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CRITICAL THINKING DISPOSITIONS AS A MEDIATOR BETWEEN TEACHERS' KNOWLEDGE AND 21ST CENTURY TEACHING IN SELANGOR, MALAYSIA

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Abstract

The study was carried out to bridge the research gap on 21st century teaching; the relationship between pedagogy, content, and technology with 21st century teaching; and the development of critical thinking dispositions. Current study aims to determine the mediating effect of critical thinking dispositions for the relationship between teachers' knowledge (pedagogy, content, and technology) with 21st century teaching among secondary school teachers in Selangor, Malaysia. This study employed causal relationship design with proportional stratified random sampling. In data analysis, inferential statistical is applied to determine the mediating effect through Structural Equation Modeling (SEM). The findings show a significant mediating effect of critical thinking dispositions for the relationship between pedagogical knowledge, content knowledge, and technological knowledge with 21st century teaching. As a conclusion, the mediating model suggests pedagogical knowledge, content knowledge, and technological knowledge with critical thinking dispositions as mediator contributing 61 percent of the variance to 21st century teaching. This final model can be considered by teachers as the efforts to enhance 21st century teaching.

Keywords: 21st century teaching, Critical thinking dispositions, Pedagogical knowledge, Content knowledge, Technological knowledge

1.0 RESEARCH BACKGROUND

Education and teachers play a vital role in develop students' 21st century skills which is through specific teaching practice such as 21st century teaching (Häkkinen et al., 2017). Teachers is the main factor that contributes to students' performance in 21st century skills (Norazlin, 2018). This means, the way teachers deliver teaching affects the learning outcomes of 21st century. Therefore, teachers need to integrate 21st century skills into effective, interesting, and interactive pedagogical practice (Valtonen et al., 2021) such as 21st century teaching.

Effective teaching need teachers who have high level of pedagogical knowledge and content knowledge. Pedagogical knowledge is the belief and perception that influence the implementation of the curriculum which reflects the lesson content as well as the teaching and learning (T&L) strategies (Bonner, 2013). Individual who know the subject well are not necessarily able to teach well. So, teachers supposed to make the content knowledge they possess be meaningful by ensuring it is easily accepted by students through the right pedagogy. Technology also gave impact in changing the way of T&L. Technology acts as a facilitator in which teachers need to combine the right elements and the precise tools into learning activities that are easy to follow (Bruggeman et al., 2021). In order to prepare students for future community life and workplaces that involve technology, teachers should encourage students' learning by engaging with the use of technology (Hatlevik & Hatlevik, 2018). Teachers need to integrating technology into pedagogy by identifying learning activities, teaching aids, and teaching materials so that can inspire students to get involved; adapt in diversity to support interaction; and develop literacy of Information and Communication Technology (ICT).

The current study examines the role of critical thinking dispositions as a mediator for the relationship between knowledge (pedagogy, content, and technology) and 21st century teaching. Critical thinking dispositions refers to the tendency to act and think in a certain way (Tiilikainen et al., 2019; Valtonen et al., 2021). By developing a critical thinking dispositions, an individual will be more prepared to use critical thinking skills. Since critical thinking skills are among the main predictors of academic achievement (Dehghanzadeh & Jafaraghaee, 2018), therefore critical thinking dispositions should be emphasized. Živkoviü (2016) suggests students need to be taught how to think critically and be given opportunity to express their opinions openly meanwhile the teachers should be encouraging students' behaviour and critical thinking by demonstration the use of thinking skills clearly and frequently.

2.0 PURPOSE OF THE STUDY

The study aims to determine the mediating effect of critical thinking dispositions towards the relationship between pedagogical knowledge, content knowledge, and technological knowledge with 21st century teaching among 332 secondary school teachers in Selangor, Malaysia.

3.0 LITERATURE REVIEW

Critical thinking dispositions is one of the dimensions of critical thinking besides critical thinking skills. Critical thinking skills consist of interpretation, analysis, evaluation, inference, explanation, and self-regulation whereas critical thinking dispositions are habits of mind and tendencies such as ability, attitude, character, and personality which are required to think critically (Davies & Barnett, 2015). Dispositions is an affective component to explain the attitude and sense of psychological readiness to use critical thinking skills. Critical thinking dispositions affects how extent of a person tends to think (Li et al., 2021), willingness to use, and independently observe the occurs of critical thinking skills.

