

# Pedagogical Practice and Content Mastery of Geography Teachers in Malaysia Based on Rasch Model Analysis

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## Abstract

Secondary school geography education in Malaysia plays an important role in shaping students who are knowledgeable, critical, sensitive to the environment, and able to understand the relationship between humans, space, and current issues. The effectiveness of geography teaching depends largely on the ability of teachers to implement appropriate pedagogical practices and master the subject content in depth. However, the actual level of pedagogical practices and content mastery of geography teachers still needs to be identified empirically, especially to determine strengths and aspects that require improvement. This study aims to assess the level of pedagogical practices and content mastery of secondary school geography teachers in Malaysia based on Rasch model analysis. This study uses a quantitative approach with a descriptive survey design. A total of 300 secondary school geography teachers were selected as respondents through proportional stratified sampling and simple random sampling. This study uses the Malaysian Geography Teacher Professionalism Questionnaire Instrument with a five-point Likert scale containing 30 items, namely 15 items for the Pedagogical Practice construct and 15 items for the Content Mastery construct. Data were analyzed using the Rasch model through WINSTEPS software by examining person and item measurements, reliability, separation, item suitability, and item order based on logit. The study findings showed that the pedagogical practices and content mastery of geography teachers were at a high level. However, more authentic pedagogical practices such as fieldwork, project-based learning, practical experiences, and inquiry strategies are still more challenging to implement consistently. In terms of content mastery, technical and applicative content such as Geographic Information Systems, the use of geographic data, and value integration still need to be strengthened. Geography teachers have a strong pedagogical and content foundation, but more focused professional

development is needed to strengthen authentic pedagogy, technical content mastery, and the use of geospatial technology in geography teaching.

**Keywords:** Pedagogical Practice, Content Mastery, Geography Teacher, Rasch Model, Geography Education

### **Introduction**

Secondary school geography education plays an important role in shaping students who are knowledgeable, critical, environmentally sensitive, and able to understand the relationship between humans, space, and current issues. In an increasingly complex and dynamic world, geography education is not merely concerned with the memorization of places, facts, or physical phenomena but serves as an important platform for students to understand real-world issues such as climate change, natural hazards, urbanization, migration, sustainable development, and the interaction between humans and the environment. This subject not only emphasizes mastery of geographical concepts and facts but also provides space for students to develop higher-order thinking skills, civic awareness, sustainability values, and the ability to make evidence-based decisions. Therefore, geography education has significant practical value because it helps students relate classroom knowledge to real-life situations and prepares them to become informed, responsible, and environmentally conscious citizens. In this regard, the effectiveness of geography teaching depends largely on the teacher's ability to master two important aspects, namely pedagogical practice and content mastery. These two aspects are crucial because they determine whether geography teaching can be delivered in a meaningful, contextual, active, and student-centered manner.

Pedagogical practices refer to the approaches, strategies, and teaching methods used by teachers to help students understand a subject effectively. Joyce et al. (2000) explain that pedagogical practices involve teaching techniques based on various learning theories to meet the needs of different students. Shulman (1987) also emphasizes that pedagogy is closely related to the teacher's knowledge of how to present content in a way that is easy for students to understand. In the context of geography education, effective pedagogical practices need to involve active learning approaches such as inquiry-based learning, project-based learning, fieldwork, and contextual and community-based pedagogy. These approaches have been found to improve conceptual understanding, critical thinking skills, civic engagement, and student character development (Irawan et al., 2021; SJ Lee et al., 2022; Seow et al., 2019). The emphasis on pedagogical practices is important because effective teaching strategies can enhance students' engagement, deepen their understanding of geographical concepts, and support the development of skills needed to analyze current spatial and environmental issues.

Inquiry-based learning emphasizes student involvement in the process of questioning, investigating, evaluating evidence, and drawing conclusions. This approach is important in geography education because it can help students understand spatial, environmental, and human issues in more depth. Through this approach, students are not only passive recipients of information but are actively involved in constructing knowledge through exploration, reasoning, and evidence-based learning. Previous studies have shown that inquiry-based learning can improve conceptual understanding, critical thinking skills, geographical competence, and student character development (J. Lee, 2026; Yani et al., 2021). However, the implementation of this approach requires teachers with good pedagogical knowledge,

continuous professional training, and the ability to integrate geospatial technologies such as GIS into teaching (Lotter et al., 2018; Whitworth et al., 2022). Thus, examining teachers' pedagogical practices is necessary to determine the extent to which inquiry-based learning can be effectively implemented in geography classrooms.

In addition, project-based learning is also an important approach in teaching geography. This approach encourages students to solve real-world problems through collaborative activities, research, and the production of learning products. The usefulness of this approach lies in its ability to connect geographical knowledge with authentic problems that students may encounter in their surroundings and daily lives. PBL has been found to increase students' motivation, autonomy, cooperation, and pro-environmental attitudes, especially when implemented in a planned manner during an appropriate learning period (Djordjevic et al., 2026; Zhang & Ma, 2023). The integration of PBL with inquiry-based learning, fieldwork, and GIS technology has also been reported to strengthen students' critical thinking, creativity, and autonomy in geography learning (Putra Sumarmi, Deffinika I., & Islam, 2021; Sofias & Pierrakeas, 2021). This indicates that project-based learning is not only useful as a teaching method but also effective in developing students' problem-solving abilities, collaboration, creativity, and environmental responsibility.

Fieldwork is an important component of geography education because it allows students to connect theory with real-world observations and experiences. Through fieldwork, students can understand geographic phenomena directly, build observation skills, collect data, analyze the environment, and reflect on local issues. This activity also supports students' cognitive, affective, value, motivation, teamwork, and transformational learning (Mihelčić, 2017; Yang et al., 2013). However, the implementation of fieldwork often faces constraints such as security aspects, logistics, curriculum pressures, and the level of teacher preparation (Larsen et al., 2020; Nkuna & Mawela, 2025). Therefore, it is important to investigate teachers' pedagogical practices in order to understand whether fieldwork is being used effectively and what forms of support are needed to improve its implementation in schools.

In addition, contextual and community-based pedagogy is also relevant in teaching geography because this approach connects learning to local issues, student experiences, and sustainable development. Activities such as community mapping, spatial storytelling, and place-based projects can increase students' emotional engagement, civic competence, and citizenship skills (Jung, 2018; Loor & Muentes, 2024; Patki et al., 2023; Rees et al., 2021; Rock, 2022). This approach is important because geography learning becomes more meaningful when students are able to relate the content learned in the classroom to their own communities, local environments, and lived experiences. Therefore, the pedagogical practices of geography teachers need to move from a traditional teacher-centered approach to a more active, contextual, authentic, and student-centered approach.

In addition to pedagogical practices, content mastery is the main foundation for the effectiveness of geography teaching. Content mastery refers to the ability of teachers to understand, master, and apply concepts, facts, and skills in the field of geography. Ball et al. (2008) explain that deep mastery of content allows teachers to teach effectively and answer students' questions accurately. Koehler & Mishra (2009) also emphasized that content mastery does not just involve theoretical understanding but also needs to be translated

through the use of relevant teaching technologies and methodologies. In the context of geography education, content mastery includes understanding of the curriculum and assessment standard documents, the ability to connect knowledge with current issues and local and global values, and the use of educational technologies such as GIS, Google Earth, story maps, and virtual reality (Blankman et al., 2016; Bos et al., 2021; Cowie, 1978; Smith, 1978; Turan et al., 2018). The need to study content mastery is therefore significant because teachers who possess strong geographical knowledge are more capable of explaining complex concepts accurately, linking content to contemporary issues, and designing meaningful learning experiences for students.

