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The Level of Teacher Readiness for the Implementation of 21st Century Learning Elements: Validity & Reliability

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ABSTRACT

Teacher readiness plays an important role to apply 21st century learning elements. The application of the 21st century learning concept, element 4C, depends on the level of readiness of a teacher. This study was conducted to determine the validity and reliability of the teacher readiness level instrument for the implementation of 21st century learning elements in preschool based on expert approval. The instrument used to obtain expert validity and reliability is an instrument on the level of readiness of teachers on the implementation of elements of 21st Century Learning in preschool.) The study employed the item content validity Indexes (I-CVI) analysis method to assess content validity. The method comprised item clarity, language appropriateness and score scale using five-point Likert scale to analyze expert evaluations of items using an instrument form. The instrument was assessed by a panel of three professionals in early childhood education research. An instrument is accepted and has a good level of content validity when it exceeds the take off value of > 0.8. The average results scale content validity index (S-CVI) of each expert review on the items ranged from 0.71 to 0.83, suggesting that no questions required repetition. Overall 24 items were refined by fitting the items to teacher readiness towards implementation of 21st century learning elements in preschool. The finding revealed that the instrument was acceptable and relevant. A pilot study was conducted involving 22 respondents of Kuala Lipis District preschool teachers for reliability testing. The study found that the instruments built had achieved a high level of reliability (Cronbach's Alpha value = 0.83), all 24 items were suitable for use and no items needed to be repaired.

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1. INTRODUCTION

The Malaysia Education Blueprint (PPPM 2013-2025) was developed by the Ministry of Education (Moe) to prepare students for the challenges of 21st Century Education. Thus, one of the key components of the Malaysia Education Blueprint is 21st century learning (PAK21). According to Moe in 2017, elements of communication, critical thinking, creativity, collaboration and the application of values and ethics are the core of learning. Recent studies emphasize that 21st-century learning requires teachers to facilitate communication, collaboration, critical thinking, creativity, and ethical values through student-centred pedagogies that prepare learners for rapidly changing educational and societal demands (Almazroa & Alotaibi, 2023). The favourable impact can be seen not just in children's achievements, but also in their development throughout time. Positive emotions successes include the courage to socialise and express thoughts with other friends, as well as the ability to think beyond the box.

Recent evidence indicates that teachers' pedagogical knowledge, practical competence, and institutional support are the primary dimensions influencing readiness to implement contemporary learning approaches (Waloyo et al., 2026). Teacher readiness, professional competence, and self-efficacy are consistently identified as key determinants of successful implementation of 21st-century learning and educational reform (Gordon et al., 2023). Teachers should be prepared by understanding the components of 21st century learning and implementing 21st century learning to the best of their abilities. However, due to pressure from different sources that expect students to understand 3M rapidly, teachers have resorted to more formal schooling rather than joyful learning by including PAK21 aspects to get the expected results. Teachers' professional disposition and commitment have been consistently recognized as fundamental factors influencing the successful implementation of 21st-century learning. Recent studies indicate that teachers' beliefs, self-efficacy, and professional attitudes significantly affect their willingness to adopt innovative pedagogical approaches and create engaging learning environments (Gordon et al., 2023). Therefore, teachers are expected to demonstrate strong professional commitment by carefully planning and continuously improving their instructional practices.

Despite numerous initiatives to strengthen teachers' readiness for implementing 21st-century learning, many educators continue to experience difficulties in effectively integrating its principles into classroom practice. This suggests that teacher readiness remains a major challenge, particularly in relation to pedagogical competence, technological proficiency, and positive professional attitudes. Recent evidence shows that the successful implementation of 21st-century learning is strongly associated with teachers' knowledge, instructional skills, attitudes, and institutional support, all of which contribute to effective teaching and meaningful student learning (Nasrullah & Arhas, 2025; Waloyo et al., 2026).