Ibrahim (2013) defines critical thinking dispositions as a tendency to solve problem and make decision critically. The measurement of critical thinking dispositions involves seven dimensions, which are analyticity, open mind, truth seeking, systematicity, self-confidence, inquisitiveness, and maturity. Ibrahim (2013) found the level of students' critical thinking dispositions is low. In addition, to measure students critical thinking dispositions, Ren et al. (2020) use four dimensions which are truth-seeking, analyticity, open-mindedness, and systematicity while Li et al. (2021) use dimensions of truth-seeking, analyticity, self-confidence, and inquisitiveness. The finding by Ren et al. (2020) show the open-mindedness obtain the highest mean value, followed by analyticity, truth-seeking, and systematicity. Meanwhile, Li et al. (2021) found analyticity obtain highest mean value, followed by inquisitiveness, truth-seeking, and self-confidence.

Current study employed theory of Technological Pedagogical Content Knowledge (TPACK; Mishra & Koehler, 2006) originally from Pedagogical Content Knowledge theory (PCK; Shulman, 1986) and resumed with a new component which is technological knowledge. TPACK theory is introduced to understand the knowledge need by teachers in effective technology integration. Mishra and Koehler (2006) explain when Shulman introduced PCK theory, the technological aspect was not as critical as it is today. Along with the change of time, technology has become an crucial in education and need to be empower in T&L.

TPACK theory consists of three main components which are technological knowledge, pedagogical knowledge, and content knowledge. From here, four more components developed including pedagogical content knowledge (PCK), technological content knowledge (TCK), technological pedagogical knowledge (TPK), and TPACK. Pedagogical knowledge is a knowledge about how to learn and how learning can be facilitated (Koehler et al., 2014). Content knowledge is knowledge about the subject to be learned or taught (Schmidt et al., 2009). Then, pedagogical knowledge and content knowledge combined to create a process of T&L. Technological knowledge is knowledge about various technologies ranging from low-tech technologies such as pencil and paper to digital technologies such as internet, digital video, interactive whiteboard, and software programs (Koehler & Mishra, 2009; Schmidt et al., 2009). TPACK defined as understanding of the interaction of knowledge (pedagogy, content, and technology) and knowledge that underlies meaningful teaching and technology skills (Koehler et al., 2013). TPACK is the foundation of effective teaching with technology which involves understanding the concept of using technology; pedagogical technique that use technology constructively in teaching content; knowledge of what makes a concepts more difficult or easy to learn and how technology can help students to cope with problem; knowledge about students' existing knowledge and epistemological theory; and knowledge of how technology can be used in growing existing knowledge, in building new epistemology or strengthening existing epistemology (Koehler et al., 2013).

Ravitz et al. (2012) refer the framework of Innovative Teaching Practice (Shear et al., 2010) and 21st century competency studies (The William and Flora Hewlett Foundation, 2010) in developing the concept and dimensions of 21st century teaching. Ravitz et al. (2012) described the concept of 21st century teaching same like the definition of student-centered pedagogy by Shear et al. (2010): T&L models include project-based, collaborative, foster knowledge building, require self-regulation and assessment, personalized (allowing for students to choice and relevance to the individual students; learn in a way that is appropriate to their background, experience , and interests), and individualized (allowing students to work at their own pace and according to their particular learning needs). Ravitz et al. (2012) also refer to Shear et al. (2010) in developing the 21st century skills dimensions which are communication, collaboration, and using technology as a tool for learning. Meanwhile, The William and Flora Hewlett Foundation (2010) is referred to explain the dimensions of critical thinking skills, collaboration, communication, creativity, innovation, self-direction, information literacy, and media literacy.

The study by The William and Flora Hewlett Foundation's (2010) on 21st century competencies involves five categories, namely analytical skills, interpersonal skills, ability to execute, information processing, and ability to learn. Analytical skills include critical thinking, problem-solving, decision making, and inquiry. Interpersonal skills involve communication, collaboration, and leadership/responsibility. Ability to execute consist of initiative/self-direction and productivity. Information processing includes information literacy, media literacy, digital society, and ICT operations/concepts. Ability to learn involve creativity/innovation, adaptive learning/learning to learn, and flexibility. Ravitz et al. (2012) defined 21st century teaching through eight skills dimensions which are critical thinking, collaboration, communication, creativity and innovation, self-direction, global connections, local connections, and skills using technology as a tool for learning.