Content mastery is also the basis for the formation of pedagogical content knowledge, or PCK. Through PCK, teachers can translate geography knowledge into teaching strategies that are appropriate for the student's level, address conceptual misunderstandings, and build critical thinking and global awareness among students (Mapulanga et al., 2022; Smit et al., 2023). At the same time, the use of geospatial technologies such as GIS, AR, and VR can increase students' spatial literacy, motivation, and understanding of complex geographic concepts (González González & Pisabarro, 2024; Schmidt & Stumpe, 2025). This shows that geography teachers' content mastery cannot be viewed in isolation from pedagogy, technology, and current learning contexts. Therefore, the effectiveness of geography teaching depends not only on what teachers know, but also on how they transform that knowledge into appropriate pedagogical strategies that support students' understanding.

However, geography teachers' content mastery still faces several challenges. Among the challenges identified are training gaps, limited infrastructure, curriculum constraints, language barriers in bilingual education, and limited pedagogical autonomy due to curriculum changes (Dhimitri et al., 2019; Fastier, 2016; Lo & Fung, 2020). In addition, technical and applied content such as the use of GIS, geographic data analysis, and migration and sustainability issues requires more specific and ongoing professional training. Previous studies have shown that professional development such as intensive training, lesson study, e-professional development, and learning communities can improve PCK and teachers' ability to integrate content knowledge with pedagogical strategies more effectively (Alimuddin et al., 2021; Manicio et al., 2023). These challenges indicate that there is a clear need for empirical research to identify the actual level of geography teachers' pedagogical practices and content mastery so that appropriate interventions, training, and professional support can be planned.

Based on the discussion, it is clear that pedagogical practices and content mastery are two important components in determining the effectiveness of geography teachers' teaching. Teachers with good content mastery are able to explain geography concepts accurately, while appropriate pedagogical practices enable the content to be conveyed more meaningfully to students. However, the actual level of both of these aspects needs to be identified empirically so that strengths and room for improvement can be more clearly determined. This study is important because it provides evidence-based information on teachers' strengths and weaknesses in pedagogy and content mastery, which can be used to improve the quality of geography teaching. The findings are also beneficial to students because more effective teaching can enhance their understanding, interest, critical thinking skills, and ability to apply geographical knowledge in real-life situations.

In this regard, this study aims to assess the level of pedagogical practice and content mastery of geography teachers based on Rasch model analysis. This study is supported by previous research on geography teachers' pedagogy, content mastery, and technology integration in teaching (Robert & Che Leh, 2024; Ahmad @ Shaari & Saidin, 2016; Mohd Badrol et al., 2022). The use of the Rasch Model allows the level of respondent tendency and the level of item difficulty to be analyzed on the same logit scale. Through this approach, the study can not only identify the overall level of pedagogical practice and content mastery of geography teachers but also identify aspects of pedagogy and content that are easier or more challenging to implement and master. The findings of this study are expected to contribute to efforts to strengthen the professional development of geography teachers, especially in improving active pedagogical practice, technical content mastery, and the use of geospatial technology in teaching. In terms of significance, this study can benefit teachers by helping them reflect on and improve their instructional practices; students by supporting more meaningful and effective learning; educational institutions by guiding the planning of professional development programs; policymakers by providing empirical input for curriculum, training, and resource development; and future researchers by offering a foundation for further studies related to geography pedagogy, content mastery, PCK, geospatial technology, and teaching effectiveness.

## **Methodology**

### *Study Design, Population, and Sample*

This study uses a quantitative approach with a descriptive survey design. This design was chosen because the study aimed to obtain an empirical picture of the level of pedagogical practices and content mastery among secondary school geography teachers in Malaysia. The survey approach allows data to be collected from a sufficient number of respondents and analyzed systematically to explain the pattern of teachers' responses to the constructs studied. The focus of this study is on two main constructs, namely, pedagogical practices and content mastery. The study population was 10,631 geography teachers in Malaysia, while 300 teachers were selected by state as the study sample. The determination of this sample size used Krejcie & Morgan (1970) as a basis, in addition to taking into account the suitability of the number of respondents for analysis using the Rasch Model.

### *Sampling Methods and Research Instruments*

The selection of study respondents was carried out using a probability sampling method, which is a combination of proportional stratified sampling and simple random sampling. At the initial stage, the population of geography teachers was divided by state as the study strata. Next, the sample size for each state was determined proportionally based on the actual number of geography teachers in the state. After the sample size for each stratum was determined, respondents were selected at simple random to ensure that the sample obtained could represent the study population more evenly and reduce selection bias. The Malaysian Geography Teacher Professionalism Questionnaire instrument was used to collect data. Two study constructs, namely Pedagogical Practices and Content Mastery, contained 15 items. The Pedagogical Practice construct included items related to fieldwork, project-based learning, practical experience, inquiry strategies, cooperative learning, student-centered activities, discussion of social issues, and student communication skills. The Content Mastery construct included items related to teachers' mastery of key concepts and themes of geography such as topographic maps, weather and climate, ecosystems, physical

environment, population migration, use of geographic data, application of values in geography teaching, and Geographic Information Systems, or GIS. This questionnaire uses a five-point Likert scale to measure the level of agreement of respondents with each item presented.

#### *Validity, Reliability, and Data Analysis*

The study instrument has gone through the face validity and content validity process to ensure that the items constructed are clear, appropriate, and in line with the constructs to be measured. Face validity pays attention to the aspects of language comprehension and item clarity, while content validity assesses the suitability of the items with the pedagogical practice and content mastery domains. In addition, the construct validity and reliability of the instrument were examined through Rasch model analysis. The study data were analyzed using the Rasch measurement model through WINSTEPS software. The Rasch model was chosen because this model allows the ability of the respondent and the difficulty of the item to be analyzed on the same measurement scale, namely logit. Therefore, the interpretation of the findings does not only depend on the raw score but also takes into account the position of the person and item measurements. The analysis involves person and item statistics, non-extreme person measurements, mean person measurements, mean item measurements, person and item reliability values, person and item separation values, MNSQ Infit and Outfit statistics, PTMEA CORR values, and item ordering based on logit measurements. For the Pedagogical Practice construct, items with positive logit values are interpreted as practices that are more challenging or less frequently implemented by teachers, while items with negative logit values indicate practices that are more commonly practiced. For the Content Mastery construct, items with high logit values depict aspects of content that are more difficult to master, while items with low logit values indicate content that is easier for teachers to master. The findings of Rasch analysis show that both constructs, namely, pedagogical practice and content mastery, have good levels of reliability. The Pedagogical Practice construct recorded good Person Reliability values, while the Content Mastery construct showed high Person Reliability and Item Reliability values. This proves that the instrument used is suitable for measuring the level of pedagogical practice and content mastery of geography teachers consistently. The use of the Rasch model through the WINSTEPS software allows the study findings to be analyzed in more depth, especially in terms of construct level, instrument reliability, item suitability, item stability, and item difficulty hierarchy. This approach also allows the study to identify pedagogical aspects and geography content that have been well mastered as well as aspects that still need strengthening.

