6	P7
1.	A	Planning a creative TL	√	√	√	√	√	√	√
2.	A1	Thinking style	√	√	√	√	√	√	√
3.	A2	Intelligence	√	√	√	√	√	√	√
4.	A3	Lesson plans	√	√	√	√	√	√	√
5.	A4	TL strategies and methods	√	√	√	√	√	√	√
6.	B	Guiding TL	√	√	√	√	√	√	√
7.	B1	Motivation	√	√	√	√	√	√	√
8.	B2	Creative personality	√	X	√	√	√	√	√
9.	B3	Mentors and facilitators	√	√	√	√	X	√	√
10.	C	Manage the TL environment	√	√	√	√	√	√	√
11.	C1	Fuel consumption	√	√	√	√	√	√	√
12.	C2	Use of ICT	√	√	√	√	√	√	√
13.	C3	TL environment	√	√	√	√	√	√	√
14.	C4	Implementation of TL	√	√	√	√	√	√	X
15.	D	Building a creative community	√	√	√	√	√	√	√
16.	D1	Relationship	√	√	√	√	√	√	√
17.	D2	Communication	√	√	√	√	√	√	√
18.	E	Evaluate and Assess	√	√	√	√	√	√	√
19.	E1	Systematic and continuous	√	√	√	√	√	√	√
20.	E2	HOTS application	√	√	√	√	√	√	√
TOTAL			20	19	20	20	19	20	19
PERCENT			100	95	10	10	95	100	95
			%	%	0	0	%	%	%
					%	%			

4. Research recommendations

This study recommends that the construct of Engineering Drawing Teaching Creativity Practice which has a high Kappa reliability index value be continued with the construction of a questionnaire-shaped instrument. It is suggested that the instrument development

process must follow the prescribed procedure and go through a specific data analysis process to ensure that the construct of the teacher's teaching creativity practice can be verified. In addition, the researcher also suggested that the ED Teacher Teaching Creativity Practice Construct that has been verified can be used as a guide and reference to develop a unidimensional Teacher Teaching Creativity Practice Framework and then be used as a guide and reference for ED teacher teaching creativity practice in schools.

5. Conclusions

Based on the research and discussions conducted, it proves that this research is relevant to be carried out for the purpose of producing a construct of ED teachers' teaching creativity that has high reliability. The results of the study are also expected to help fulfill the literacy gap related to the study of teachers' teaching creativity, especially in the subject of Engineering Drawing. In addition to that, the researcher is also confident that this study can contribute to the MoE, State Education Department, schools and teachers in ensuring the effectiveness of teachers' teaching and learning in order to achieve the practice and culture of creativity among Malaysians.

Ethics Approval and Consent to Participate

The researchers used the research ethics guidelines provided by Universiti Teknologi Malaysia (UTM) Research Ethics Committee. All procedures performed in this study involving human subjects were conducted in accordance with the ethical standards of the institutional research committee. Permission and consent to participate in the study was also obtained from all study participants.

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Conflict of Interest

The authors reported no conflicts of interest for this work and declared that there was no potential conflict of interest with respect to the research, authorship, or publication of this article.

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