Ravitz et al. (2012) conducted a study to determine the effect of project-based learning (PBL) with the support of professional development programs on students' 21st century skills. PBL is one of T&L models that emphasizes the concept of teaching and 21st century skills which gave students the opportunity to learn content knowledge deeply along with 21st century skills. Ravitz et al. (2012) found teachers who use PBL with the support of professional development programs are more likely to teach and assess 21st century skills. Ghamrawi et al. (2017) measured teaching practice based on 21st century skills and found the dimensions of collaboration and communication obtained moderate level while the dimensions of critical thinking, creativity and innovation, self-direction, global connections, local connections, and skills in using technology as a tool for learning were at a low level. This suggests that teaching practice

are still less emphasize on 21st century skills. Ahmad et al. (2019) surveyed teachers' perceptions of 21st century T&L practice and found the dimensions of problem-solving, communication, critical thinking, reflection, and technology were at a high level while the dimensions of assessment, creativity/innovation, and collaboration were at a moderate level. The results of Ahmad et al. (2019) prove that 21st century T&L practice have a positive effect on students' development.

Critical Thinking Dispositions as a Mediator between Pedagogical Knowledge and 21st Century Teaching

Current researchers found no previous study that clearly examines the mediating effect of critical thinking dispositions for the relationship between pedagogical knowledge and 21st century teaching. However, there are a few past studies that are seen to be related to this study. Cheng and Wang (2017) found a significant mediating effect of critical thinking dispositions for the relationship between pedagogy and critical thinking skills through the SEM analysis. Pedagogy is one of the dimensions studied in the classroom learning environment with three sub-dimensions namely, multiple perspectives, challenging task, and students' negotiation. Critical thinking skills is one of the dimensions of 21st century teaching (P21.org, 2019). Besides that, a quasi-experimental study by Karami et al. (2015) explored the effectiveness of collaborative and inquiry pedagogy in developing students' critical thinking dispositions. Both of these learning pedagogies (collaborative and inquiry) emphasize 21st century teaching such as collaboration, critical thinking, and self-direction. In collaborative learning, involvement and cooperation encourage the sharing of skills while inquiry learning involves questioning that lead to critical thinking process. The use of inquiry supports internal motivation that can enhance critical thinking dispositions. Karami et al. (2015) noticed the increasing of critical thinking dispositions after the collaborative and inquiry pedagogy.

In addition, Talmi et al. (2018) implementing project-based pedagogy to discover its relationship towards intrinsic motivation and 21st century skills. Talmi et al. (2018) noted the involvement in a racing car design project allows the acquisition of 21st century skills, especially thinking skills then promote a sense of autonomy (the ability to make independent decisions); competence (participant's desire to succeed in the task and receive positive feedback and respect from teammates and mentors); and relatedness (a sense of being part of the engineering community as well as the current learning community). Autonomy, competence, and relatedness are three basic psychological needs that form intrinsic motivation (Koh et al., 2010). Talmi et al. (2018) found a relationship between intrinsic motivation and 21st century skills which explain the engagement in project assist to develop 21st century skills then increase intrinsic motivation to participate.

Study by Dogan and Sendir (2022) involves simulation pedagogy to support 21st century skills among medical university students. The Objective Structured Clinical Evaluation instrument is used to evaluate the performance of simulation based on decision making, critical thinking, and communication. All these three aspects are highlighted in 21st century teaching. For example, decision making (Guerriero & Révai, 2017), critical thinking (P21.org, 2019), and communication (P21.org, 2019). Dogan and Sendir (2022) noted an increase of critical thinking dispositions after simulation. The simulation involves two types, high-fidelity simulators (HFS) and standardized patients (SP). HFS allows respondent to gain experience in decision making and professional practice (Flude et al., 2012) whereas SP involve respondent with clinical experience that closely real-life scenario resulting in strengthening conceptual knowledge, critical thinking, decision making, and psychomotor skills.