Teacher readiness encompassing knowledge, skills, and attitudes is therefore essential for the successful implementation of 21st-century learning. Teachers who possess adequate pedagogical knowledge and positive attitudes are more likely to design interactive, student-centred learning experiences that encourage collaboration, critical thinking, creativity, and active participation. Conversely, insufficient readiness may result in teacher-centred instruction that reduces student engagement, limits learning motivation, and ultimately affects students' academic achievement. Contemporary studies have demonstrated that innovative teaching strategies aligned with 21st-century learning significantly improve students' learning engagement, motivation, and academic performance (Almazroa & Alotaibi, 2023).

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Teachers continue to encounter numerous challenges in implementing 21st-century learning effectively. Recent studies have shown that limited instructional time, insufficient professional development, inadequate technological infrastructure, and restricted access to innovative teaching resources remain major barriers to adopting student-centred pedagogies in schools (Bentri et al., 2025). These constraints often encourage teachers to rely on traditional instructional practices because they are considered more practical and manageable within existing classroom conditions.

Consequently, teacher-centred instruction, such as lecture-based teaching and textbook-oriented learning, continues to dominate classroom practice despite educational reforms promoting active learning. This situation is closely associated with teachers' limited technological pedagogical competence and insufficient confidence in integrating technology into classroom instruction. Strengthening teachers' Technological Pedagogical Content Knowledge (TPACK) has therefore become an important strategy for supporting the implementation of 21st-century learning (Adipat, 2021; Utari et al., 2025). Furthermore, prospective teachers with stronger digital competence and higher self-confidence demonstrate greater readiness to implement innovative teaching approaches (Simanjuntak & Hasyim, 2025).

Apart from teacher-related factors, successful implementation of 21st-century learning also depends on students' individual characteristics and developmental readiness. Learners possess diverse cognitive abilities, learning preferences, interests, motivation, and socio-emotional characteristics that influence how they participate in classroom activities. Therefore, teachers should design differentiated and inclusive learning experiences that accommodate these individual differences to maximize student engagement and learning outcomes (Melissa & Kristanto, 2024).

Considering these diverse learning needs, teachers play a pivotal role in designing meaningful, flexible, and inclusive learning environments. Professional competence, pedagogical adaptability, and digital literacy enable teachers to develop learning experiences that foster creativity, collaboration, communication, and critical thinking while responding to students' developmental needs. Accordingly, continuous professional learning and the strengthening of digital pedagogical competencies are essential for achieving effective implementation of 21st-century learning in primary education (Maghfiroh et al., 2024; Bentri et al., 2025). There are three aspects that affect the effectiveness of implementation in education, namely the input aspect, workflow, and attitude, as shown in **Figures 1 and 2**.