#### **Findings and Discussion**

##### *Levels of Pedagogical Practice*

The analysis of the findings was conducted systematically using the Rasch model analysis. The analysis focused on person and item statistics, non-extreme person measurements, and item order analysis to explain the level of pedagogical practice of the respondents in more detail. Through this analysis, the interpretation of the response pattern, the level of respondent tendency, and the position of the items were explained more clearly and meaningfully.

Table 1

Statistical Analysis of Person and Pedagogical Practice Items

SUMMARY OF 300 MEASURED PERSON

	TOTAL SCORE	COUNT	MODEL MEASURE	INFIT S.E.	OUTFIT MNSQ	ZSTD	MNSQ	ZSTD
MEAN	57.3	15.0	1.60	.42	1.03	-.09	1.00	-.14
SEM	.4	.0	.07	.00	.03	.09	.03	.09
P.SD	6.4	.0	1.16	.06	.60	1.53	.58	1.52
S.SD	6.4	.0	1.16	.06	.60	1.53	.58	1.53
MAX.	73.0	15.0	5.42	.79	3.62	4.49	3.57	4.50
MIN.	43.0	15.0	-.57	.36	.21	-3.01	.22	-3.10
REAL RMSE	.47	TRUE SD	1.06	SEPARATION	2.23	PERSON RELIABILITY	.83	
MODEL RMSE	.42	TRUE SD	1.08	SEPARATION	2.54	PERSON RELIABILITY	.87	
S.E. OF PERSON MEAN = .07								

PERSON RAW SCORE-TO-MEASURE CORRELATION = .99  
 CRONBACH ALPHA (KR-20) PERSON RAW SCORE "TEST" RELIABILITY = .85  
 SEM = 2.51  
 STANDARDIZED (50 ITEM) RELIABILITY = .96

SUMMARY OF 15 MEASURED ITEM

	TOTAL SCORE	COUNT	MODEL MEASURE	INFIT S.E.	OUTFIT MNSQ	ZSTD	MNSQ	ZSTD
MEAN	1145.1	300.0	.00	.09	.99	-.27	1.00	-.16
SEM	29.5	.0	.24	.00	.06	.68	.06	.71
P.SD	110.5	.0	.90	.01	.22	2.55	.23	2.65
S.SD	114.3	.0	.93	.01	.22	2.63	.24	2.74
MAX.	1278.0	300.0	1.77	.10	1.39	4.18	1.41	4.32
MIN.	919.0	300.0	-1.18	.08	.72	-3.79	.71	-3.74
REAL RMSE	.10	TRUE SD	.90	SEPARATION	9.24	ITEM RELIABILITY	.99	
MODEL RMSE	.09	TRUE SD	.90	SEPARATION	9.61	ITEM RELIABILITY	.99	
S.E. OF ITEM MEAN = .24								

ITEM RAW SCORE-TO-MEASURE CORRELATION = -1.00

Global statistics: please see Table 44.

UMEAN=.0000 USCALE=1.0000

Based on Table 1, the construct of pedagogical practice is at a high level. This is shown by the mean of the person measure, 1.60 logits, which is higher than the mean of the item measure, 0.00 logits. In the context of the Rasch Model, this situation shows that overall respondents have a high tendency to agree with the items that measure the construct of pedagogical practice. This finding is also supported by the mean raw score of the person, 57.3 for 15 items, which is equivalent to an average of around 3.82 out of 5.00 (MEAN TOTAL SCORE = 57.3 divided by COUNT = 15 items) for each item. This finding means that geography teachers in this study generally frequently practice the pedagogical elements contained in the instrument.

Table 2

*Analysis of Non-Extreme Person Sizes for Pedagogical Practices*

TOTAL FOR ALL 300 NON-EXTREME PERSON

	TOTAL		MODEL	INFIT	OUTFIT				
	SCORE	COUNT	MEASURE	S.E.	MNSQ	ZSTD	MNSQ	ZSTD	MNSQ
MEAN	57.3	15.0	1.60	.42	1.03	-.09	1.00	-.14	
SEM	.4	.0	.07	.00	.03	.09	.03	.09	
P.SD	6.4	.0	1.16	.06	.60	1.53	.58	1.52	
S.SD	6.4	.0	1.16	.06	.60	1.53	.58	1.53	
MAX.	73.0	15.0	5.42	.79	3.62	4.49	3.57	4.50	
MIN.	43.0	15.0	-.57	.36	.21	-3.01	.22	-3.10	
REAL RMSE	.47	TRUE SD	1.06	SEPARATION	2.23	PERSON			
RELIABILITY	.83								
MODEL RMSE	.42	TRUE SD	1.08	SEPARATION	2.54	PERSON			
RELIABILITY	.87								
S.E. OF PERSON MEAN	= .07								
MEDIAN	= 1.46								

The findings in Table 2 show that the non-extreme person measure is also at a good and stable level. The SE value of the person mean = 0.07 indicates a low error of mean estimation, while the standard deviation = 1.16 logit and median = 1.46 logit show that although the overall level of pedagogical practice is high, there is still variation in the level of practice among respondents. The range of person measures from -0.57 logit to 5.42 logit shows that there are teachers who have a lower tendency to practice, but the majority of respondents are still at a higher level. The fact that all 300 persons were reported as non-extreme also shows that the data is suitable for stable interpretation in the Rasch model.

From the aspect of instrument reliability, the Person Reliability value of 0.83 for the real estimate and 0.87 for the model estimate shows that this instrument has a good level of

reliability. The separation value of 2.23 to 2.54 proves that the instrument is able to differentiate respondents into several different levels of pedagogical practice. In addition, the Cronbach Alpha (KR-20) value of 0.85 in Table 1 shows that the items in this construct have good internal consistency. Therefore, the Pedagogical Practice instrument is not only able to show the level of teachers' pedagogical practice but is also reliable in measuring the construct.

Table 3  
Statistical Analysis of Items According to the Order of Pedagogical Practice Items

