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Pedagogical and Content Knowledge: Geography Teachers' and Students' Perceptions

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Abstract

This convergent parallel mixed-methods study, grounded in a pragmatist worldview, explored the perceptions of geography teachers' pedagogical and content knowledge (PCK) in secondary schools across five central-eastern regions of Bhutan. The research involved 42 teachers (22M and 21F) and 139 students (69M and 70F), selected through stratified random and purposive sampling, with additional interviews conducted with 10 teachers and 10 students. Descriptive analysis was performed on survey data, while interviews were analysed using thematic analysis. The findings revealed that both teachers and students have a comprehensive understanding of PCK and its critical role in effective content delivery. While participants expressed positive perceptions of teachers' PCK, the study identified significant challenges, including limited subject knowledge, resource constraints, and time limitations, underscoring the need for continuous professional development. Teachers employed various strategies to address these challenges, such as leveraging social media, co-teaching, and engaging in self-reflection. The study highlights the positive impact of strong PCK on teaching and learning outcomes and emphasises the necessity of subject-specific training to bridge the gap between pedagogical knowledge and practical application. However, the exclusive focus on geography limits the study's generalisability, suggesting that further research with a larger and more diverse sample is required to comprehensively understand the factors influencing PCK.

Keywords: Pedagogical knowledge, content knowledge, perceptions, geography teachers, geography students, benefits, challenge

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Introduction

Pedagogical Content Knowledge (PCK) integrates teachers' subject matter expertise with their pedagogical skills. Shulman (2004) emphasised that PCK enables teachers to employ effective pedagogical practices grounded in deep content knowledge, thereby making learning meaningful for students. The Bhutan Professional Teachers' Standard (2020) highlights the importance of PCK in classroom instruction for ensuring effective teaching and learning. While much of the research on PCK has concentrated on science and mathematics, studies examining its role in geography education remain limited (Lane, 2009, 2011, 2015; Park & Olivia, 2008; Patra & Guha, 2017). This study underscores the need to explore PCK within the context of geography.

Research indicates that PCK is critical for fostering interest and improving the quality of geography education. For instance, Sanina (2019) reported that students often perceive geography as challenging, which leads to diminished interest. Similarly, Brooks (2006) observed a decline in the quality of geography education in England and Wales due to insufficient subject content knowledge among teachers. In the United States, negative perceptions of social studies, including geography, have been linked to inadequate teacher PCK (Chapin, 2006; Zhao & Hoge, 2005). Lane (2009, 2011, 2015) highlighted a strong relationship between teachers' PCK and students' learning outcomes.

Global frameworks, such as the International Charter on Geographical Education [ICGE] (1992) and Morgan et al. (2005), advocate for geography teachers to specialise in both content and pedagogical knowledge to enhance student engagement and achievement. Patra and Guha (2017) further emphasised the correlation between PCK, effective teaching practices, and student success.

In Bhutan, the importance of PCK has been recognised through initiatives such as the Ministry of Education's professional development programmes on 21st Century Transformative Pedagogy. However, challenges persist. Halim et al. (2012) observed that teachers often focus on curriculum delivery rather than assessing students' understanding. Dorji (2009) noted that Bhutanese teachers frequently fail to implement the methods and strategies acquired through training in real classroom settings. Additionally, geography educators face difficulties teaching complex topics such as map projections, GIS, and remote sensing due to inadequate PCK. Consequently, student performance in geography remains low, with a national average score of 48.58% (Pupil Performance Report [PPR], 2021).

Given these challenges and the limited research on PCK in geography, this study examined secondary geography teachers' and students' perceptions of teachers' PCK and its impact on teaching and learning.

The main rsearch question is What are teachers' and students' perceptions to teachers' PCK in teaching learning Geography?

To address the main question the following sub questions were posed:

i. What are the effects of Pedagogical Content Knowledge (PCK) on teaching and learning geography?
ii. How do teachers integrate Pedagogical Content Knowledge (PCK) into their geography teaching practices?

Literature Review

Defining Pedagogical Content Knowledge

The concept of PCK was first introduced by Lee Shulman in 1986, highlighting its importance as a knowledge base that allows teachers to transform content into effective pedagogical strategies (Shulman, 1986, 1987; Verloop et al., 2001). PCK integrates subject matter knowledge with pedagogical knowledge, encompassing the understanding of what to teach, how learners learn, and how to facilitate effective learning (Shulman, 1986, 1987, 2004). Different researchers have offered varied definitions of PCK. Magnusson et al. (1999) highlighted the importance of transforming content knowledge into effective teaching practices, whereas Rohan et al. (2009) emphasised the use of instructional strategies tailored to address learners' misconceptions. De Jong (2009) distinguished PCK as discipline-oriented and separate from general pedagogical knowledge.

Understanding the Components of PCK

Shulman (1987) defined PCK as a blend of content and pedagogical knowledge tailored to meet diverse learners' needs. Since its introduction, PCK has gained attention in teacher education, particularly in science and mathematics. Researchers have deconstructed PCK into various components to better understand its structure and application. For instance, Grossman (1990) and Magnusson et al. (1999) proposed a model for science teachers encompassing knowledge of instructional strategies, student understanding, assessment, curriculum, and teachers' conceptions of teaching science. Pajares (1992) highlighted the significant influence of teachers' beliefs on their PCK. Rollnick et al. (2008) introduced a model that includes learners' prior knowledge and subject matter representations. Additionally, Park and Oliver (2008) emphasised teachers' efficacy as a critical element of PCK.

