Factors Influencing 21st Century Teaching among Secondary School Teachers in Selangor, Malaysia

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Abstract
Students' 21st century skills can be enhanced through specific teaching practices such as 21st century teaching. The concept of 21st century teaching is student-centred learning. Yet, several past studies have highlighted the lack of 21st century teaching in practice since teachers prefer to implement a teacher-centred approach. This study aims to determine the effect between four factors, which are pedagogical knowledge, content knowledge, technological knowledge, and critical thinking dispositions towards 21st century teaching among 332 secondary school teachers in Selangor, Malaysia. This study employed the causal relationship design with proportional stratified random sampling. For data collection, a questionnaire was used. Inferential statistical analysis was executed to determine the direct effect through Structural Equation Modelling by using the Analysis of Moment Structure software. The findings showed that pedagogical knowledge, content knowledge, technological knowledge, and critical thinking dispositions had a significant direct effect on 21st century teaching. The findings showed that teachers who have a high level of pedagogical knowledge, technological knowledge, and critical thinking dispositions support them to execute 21st century teaching. However, teachers' content knowledge showed a negative significant direct effect on 21st century teaching, which means that a high level of content knowledge leads to hesitations in implementing 21st century teaching. As a conclusion, the direct effect model of the current study showed that these four factors contributed to 52 percent in variance for 21st century teaching, indicating that this model can be implemented to secondary school teachers in Selangor to improve the 21st century teaching practice.
Keywords: Content Knowledge, Critical Thinking Dispositions, Pedagogical Knowledge, Technological Knowledge, 21st Century Teaching

Introduction

A unilateral delivery method in teaching limits students' engagement and prevents social interaction. Students become easily bored with this method of teaching as it does not provide them the opportunity to voice their opinions (Rahmah et al., 2017). In short, teacher-centred teaching provides little opportunity for students to engage in exploration, reasoning, or strategic thinking (Schwartz et al., 2019). Liu and Willis (2021) stated that learning in Asian countries is largely teacher-centred (Otara et al., 2019; Živkoviü, 2016). Based on previous studies, current researchers suggested that teaching and learning (T&L) today is still teacher-centred, where teachers dominate the delivery process or discussion and students are not supported to be actively involved in the process (Ainun et al., 2017; Otara et al., 2019; Simah et al., 2021). This situation affects the implementation of student-centred T&L such as 21st century teaching.

Teachers affect students' performance in 21st century skills (Norazlin, 2018). This explains the teachers' characteristics and how they approach teaching influences 21st century learning outcomes. Therefore, for the purpose of developing students' 21st century skills, teachers are expected to empower themselves with pedagogical knowledge, content knowledge, technological knowledge, and critical thinking dispositions, so that they can implement effective, interesting, and interactive pedagogical approaches.

In order to prepare students for the global progress of technology and their future social life and the workplace, teachers should support students' learning through the use of technology. Teachers need to integrate technology into pedagogy by identifying learning activities, teaching aids, and teaching materials that can encourage students to get involved, adapt to diversity to support interaction, and develop Information and Communications Technology (ICT) literacy. Nevertheless, lack of knowledge about ICT is the reason for the low use of ICT by teachers (Azhar et al., 2020; Boelens et al., 2017; Jonker et al., 2020). The use of technology provides opportunities for students to develop 21st century skills. In the context of critical thinking dispositions, an individual will be more prepared to use critical thinking skills when they have a disposition for it (Živkoviü, 2016). Since critical thinking skills are among the main predictors of academic achievement (Dehghanzadeh & Jafaraghaee, 2018), there is a need to develop critical thinking dispositions. Teacher dispositions guide them in instructional selection (Altan et al., 2017). Thus, critical thinking dispositions should be able to assist teachers to choose instruction that emphasise on the application of critical thinking skills to students, for example, 21st century teaching.