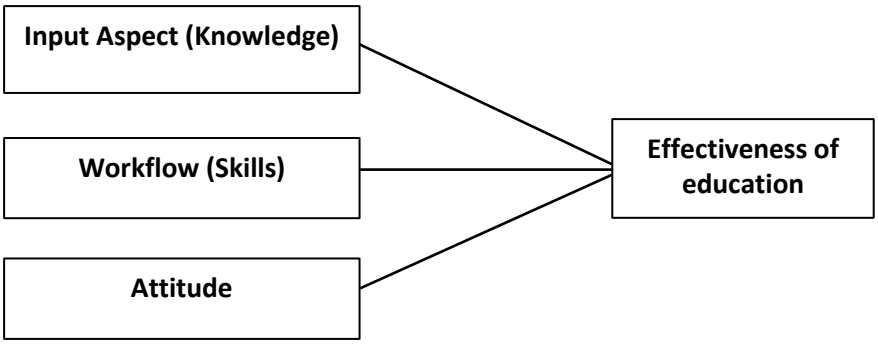

Figure 1. Bryant's Education Process Model

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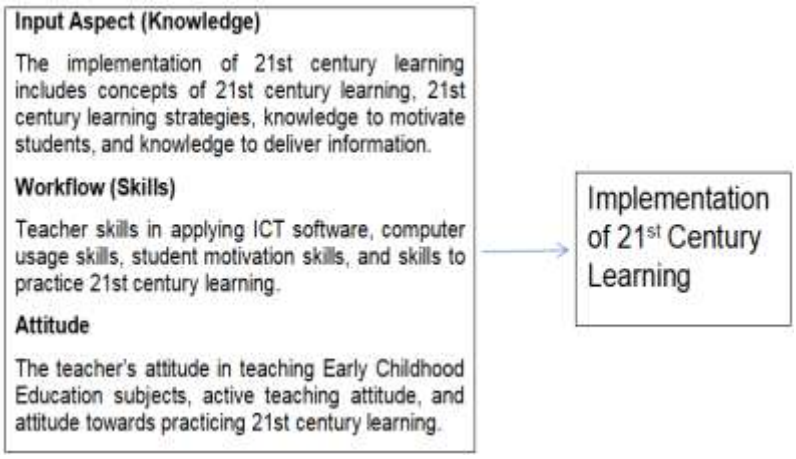

Figure 2. Framework of Bryant Education Process Model

According to Bryant's Education Process Model, educational effectiveness is influenced by three interconnected dimensions: input, process, and attitude. In the context of teacher readiness, the input dimension refers to teachers' professional knowledge, the process dimension represents their pedagogical and instructional skills, while the attitude dimension reflects teachers' beliefs, motivation, and commitment toward implementing effective teaching practices. Recent studies have confirmed that these three dimensions collectively determine teachers' readiness to implement innovative learning approaches and respond to the demands of 21st-century education (Bentri et al., 2025).

In the present study, teacher readiness is conceptualized through three major components: knowledge, skills, and attitudes, which are adapted from Bryant's Education Process Model. The knowledge component refers to teachers' understanding of 21st-century learning concepts, instructional strategies, student motivation, assessment practices, and effective communication during the teaching and learning process. Teachers with adequate pedagogical knowledge are more capable of designing meaningful learning experiences and integrating 21st-century learning principles into classroom practice. Consequently, a higher level of teacher knowledge contributes significantly to the successful implementation of student-centred learning and promotes more engaging and effective learning environments (Maghfiroh et al., 2024).

The workflow factor in this study refers to the teacher's skills in implementing 21st century learning in preschool. Teacher skills in this study refer to the teacher's ability to use ICT tools, computer literacy, student motivation skills, and the ability to practice 21st century learning. Teachers who are proficient in using ICT can capture students' interest and attention in the classroom. Furthermore, by practicing 21st century learning skills or strategies in preschool, teachers can foster higher-order thinking skills in the children. This demonstrates that a high level of teacher skill helps in planning more effective learning activities.

As for the teacher' attitude towards 21st century learning, it is related to the attitude factor in this model. The attitude factor in this study refers to the teacher's attitude towards teaching early childhood education, active engagement in teaching, and the practice of 21st century learning, among others. The teacher's attitude in 21st century learning is crucial for motivating children in the classroom. If a teacher displays a bored or negative attitude, then the successful implementation of 21st century learning becomes challenging. Teachers should engage in innovation and regularly participate in professional development courses to enhance their knowledge. It has been proven that a teacher's attitude affects the effectiveness of teaching and learning in preschool.

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2. METHODS

This study employed a quantitative research design to establish the validity and reliability of an instrument measuring preschool teachers' readiness to implement 21st-century learning elements. The instrument was adapted and modified from the teacher readiness instrument developed by Tajudin & Abdullah (2018) to suit the objectives and context of the present study. The adaptation process ensured that the questionnaire remained conceptually consistent with the original instrument while reflecting the context of preschool teachers and the objectives of the present study (Hadi et al., 2023). The questionnaire consisted of four sections comprising 31 items measured using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The use of a five-point Likert scale in **Table 1** is considered appropriate for measuring respondents' perceptions and attitudes because it provides sufficient response variability while maintaining ease of interpretation in educational research (Robie et al., 2022).