While many models have been developed for science and mathematics education, geography education has seen limited exploration of PCK. Some researchers have examined geography teachers' PCK through case studies (Blankman et al., 2015; Lane, 2009; Lane, 2015), but these findings may not be broadly applicable (Hong et al., 2018). They proposed the GeoKBT model for geography teaching, identifying six key components: orientations toward teaching geography, knowledge of geography curricula, understanding students' responses to geography learning, instructional strategies for geography, assessment methods in geography learning, and educational contexts.

Despite various models being widely implemented, debates continue regarding the role of content knowledge within PCK itself. Kind (2009) highlighted differing views on whether content knowledge is part of PCK or a separate foundation. In Shulman's original proposal, content knowledge was not considered a part of PCK but was viewed as one of the seven essential teacher knowledge bases. Turner (1999) argued that PCK cannot be separated from content knowledge, while Gess-Newsome (2015) noted that although content knowledge is a source for developing PCK, it is not an integral component.

Content Knowledge of Geography Teachers

Content knowledge is a core component of PCK and refers to teachers' understanding of their subject matter. De Jong (2009) and Ryan and McCrae (2005) described it as encompassing discipline-specific processes and concepts. Halim (2010) emphasised that mastery of subject content is crucial for effective teaching, while Rusdi (2017) noted that pedagogical content knowledge is linked to understanding a subject differently than experts do. For geography teachers, substantial content knowledge is essential, not only to teach it effectively but also to transform this knowledge into teachable forms while fostering responsible citizenship among students (Blankman et al., 2015). Shulman (1987) further highlighted the importance of curriculum knowledge in understanding educational materials and their use in teaching contexts.

Pedagogical Knowledge of Geography Teachers

Teachers' pedagogical knowledge involves understanding how to convey knowledge effectively. Hanifah et al. (2019) defined it as encompassing classroom management and appropriate teaching methods. Shulman explained that this includes knowing why certain topics may be challenging for students and how to represent them effectively.

Hong (2018) categorised pedagogical knowledge into three types: instructional strategies useful for teaching geography, strategies for helping students understand specific concepts, and the ability to combine various instructional methods effectively. Effective teachers employ diverse strategies to enhance learning experiences (Harichandan et al., 2013).

Teachers' Knowledge of Students

Knowledge about learners encompasses understanding students' preconceptions and learning difficulties related to geography topics (Shulman, 1986). Hong (2018) asserted that this includes recognising students' prior knowledge and experiences. Gipps and Brown (1999) argued that understanding students' abilities is crucial for selecting appropriate teaching strategies.

York (2014) emphasised that teachers should recognise each student's unique skills and experiences to tailor instruction effectively, fostering an engaging learning environment where students can thrive.

Students' Perception of Teachers' PCK on Teaching and Learning

Uner and Akkus (2019) argued that student perceptions are a valuable source for examining and understanding teachers' PCK. This is especially important because, Jang (2010) pointed out, teachers in traditional classrooms often hold a high level of authority and may become self-centred, making it challenging to reflect on their own teaching and PCK. By considering students' perceptions, teachers can assess their PCK, identify effective knowledge types for student learning, and enhance teaching quality. Understanding students' perspectives also helps to identify learning needs and encourages reflection on instructional methods (Halim et al., 2014).

Similarly, Senocak (2009) argued that teachers must consider students' perceptions to understand their learning. Halim et al. (2013) stated that students' perceptions reflect the quality of their teachers and how effectively teachers address their learning needs. Understanding these perceptions helps identify learning needs and supports both teachers and students in enhancing their teaching and learning. Knight and Waxman (1991) noted that students' perceptions may partially reflect the realities of the teaching situation. Uner and Akkus (2019) reinforced that

students' perceptions are valuable for evaluating teachers' PCK as they offer insights into the effectiveness of instructional practices. Exploring these perceptions can help researchers understand perceived instructional and contextual factors, leading to improved educational practices.

Teachers' Perception of Their PCK on Teaching and Learning

There is limited literature on how teachers perceive their own PCK, with most studies focusing on pre-service teachers. Choy et al. (2012) emphasised the role of pre-service teachers' perceptions in shaping their teaching effectiveness. Guler-Nalbantoglu and Aksu's study found that pre-service science teachers often perceive their PCK as strong but lacks understanding of students' learning needs. This study aims to explore in-service geography teachers' perceptions of their PCK, as most research on PCK focuses on pre-service, novice, and prospective teachers, with few studies examining in-service teachers (Puteh, 2014).