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PERSON: REAL SEP.: 2.23 REL.: .83 ... ITEM: REAL SEP.: 9.24 REL.: .99
ITEM STATISTICS: ENTRY ORDER
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|ENTRY TOTAL TOTAL JMLE MODEL| INFIT | OUTFIT |PTMEASUR-
AL|EXACT MATCH| |
|NUMBER SCORE COUNT MEASURE S.E. |MNSQ ZSTD|MNSQ ZSTD|CORR.
EXP.| OBS% EXP%| ITEM |
|-----+-----+-----+-----+-----+-----|
| 1 1109 300 .37 .09|.75 -3.16|.77 -2.96| .56 .57| 64.0 57.1| A1
|
| 2 968 300 1.44 .08|1.34 3.59|1.40 4.19| .43 .60| 50.7 54.8|
A2 |
| 3 1187 300 -.31 .10|1.39 4.18|1.33 3.60| .52 .55| 57.0 59.3|
A3 |
| 4 1189 300 -.33 .10|1.13 1.48|1.12 1.43| .58 .55| 61.0 59.4|
A4 |
| 5 949 300 1.57 .08|1.02 .24|1.06 .67| .55 .60| 50.0 54.2| A5
|
| 6 1278 300 -1.18 .10|.77 -3.11|.75 -3.00| .61 .51| 71.3 61.6|
A6 |
| 7 1219 300 -.61 .10|.81 -2.41|.79 -2.67| .62 .54| 64.7 60.2| A7
|
| 8 1209 300 -.51 .10|.94 -.75|.93 -.85| .55 .54| 63.0 60.1| A8
|
| 9 1207 300 -.49 .10|.88 -1.43|.87 -1.65| .64 .54| 64.0 60.0| A9
|
| 10 1092 300 .51 .09|.94 -.65|.97 -.34| .63 .57| 56.7 56.7| A10
|
| 11 1157 300 -.04 .09|.84 -2.02|.84 -1.95| .62 .56| 64.7 58.2|
A11 |
| 12 1227 300 -.68 .10|1.13 1.53|1.19 2.19| .41 .54| 57.7 60.6|
A12 |
| 13 919 300 1.77 .08|1.34 3.75|1.41 4.32| .51 .61| 45.3 53.7|
A13 |
| 14 1211 300 -.53 .10|.88 -1.53|.86 -1.72| .62 .54| 60.7 60.1|
A14 |

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	15	1255	300	-0.95	.10	.72	-3.79	.71	-3.74	.62	.52	70.3	61.2
A15													
MEAN	1145.1	300.0		.00	.09	.99	-.27	1.00	-.16			60.1	58.5
P.SD	110.5	.0	.90	.01	.22	2.55	.23	2.65			7.1	2.5	

At the item level, the analysis in Table 3 shows that there are several items with positive and high logit measures, which are items that are more difficult to agree with and less frequently practiced by respondents. The highest item is A13 = 1.77 logit, which is “I teach the topic of plate tectonics through practical experience.” This item is followed by A5 = 1.57 logit, which is “I involve students in learning based on geographical projects,” and A2 = 1.44 logit, which is “I carry out fieldwork with students.” In addition, A10 = 0.51 logit and A1 = 0.37 logit are also at a positive level. This pattern shows that although the overall level of teachers’ pedagogical practices is high, practices involving practical experience, project-based learning, fieldwork, inquiry strategies, and the development of critical thinking are still more challenging aspects to implement consistently.

On the other hand, items with negative logit measurements are items that are easier to agree with and more commonly practiced by respondents. Among the lowest items is A6 = -1.18 logit, which is “I guide students to discuss social issues,” followed by A15 = -0.95 logit, which is “I incorporate teaching and learning activities that develop students’ communication skills.” Next, A12 = -0.68 logit, A7 = -0.61 logit, A14 = -0.53 logit, A8 = -0.51 logit, and A9 = -0.49 logit are also at negative levels. This finding illustrates that teachers are more likely to implement pedagogical practices that are interactive, collaborative, student-centered, and easy to integrate into the classroom. These include discussions of social issues, group activities, use of visual materials, cooperative learning, reflection on the environment, application of patriotism values, and development of students’ communication skills.

In terms of item quality in Table 3, all items were found to move in the direction of the Pedagogical Practice construct because the PTMEA CORR values for all items were positive, ranging from 0.41 to 0.64. This indicates that all items consistently contributed to the measurement of the construct. However, several items showed relatively high fit values, especially A13 with Infit MNSQ = 1.34 and Outfit MNSQ = 1.41, A2 with Infit MNSQ = 1.34 and Outfit MNSQ = 1.40, and A3 with Infit MNSQ = 1.39 and Outfit MNSQ = 1.33. However, these values are still not too extreme and are acceptable in making measurements.

Overall, the findings of Rasch analysis show that the level of pedagogical practice of geography teachers in Malaysia is in the high category. This finding is supported by the positive mean of the person measure and exceeds the mean of the item measure, high average raw score, good person reliability value, satisfactory separation value, and item pattern that moves in the direction of the measured construct. However, the item findings show that the more commonly practiced pedagogical practices are interactive and student-centered practices, while more complex and authentic practices such as fieldwork, project-based learning, practical experience, and inquiry strategies still need to be strengthened. Therefore, although the level of pedagogical practice is at a high level, there is still room for

improvement, especially in strengthening more complex, contextual, and authentic pedagogical practices in the teaching and learning of geography teachers in Malaysia.

This finding indicates that geography teachers have a fairly strong pedagogical foundation to support the implementation of the 2027 school curriculum as intended. This is in line with the current curriculum orientation, which demands active learning, meaningful learning experiences, and holistic student development, thus placing pedagogy as the core of the effective implementation of the curriculum (Malaysia, 2023a). At the same time, this finding is also in line with Hanifah et al. (2019), who found that geography teachers in Malaysia generally demonstrate good professional and pedagogical competence, particularly in matters related to lesson planning and lesson implementation. However, this high level should not be interpreted too generally, because pedagogical practices are not uniform constructs; some forms of pedagogy are more easily routine in the classroom, while others require much more profound changes in practice (Hanifah et al., 2019; Malaysia, 2023b).

More specifically, the pattern of findings shows that teachers are more likely to adopt interactive, collaborative, and student-centered forms of pedagogy that can be implemented directly in the classroom, such as discussions of social issues, group activities, use of visual materials, reflection, and the development of communication skills. This pattern may be regarded as a positive development, as it indicates that teachers are no longer wholly reliant on a one-way transmission of information but have begun to integrate active learning elements into their instructional practices. This interpretation is also in line with the argument. Black & William (2018) that pedagogy and assessment in the classroom develop inextricably through interaction, dialogue, and active student engagement. However, from a more critical perspective, these findings indicate that the most commonly practiced forms of active pedagogy are those that are still within the control of the teacher in the classroom. This means that pedagogical changes may be more at the level of student engagement strategies but have not necessarily developed into the most authentic and closest to actual disciplinary practice in geography pedagogy (Black & Wiliam, 2018; Hanifah et al., 2019).

The finding that fieldwork, project-based learning, practical experiences, and inquiry are among the more challenging practices to consistently practice is very significant. This finding is very much in line with the geography education literature, which emphasizes that authentic pedagogy is core to the identity of the subject. Seow et al. (2019) argue that field-based inquiry is a signature pedagogy for school geography because the approach socializes students to the concepts, practices, and values of the discipline of geography. A comment by Smith et al. (2023) also asserted that the quality of geography teaching depends greatly on how teachers integrate the content of the discipline with the way they teach it to specific students in specific contexts. Therefore, when practices such as fieldwork, projects, inquiry, and practical experiences are found to be less robust than interactive classroom strategies, this finding should not be read as a mere technical shortcoming. Rather, it suggests that the main challenge for geography teachers lies in translating active pedagogical principles into discipline-specific forms of pedagogy that are truly grounded in inquiry, place context, and real-world experience (Rawlings Smith & Rushton, 2023; Seow et al., 2019).