Table 1. 5 Point Likert Scale

Score	Statement
1	Strongly Disagree
2	Disagree
3	Neutral
4	Agree
5	Strongly Agree

The instrument validation process was conducted in two stages. The first stage involved face validity and content validity to ensure that the instrument adequately represented the intended constructs. Face validity was assessed by a language expert who evaluated the clarity, readability, grammar, terminology, and comprehensibility of each questionnaire item. Content validity was subsequently evaluated by three experts in early childhood education who examined the relevance, representativeness, and clarity of every item according to the research objectives. **Figure 3** below illustrates the process for establishing the validity and reliability of this research.

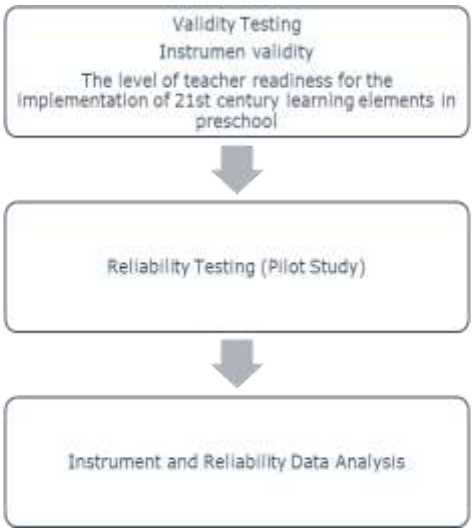

Figure 3. The Process of Establishing the Validity and Reliability of the Study

3. RESULTS AND DISCUSSION

At this stage, for face validity, the instrument was given to one lay expert on the research topic. The lay expert evaluated the instrument on the clarity of the questions, as in whether

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the questions is easy to understand and less likely to cause misinterpretations or confusion. Subsequently, the expert rated the instrument concerning problem, ambiguity, clarity, correct terminology and grammar, and comprehension. The detail of the lay expert is summarized in **Table 2**.

Table 2. Lists of Face Validity Expert

Expert	Expertise	Experience (years)	Institution	Validity
Expert 1	Bahasa Melayu	26	Institute of Teacher Education Tengku Ampuan Afzan	Face validity

Content validity refers to the extent to which the items of an instrument adequately represent the construct being measured and are relevant to the objectives of the study (Alzamanan et al., 2024). Establishing content validity is an essential step in instrument development because it provides evidence that each item appropriately reflects the intended construct before empirical testing is conducted (Hadi et al., 2023). Content validity is commonly evaluated through expert judgment, where specialists assess the relevance, clarity, representativeness, and comprehensiveness of each questionnaire item (Xu et al., 2024).

In this study, the content domain was identified through an extensive review of the literature and adapted to the conceptual framework of preschool teachers' readiness to implement 21st-century learning. The questionnaire items were subsequently refined to ensure consistency with the research objectives and the theoretical constructs. Following item development, the instrument was reviewed and organized into a structured questionnaire suitable for administration.

The content validity of the instrument was evaluated using the Content Validity Index (CVI), which is one of the most widely recommended approaches for quantifying experts' agreement regarding item relevance (Alzamanan et al., 2024). Three experts with expertise in early childhood education and educational research participated in the validation process by evaluating each questionnaire item. Their evaluations were used to calculate the Item-Level Content Validity Index (I-CVI) and the Scale-Level Content Validity Index (S-CVI), as presented in **Table 3**.

Table 3. List of Content Validity Experts

Experts	Expertise	Experience (years)	Institution	Validity
Expert 1	Early Childhood Education	20	Institute of Teacher Education Tengku Ampuan Afzan	Content validity
Expert 2	Early Childhood Education & Preschool	12	Institute of Teacher Education Tengku Ampuan Afzan	Content validity
Expert 3	Early Childhood Education	10	Institute of Teacher Education Tengku Ampuan Afzan	Content validity

Content validity index (CVI) is widely used index in quantitative evaluation. There are 2 types of CVI: I-CVI (item level) and S-CVI (scale level). Prior to the calculation of CVI, the scale is dichotomized by recording all responses with 3 and 4 as 1 and all responses with 1 and 2 as zero. Where 1 means 'relevant' and 0 means 'not relevant'.