Importance of Geography Teachers' PCK

Incorporating PCK in geography education is crucial due to the subject's multidisciplinary nature, which demands a clear conceptual understanding and strategies that cater to the diverse needs of learners (Ondigi, 2012). Geography should be taught by well-trained specialists who are both knowledgeable in their discipline and skilled in geographical education practices (Reitano & Harte, 2016). Effective teaching depends not only on subject mastery but also on the application of appropriate pedagogical methods that address student needs (Jones & Moreland, 2015; Oumnia, 2022). Understanding the significance of key concepts enables educators to design lessons that effectively address students' prior knowledge and misconceptions. In conclusion, examining geography teachers' PCK is essential for enhancing educational practices and improving student outcomes by employing effective teaching methodologies that cater to diverse learner needs.

Methodology

Grounded in the pragmatist paradigm (Creswell & Creswell, 2018), this study used a convergent mixed-methods design to examine teachers' and students' perceptions of geography teachers' pedagogical and content knowledge. According to Creswell (2014), mixed methods integrate both qualitative and quantitative data within a single study. In the convergent design, qualitative and quantitative data are collected and analysed separately before being merged for interpretation (Creswell & Plano Clark, 2018; Schoonenboom & Johnson, 2017). This approach allows for comparing and validating results from different perspectives. Through surveys and interviews with secondary geography teachers and students from five dzongkhags in central-eastern Bhutan, this study provides insights into the impact of teachers' PCK on geography classrooms.

Research Context and Participants

This study targeted secondary geography teachers and students from central-eastern Bhutan, selected based on accessibility, location, and academic performance in Geography, as reported in the 2021 Pupil Performance Report (PPR). A combination of purposive and stratified random sampling techniques was used.

Purposive sampling selected 10 geography teachers (5M, 5F) and 10 students (5M, 5F) from Grades IX to XII for semi-structured interviews, ensuring participants could provide specific insights relevant to the research questions (Bhardwaj, 2019; Maxwell, 1996). Stratified random

sampling was employed to collect survey data. The survey included 139 students (69M, 70F) and 42 teachers (22M, 20F), ensuring a representative sample by dividing the population into subgroups and randomly selecting participants from each stratum (Cohen et al., 2018; Nikolopoulou, 2022).

Data Collection

This study employed a survey questionnaire, semi-structured interviews, and document analysis (lesson plans) to collect data.

Survey Questionnaire

Surveys allow researchers to collect data from a sample or entire population to describe, compare, relate, or predict their attitudes, opinions, behaviours, characteristics, or knowledge (Creswell, 2012, 2018). Two separate online survey, for teachers and students, were constructed to gather quantitative data on the teachers' and students' perception of teachers' PCK. This study utilised a six-point Likert scale survey administered online, offering a convenient and efficient method for collecting data from a geographically dispersed population (Taherdoost, 2019). Two separate online survey questionnaires were designed for both teachers and students based on six-point Likert scale: 1= Strongly Disagree, 2=Disagree, 3=Slightly Disagree 4=Slightly Agree, 5=Agree and 6=Strongly Agree. The survey themes were predetermined and consisted of Section A which involved demographic information of the participants and Section B involved items related to teachers' and students' perception to teachers' pedagogical and content knowledge. The survey consisted of 5 themes with 51 items for teachers' survey (see Appendix A) and 38 items for student's survey (see Appendix B). The themes for teachers' survey: 1) teachers' Pedagogical and Content knowledge (5 items); 2) Components' of Pedagogical and Content Knowledge which includes, teachers' Content Knowledge, teachers' Pedagogical knowledge and teachers' knowledge of students (18 items); 3). Effect of teachers' PCK on teaching and learning (6 items); 4) Challenges of PCK (14 items); and 5) Ways to address the challenges of PCK (8 items). Likewise, the themes for student survey: 1) Teachers' PCK (17 items), 2) Components of PCK which includes teachers' content knowledge, pedagogical knowledge and knowledge of teachers (27 items); 3) effects of teachers' PCK on teaching and learning (9items). For this survey, 42 teachers and 139 students were involved.

A Cronbach's Alpha Coefficient test was conducted on survey data, yielding a value of 0.96 from 10 teachers in the pilot test and 0.93 from 139 students in the final collection, indicating high reliability. Hulin et al. (2001) noted that alpha values between 0.6 and 0.7 are acceptable, with values closer to 1.00 indicating greater reliability (Mertens, 2010).

Semi-Structured Interviews

This study employed semi-structured email interviews to explore teachers' and students' perceptions of pedagogical content knowledge (PCK), challenges related to PCK, and strategies for improvement (Creswell & Creswell, 2018). Combining open-ended questions with predefined themes, this method allowed for in-depth exploration and flexibility to adapt to emerging insights (Bernard, 2018; Liamputtong, 2009).

Document Analysis

Document analysis involves the examination of public or private documents to obtain data (Bowen, 2009; Creswell & Creswell, 2018). In this study, lesson plans were analysed to supplement the findings from surveys and interviews, providing additional context and validation.

Data Analysis

The study employed a mixed-methods approach to analyse teachers' and students' perceptions of geography teachers' pedagogical and content knowledge (PCK) in Bhutanese secondary schools. Descriptive statistics, such as mean and standard deviations, were calculated for survey data. Thematic analysis was employed to identify patterns or themes within the qualitative data (Maguire & Delahunt, 2017). The data from interviews and document analysis were coded and organised based on predetermined themes, allowing for a comprehensive understanding of the challenges and opportunities of PCK. Member checking was used to verify the accuracy of transcribed interview data. In addition, data from the three sources were triangulated to ensure reliability and a comprehensive understanding. The study obtained prior approval from participants, and pseudonyms were used to ensure confidentiality when interpreting the data.