This finding confirms that there is a gap between general active pedagogy and authentic geography pedagogy. Pedagogies such as group work, discussion of social issues, and the use

of visual materials are important, but they do not necessarily represent the form of geography teaching. Geography education, as emphasized in the literature, requires students to build understanding through direct or near-direct observation, investigation, evidence collection, and interpretation of human–environment relationships. Thus, when pedagogies such as fieldwork, field inquiry, geographical projects, and practical experiences are still more difficult to implement, this finding reflects that teachers have moved towards active pedagogy, but not all have succeeded in reaching a level of pedagogy that truly reflects the epistemology of geography itself (Seow et al., 2019; Smit et al., 2023). This is consistent with discussions of community pedagogy and place-based learning, which assert that geography teaching becomes more meaningful when students engage with local issues, real spaces, and authentic social experiences, but such approaches typically require more complex instructional design (Rock, 2022).

The challenge of this more authentic pedagogical element is also closely related to issues of discipline-specific pedagogical knowledge and teachers' ability to integrate geospatial technology. In the literature review, technologies such as GIS are directly linked to strengthening inquiry and data-based learning. Studies by Lateh & Muniandy (2010) show that GIS is very suitable for implementation in geography education in Malaysia, but its implementation is still limited by various constraints such as technical difficulties, curriculum integration, and teacher preparedness. In addition, Bikar et al. (2022) show that teaching geography integrated with GIS has the potential to increase student motivation. This situation explains why pedagogical elements involving practical experiences, projects, and technical applications are more challenging. Teachers not only need to know the content but also need to have pedagogical confidence, technological literacy, and environmental support to apply it. Therefore, the pedagogical challenge in this study should be understood as an integrative challenge that involves content, pedagogy, technology, and implementation context simultaneously (Bikar et al., 2022; Lateh & Muniandy, 2010; Smit et al., 2023).

In the context of the 2027 curriculum framework, these findings have very clear implications. The new curriculum calls for more contextual, authentic, and experiential learning, not just general active learning. So, when the study findings show that the most robust practices are still focused on interactive pedagogy in the classroom, while practices such as fieldwork, projects, inquiry, and practical experiences are still less consistent, this indicates that pedagogical transformation is still in a transitional stage. The transition has already occurred from traditional teaching to basic active pedagogy but has not yet fully reached an authentic geographical pedagogy that is truly in line with the spirit of curriculum reform (Malaysia, 2023b; Seow et al., 2019). Therefore, a high level of pedagogical practice should not be read as an indication that all forms of pedagogy required by the 2027 school curriculum have been implemented in a balanced manner. On the contrary, it indicates that teachers have a good foundation but still need to strengthen more complex, open, and discipline-specific aspects.

Overall, the findings of the study show that the pedagogical practices of geography teachers in Malaysia are high in the level of interactive, collaborative, and student-centered pedagogy but have not yet developed equally to the authentic pedagogical form that is the distinctive identity of geography education. In other words, teachers' strengths are more evident in practices that are easily integrated into the classroom, while practices that require field investigations, projects, practical experiences, the use of geospatial technology, and more

open learning designs still need to be strengthened. These findings indicate that the professional development of geography teachers in the future cannot be limited to general pedagogy but needs to focus more sharply on geography pedagogy that is based on place, community, data, inquiry, and students' real-world experiences (Rock, 2022; Seow et al., 2019; Smit et al., 2023).

*Content Mastery Level*

The analysis of findings for the content mastery construct was conducted using Rasch model analysis, which includes person and item statistics, non-extreme person measurements, and item order to explain the respondent's content mastery level more clearly.

Table 4  
*Statistical Analysis of Person and Content Mastery Items*

SUMMARY OF 279 MEASURED (NON-EXTREME) PERSON

	TOTAL SCORE	COUNT	MODEL MEASURE	INFIT S.E.	OUTFIT MNSQ	ZSTD	MNSQ
MEAN	65.3	15.0	3.55	.65	1.01	.01	.99
SEM	.4	.0	.13	.01	.04	.08	.08
P.SD	6.7	.3	2.15	.21	.63	1.40	.88
S.SD	6.7	.3	2.15	.21	.63	1.40	.88
MAX.	74.0	15.0	7.35	1.27	4.68	6.71	7.67
MIN.	37.0	10.0	-2.01	.47	.08	-3.44	.06
REAL RMSE	.77	TRUE SD	2.00	SEPARATION	2.60	PERSON RELIABILITY	.87
MODEL RMSE	.69	TRUE SD	2.03	SEPARATION	2.95	PERSON RELIABILITY	.90
S.E. OF PERSON MEAN = .13							

MAXIMUM EXTREME SCORE: 21 PERSON 7.0%

SUMMARY OF 300 MEASURED (EXTREME AND NON-EXTREME) PERSON

	TOTAL SCORE	COUNT	MODEL MEASURE	INFIT S.E.	OUTFIT MNSQ	ZSTD	MNSQ
MEAN	66.0	15.0	3.93	.75			
SEM	.4	.0	.14	.02			
P.SD	6.9	.3	2.50	.40			
S.SD	7.0	.3	2.50	.40			
MAX.	75.0	15.0	9.01	2.00			

MIN.	37.0	10.0	-2.01	.47					
REAL RMSE	.91	TRUE SD	2.32	SEPARATION	2.55	PERSON			
RELIABILITY	.87								
MODEL RMSE	.85	TRUE SD	2.35	SEPARATION	2.77	PERSON			
RELIABILITY	.88								
S.E. OF PERSON MEAN =	.14								

PERSON RAW SCORE-TO-MEASURE CORRELATION = .95 (approximate due to missing data)

CRONBACH ALPHA (KR-20) PERSON RAW SCORE "TEST" RELIABILITY = .94 SEM = 1.65

(approximate due to missing data)

STANDARDIZED (50 ITEM) RELIABILITY = .96

SUMMARY OF 15 MEASURED (NON-EXTREME) ITEM

	TOTAL		MODEL	INFIT	OUTFIT				
	SCORE	COUNT	MEASURE	S.E.	MNSQ	ZSTD	MNSQ	ZSTD	MNSQ
MEAN	1319.5	299.2	.00	.14	.98	-.35	.98	-.16	
SEM	21.7	.5	.33	.00	.08	.83	.13	.82	
P.SD	81.0	1.7	1.23	.01	.31	3.09	.48	3.05	
S.SD	83.9	1.8	1.27	.01	.32	3.20	.49	3.16	
MAX.	1393.0	300.0	3.93	.15	1.94	8.61	2.10	9.12	
MIN.	1042.0	293.0	-1.38	.12	.71	-3.31	.59	-2.66	
REAL RMSE	.15	TRUE SD	1.22	SEPARATION	8.31	ITEM	RELIABILITY		
							.99		
MODEL RMSE	.14	TRUE SD	1.22	SEPARATION	8.71	ITEM	RELIABILITY		
							.99		
S.E. OF ITEM MEAN =	.33								

ITEM RAW SCORE-TO-MEASURE CORRELATION = -.99 (approximate due to missing data)

Global statistics: please see Table 44.

UMEAN=.0000 USCALE=1.0000

MISSING RESPONSES: .3% (APPROXIMATE)

Based on Table 4, the Content Mastery construct is at a high level. This finding is shown by the mean non-extreme person measure = 3.55 logit, which is far higher than the mean item measure = 0.00 logit. In the Rasch Model, this situation shows that overall respondents have a high ability or tendency to agree with the items that measure content mastery. This finding is also supported by the mean raw score of all 300 respondents, which is 66.0 out of 75, equivalent to an average of approximately 4.40 for each item (MEAN TOTAL SCORE = 66

divided by COUNT = 15 items), thus showing that the geography teachers in this study have a high level of content mastery.