Literature Review

The concept of 21st century teaching is student-centred pedagogy, where T&L models utilise project-based, collaborative, knowledge building learning through self-regulation and assessment. It can be personalised in that it allows students to make choices, is relevant to the individual students, and is appropriate to the students' background, experience, and interests. This form of teaching is also individualised as it allows students to work at their own pace and according to their particular learning needs. In fact, this concept has been linked to the positive outcomes of the development of 21st century skills. Generally, 21st century skills include critical thinking, self-direction, global connections, communication, collaboration, skills in using technology as a tool for learning, creativity, innovation, and local connections among others (Ravitz et al., 2012; Shear et al., 2010; The William and Flora Hewlett Foundation, 2010). For example, critical thinking refers to students being able to analyse a complex problem, investigate questions for which there are no clear-cut answers, evaluate

different points of view or sources of information, and draw appropriate conclusions based on evidence and reasoning. Meanwhile, self-direction relates to the students' ability to take responsibility for their own learning by identifying a topic to pursue and process for their own learning and being able to review their own work and respond to feedback. Global connections is defined as the students' ability to understand global, geo-political issues including awareness of geography, culture, language, history, and literature from other countries. Collaboration refers to the students' ability to work together to solve problems or answer questions, to work effectively and respectfully in teams to accomplish a common goal, and to assume shared responsibility for completing a task. Skills in using technology as a tool for learning refers to the students' ability to manage their learning and produce products by using appropriate information and communication technologies (Ravitz, 2014).

Based on previous studies, current researchers have found that most were survey-based and were conducted by measuring educators' perceptions. This has led to varied findings on the level of 21st century teaching practice according to different dimensions (Ahmad et al., 2019; Hisham & Nasruddin, 2016; Ghamrawi et al., 2017). For instance, Ahmad et al (2019) surveyed Malaysian teachers' perceptions on 21st century T&L and found that this practice has a positive effect on students' development. Ahmad et al (2019) noticed that 21st century T&L based on communication, problem-solving, critical thinking, and technology were at a high level, while creativity, innovation, and collaboration were at a moderate level of practice. Hisham and Nasruddin (2016) measured Malaysian lecturers' perceptions of 21st century T&L practices. They found that communication, collaboration, and problem-solving were at a high level of practice whereas critical thinking, reflection, technology, and creativity and innovation were at a low level of practice. The findings of Ghamrawi et al (2017) showed that the teachers had a moderate level of 21st century teaching practices based on collaboration and communication and low level of critical thinking, creativity and innovation, self-direction, global connections, local connections, and skills in using technology as a learning tool. In addition, the study by Liew et al (2023) showed that students' academic performance significantly improved after employing innovative approaches. The students strongly agreed that these innovative approaches promoted active interaction, enhanced the attainment of the contents, delivered the contents effectively, assured satisfaction, and were able to engage students actively in the online T&L. An interactive simulations tool based on the Wolfram Demonstration Project platform was found to be useful, interesting, and engaging, which enabled it to enhance the content and delivery of the curriculum in dealing with complex engineering problems (Norhusna & Aida, 2023). Consequently, Hamsiah and Suhaida (2019) found that Malaysian teachers were at a moderate level of readiness to apply higher order thinking skills in their teaching.

Teacher needs to possess comprehensive pedagogical knowledge. Koehler et al (2014) defined pedagogical knowledge as knowledge about how to learn and how learning can be facilitated. Knowledge of pedagogy and content are combined to create the T&L process. Content knowledge refers to knowledge about the subject to be learned or taught (Schmidt et al., 2009). Teachers who do not have enough content knowledge may result in students acquiring inaccurate knowledge and misconceptions (Koehler & Mishra, 2009). Technological knowledge refers to knowledge about various technologies that range from low-tech technologies such as pencil and paper to digital technologies such as the internet, digital video, interactive whiteboard, and software program (Koehler & Mishra, 2009; Schmidt et al.; 2009). Norbany et al (2021) said that the empowerment of education needs educators who are knowledgeable about the latest technologies to be applied in the T&L process. The use of

technology is increasingly vital in generating and developing ideas and creativity among educators regarding the T&L process. These three domains of knowledges (pedagogy, content, and technology) lead to the Technological Pedagogical Content Knowledge (TPACK) framework (Mishra & Koehler, 2006), which is defined as understanding the interaction of knowledges and knowledge that underlie meaningful teaching and technology skills (Koehler et al., 2013). A study by Umar et al (2020) found that lecturers' TPACK significantly affected ICT usage, which means that lecturers' TPACK allows them to face tasks that need them to integrate ICT into classroom teaching. Meanwhile, Nazem (2013) defined critical thinking dispositions as the tendency to solve problems and make decisions critically. Facione (2013) assumed critical thinking dispositions as a spirit in the exploration of knowledge born from curiosity, intelligence, passion to prove something, and determination to get accurate information.