Results and Discussion

The findings are presented undre the following eight themes namely Teachers' and Students' Perceptions of Teachers' PCK, Components of Pedagogical and Content Knowledge, Teachers' and Students' Perceptions of Pedagogical Knowledge, Teachers' and Students' Perceptions of Teachers' Knowledge of Students' Prior Knowledge and Misconceptions, Integration of Pedagogical and Content Knowledge, Effect of PCK on Teaching and Learning, Positive effect of Teachers' PCK on Learning, and Benefits of Teachers' Pedagogical Content Knowledge.

Theme 1: Teachers' and Students' Perceptions of Teachers' PCK

This theme explored the teachers' and students' understanding and perceptions of the geography teachers' PCK, which is defined as the integration of subject matter knowledge and pedagogical expertise (Shulman, 2004).

The findings revealed that both teachers and students generally possess a strong understanding of PCK, recognising its crucial role in effective teaching and learning. Most teachers (n=8) described PCK as a combination of content knowledge and pedagogical expertise, essential for delivering lessons effectively. They demonstrated their understanding through their awareness of geographical concepts and the use of various instructional strategies, such as lectures, field study, problem-based learning, co-teaching, group activities, and project-based learning. Similarly, the majority of students (n=7) perceived PCK as a pivotal tool employed by teachers to facilitate effective content delivery. Both groups highlighted PCK's importance in making complex subject matter accessible and promoting meaningful learning experiences. This aligns with Shulman's (1986) framework, which emphasises the integration of subject matter and pedagogy to make content comprehensible.

The quantitative results from both teachers and students revealed generally positive perceptions of the teachers' pedagogical and content knowledge. As shown in Table 1, the average mean for Theme 1: Teachers' Perception of Their PCK is 5.17, with a standard deviation of 0.42,

indicating a highly positive perception. This suggests that 100% of teachers (M = 5.17, SD = 0.42) have a strong belief in their pedagogical and content knowledge. Furthermore, the majority of participants demonstrated high confidence in their ability to select and integrate effective teaching strategies, as reflected by the highest mean score of 5.29 for Statement 4, with a standard deviation of 0.67.This suggested that teachers feel proficient in their capacity to employ instructional methods that enhance the effectiveness of content delivery. Similarly, the survey results of the students also showed a positive perception of teachers' PCK with an overall mean score of 5.06 and a Standard Deviation of 0.65 (Table 1). The majority (95%) of the participants agreed that their geography teachers have adequate PCK to teach geography.

Conversely, the lowest mean score of 5.05 for statement 5, which pertains to teachers' need for improvement in pedagogical and content knowledge, indicated a slightly lower level of confidence. This indicated that a few teachers showed a low level of PCK and acknowledged the need for further enhancement of their pedagogical and content knowledge. The qualitative data supported this finding, revealing that while most teachers expressed confidence in their PCK, some acknowledged deficiencies. These gaps were often attributed to a lack of specialised pedagogical training or challenges in adapting to different grade levels. Teachers emphasised the importance of continuous professional development to stay updated with evolving educational practices and enhance their PCK for effective teaching.

These insights underscore the critical role of PCK in shaping meaningful teaching and learning experiences in geography classrooms. The findings highlight the need for ongoing professional development and self-reflection among teachers to improve their PCK, ultimately benefiting student engagement and learning outcomes. In this context, Dorji and Sherab (2009) emphasised that teachers should possess strong subject knowledge and a willingness to reflect on their pedagogical practices to deliver lessons that captivate learners. Similarly, BPST (2020) noted that effective teaching stems from a solid grasp of subject content, effective classroom practices, a passion for learning, and a belief in the transformative power of education. Thus, the findings reaffirm that teachers' PCK is a cornerstone of the teaching and learning process, directly influencing the quality of education and student success.

Table 1

Teachers' and Students' Perception to their Teachers' Pedagogical Content Knowledge

Theme 1	**N**	**Mean**	**std. D**	**Level of perception**
Techers	42	5.17	.42	Highly positive
Students	139	5.07	.65	Positive

Theme 2: Components of Pedagogical and Content Knowledge

This theme focused on three fundamental elements of PCK in geography education: content knowledge, pedagogical knowledge, and knowledge of students, emphasising geography teachers' expertise in their subject, their ability to implement effective teaching strategies, and their understanding of students' prior knowledge and misconceptions.