Tseng et al. (2022) examined multidimensional teaching strategies to support 21st century teaching and their relationship with university students' critical thinking dispositions. Multi-dimensional teaching strategies consist of 5E learning model (engage, explore, explain, elaborate, and evaluate) and self-efficacy teaching strategy. The 5E learning model is an approach to enhance critical thinking. The implementation of 5E learning model comprises: 1) involvement: respondent watch video; 2) exploratory: respondent use prior knowledge and experience for analytical purposes. Then, group discussion is conducted to identify problem, draw conclusion, and participate in activity (collaboration); 3) explanation: presentation of result (communication); 4) elaboration: respondent use existing knowledge to other situations, group discussion; and 5) assessment: teacher examine learning outcome through quiz, case study, or experience. Meanwhile, self-efficacy learning strategy focuses on the acquisition of experience via test, video, lecture, and work visit. Tseng et al. (2022) noticed the increasing of critical thinking dispositions after the multi-dimensional teaching strategies.

Critical Thinking Dispositions as a Mediator between Content Knowledge and 21st Century Teaching

Current researchers found no previous study that clearly examines the mediating effect of critical thinking dispositions on the relationship between content knowledge and 21st century teaching. However, there are a few past studies that seem to be able to backing this study. For instances, Cheng and Wan (2017) explores the effect of the classroom learning environment on students' critical thinking skills and critical thinking dispositions. They found a significant mediating effect of critical thinking dispositions on the relationship between content and critical thinking skills through the analysis of SEM. Content is one of the dimensions in the classroom learning environment which consist of uncertainty and personal relevance sub-dimensions while critical thinking skills is a dimension in 21st century teaching (P21.org, 2019).

A quasi-experimental study by Evren et al. (2012) is linked to this study because involves content knowledge of science subject and 21st century teaching through the use of V diagram which is seen as potentially developing critical thinking and collaboration. Result of Evren et al. (2012) show the use of V diagram only had a significant effect on the self-confidence dimension in critical thinking dispositions. However, there was an increase on dimensions of analyticity, curiosity, self-confidence, and systematicity in critical thinking dispositions after the intervention. To build V diagram, students have to think critically by doing observation, inference, assumption, discussion, and comparison of opinions. Dogan and Sendir (2022) study the simulation method that require specific content knowledge. This method allows students to gain experience in decision making, critical thinking, and communication. These three aspects are emphasized in 21st century teaching. Although Dogan and Sendir (2022) found the simulation method did not have a significant effect on critical thinking dispositions, knowledge level, and simulation performance but, there is still an increase of critical thinking dispositions after this method.

Critical Thinking Dispositions as a Mediator between Technological Knowledge and 21st Century Teaching

Current researchers found no previous study that clearly examines the mediating effect of critical thinking dispositions in the relationship between technological knowledge and 21st century teaching. However, there are a few past studies related to current research. Dehghanzadeh and Jafaraghaee (2018) found the teaching using flipped classroom method had a positive and significant effect on critical thinking dispositions among university students. The flipped classroom is a T&L method with the use of technology to supports active learning, empowering collaboration, communication, and critical thinking skills. The flipped classroom intervention begins with the instructor preparing content in the form of electronics/technology. Next, respondent study the electronic content before session and participate in collaborative activity.

Additionally, a study by Osborne et al. (2018) also support the use of technology tool in T&L gave impact on engagement, critical thinking, and collaboration. They use asynchronous online discussion boards (AOD) that allow user to access them at any time without having to be online simultaneously. Online discussion board are among the tools commonly used in online teaching to promote engagement, collaboration, and deep learning (Lyons & Evans, 2013). The use of AOD is related to 21st century teaching because this method highlights the use of technology, active involvement, critical thinking, and collaboration.

Gever et al. (2021) conducted a quasi-experimental study using an interactive television contain 20 episodes broadcast. The content in broadcast aims to educate and expose participant about critical thinking skills and critical thinking dispositions. The learning has interactive feature which the instructor and participant can interact through questions and answers during the learning session which provides experience of involvement. Interactive television teaching is related to 21st century teaching because involves the use of technology (P21.org, 2019), communication (P21.org, 2019), and active involvement (Dehghanzadeh & Jafaraghaee, 2018; Talmi et al., 2018). Gever et al. (2021) suggest the use of interactive television is effective in improving critical thinking skills and critical thinking dispositions.