Pedagogical Knowledge and 21st Century Teaching

Teacher quality is an essential factor in improving student achievement. However, there is a challenge in producing quality teachers (The Organization for Economic Co-operation and Development [OECD], 2017). The study of teachers' pedagogical knowledge is still new, causing many domains to remain under-researched (Sonmark et al., 2017). For example, the impact of teachers' innovative pedagogical knowledge has not been scientifically proven.

The outcomes of 21st century learning are related to the way teachers carry out teaching. Therefore, there is a need for teachers to develop T&L that fosters 21st century skills through effective, exciting, and interactive pedagogical practices (Ariffin & Yunus, 2017; Valtonen et al., 2021). Lavi et al (2021) found that active T&L methods such as projects, assignments, research, and laboratory lessons develop many 21st century skills such as individualised learning and complex problem-solving. Meanwhile, passive T&L methods such as reviewing material, studying material, and preparing for exams cause difficulties in developing 21st century skills. A study by Virtanen and Tynjälä (2019) found that pedagogical practices such as constructivist learning environments and integrative pedagogy support the learning of creativity, ability to act in new situations, and problem-solving. However, traditional pedagogical practices such as lectures, reading, and studying alone do not support the learning of generic skills. Besides that, Mongkonthan (2021) suggested a correlation between pedagogy and 21st century teaching. Mongkonthan (2021) found that research-based learning such as exploring and observing was able to develop 21st century skills including collaboration, communication, ICT literacy, and social skills. Lucas et al (2020) explored the role of educational games, namely the party hat, in improving students' communication and collaboration. They concluded that this educational game with a question-and-answer session helped the students to understand the challenges of 21st century skills, especially effective communication and collaboration.

Content Knowledge and 21st Century Teaching

Content knowledge affects the implementation of teaching approaches and achievement (Johari et al., 2016). Teachers who have limited content knowledge make it difficult for students to understand. Some teachers lack knowledge about certain areas such as Malay essays, leading to students facing problems in writing skills (Andrew et al., 2019). This situation results in teachers becoming less inclined to implement student-centred teaching, which then impacts the nurturing of 21st century skills. For example, teachers with a low level of science content knowledge may have difficulty supporting students in an

inquiry-based approach (Morrison, 2013). An inquiry-based approach is relevant to 21st century teaching since it points to critical thinking, collaboration, communication, and self-direction.

The Framework for 21st Century Learning (Partnership for 21st Century Skills, 2019) emphasises on the necessity to master core subjects (e.g.: English, mathematics, economics) and themes of 21st century (e.g.: global awareness, financial literacy, environmental literacy) in order to develop 21st century skills among students. The framework also explains how these can be achieved through a support system. This shows that to compete in the 21st century, students need to gain content knowledge and develop extensive knowledge about the surrounding and current issues. Two support systems related to mastery of subject content and themes of the 21st century are 1) standards and assessments and 2) curriculum and instruction. The standards and assessments support system is important to develop understanding across core subjects and 21st century themes. This support system can be implemented by emphasising deep understanding; actively engaging students in solving problems with the use of real data, real tools, and collaboration with experts; and perform various assessments across broad masteries. Meanwhile, the curriculum and instruction support system work to integrate 21st century skills into the content subject. This support system can be implemented in several ways. For instance, teachers can directly teach 21st century skills discreetly in the context of core subjects and 21st century themes. In addition, they can provide opportunities for students to foster 21st century skills across content subjects and adopt innovative learning methods that integrate the use of technology, inquiry, problem-based approaches, and higher order thinking skills. They can also promote the integration of community resources outside the school.

Technological Knowledge and 21st Century Teaching

Technological knowledge has been shown to impact teachers' ability to teach using computers and information technology. Hatlevik and Hatlevik (2018) asserted that not all teachers have the knowledge to teach using digital technology. Limited knowledge about ICT is a reason for the low use of ICT among teachers (Boelens et al., 2017; Jonker et al., 2020). For instance, lack of knowledge and understanding about how to use website-based learning results in teachers applying it less in T&L (Azhar et al., 2020). In addition, the little emphasis on the knowledge that teachers need to integrate lessons through the use of technology (Voogt & McKenney, 2017) has caused a few teachers to become hesitant and subsequently choose not to use technology in teaching. The use of technology is one of the aspects of 21st century T&L. The use of technology provides opportunities for students to develop 21st century skills, including communication, group work, and critical thinking (Rahmah et al., 2017).