Theme 2.1 : Teachers' and Students' Perceptions of Content Knowledge

Table 2

Teachers' Perception to their Content Knowledge

No. of Items	Mean	Std. D	Level of Perception
1. I have sufficient content knowledge of my subject	4.88	.86	Positive
2. I have knowledge about theories and principles related to the subject matter	4.88	.67	Positive
3. I have a full understanding of geography curriculum programs, materials, and specific topics within the geography curriculum.	4.88	.83	Positive
4. I am competent to teach all the topics in my subject including map works, practical, time calculation, GIS, QGIS, and remote sensing.	4.43	.74	Moderately Positive
5. I can explain the importance and usefulness of the subject matter in the real world to my students.	5.43	.55	Highly Positive
Total	4.90	.49	Positive

Table 3

Students' Perception to their Teachers' Content Knowledge

	Mean	Std. D	Level of Perception
1. My teacher has adequate knowledge of subject she/she is teaching.	5.09	.82	Positive
2. My teacher clearly explains the subject matter	5.04	.96	Positive
3. My teacher has knowledge about theories and principles related to the subject matter.	5.16	.85	Positive
4. My teacher selects the appropriate content for students.	5.12	.92	Positive
5. My teacher knows the answers to questions that I ask about the subject or topic.	5.16	.89	Highly Positive
6. My teacher explains the importance and usefulness of the subject matter in the real world.	5.15	.92	Highly Positive
7. My teacher knows how to link information with one another.	5.14	.85	Positive

8.	My teacher has a full understanding of geography curriculum programs, materials, and specific topics within the geography curriculum.	5.02	.89	Positive
	Total Mean	5.11	0.68	Positive

The quantitative analysis of both teachers' and students' perceptions of teachers' content knowledge (CK) in geography revealed generally positive evaluations, with teachers' mean score at 4.90 (SD = 0.49) and students' mean score at 5.11 (SD = 0.68), as shown in Tables 2 and 3. Teachers reported a strong ability to connect subject matter to real-world applications, as indicated by the highest mean score of 5.43. However, a few teachers faced challenges in specific areas such as map work, practical exercises, time calculation, GIS, QGIS, and remote sensing, reflected in a lower mean score of 4.43. These challenges could be attributed to a lack of subject-specific and topic-focused professional development.

In contrast, students had highly positive perceptions, with 100% agreeing that their teachers possess adequate CK, supporting the literature that correlates strong teacher CK with effective student learning (Harlen & James, 1997; Jones & Moreland, 2015).

Additionally, the qualitative findings from both teachers and students supported the quantitative findings. The findings revealed that the majority of teachers (n=7) had a positive perception of their content knowledge, while a few teachers (n=3) acknowledged their limitations. These limitations were attributed to factors such as limited teaching experience, lack of specialised training, and the complexity of certain topics, as illustrated by teachers' statements on the challenges of teaching theoretical and scientific content in geography (P3, P8). These findings align with the arguments of Shulman (1987) and Hong (2018), who emphasise that effective teaching necessitates a profound understanding of the curriculum, specialized geography programmes, and relevant educational materials.

Further, student interviews (N=8) consistently highlighted positive perseptions of their teachers' CK, attributing teachers' proficiency to their extensive teaching experience. The unanimous student confidence in their teachers' subject knowledge was significant, as it reflected a high level of trust in their instructional capabilities. This was further supported by the analysis of lesson plans across different grade levels, which demonstrated teachers' proficiency in content knowledge (CK). For example, the lesson plan demonstrates the teacher’s solid content knowledge, as evidenced by the clear learning objectives, use of diverse methods such as KWL charts, Group activities, roundtable concept mapping, team presentation and extended learning activities to engage students. Additionally, the use of formative assessment such as concept mapping, group discussion, presentation and extended questions allows for a comprehensive assessment of student understanding. Teacher expertise in subject matter ensures that these strategies translate into a meaningful outcome.These findings align with existing literature, which stresses the importance of mastering subject content to ensure teaching effectiveness (Blankman et al., 2015; Halim, 2010; Harlen & James, 1997). In conclusion, while the study revealed a generally positive perception of teachers' CK, it also highlighted the need for ongoing professional development and targeted training to address specific content challenges, thereby enhancing the quality of geography education.

Theme 3: Teachers' and Students' Perceptions of Pedagogical Knowledge

The analysis of both quantitative and qualitative data revealed that teachers and students hold a positive perception of teachers' pedagogical knowledge (PK) in geography education. Quantitative findings showed that 90% of teachers believed they possessed adequate PK for teaching geography effectively, with a mean score of 5.10 and a standard deviation of 0.52 (Table 4). This indicates teachers' confidence in their ability to utilise diverse teaching methods to convey subject content effectively. These findings align with existing literature emphasising the critical role of PK in fostering student understanding (Hanifah et al., 2019; Shulman, 1986; Shulman, 1987).

Table 4

Teachers' Perception to their Pedagogical Knowledge

	Mean	Std. D	Level of Perception
1. I can help my students enhance their thinking skills by designing challenging tasks and monitoring their learning.	5.17	.70	Highly Positive
2. I can adapt my teaching style to diverse learners in the classroom to help students comprehend specific geography concepts or topics.	4.98	.60	Positive
3. I can use a wide range of teaching approaches including ICT in a classroom setting based upon the student's learning abilities and needs.	5.02	.71	Positive
4. I am familiar with common student understandings and misconceptions	5.05	.67	Positive
5. I know how to organize and maintain classroom management.	5.31	.64	Highly Positive
6. I can assess student learning in multiple ways.	5.12	.60	Positive
Overall Mean	5.10	.52	Positive

Qualitative data from teacher interviews further supported these findings, with the majority of teachers (n=10) reporting the use of various instructional strategies, including 21st-century pedagogies, active learning, and traditional methods. Examples included collaborative learning, project-based learning, and ICT integration, demonstrating adaptability to diverse student needs (Harichandan et al., 2013; Meyer & Rose, 2005). However, a few teachers (n=4) still relied on lecture methods, often due to content complexity, time constraints, or limited pedagogical knowledge. These findings aligned with previous studies suggesting that Bhutanese teachers do not consistently implement diverse strategies in classroom settings (Dorji, 2009; Halim et al., 2012). A likely reason for this is that teachers are comfortable with their established methods and

may be reluctant to embrace change or take on the role of change agents.