■ 4.0 METHODOLOGY

The study employed causal relationship design with proportional stratified random sampling. Proportional stratified random sampling was carried out involving 10 districts with a population size of 26,431 teachers from 278 secondary schools in Selangor, Malaysia. A questionnaire was used as an instrument for data collection. The instrument was modified based on three past instruments including West Virginia 21st Century Teaching and Learning Survey (WVDE-CIS-28; Ravitz, 2014), Survey of Preservice Teachers' Knowledge of Teaching and Technology (Schmidt et al., 2009), and instrument of critical thinking dispositions by Ibrahim (2013). The adaptation of the past instruments is applied after got permission from the instruments' owner. This study also permitted to be conducted by educational institution (Ethic Committee for Research Involving Human Subject, Universiti Putra Malaysia). WVDE-CIS-28 measures teachers' perceptions about how extent they perform their role in ensuring students learning is directed towards the use of 21st century skills. After validity, reliability, Exploration Data Analysis (EDA), and Exploratory Factor Analysis (EFA for pilot test) of WVDE-CIS-28, 25 items used in current study involving five dimensions, namely critical thinking, collaboration, self-direction, global and local connections, and skills in using technology as a tool for learning. The Survey of Preservice Teachers' Knowledge of Teaching and Technology measures teachers' perceptions about how extent they know about approaches, styles, and evaluations in the T&L according to students diversity (pedagogy); knowing the subject in general without touching on specific subject content knowledge and emphasizing the role of content knowledge on teaching quality (content); and know and explore the use of various types of technology (technology). After validity, reliability, EDA, and EFA (pilot test) of the Survey of Preservice Teachers' Knowledge of Teaching and Technology, 15 items used in this study. Critical thinking dispositions instrument by Ibrahim (2013) measures the teachers' perception about how extent they tend to think deeply about a matter and this tendency was resulting from nature to explore knowledge, orderly management, confidence with own abilities, and high curiosity. After validity, reliability, EDA, and EFA (pilot test) of critical thinking dispositions instrument, 14 items used in current study involving four dimensions namely analyticity, systematicity, self-confidence, and inquisitiveness.

Content validity and face validity important in clarity and appropriateness of items to measure a construct (DeVellis, 2017). In this study, content validity and face validity were reviewed by four experts. They examined the items based on conceptual relevance, term usage, and sentence order. Meanwhile, construct validity was assessed through Confirmatory Factor Analysis (CFA) which aims to identify, eliminate, and organize items into specific factors. Construct validity is based on convergent validity and discriminant validity as suggested by Cohen et al. (2018) and Hair et al. (2014). A pilot study executed involving 84 secondary school teachers in order to find out the reliability. A pilot study was carried out to ensure the language and structure of the sentences in instrument could be understood, matched with the respondents' experience, and items presented were able to produce the desired answers. Before actual data collection, the researchers inform first the schools' administration by email attached with approval letters from Educational Planning and Policy Research Division (EPRD MOE), Selangor Education Department, and educational institution (UPM). Later on, data was administered directly which are the researchers met with a school representative to submit instrument then he distributes to the selected teachers. The data obtained was analyzed via inferential statistical analysis method (SEM and AMOS software).

■ 5.0 RESEARCH FINDINGS AND DISCUSSIONS

The result was showed in Figure 1. It was found the mediating model explained 61 percent variance of 21st century teaching.

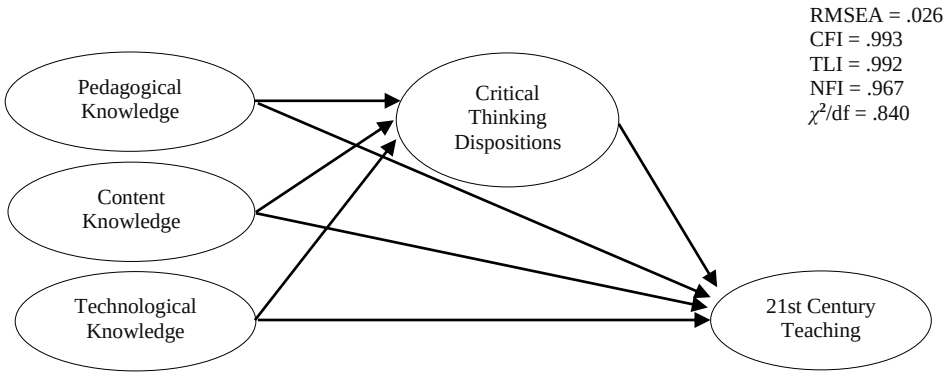

Figure 1: Mediating model (Final model)

Mediating Effects between Pedagogical Knowledge and 21st Century Teaching

Result for the mediating effects of critical thinking dispositions for the relationship between pedagogical knowledge and 21st century teaching is presented in Table 1.