To prepare students for the technology of the future workplace and society, teachers should support students' learning through the use of technology (Hatlevik & Hatlevik, 2018). Andersen and Rustad (2022) found that the use of a computer educational game (i.e. Minecraft) was able to develop 21st century skills, especially collaboration. Meanwhile, Ravitz et al (2020) noted that teachers can use technology effectively in developing 21st century skills based on teacher self-evaluation via the Impactful Technology Use (ITU) framework. The ITU framework consists of six core areas of 21st century skills including critical thinking, collaboration, communication, creativity and innovation, agency, and technology use. Chen and Swan (2020) found a positive link between technology and 21st century teaching. Their study shows that teaching based on online debates and collaborative writing in Google Docs

led to active learning, critical thinking, interaction and involvement, collaboration, improved learning, and willingness for future collaborative project, which is a high level practice. Azhar et al (2020) noted that a website-based virtual learning environment (i.e. Frog VLE) that was introduced in 2013 by the Malaysian Ministry of Education to improve 21st century learning achievement made T&L more self-directed and was able to help educators shift learning from being teacher-centred to student-centred. With this, creative and critical thinking skills can be nurtured among students through the support of various media technologies and internet networks.

Critical Thinking Dispositions and 21st Century Teaching

Teacher-centred teaching such as lectures does not support students' critical thinking dispositions (Dehghanzadeh & Jafaraghaee, 2018). Hence, the development of students' critical thinking dispositions requires specific and up-to-date teaching methods such as 21st century teaching. In addition, previous studies have shown that current critical thinking dispositions among university students is low (Nazem, 2013). Ibrahim Nazem's study (2013), which measured the critical thinking dispositions of students, mentioned that students' critical thinking is driven by the teacher's role (Živkoviü, 2016). Notably, previous studies are limited in measuring teachers' critical thinking dispositions.

Students need to be taught how to think critically and be given the opportunity to express their opinions openly. Hence, teachers should encourage students' behaviour towards critical thinking by demonstrating or practicing thinking skills clearly and frequently. Kirmizi et al (2015) found a significant relationship between critical thinking dispositions and problem-solving skills, which is one of the dimensions of 21st century skills (P21.org, 2019). A quasi-experimental study by Dehghanzadeh et al (2018) found that critical thinking dispositions increased significantly using the flipped classroom. The flipped classroom involves skills in using technology as a tool for learning, which is one of the dimensions of 21st century teaching.

Research Methodology

This study aims to determine the effect between pedagogical knowledge, content knowledge, technological knowledge, and critical thinking dispositions towards 21st century teaching among 332 secondary school teachers in Selangor, Malaysia. The study employed the causal relationship design with proportional stratified random sampling. Although the sample size needed was 379 (based on Raosoft and Hair's sample size calculator), the researchers decided to select 400 initial samples with the consideration of damaged questionnaires or drop outs during data collection. Proportional stratified random sampling was important to ensure that the sample distribution was homogenous and able to cover the entire population. The sampling involved 10 districts with a population size of 26,431 teachers from 278 secondary schools in Selangor. The proportional stratified random sampling in this study involved seven steps: 1) list the number of teachers and schools in each district; 2) determine the sample size of teachers needed in each district; 3) determine the number of schools needed in each district; 4) select 34 schools via stratified random sampling; 5) list the number of teachers for each selected school; 6) determine the sample size of teachers needed in each selected school; and 7) select 400 teachers using proportional stratified random sampling in each selected school to represent the population of secondary school teachers in Selangor. Table 1 shows the sample size of teachers based on district and schools using proportional stratified random sampling. For example, Table 1 shows that the sample size

needed for district 1 is 57 teachers, which include 20 teachers from school 1, 6 teachers from school 2, 11 teachers from school 3, 14 teachers from school 4, and 6 teachers from school 5.

Table 1
The sample size of teacher based on district and school

		n for school strata									n for district strata
District 1	School	1	2	3	4	5					
	n for teacher strata	20	6	11	14	6					57
District 2	School	1	2	3	4	5	6	7			
	n for teacher strata	11	13	7	10	9	9	9			68
District 3	School	1									
	n for teacher strata	21									21
District 4	School	1	2	3	4	5	6				
	n for teacher strata	8	10	16	16	4	9				63
District 5	School	1									
	n for teacher strata	24									24
District 6	School	1									
	n for teacher strata	26									26
District 7	School	1	2	3	4	5	6	7	8	9	
	n for teacher strata	9	8	7	9	7	6	8	12	6	72
District 8	School	1	2								
	n for teacher strata	19	13								32
District 9	School	1									
	n for teacher strata	18									18
District 10	School	1									
	n for teacher strata	19									19
	Total sample size										400