Students also held a positive perception of their teachers' PK, with a mean score of 5.03 and a standard deviation of 0.70 (Table 5), indicating that they recognised their teachers' ability to employ various teaching strategies effectively. Student interviews also confirmed that teachers use multiple strategies, such as group work, project-based activities, and technology, to enhance engagement and learning. However, a detailed analysis of the lesson plans presents a contrasting perspective. The lesson plans predominantly indicate a reliance on similar instructional approaches, such as activity-based and problem-based strategies, with a significant emphasis on lecture methods. Furthermore, experiential learning opportunities, such as field trips, were seldom integrated into the lesson plans. This disparity highlights an incongruity between students' perceptions of teaching practices and the instructional methodologies formally documented in the lesson plans.

Table 5

Students' Perception to their Teachers' Pedagogical Knowledge

	Mean	Std. D	Level of Perception
1. My teacher uses a variety of teaching approaches to transform subject matter into comprehensible knowledge.	4.98	.747	Positive
2. My teacher uses appropriate examples to explain concepts related to subject matter.	5.24	.797	Highly Positive
3. My teacher provides opportunities for me to express my views in the class.	5.14	.918	Positive
4. My teacher provides constructive feedback, and support when I encounter difficulties in learning geographical concepts.	5.06	.858	Positive
5. My teacher's teaching methods keep me interested in the subject.	4.98	1.025	Positive
6. My teacher uses different methods to assess my performance and learning in the classroom.	5.05	.927	Positive
7. My teacher designs challenging and engaging activities that keeps me interested in the subject.	4.94	1.111	Positive
8. My teacher uses varied teaching approaches to stimulate learning.	4.91	.872	Positive
9. My teachers' teaching methods boost my thinking skills of geographical concept.	4.99	.917	Positive
Overall mean	5.03	.70	Positive

In addition, students emphasised the importance of interactive and collaborative methods, such as group discussions and project-based activities, which foster active learning and enhance student engagement. A few students (n=3) also noted that their teachers integrate technology, incorporate real-world examples, and employ flexible teaching methods, including remedial classes for low achievers, to cater to diverse learning needs. This comprehensive approach aligns with Sherab and Choden's (2020) assertion that teachers play a pivotal role in shaping the classroom environment and influencing students' attitudes. However, the lesson plan analysis showed that teachers frequently relied on similar instructional methods, rather than incorporating a wider variety of strategies to address diverse student needs effectively.

In conclusion, the study underscores the importance of strong PK in geography education, highlighting the need for continuous professional development to enhance teachers' instructional skills. Effective geography teachers adapt their methods to cater to diverse student needs, fostering a more engaging and meaningful learning experience. This study aligns with existing literature, reinforcing the value of diverse pedagogical strategies in promoting effective teaching and learning in geography education.

Theme 4: Teachers' and Students' Perceptions of Teachers' Knowledge of Students' Prior Knowledge and Misconceptions

Table 6

Teachers' Perception to their Knowledge of Students

	Mean	Std. D	Level of Perception
1. I am aware of my student's prior knowledge and experience that they bring along to the classroom.	5.14	.69	Positive
2. I can adapt my teaching based on the student's prior knowledge.	5.24	.58	Highly Positive
3. I can identify the learning difficulties of the students in the classroom.	5.10	.70	Positive
4. I respect and listen to the different opinions of my students in the classroom	5.40	.70	Highly Positive
5. I can adapt different assessment techniques based on the student's level of learning.	5.10	.43	Positive
6. I can choose appropriate teaching strategies and adjust the pace of instruction based on my student's learning needs.	5.19	.68	Highly Positive
7. I know how to design activities based on the student's interest and their level of understanding.	5.02	.57	Positive
Total	5.17	.43	Highly Positive

Table 7

Students' Perception to their Teachers' Knowledge of their Students

	Mean	Std. D	Level of Perception
1. My teacher recalls students' prior knowledge at the beginning of the lesson.	4.91	.98	Positive
2. My teacher is aware of the students' learning difficulties of the subject matter.	4.80	1.01	Positive
3. My teacher knows about my understandings and misconceptions of the geographical concepts in the classroom.	4.58	1.09	Positive
4. My teacher's questions evaluate my understanding of a topic	4.85	.82	Positive
5. My teacher uses different assessment methods to evaluate my understanding of the subject/topic.	4.94	.73	Positive
6. My teacher pays attention to students' reactions during class and adjusts his/her teaching method.	5.06	.91	Positive
7. My teacher knows about my weakness and strengthens in learning.	4.53	1.19	Positive
8. My teacher designs interesting and challenging activities.	4.89	1.03	Positive
9. My teacher creates a classroom circumstance to promote my interest for learning.	4.75	1.04	Positive
10. My teacher provides an appropriate interaction and a good classroom atmosphere.	4.98	.83	Positive
Overall mean	4.82	0.70	Positive