In addition, Table 4 also shows that 21 respondents (7.0%) were at the extreme maximum score. This finding gives the impression that some respondents have a very high level of content mastery to the point of reaching the maximum score of the instrument. Indirectly, this further reinforces that the content mastery construct is at a high level among the study sample. However, the existence of these extreme persons also shows that some items may be quite easy to agree with by respondents who truly master the content of geography.

Table 5  
*Analysis of Non-Extreme Person Size for Content Mastery*

TOTAL FOR ALL 279 NON-EXTREME PERSON

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	TOTAL		MODEL	INFIT	OUTFIT				
	SCORE	COUNT	MEASURE	S.E.	MNSQ	ZSTD	MNSQ	ZSTD	MNSQ
MEAN	65.3	15.0	3.55	.65	1.01	.01	.99	-.09	
SEM	.4	.0	.13	.01	.04	.08	.05	.08	
P.SD	6.7	.3	2.15	.21	.63	1.40	.88	1.39	
S.SD	6.7	.3	2.15	.21	.63	1.40	.88	1.39	
MAX.	74.0	15.0	7.35	1.27	4.68	6.71	7.67	6.37	
MIN.	37.0	10.0	-2.01	.47	.08	-3.44	.06	-3.41	
REAL RMSE	.77	TRUE SD	2.00	SEPARATION	2.60	PERSON	RELIABILITY	.87	
MODEL RMSE	.69	TRUE SD	2.03	SEPARATION	2.95	PERSON	RELIABILITY	.90	
S.E. OF PERSON MEAN	= .13								
MEDIAN	= 3.75								

---

MAXIMUM EXTREME SCORE: 21 PERSON 7.0%

TOTAL FOR ALL 300 EXTREME AND NON-EXTREME PERSON

---

	TOTAL		MODEL	INFIT	OUTFIT				
	SCORE	COUNT	MEASURE	S.E.	MNSQ	ZSTD	MNSQ	ZSTD	MNSQ
MEAN	66.0	15.0	3.93	.75					
SEM	.4	.0	.14	.02					
P.SD	6.9	.3	2.50	.40					
S.SD	7.0	.3	2.50	.40					
MAX.	75.0	15.0	9.01	2.00					
MIN.	37.0	10.0	-2.01	.47					

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REAL RMSE	.91	TRUE SD	2.32	SEPARATION	2.55	PERSON			
RELIABILITY	.87								
MODEL RMSE	.85	TRUE SD	2.35	SEPARATION	2.77	PERSON			
RELIABILITY	.88								
S.E. OF PERSON MEAN =	.14								
MEDIAN =	4.03								
-----									

Next, based on Table 5, the non-extreme person measure shows a stable and convincing pattern. The SE value of the person's mean = 0.13 indicates a low error of mean estimation, while the standard deviation = 2.15 logit and median = 3.75 logit illustrate that although the overall level of content mastery is high, there is still variation among respondents. The range of person measures from -2.01 logit to 7.35 logit indicates that there are a few teachers at a lower level, but the majority are at a high level. Furthermore, the difference between the non-extreme mean (3.55 logit) and the mean of all respondents, including extremes (3.93 logit), also shows that the presence of extreme persons slightly increases the overall average, but the general pattern of the construct still remains high.

From a reliability perspective, the findings in Table 4 show that the Content Mastery instrument has very good measurement quality. The Person Reliability value of 0.87 for the real estimate and 0.90 for the model estimate shows high reliability. The separation value = 2.60 to 2.95 proves that this instrument is able to differentiate respondents into several different levels of content mastery. In addition, the Cronbach alpha (KR-20) value of 0.94 shows very good internal consistency of the items. For the items, Item Reliability = 0.99 and Item Separation = 8.31 to 8.71 show that the item difficulty hierarchy is very stable.

Table 6  
*Statistical Analysis of Items According to Content Mastery Item Order*

-----													
PERSON: REAL SEP.: 2.55 REL.: .87 ... ITEM: REAL SEP.: 8.31 REL.: .99													
ITEM STATISTICS: ENTRY ORDER													
-----													
ENTRY	TOTAL	TOTAL	JMLE	MODEL	INFIT	OUTFIT	PTMEASUR-						
AL EXACT MATCH													
NUMBER	SCORE	COUNT	MEASURE	S.E.	MNSQ	ZSTD	MNSQ						
ZSTD CORR.	EXP.	OBS%	EXP%	ITEM									
-----+-----+-----+-----+-----+-----													
1	1387	300	-1.24	.15	1.26	2.50	2.10	3.70	.57	.64	79.6	79.6	
B1													
2	1317	300	.20	.14	1.09	1.02	1.07	.57	.68	.71	74.2	74.4	
B2													
3	1360	300	-.64	.15	.81	-2.07	.74	-1.53	.72	.68	79.2	78.2	
B3													
4	1340	299	-.31	.14	.77	-2.50	.66	-2.50	.76	.69	80.2	76.9	
B4													
5	1311	299	.25	.14	.80	-2.30	.79	-1.79	.77	.71	76.3	74.3	
B5													

B6	6	1356	299	-0.64	.15	.71	-3.31	.59	-2.66	.75	.68	84.9	78.3
B7	7	1378	300	-1.03	.15	.80	-2.17	.64	-1.89	.72	.66	86.4	79.3
B8	8	1274	299	.89	.13	1.02	.31	1.00	.05	.73	.73	73.7	71.5
B9	9	1307	300	.38	.13	1.16	1.75	1.09	.78	.66	.72	72.8	73.7
B10	10	1393	300	-1.38	.15	.77	-2.54	.61	-1.72	.69	.63	87.1	79.8
B11	11	1363	300	-0.70	.15	.76	-2.67	.66	-2.06	.73	.68	80.6	78.5
B12	12	1334	300	-0.12	.14	.75	-2.84	.74	-1.98	.74	.70	81.7	75.9
B13	13	1042	293	3.93	.12	1.94	8.61	2.09	9.12	.61	.81	48.9	67.0
B14	14	1326	300	.04	.14	.87	-1.39	.72	-2.30	.76	.71	82.8	75.3
B15	15	1305	299	.34	.13	1.22	2.33	1.24	1.87	.68	.72	74.1	73.9
MEAN		1319.5	299.2	.00	.14	.98	-.35	.98	-.16			77.5	75.8
P.SD		81.0	1.7	1.23	.01	.31	3.09	.48	3.05			8.8	3.4

When examined at the item level through Table 6, several items have positive and high logit measures, which indicate that these items are more difficult to agree with or less consistently mastered by respondents. The highest item is B13 = 3.93 logits, which is “I explain the concept of GIS and its importance to students. In terms of raw scores, this item also recorded the lowest average, which is around 3.56, indicating that the GIS aspect is the most challenging content component in this construct. The next items are B8 = 0.89 logit (“I analyze the issue of world population migration against population”), B9 = 0.38 logit (“I use data such as maps and graphs to facilitate students’ understanding”), B15 = 0.34 logit (“I integrate values in teaching geography”), B5 = 0.25 logit, and B2 = 0.20 logit. This pattern indicates that while the overall level of content mastery is high, more specific, analytical, and applicative aspects such as GIS, migration, geographic data usage, value integration, and resource relationships with resource management are still more challenging to master consistently.