Note: *n*=sample size; Source: Educational Planning and Policy Research Division, Malaysia

Instrumentation and Validation

A questionnaire was adopted and adapted from three past instruments. West Virginia 21st Century Teaching and Learning Survey WVDE-CIS-28 Ravitz (2014) was referred to measure 21st century teaching, hence 25 items using a 7-point Likert scale ("1" is "Never" and "7" is "Very often") were used in the current study involving five dimensions. Meanwhile, the Survey of Preservice Teachers' Knowledge of Teaching and Technology Schmidt et al (2009) was used to measure teachers' knowledge comprising 15 items using a 7-point Likert scale ("1" is "Strongly disagree" and "7" is "Strongly agree"). To measure critical thinking dispositions, an instrument by Nazem (2013) was referred, resulting in 14 items using a 7-point Likert scale ("1" is "Strongly disagree" and "7" is "Strongly agree") involving four dimensions. Table 2 shows the example of items for each construct and dimension.

Table 2
Example of items in questionnaire

21stCT	In your teaching, how often do you ask students to do the following:
1.Critical thinking	Item: Develop strong argument based on supporting evidence.
2. Collaboration	Item: Work with other students to set goals and create a plan for their team.
3. Self-direction	Item: Choose for themselves what examples to study or resources to use.
4. Global and local connections	Item: Reflect on how their own experiences and local issues are connected to global issues. Item: Analyse different opinions among members of local communities on a certain issue.
5. Skills in using technology as a tool for learning	Item: Use technology to analyse information (e.g.: databases, graphic programs, etc.).

PK	
Item: Visual images are used to support understanding of ideas.	

CK	
Item: I have sufficient knowledge about the subject.	

TK	
Item: I find it easy to learn technology.	

CTD	
1. Analyticity	Item: I try to analyse the idea on my own related to what I read from the books.
2. Systematicity	Item: I always organise my own time during the work day.
3. Self-confidence	Item: I have confidence in my ability to achieve competitive goals.
4. Inquisitiveness	Item: I ask a lot of questions to understand many issues.

Note: 21stCT=21st century teaching; PK=Pedagogical knowledge; CK=Content knowledge; TK=Technological knowledge; CTD=Critical thinking dispositions

Content validity and face validity were reviewed by four experts. Then, the researchers made changes to items such as the terms and sentence structure. For example, the term "getting used to misconceptions" was changed to "detecting misconceptions". The sentence structure was also improved, for instance "I explore the use of technology" was changed to "I often use technology". The question sentence, "During teaching, do I often ask students to make conclusions based on the analysis of relevant information?" was changed to a statement sentence, "I ask students to make a conclusion based on the analysis of relevant information." The validity results allowed the researchers to make improvements on items in the questionnaire. Construct validity was based on convergent validity and discriminant validity as suggested by (Cohen et al., 2018; Hair et al., 2014). Table 3 shows that convergent validity was achieved as factor loading (Λ) and average variance extracted (AVE) were higher than 0.50 and construct reliability (CR) was above 0.60. Discriminant validity was assessed based on two methods, namely 1) comparison of the square root of AVE with correlation and 2) cross-loadings. Based on Table 4, the diagonal value (bold number) was the square root values of AVE while the other values were the correlation values. The findings showed that

the square root value of AVE was greater than other values in its rows and columns. This means that the discriminant validity in this study had been achieved.

The pilot study involved 84 secondary school teachers to establish reliability. Based on Table 5, the result of Cronbach's alpha was interpreted as good and excellent reliability. Then, exploratory factor analysis (EFA) was applied on the pilot data to get an initial frame of the actual findings. The results of the EFA on the pilot data helped to improve the quality of the actual instrument. EFA was measured based on Kaiser-Meyer-Olkin's measure of sampling adequacy (KMO>0.60), Bartlett's test of sphericity ($p < 0.05$), factor loading ($\Lambda > 0.60$), and Eigenvalue (>1.0). EFA on pilot data resulted in five factors of 21st century teaching, including global and local connections, critical thinking, self-direction, collaboration, and skills in using technology as a tool for learning; one factor for each knowledge (pedagogical, content, and technological); and four factors of critical thinking dispositions including inquisitiveness, self-confidence, analyticity, and systematicity. Actual data collection was administered directly where the researchers met with a school representative to submit instruments, which were then distributed to the selected teachers. The data obtained was analysed via the inferential statistical analysis method (SEM and AMOS software).