Tables 6 and 7 show the teachers' and students' perceptions of teachers' knowledge of students' prior knowledge and misconceptions. Both the quantitative and qualitative findings showed a positive perception among teachers and students regarding teachers' knowledge of their students' prior knowledge and misconceptions in geography. Quantitative results revealed that teachers have a high level of awareness of their students' prior knowledge and misconceptions, with an overall mean score of 5.17 and a standard deviation of 0.43. This suggested that teachers perceive themselves as knowledgeable about their students' backgrounds, which is crucial for effective teaching (Shulman, 1986).

Qualitative findings supported these results, with the majority of teachers (n=9) emphasising the importance of understanding students' prior knowledge and misconceptions as a key component of Pedagogical Content Knowledge (PCK). This awareness enables teachers to identify common misconceptions, address learning difficulties, and build confidence and trust in the classroom (Hong, 2018). Additionally, several teachers (n=4) highlighted that knowledge of students' prior understanding allows them to differentiate instruction, modify lessons, and select appropriate teaching strategies to meet diverse learner needs, aligning with the recommendations of Gipps and Brown (1999) and Hattie and Yates (2014).

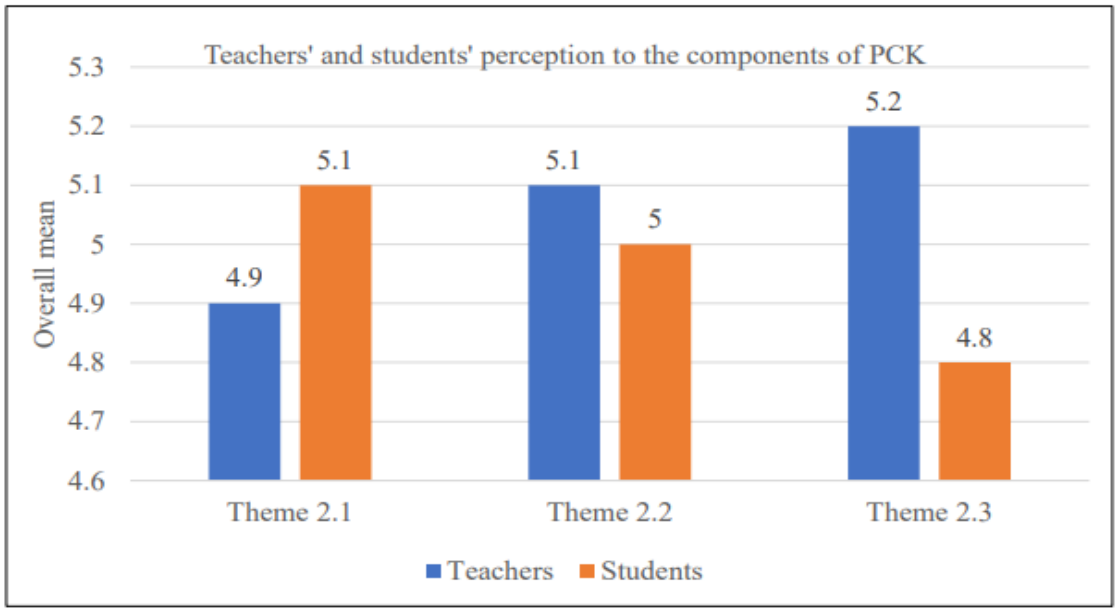
Students' perceptions were similarly positive, with an overall mean score of 4.82 and a standard deviation of 0.70, indicating that the majority of students agreed that their teachers were aware of their prior knowledge and misconceptions. Qualitative data from student interviews corroborated this, as most of the students (n=5) reported that their teachers use strategies such as revising previously learned lessons, conducting remedial classes, and providing personalised support to address individual learning needs. This approach is consistent with the principles of differentiated instruction, which emphasise tailoring teaching methods to students' specific learning needs (Hill & Chin, 2018; Williamson & Watson, 2007).

Overall, both quantitative and qualitative findings highlighted the significance of teachers' knowledge of their students' prior knowledge and misconceptions in promoting effective teaching and learning. Teachers who possess a deep understanding of their students' backgrounds are better equipped to design engaging, inclusive, and meaningful learning experiences, as supported by existing literature on PCK (Hattie & Yates, 2014; Shulman, 1986). The study highlights the dynamic nature of effective pedagogy, emphasising the need for teachers to continually adapt their instructional approaches to accommodate diverse student needs and foster a positive learning environment.

The comparison of teachers' and students' perceptions regarding three components of Pedagogical Content Knowledge (PCK)—Content Knowledge, Pedagogical Knowledge, and Knowledge of Students—revealed some key insights as reflected in Figure 1. Teachers exhibited a generally positive perception of their PCK, with a slightly higher emphasis on Knowledge of Students. However, they rated their Content Knowledge lowest among the three components. This suggests that while teachers believe that they understand their students well, they may underestimate their content expertise, aligning with the view that teachers often focus more on pedagogy than content mastery (Shulman, 1986).