On the other hand, items with negative logit measures are items that are easier to agree with and more commonly mastered by respondents. Among the lowest items is B10 = -1.38 logit, which is “I explain the impact of human activities on the physical environment,” followed by B1 = -1.24 logit (“I master concepts in topographic maps such as direction, scale, distance, and position”) and B7 = -1.03 logit (“I understand the impact of natural vegetation and wildlife on ecosystems”). Other items that are also at a negative level are B11 = -0.70 logit, B3 = -0.64 logit, B6 = -0.64 logit, B4 = -0.31 logit, and B12 = -0.12 logit. This shows that teachers have more mastery of the basic and core content of geography, especially related to topography,

weather and climate, ecosystems, the physical environment, sustainability, and the relationship between physical systems and humans.

The average item score results found that the item with the highest score was B10 (around 4.64), followed by B1 (around 4.62), B7 (around 4.59), B11 (around 4.54), and B6 (around 4.54). On the other hand, the lowest item mean score was B13 (around 3.56), followed by B8 (around 4.26) and B9 (around 4.36). This finding is in line with the item logit measure, namely, items with low logit tend to have higher mean scores, while items with high logit record lower means. This confirms that geography content that is more fundamental and closely aligned with daily instructional practices is mastered more effectively than content that is more technical and specialized. In terms of item quality in Table 4.12, all items show positive PTMEA CORR values, which are between 0.57 and 0.77, indicating that all items move in the direction of the Content Mastery construct and contribute positively to the measurement, and it is identified that the items can still contribute to the construct.

Overall, the findings of Rasch analysis show that the level of content mastery of geography teachers is high. This finding is supported by the high mean of person measure and exceeding the mean of item measure, a high average raw score, the presence of some extreme respondents at maximum score, very good person and item reliability, and a satisfactory separation value. However, the item analysis shows that more technical and specialized content, such as GIS, migration analysis, and the use of geographic data, is still a more challenging aspect compared to more basic geography content. Therefore, although the level of content mastery is at a high level, there is still room for improvement, especially in strengthening the mastery of more complex, technical, and application-oriented content in geography teaching.

The study findings show that geography teachers' content mastery is at a high level. Content mastery is the main foundation of teacher professionalism and a prerequisite for effective curriculum implementation (Hanifah et al., 2019; Smit et al., 2023). Teachers who master the content well are not only able to explain concepts accurately but are also able to connect the content of the lesson with current issues, develop spatial thinking, and plan more meaningful and problem-solving-oriented learning (Blankman et al., 2016; Smit et al., 2023). Within the framework of the 2027 school curriculum, this need becomes increasingly important as the new curriculum requires teachers to support student development holistically through more contextual, critical, and authentic learning (Malaysia, 2023b). Therefore, the finding that teachers have a high level of content mastery gives the impression that there is good professional capital to support the implementation of the curriculum reform (Hanifah et al., 2019; Malaysia, 2023b).

However, a high level of content mastery does not mean that all content dimensions are mastered equally. On the contrary, the pattern of findings shows that teachers are stronger on the basic and core content of geography but face greater challenges on the more technical, analytical, applicative, and technological content (Blankman et al., 2016; Smit et al., 2023). Literature highlights in geography education emphasize that content mastery does not only mean knowing basic facts or concepts but also includes the ability to connect content with current issues, local and global values, and relevant technology in teaching (Blankman et al., 2016; Cowie, 1978; Smit et al., 2023). Therefore, when the study findings show that teachers

are more solid in the basic sections than in the more advanced sections, this reflects that teachers' content mastery is still stronger at the level of core disciplinary knowledge than at the level of content knowledge that is transformative and applicative in nature (Mapulanga et al., 2022; Smith, 1978).

The clearest strength in basic content such as topography, weather and climate, ecosystems, the impact of human activities on the environment, and the relationship between physical systems and humans is a logical and convincing finding. These contents are a core part of the secondary school geography syllabus and are closer to teachers' daily teaching routines (Hanifah et al., 2019; Malaysia, 2023b). Because this content is taught more consistently and repeatedly, teachers are likely to have greater confidence in it, both in terms of understanding the concepts and explaining them to students (Blankman et al., 2016; Smit et al., 2023). This finding shows that teachers have mastered the core content of the discipline that is the foundation for effective geography teaching, and this is very important because without mastery of the basic content, teachers will find it difficult to build strong PCK or relate lessons to a broader context (Rawlings Smith & Rushton, 2023; Ward et al., 2015).

However, the study findings also show that the more challenging content is content that requires issue analysis, the use of geographic data, spatial interpretation, and technology integration, especially related to GIS, population migration, maps, graphs, and the integration of values in teaching content. This finding is very important because it indicates that the challenge for geography teachers is not simply in knowing the content but in mastering the content in a more contemporary, dynamic, and applicable form in the current context (Lateh & Muniandy, 2010; Rawlings Smith & Rushton, 2023). In the literature, GIS, Google Earth, story maps, AR, and VR are increasingly considered important elements in the formation of students' spatial thinking as well as in enriching the geography learning experience (Bos et al., 2021; Hursen & Beyoğlu, 2025; Turan et al., 2018). Studies in Malaysia have shown that teaching geography integrated with GIS has the potential to increase student motivation and engagement, indicating that this technical content is increasingly becoming part of the core competencies of modern geography teachers (Bikar et al., 2022; Lateh & Muniandy, 2010). Therefore, study findings that show that content such as GIS and data use are more challenging should be understood as an indication that teachers are still in the process of moving from traditional content mastery to more digital, spatial, and application-oriented content mastery (Bikar et al., 2022; Lateh & Muniandy, 2010; Sebastián López et al., 2023).

From a theoretical perspective, these findings can be explained more clearly through the Pedagogical Content Knowledge (PCK) framework. According to Smith et al. (2023), content mastery is only truly meaningful when teachers can translate disciplinary content into a form that students can understand, taking into account student misconceptions, classroom context, and appropriate teaching strategies. This means that teachers may know a topic conceptually but may not necessarily be able to teach it effectively if the topic requires skills in data interpretation, technology application, or connections to current issues (Mapulanga et al., 2022; Smit et al., 2023). In the context of this study's findings, the challenges of more technical and applicative content indicate that teachers' PCK development may still be stronger on basic content than on content that requires more complex integration between knowledge, technology, and pedagogy (Reitano & Harte, 2016; Smit et al., 2023). Therefore, the issue of content mastery in this study should not be interpreted as a lack of facts or

concepts alone but as an issue of inconsistency in content development between the basics and those requiring more advanced pedagogical translation (Blankman et al., 2016; Smit et al., 2023).

Another important dimension of these findings is the challenge of integrating value aspects into content teaching. Geography content mastery is not defined simply as mastery of concepts and facts but also as the teacher's ability to connect content with local and global values (Blankman et al., 2016; Martínez-Martín et al., 2024). This is very relevant because geography is a subject that is loaded with social dimensions, the environment, sustainability, place identity, and human relationships with space. Therefore, when value integration is found to be more challenging than basic content, this finding indicates that teachers may be more comfortable teaching geography content at the information and explanation level, but not all are able to consistently connect it with the dimensions of values, ethics, and social responsibility (Lickona, 1997; Malaysia, 2023b). In the context of the 2027 school curriculum, this is very significant because the curriculum places the development of a prosperous person and meaningful learning among its main cores (Malaysia, 2023a). Therefore, high content mastery but not accompanied by solid value integration can cause teaching to be accurate from an academic perspective but lacking depth from a holistic student development perspective.