Table 3
Construct validity

Factor loading (Λ>.50)	Average Variance Extracted (AVE≥.50)	Construct reliability (CR>.60)
21stCT		
.72-.89	.67	.98
PK		
.74-.87	.68	.89
CK		
.88-.94	.85	.96
TK		
.84-.93	.79	.94
CTD		
.84-.94	.81	.98

Note: 21stCT=21st century teaching; PK=Pedagogical knowledge; CK=Content knowledge; TK=Technological knowledge; CTD=Critical thinking dispositions

Table 4
Discriminant validity

	21stCT	PK	CK	TK	CTD
21stCT	**.82**				
PK	.78	**.82**			
CK	.54	.75	**.92**		
TK	.57	.47	.35	**.89**	
CTD	.67	.79	.73	.542	**.90**

Note: 21stCT=21st century teaching; PK=Pedagogical knowledge; CK=Content knowledge; TK=Technological knowledge; CTD=Critical thinking dispositions

Table 5
Reliability test

	Cronbach's alpha	Interpretation
21stCT	.90	Good
PK	.85	Good
CK	.90	Good
TK	.94	Excellent
CTD	.84	Good

Note: 21stCT=21st century teaching; PK=Pedagogical knowledge; CK=Content knowledge; TK=Technological knowledge; CTD=Critical thinking dispositions
Source: George and Mallery (2001)

Result and Discussion
The result was shown in Fig. 1. It was found that the direct effect model explained 52 percent variance of 21st century teaching.
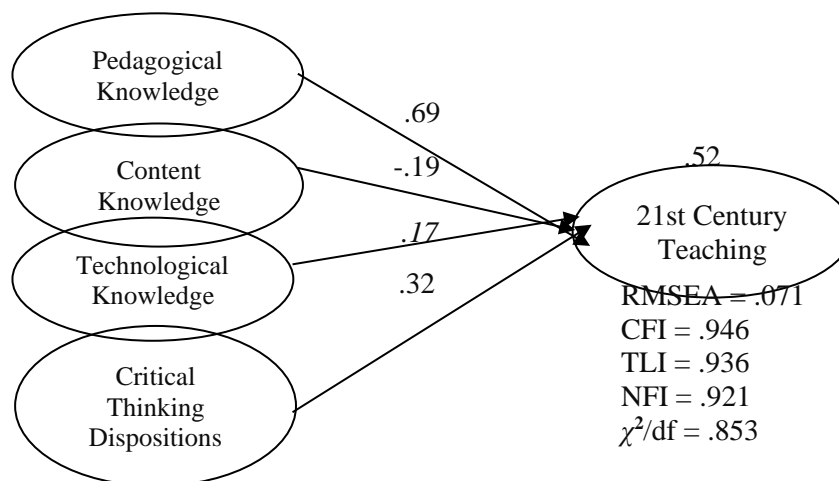
Fig. 1 Direct effect model

The hypothesis aimed to examine the direct effect between pedagogical knowledge, content knowledge, technological knowledge, and critical thinking dispositions on 21st century teaching. The Maximum Likelihood Estimation (MLE) technique was used to estimate the model. The hypothesised relationships in the direct effect model are shown in Table 6.

Table 6
Hypothesized relationships in direct effects model

Hypothesized relationships			B	S.E.	Beta (β)	C.R.	ρ
PK	→	21st CT	.669	.103	.686	6.508	***
CK	→	21st CT	-.162	.073	-.191	-2.220	.026
TK	→	21st CT	.113	.038	.168	2.943	.003
CTD	→	21st CT	.311	.061	.319	5.066	***

Note: 21stCT=21st century teaching; PK=Pedagogical knowledge; CK=Content knowledge; TK=Technological knowledge; CTD=Critical thinking dispositions; B=Unstandardised regression weight; S.E.=Standardised effects; Beta (β)=Standardised regression weight; C.R.=Critical ratio; ρ=Significant level (<.05); ***=Highly significant level at<0.01