Table 1: Bootstrapping for the mediating effects of critical thinking dispositions for the relationship between pedagogical knowledge and 21st century teaching

Model/ Hypothesis Path	**Beta (β)**	**ρ**	**95% *Bootstrap* BC CI**		**κ^2**
			LB	**UB**	
Direct Effects Model					
PK→21st CT	.686	***			
Mediating Model					
PK→21st CT	.572	***			
(Direct effects)					0.219
SIE	.162	.033	.017	.348	

Note: PK=Pedagogical knowledge;21st CT=21st century teaching; SIE=*Standardized indirect effects*; BC=*Bias-corrected*; CI=*Confidence intervals*; Beta (β)=*Standardized regression weight*; ρ=*Significant level*; LB=*Lower bound*; UB=*Upper bound*; κ^2=*Effects Size*

Bootstrapping analysis shows the mediating effects occurs, which is the indirect effects of the relationship between pedagogical knowledge and 21st century teaching through the mediator of critical thinking dispositions is statistically significant at a significant level of 0.05 (β=0.162, ρ=0.033). According to Preacher and Hayes (2008), mediating effects occurs when the indirect effects does not include "0" between the lower limit (LB=0.017) and the upper limit (UB=0.348) or "outside" at the 95 percent CI. Therefore, critical thinking dispositions is a mediator for the relationship between pedagogical knowledge and 21st century teaching based on the perception of secondary school teachers in Selangor.

The significant direct effects (mediating model and direct effects model), a significant indirect effect (mediating model), and "outside" at 95 percent CI (Bahaman, 2017) explain the role of critical thinking dispositions as a partially mediator for the relationship between pedagogical knowledge and 21st century teaching. The coefficient of determination (R^2) shows the indirect effects of pedagogical knowledge on 21st century teaching through the mediator of critical thinking dispositions is moderate (κ^2=0.219).

The current findings show a significant and moderate mediating effects of critical thinking dispositions for the relationship between pedagogical knowledge and 21st century teaching. This means teachers' pedagogical knowledge along with critical thinking dispositions were significantly contribute to 21st century teaching practice. The high level of pedagogical knowledge and critical thinking dispositions (result from the descriptive statistical analysis) are moderately increase the frequency of 21st century teaching among secondary school teachers in Selangor. This means teachers who know about effective teaching delivery, approach, style, and assessment in T&L and along with tendency to analyse and confidence with own abilities were contribute to the teaching frequency which aims to integrate 21st century skills and student-centered.

Karami et al. (2015) support the findings of this study which is critical thinking dispositions increase after collaborative and inquiry learning. Collaborative learning involves discussion, interaction, and opportunity to question and answer that encourage higher order thinking and stimulate critical thinking dispositions. Meanwhile, inquiry learning keeps up internal motivation then leads to critical thinking dispositions. The collaborative and inquiry pedagogy embraced 21st century skills and then enhance critical thinking skills and dispositions. Cheng and Wan (2017) also backing the current study results by found a significant mediating effects of critical thinking dispositions for the relationship between pedagogy in the classroom learning environment and critical thinking skills. The classroom learning environment emphasize 21st century teaching which is self-directed (shared control) and critical thinking (challenging task), then improve critical thinking dispositions. Tseng et al. (2022) found 5E learning and the self-efficacy learning model increase reflective thinking in critical thinking dispositions. These pedagogies (5E learning and self-efficacy) highlight 21st century teaching (critical thinking) and subsequently promote critical thinking dispositions.

Mediating Effects between Content Knowledge and 21st Century Teaching

Result for the mediating effects of critical thinking dispositions for the relationship between content knowledge and 21st century teaching is presented in Table 2.

Table 2: Bootstrapping for the mediating effects of critical thinking dispositions for the relationship between content knowledge and 21st century teaching

Model/ Hypothesis Path	**Beta** (β)	**ρ**	**95% *Bootstrap* BC CI**		**κ^2**
			LB	**UB**	
Direct Effects Model					
CK→21st CT	-.191	.026			
Mediating Model					
CK→21st CT	-.189	.020			
(Direct effects)					0.078
SIE	.075	.034	.005	.205	

Note: CK=Content knowledge; 21st CT=21st century teaching; SIE=*Standardized indirect effects*; BC=*Bias-corrected*; CI=*Confidence intervals*; Beta **(**β)=*Standardized regression weight*; ρ=*Significant level*; LB=*Lower bound*; UB=*Upper bound*; κ^2=*Effects Size*