The findings of this study can also be synthesized with the issue of teacher professional development. The content mastery gap can be reduced through intensive training, lesson study, e-professional development, and professional learning communities to help teachers strengthen PCK and integrate content with pedagogy (Alimuiddin et al., 2021; Blankman et al., 2016; Manicio et al., 2023). In this context, the study findings indicate that relative weaknesses in technical content such as GIS, migration, geographic data use, and value integration do not necessarily reflect permanent weaknesses but rather content areas that require more focused professional development interventions (Bikar et al., 2022; Lateh & Muniandy, 2010; Tsehay Mengistie, 2025). This is also consistent with the finding that short-term training can increase teachers' knowledge, but mastery of more complex skills still requires ongoing support and professional development (Blankman et al., 2016; Reitano & Harte, 2016). Therefore, the findings of this study are actually very useful not only for indicating the level of content mastery but also for identifying which content requires further training support.

From a broader perspective, these findings imply that the implementation of the 2027 School Curriculum will depend largely on the extent to which teachers' content mastery develops from basic content to more critical, digital, and applicative content (Malaysia, 2023b; Smit et al., 2023). The new curriculum demands students who are able to think critically, connect knowledge to real issues, and evaluate the world in a more global and sustainable way (Malaysia, 2023b). In the subject of geography, this demand can only be met if teachers are not only solid in basic content but also competent in integrating data, geospatial technology, migration issues, sustainability, and values in teaching (Bikar et al., 2022; González González & Pisabarro, 2024; Lateh & Muniandy, 2010). Therefore, the finding that teachers are stronger on basic content than more advanced content not only explains the existing level of professionalism but also indicates the direction of improvement that needs to be prioritized

to ensure that content mastery is truly in line with the curriculum aspirations and demands of contemporary geography education.

Overall, the study findings show that the level of content mastery of geography teachers is high, but the strength is more prominent in the basic and core content of the discipline compared to more technical, analytical, data-based, technological, and application-oriented content (Hanifah et al., 2019; Smit et al., 2023). The synthesis of the findings of this study shows that content mastery has been strong at a certain level but still requires enrichment at a level that is more in line with contemporary geography and the 2027 School Curriculum (Lateh & Muniandy, 2010; Malaysia, 2023a). Therefore, content mastery in the context of this study needs to be seen as a dynamic dimension of professionalism, which needs to be continuously strengthened through training, technological support, and pedagogical development so that teachers can move from basic content mastery to more critical, spatial, digital, and meaningful content mastery for 21st-century students.

### **Conclusion and Recommendations**

This study found that the level of pedagogical practice and content mastery of secondary school geography teachers in Malaysia is at a high level based on Rasch model analysis. This finding answers the study's objective, which aims to assess the level of pedagogical practice and content mastery of geography teachers. The mean person measure for both constructs, which exceeds the mean item measure, shows that the respondents have a good tendency and ability towards the items that measure both constructs. This illustrates that geography teachers have a strong professional foundation in implementing teaching, especially in terms of the use of pedagogical strategies as well as mastery of concepts and main themes in the subject of geography.

However, the study findings also show that the high level does not occur evenly across all aspects. In terms of pedagogical practices, teachers are more likely to implement interactive, collaborative, and student-centered approaches, such as discussing social issues, doing group activities, using visual materials, and developing communication skills. However, more authentic and complex pedagogical practices such as fieldwork, project-based learning, practical experiences, and inquiry strategies are still more challenging to implement consistently. In terms of content mastery, teachers are more solid in basic and core geography content such as topographic maps, weather and climate, ecosystems, and the physical environment, while more technical, analytical, and applicative content such as Geographic Information Systems, migration analysis, the use of geographic data, and the integration of values still needs strengthening.

In this regard, geography teachers are advised to expand the use of more authentic, contextual, and student-experience-based pedagogical approaches. Geography teaching should not only focus on explaining concepts in the classroom but should instead provide space for students to explore, investigate, interpret, compare, and connect geography knowledge with the realities of life. Therefore, the implementation of fieldwork, project-based learning, inquiry-based learning, problem-solving, and the use of geographic data should be strengthened so that geography learning becomes more meaningful, active, and oriented towards real applications.

In addition, teachers also need to improve their mastery of technical and contemporary content, especially related to geographic information systems, the use of maps and graphs, geographic data analysis, migration issues, sustainability, and human-environmental relationships. Mastery of basic content such as topography, weather and climate, and ecosystems needs to be maintained, but teachers also need to move towards mastery of content that is more analytical, digital, spatial, and oriented towards current issues. This is important so that teachers can deliver geography content more accurately, relevantly, and in line with the development of current geography education.

Schools, especially geography committee leaders, are advised to plan professional development activities with a greater focus on two main aspects, namely authentic pedagogy and technical content mastery. Internal workshops, best practice sharing sessions, professional learning communities, peer mentoring, and lesson studies can be implemented to help teachers share more effective teaching strategies. Geography committees can also plan specific programs such as fieldwork workshops, project-based learning module development, training in the use of geographic information systems, map and graph analysis, and teaching based on current issues. School support in terms of time, facilities, teaching aids, and access to technology is very important so that teachers can implement more innovative and authentic geography teaching.

At the grassroots level, the Malaysian Ministry of Education is recommended to provide more specialized, phased, and continuous professional training for geography teachers. General training needs to be strengthened with modules that focus on discipline-specific geography pedagogy such as fieldwork, inquiry-based learning, project-based learning, the use of geographic data, and the integration of geospatial technology. In addition, content mastery training also needs to be given attention, especially for more challenging topics such as geographic information systems, migration analysis, the use of maps and graphs, sustainability issues, and data applications in teaching. Such training can help teachers master more complex skills and apply them more confidently in the classroom.

Teacher training institutions such as the Institute of Teacher Education and faculties of education in universities are also advised to strengthen the geography teacher training curriculum by giving a clearer emphasis on authentic pedagogical practices and contemporary content mastery. Teacher trainees need to be trained not only to understand teaching theory but also to plan and implement fieldwork, project-based learning, inquiry learning, and the use of geospatial technology and geographic data analysis. Practical training such as microteaching, teaching simulations, geography module design, place-based assignments, and the use of digital maps and Geographic Information System applications needs to be expanded so that prospective teachers are better prepared to teach geography in a meaningful, contextual, and student-experience-based way.

Overall, although geography teachers in Malaysia demonstrate a high level of pedagogical practice and content mastery, there is still room for improvement in more complex, authentic, and application-oriented aspects of current education. Therefore, teacher professional development efforts need to be implemented continuously, focused, and evidence-based. The use of the Rasch model in this study has provided a clearer empirical picture of the strengths and challenges of geography teachers, thus helping stakeholders plan

more accurate training, interventions, and professional support to improve the quality of geography teaching in secondary schools.

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