Direct Effect between Pedagogical Knowledge and 21st Century Teaching

Based on Table 6 and Fig. 1, the hypothesis was supported by statistical findings that pedagogical knowledge has a significant effect on 21st century teaching based on the perception of secondary school teachers in Selangor ($\beta=0.686$, $\rho=0.000$). A unit change in pedagogical knowledge improves 21st century teaching by 0.669 units. The findings describe that the teachers' pedagogical knowledge contributed to 21st century teaching. Teachers who are knowledgeable about pedagogy often implement 21st century teaching. Therefore, knowledge on effective teaching delivery, approach, style, and assessment in the T&L encourages teachers to implement teaching that aims to apply 21st century skills. Teachers' knowledge on providing learning experiences that are adapted to various learning methods, use of narrative methods across subject content, and use of visual images to support the understanding of an idea, cause them to often carry out teaching that involves students in problem analysis and forming conclusions based on evidence/reasoning (critical thinking); taking responsibility for their own learning, implementing self-monitoring and self-evaluation (self-direction); and explore global issues (global connections).

The findings of this study are related to Lavi et al (2021), where active pedagogy supports the development of 21st century skills. Virtanen and Tynjälä (2019) also found that the critical examination of pedagogy of knowledge has an impact on students' critical thinking. Mongkonthan's (2021) findings are consistent with this study, where research-based pedagogy improves critical thinking skills. Lucas et al (2020) supported the finding that pedagogy of educational games with question-and-answer sessions increase critical thinking. Sonmark et al (2017) found a relationship between pedagogical knowledge and recent pedagogical approaches to achieve 21st century T&L. Meanwhile, Gholami et al (2016) noticed that students' critical thinking increases after problem-based pedagogy.

Direct Effect between Content Knowledge and 21st Century Teaching

Based on Table 6 and Fig.1, the hypothesis was supported by statistical findings where content knowledge was found to have a significant negative effect on 21st century teaching based on the perception of secondary school teachers in Selangor ($\beta=-0.191$, $\rho=0.026$). A unit change in content knowledge reduces 21st century teaching by 0.162 units. These findings explain that teachers' content knowledge contributed to 21st century teaching. Teachers who have a high level of content knowledge are less likely to implement teaching that aims to foster 21st century skills. This means that teachers' deep knowledge of the content subject allows better ideas to be channelled to students and increased capability of dealing with students' misconceptions, which causes the lack of lessons that require students to think critically, take responsibility for their own learning, and explore global issues.

The negative effect between content knowledge and 21st century teaching gives the impression that teachers who have high content knowledge tend to practice passive teacher-centred teaching rather than active student-centred learning such as 21st century T&L. This result was believed to be due to the age of the respondents. Most of them were between 41 to 50 years old and had served as a teacher for more than 21 years. This finding means that the teachers' very high content knowledge was a catalyst to deliver as many possible contents to the students. This situation caused teachers to face time constraints in implementing student-centred T&L that provides more opportunities, space, control, and time to students in the learning process. The findings of this study are supported by Suviste et al (2017), who found that more experienced teachers preferred to use teacher-centred T&L.

Direct Effect between Technological Knowledge and 21st Century Teaching

Based on Table 6 and Fig. 1, the hypothesis was supported by the statistical findings where technological knowledge has a significant effect on 21st century teaching based on the perception of secondary school teachers in Selangor (β=0.168, ρ=0.003). A unit change in technological knowledge increases 21st century teaching by 0.113 units. The findings show that teachers' technological knowledge contributes to 21st century teaching. Teachers who have a high level of technological knowledge are encouraged to adopt 21st century teaching. Consequently, a high level of knowledge about the use of technology and the process of exploring the use of various types of technology encourages teachers to apply 21st century skills in their teaching. Teachers who can learn technology easily, who know about various technologies, and who have the technical skills required to use technology cause them to carry out teaching that involves students in critical thinking, self-direction, and global connections.

Andersen and Rustad (2022) suggest that using educational games with the support of computers stimulates the development of 21st century skills. Chen and Swan (2020) found that online group discussion-based teaching strategies improve critical thinking skills. The current findings were also supported by Osborne et al (2018), who found that T&L involving the use of technology such as asynchronous online discussion boards (AOD) support students' critical thinking and self-direction. In addition, Dehghanzadeh (2018) found that the flipped classroom method strengthens deep learning by increasing the desire to learn and reducing the tendency towards shallow learning such as memorising and accepting concepts without making connections (Lacher & Lewis, 2015).