Bootstrapping analysis shows the mediating effects occurs, which is the indirect effects of the relationship between content knowledge and 21st century teaching through the mediator of critical thinking dispositions is statistically significant at a significant level of 0.05 (β=0.075, ρ=0.034). According to Preacher and Hayes (2008), mediating effects occurs when the indirect effects does not include "0" between the lower limit (LB=0.005) and the upper limit (UB=0.205) or "outside" at the 95 percent CI. Therefore, critical thinking dispositions is a mediator for the relationship between content knowledge and 21st century teaching based on the perception of secondary school teachers in Selangor.

The significant direct effects (mediating model and direct effects model), a significant indirect effect (mediating model), and "outside" at 95 percent CI (Bahaman, 2017) explain the role of critical thinking dispositions as a partially mediator for the relationship between content knowledge and 21st century teaching. The coefficient of determination (R^2) shows the indirect effects of content knowledge on 21st century teaching through the mediator of critical thinking dispositions is small (κ^2=0.078).

Analysis of this study show a significant and small mediating effects of critical thinking dispositions for the relationship between content knowledge and 21st century teaching. This describe teachers' content knowledge along with critical thinking dispositions were significantly contribute to 21st century teaching practice. The very high level of content knowledge and a high level of critical thinking dispositions (result from the descriptive statistical analysis) slightly reduce the frequency of 21st century teaching among secondary school teachers in Selangor. This means teachers who conquer lesson content and along with tendency to analyze and confidence with own abilities contribute to the decreasing of teaching frequency that intends to integrate 21st century skills and student-centered. However, this kind of result was believed occur due to the majority of respondents (61.5 percent) are experienced teachers who been in service more than 15 years. These senior teachers prefer more to use teacher-centered rather than student-centered and they possess a wide of content knowledge to deliver to their students. Suviste et al. (2017) said the experience teachers are likely to execute teacher-centered pedagogy.

Evren et al. (2012) study's a bit related to this research which is the use of V diagram in T&L increase the tendency to think critically (analytic and self-confidence). The use of V diagram is connected to 21st century teaching specifically critical thinking that was gain from observation, inference, assumption, discussion, and comparison of opinions, then it affects the critical thinking dispositions. In addition, Dogan and Sendir (2022) noticed an increasing of critical thinking dispositions after the simulation method. This method associates with 21st century teaching and emphasized critical thinking skills.

Mediating Effects between Technological Knowledge and 21st Century Teaching

Result for the mediating effects of critical thinking dispositions for the relationship between technological knowledge and 21st century teaching is presented in Table 3.

Table 3: Bootstrapping for the mediating effects of critical thinking dispositions for the relationship between technological knowledge and 21st century teaching

Model/ Hypothesis Path	**Beta** (β)	**ρ**	**95% *Bootstrap* BC CI**		**κ^2**
			LB	**UB**	
Direct Effects Model					
TK→21st CT	.168	.003			
Mediating Model					
TK→21st CT	.130	.033			
(Direct Effects)					0.096
SIE	.081	.033	.009	.191	

Note: TK=Technological knowledge; 21st CT=21st century teaching; SIE=*Standardized indirect effects*; BC=*Bias-corrected*; CI=*Confidence intervals*; Beta **(**β**)**= *Standardized regression weight*; ρ**=***Significant level***;** LB=*Lower bound*; UB=*Upper bound*; κ^2=*Effects Size*

Bootstrapping analysis shows the mediating effects occurs, which is the indirect effects of the relationship between technological knowledge and 21st century teaching through the mediator of critical thinking dispositions is statistically significant at a significant level of 0.05 (β=0.081, ρ=0.033). According to Preacher and Hayes (2008), mediating effects occurs when the indirect effects does not include

"0" between the lower limit (LB=0.009) and the upper limit (UB=0.191) or "outside" at the 95 percent CI. Therefore, critical thinking dispositions is a mediator for the relationship between technological knowledge and 21st century teaching based on the perception of secondary school teachers in Selangor.

The significant direct effects (mediating model and direct effects model), a significant indirect effect (mediating model), and "outside" at 95 percent CI (Bahaman, 2017) explain the role of critical thinking dispositions as a partially mediator for the relationship between technological knowledge and 21st century teaching. The coefficient of determination (R^2) shows the indirect effects of technological knowledge on 21st century teaching through the mediator of critical thinking dispositions is moderate (κ^2= 0.096).