I-CVI = Experts in Agreement/ Total No. of experts

S-CVI = The average of proportion relevance scores across all experts

A pilot study was conducted prior to the main study to evaluate the feasibility of the research procedures and the internal consistency of the instrument. Recent methodological literature recommends conducting a pilot study using a relatively small sample that is

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sufficient to identify potential issues with the questionnaire and to estimate preliminary reliability before full-scale data collection (Tseng & Sim, 2021). Accordingly, a total of 22 preschool teachers from the Kuala Lipis District, Pahang, Malaysia, were selected to participate in the pilot study. The collected data were analyzed using Cronbach's Alpha to determine the internal consistency of the instrument. The interpretation of the Cronbach's Alpha coefficients adopted in this study is presented in **Table 4**.

Table 4. Interpretation of Cronbach's Alpha Scores

Alpha Cronbach Score	Reliability
0.9-1.0	Very good and effective with a high level of consistency
0.7 0.8	Good and acceptable
0.6-0.7	Acceptable
<0.6	Items need improvement
<0.5	Items need to be dropped

Based on expert opinions, the face validity of the instrument for the instrument for the level of teacher readiness for the implementation of 21st century learning element in preschool is based on **Table 5**. The table below is the face validity review table.

Table 5. Validity Review

No	Item	Review
1.	The instrument format is suitable and attractive.	Suitable
2.	The items measure the intended domains.	Suitable
3.	The language used is easily understood.	Yes
4.	The font size is suitable and easy to read.	Yes
5.	The meaning of each item is sufficient.	Yes
6.	The number of items is sufficient.	Sufficient
7.	The objectives are clear.	Clear
8.	The instructions are clear.	Clear
9.	The spelling is correct.	Correct
	Overall Review	The overall instrument is correct and suitable for the survey study. Best of luck!

The following are the findings for the content validity of the level of teacher readiness for the implementation of 21st century learning element in preschool, divided into three Table: **Table 6.** Teacher Readiness in Terms of Knowledge in Implementing 21st Century Learning Elements, **Table 7.** Teacher Readiness in Terms of Skills in Implementing 21st Century Learning Elements, and **Table 8.** Teacher Readiness in Terms of Attitude in Implementing 21st Century Learning Elements.

Table 6. Teacher Readiness in Terms of Knowledge in Implementing 21st Century Learning Elements

Items	Expert 1	Expert 2	Expert 3	I-CVI
Q1	1	1	0	0.67
Q2	1	1	0	0.67
Q3	1	1	0	0.67
Q4	1	1	1	1
Q5	1	1	1	1
Q6	1	1	0	0.67
Q7	1	1	0	0.67
Q8	1	0	0	0.33
			S-CVI/AVE	0.71

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Table 7. Teacher Readiness in Terms of Skills in Implementing 21st Century Learning Elements

Items	Expert 1	Expert 2	Expert 3	I-CVI
Q1	1	1	0	0.67
Q2	1	0	1	0.67
Q3	1	0	0	0.33
Q4	1	1	1	1
Q5	1	1	1	1
Q6	1	0	0	0.33
Q7	1	1	1	1
Q8	1	1	1	1
			S-CVI/AVE	0.75

Table 8. Teacher Readiness in Terms of Attitude in Implementing 21st Century Learning Elements

Items	Expert 1	Expert 2	Expert 3	I-CVI
Q1	1	0	0	0.33
Q2	1	1	1	1
Q3	1	1	1	1
Q4	1	1	0	0.67
Q5	1	1	1	1
Q6	1	1	1	1
Q7	1	1	0	0.67
Q8	1	1	1	1
			S-CVI/AVE	0.83

For **Table 6**, the I-CVI ranges from 0.33 to 1, and the S-CVI is 0.71. For **Table 7**, the I-CVI ranges from 0.33 to 1, and the S-CVI is 0.75. For **Table 8**, the I-CVI ranges from 0.33 to 1, and the S-CVI is 0.83. Referring to I-CVI and S-CVI, the provided instrument indicates a high level of validity. Below are the suggestions for the improvements and the overall expert review of the content validity of the Level of Teacher Preparedness Instrument in Implementing 21st Century Learning Elements. **Table 9** presents the suggested improvements and the overall expert reviews of the content validity.