Direct Effect between Critical Thinking Dispositions and 21st Century Teaching

Based on Table 6 and Fig. 1, the hypothesis was supported by statistical findings where critical thinking dispositions have a positive significant effect on 21st century teaching based on the perception of secondary school teachers in Selangor (β=0.319, ρ=0.000). A unit change in critical thinking dispositions increases 21st century teaching by 0.311 units. The findings explain that the teachers' critical thinking dispositions contribute to 21st century teaching. Teachers who have a high level of critical thinking dispositions tend to implement 21st century teaching. This means that the tendency to achieve critical thinking skills is born from the tendency to analyse something (analyticity), and confidence in one's own abilities (self-confidence), which encourages teachers to integrate 21st century skills in teaching.

The findings of the current study are supported by Kirmizi et al (2015), who found that critical thinking dispositions affect problem solving skills. In addition, Gholami et al (2016) found that problem-based learning influences critical thinking dispositions. Dehghanzadeh et al (2018) also noticed an increase in students' critical thinking dispositions after using the flipped classroom. The flipped classroom emphasises 21st century skills by using technology as a learning tool.

Implication of Study

Theoretically, a new implication was drawn regarding 21st century teaching and critical thinking dispositions. The EFA on actual research data showed that 21st century teaching can be measured by only five dimensions (critical thinking, collaboration, self-direction, global and local connections, and skills in using technology as a tool for learning) compared to eight dimensions from past studies (Ravitz, 2014). The dimensions of communication and creativity/innovation were rejected, while global connections and local connections were

combined to form a new dimension, which was global and local connections. For critical thinking dispositions, the results of EFA showed that it can be measured based on three dimensions (analyticity, systematicity and self-confidence, and inquisitiveness) compared to seven dimensions suggested in a past study (Nazem, 2013). The three dimensions, namely open mind, truth seeking, and maturity, were rejected whereas systematicity and self-confidence were combined to form a new dimension called systematicity and self-confidence. Finally, the SEM analysis suggested that 21st century teaching was represented by global connections, self-direction, and critical thinking, while critical thinking dispositions was represented by self-confidence and analyticity. This implies that 21st century teaching and critical thinking dispositions were measured differently in past studies based on the context of secondary school teachers in Selangor, Malaysia.

The study contributes to several practices. For instance, to produce new knowledge in the area and improve teaching methodology in the 21st century. This study found that four factors, namely pedagogical knowledge, content knowledge, technological knowledge, and critical thinking dispositions, affected 21st century teaching. Therefore, the results can be referred by educational organisations to empower teachers' knowledge and dispositions so that they can contribute to 21st century teaching. Educational organisations can upgrade the curriculum or content of teacher education training and teacher professional development programs by providing guidance on current instructional practices, such as 21st century teaching. Such information dives into the foundations of education and curriculum design. The findings can also be useful to teachers to understand their roles in realising 21st century teaching. Teachers may also be empowered with the knowledge and dispositions to carry out the current teaching method effectively. In this regard, teachers are expected to enhance their understanding, practice, belief, perspective, additional effort, and commitment towards 21st century teaching.

Conclusion

The findings of this study explain that pedagogical knowledge, content knowledge, technological knowledge, and critical thinking dispositions have significant effects on the 21st century teaching of secondary school teachers in Selangor. Overall, the direct effect model shows that pedagogical knowledge, content knowledge, technological knowledge, and critical thinking dispositions contribute 52 percent of variance to 21st century teaching. This shows that pedagogical knowledge encourages teachers to carry out teaching with the aim of fostering 21st century skills. Teachers' knowledge about technology usage and the process of exploring various technologies also support them in implementing 21st century teaching. In addition, the development of critical thinking skills was initiated by the tendency to analyse, and belief in one's own abilities (critical thinking dispositions), which encouraged teachers to practice 21st century teaching. However, a very high level of teachers' content knowledge constrains them from executing 21st century teaching. In this regard, the final model of this study could be implemented for secondary school teachers in Selangor as an effort to improve 21st century teaching practices. This study has provided new insights on 21st century teaching, which can be enhanced by factors such as pedagogical knowledge, content knowledge, technological knowledge, and critical thinking dispositions.

Co-Author Contribution

The authors affirmed that there is no conflict of interest in this article. Author1 carried out the fieldwork and prepared the writeup of the whole article (literature review, research

methodology, data analysis, and interpretation of the results). Author2 was involved in preparing the instrument and supervising the research methodology process and ethical consideration. Author3 guided the process of statistical analysis, interpretation of the results, and improvement of the article writeup.

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