The results of this study found a significant and moderate mediating effects of critical thinking dispositions on the relationship between technological knowledge and 21st century teaching. This clarify teachers' technological knowledge along with critical thinking dispositions were significantly contribute to 21st century teaching practice. The high level of technological knowledge and critical thinking dispositions (result from the descriptive statistical analysis) moderately increase the frequency of 21st century teaching among secondary school teachers in Selangor. This means teachers who knowledgeable about the use of technology and exploring the use of various types of technology and along with tendency to analyse and confidence with own abilities contribute to the increasing of teaching frequency which aims to integrate 21st century skills and student-centered.

Study by Dehghanzadeh and Jafaraghaee (2018) are seen quite similar with current study which flipped classroom teaching gave a significant effect on critical thinking dispositions. Flipped classroom featured by 21st century teaching because includes technology and critical thinking then resulting in upgrade the critical thinking dispositions. In addition, Gever et al. (2021) suggest the teaching using technology tool such as interactive television enhances critical thinking skills and dispositions. This kind of teaching cover questions and answers during learning session and individualized learning by personal feedback based on the needs and abilities. The interactive television teaching is related to 21st century teaching by highlighting the critical thinking and individualized learning.

■ 6.0 IMPLICATION OF STUDY

Theoretically, current research supports the theory of Knowledge, Attitudes, and Practices (KAP; Ross & Smith, 1969) by explaining the relationship between knowledge, attitude, and practice/behavior. Knowledge is fundamental for changing behavior while attitude is a catalyst for behavior change. KAP theory is based on the cognitive-affective-behavioral theory in social psychology field which suggests the increasing of knowledge affect the attitude and subsequently behavior. KAP theory purpose to obtain what is known (knowledge), believed (attitude), and action (practice) in a specific context (Andrade et al., 2020). Although KAP theory is often used in health dicipline compared to education, but in this study, the theory is referred to explain the link between teachers' knowledge (pedagogy, content, and technology); attitude (critical thinking dispositions) and practice/behavior (21st century teaching). Also, this study support TPACK theory (Mishra & Koehler, 2006) by providing evidence about the role of teachers' knowledge (pedagogy, content, and technology) to achieve effective teaching and enhance students understanding. Finally, this study proposes a model to improve 21st century teaching with analysis of SEM. Pedagogical knowledge, content knowledge, and technological knowledge along with critical thinking dispositions contribute to 21st century teaching among secondary school teachers in Selangor, Malaysia.

The study contributes to several practices. For instance, to produce new knowledge in certain area and enlighten 21st century teaching. This study found out the knowledge (pedagogy, content, technology) and critical thinking dispositions were affect 21st century teaching. The quality of teachers' knowledge is relate to the access of opportunities to learn a wide of pedagogical content and scope. Therefore, the educational organizations need to empower teachers' knowledge and dispositions so that they can execute 21st century teaching. This means the educational organizations should consider the necessity to include more meaningful contents and activities in teacher education training and teacher professional development program that aim to strengthen knowledge about pedagogy, content, technology, and critical thinking. Teacher education training and teacher professional development program compulsory in providing crystal clear guidance on the current instructional practices, such as 21st century teaching.

In addition, current finding also useful to the teachers to review their own knowledge, critical thinking dispositions, and teaching practice. Accordingly, teachers should put some efforts to master the knowledge (pedagogy, content, technology) and dispositions (critical thinking) in order to deliver teaching effectively. Critical thinking dispositions assist teachers in self-reflection, research on current teaching practices, and integrate critical thinking skills into subject content to create a learning situation that stimulates students to use those skills. Teachers also can track or assess their progress in the implementation of 21st century teaching based on critical thinking, collaboration, self-direction, global and local connections, and skills in using technology as a tool for learning.

■ 7.0 CONCLUSION

As a conclusion, the final model (Figure 1) shows pedagogical knowledge, content knowledge, and technological knowledge with critical thinking dispositions as mediator contributing 61 percent of the variance to 21st century teaching. That means teacher's knowledge (pedagogy, content, and technology) along with critical thinking dispositions affecting 21st century teaching. Thus, the current study provides new insights about 21st century teaching that can be enhanced through specific knowledge and dispositions.

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