Table 9. Suggestions for Improvements and the Overall Expert Review on Content Validity

Experts	Section B	Section C	Section D	Overall Review
Expert 1	Congratulations, keep up your efforts.	Congratulations, keep up your efforts.	Congratulations, keep up your efforts.	The instrument developed in Sections B, C and D can be used to measure teachers' readiness levels for implementing 21st century learning elements in preschool.
Expert 2	Make improvements for certain terms/ word usage appropriate in the context of 21st century learning elements in preschool.	Amend some items that need correction.	Amend some items in the instrumen.	Make minor improvements to some questions in the survey items.

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Experts	Section B	Section C	Section D	Overall Review
Expert 3	Survey items should align with the researcher's requirements based on the formulated questions	Use the same wording as the research title.	Correct the construction of survey items to be specific to the research title.	The survey can be improved based on the feedback provided. Continue your research.

This text summarizes the expert's feedback on improving the instrument's content validity for measuring the level of teachers' readiness in implementing 21st century learning elements in preschool. The constructs discussed in this study consist of three table: table 6, table 7, table 8. The Cronbach's Alpha values for the instrument are based on the **Table 10**.

Table 10. Cronbach Alpha

Table	Number of Items	Cronbach Alpha Score	Interpretation
Table 6. Teacher Readiness in Terms of Knowledge in Implementing 21st Century Learning Elements	8	0.82	Good and acceptable
Table 7. Teacher Readiness in Terms of Skills in Implementing 21st Century Learning Elements	8	0.76	Good and acceptable
Table 8. Teacher Readiness in Terms of Attitude in Implementing 21st Century Learning Elements	8	0.88	Good and acceptable
Overall Cronbach's Alpha Value		0.83	Good and acceptable

Table 10 shows the Cronbach's Alpha Score of 0.82, o.76 and 0.88 for Section B, Section C and Section D respectively which are good and acceptable. Overall, the Cronbach's Alpha Value for the instrument The Level of Teacher Readiness for the Implementation of 21st century learning elements in preschool is 0.83 which is good and acceptable.

Validity refers to the extent to which an instrument accurately measures the construct it is intended to assess. It provides evidence that the instrument adequately represents the intended construct and supports the interpretation of the measurement results. Instrument validity is commonly classified into several forms, including content validity, construct validity, and criterion-related validity, each of which contributes to the overall quality of the measurement instrument (Anggara & Abdillah, 2023; Masuwai et al., 2024).

Reliability refers to the degree to which an instrument produces consistent and stable measurement results. In this study, internal consistency reliability was assessed using Cronbach's Alpha coefficient, which remains one of the most widely accepted statistics for evaluating the reliability of Likert-scale instruments. A Cronbach's Alpha coefficient of 0.70 or above generally indicates acceptable reliability, whereas values of 0.80 or higher indicate good internal consistency (Chabrera et al., 2023, 2023; Mohammadi et al., 2024).

The pilot study results showed that the Cronbach's Alpha coefficients ranged from 0.76 to 0.88, indicating acceptable to good internal consistency across all questionnaire constructs. Furthermore, the overall Cronbach's Alpha coefficient exceeded 0.83, demonstrating that all questionnaire items were suitable for use in the main study without requiring item deletion or modification. These findings indicate that the instrument possesses satisfactory reliability and is appropriate for measuring preschool teachers' readiness to implement 21st-century learning.

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4. CONCLUSION

The result of the study demonstrates that the Level of Teacher Readiness for the Implementation of 21st century learning elements in preschool meets the criteria as a reliability (fairly acceptable criteria) and valid (good criteria) assessment tool for assessing teachers' knowledge, skills and attitudes towards the implementation of 21st century learning elements in preschool. The high internal consistency and construct validity support the application of Level of Teacher Readiness for the Implementation of 21st century learning elements in preschool as an easy-administered tool to assess teachers' knowledge, skills, and attitudes regarding the implementation of 21st century learning elements in preschool.

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