Figure 1

Comparison of teachers' and students' perception to three components of PCK.

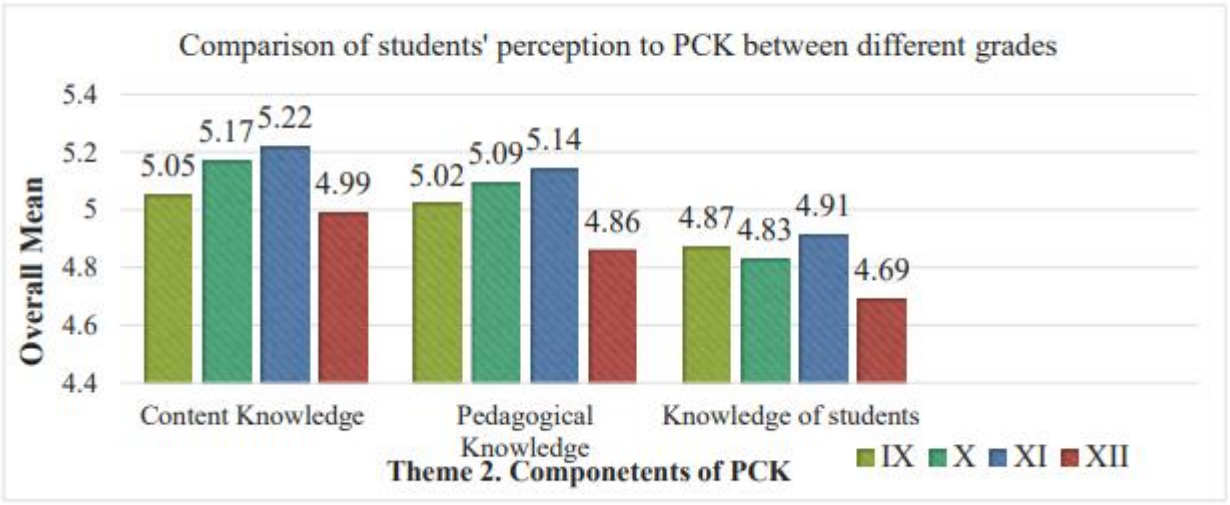


Students rated their teachers' Content Knowledge as the strongest area, followed by Pedagogical Knowledge and Knowledge of Students. This difference reveals a potential disconnect between how teachers perceive their understanding of students and how students view it. While teachers believe they are aware of students' prior knowledge, students feel their teachers are less attuned to their existing knowledge and misconceptions, indicating a gap in personalised instruction (Jang, 2010). This finding supports York's (2014) argument that teachers must understand students' unique skills and experiences to deliver effective, tailored instruction. Although students recognise their teachers' strengths in content knowledge and pedagogy, they highlight the need for greater focus on addressing individual learning needs.

Further analysis showed that students' perceptions of their teachers' PCK vary across grade levels. Students in grades IX and X reported positive perceptions of their teachers' Pedagogical and Content Knowledge, with mean scores ranging from 5.02 to 5.17, which may reflect simpler curriculum content and greater familiarity with teachers' styles as reflected in Figure 2. However, grade XII students showed slightly lower perceptions, with mean scores of 4.99 and 4.69 for Content and Pedagogical Knowledge, respectively. This decline could be due to the increasing complexity of the curriculum and possible gaps in specific subject-related training for teachers. The findings also resonate with Jang et al. (2009), who noted that students often feel their teachers lack awareness of their learning difficulties, particularly in diverse and large classrooms.

Figure 2

Comparison of students' perception to three components of PCK in relation grades



The disparity in perceptions between teachers and students suggests the need for teachers to engage more actively with students to understand and address their individual learning needs. Effective communication, student-centred approaches, and strategies that align with students' prior knowledge are essential for bridging this gap (Uner & Akkus, 2019). Additionally, encouraging feedback and reflection can help teachers refine their PCK, ensuring that it encompasses not only content and pedagogy but also a deep understanding of students (Rudduck et al., 1996).

In conclusion, while both teachers and students recognise the importance of PCK, there are differences in how each group perceives its components, particularly Knowledge of Students. Addressing these differences is crucial for enhancing the overall effectiveness of teaching and learning. Future research could further investigate these perceptual gaps and explore strategies to align teachers' self-perceptions with students' experiences, ultimately fostering a more inclusive and effective educational environment

Theme 5: Integration of Pedagogical and Content Knowledge

The integration of Pedagogical Content Knowledge (PCK) is vital for effective teaching, particularly in geography education. Initially conceptualised by Shulman (1986), PCK represents the fusion of content knowledge with pedagogical strategies to transform subject matter into meaningful and engaging learning experiences.

The findings revealed that geography teachers generally feel confident in applying PCK, as supported by both qualitative and quantitative data. Teachers reported using diverse instructional strategies, including active learning, collaborative methods, project-based learning, and technology integration. The choice of strategies is influenced by factors such as the nature of the topic, classroom size, student needs, and available resources. Despite recognising the importance of PCK, teachers face challenges such as limited subject-specific training, large class sizes, and resource constraints (Artvinli, 2010; Kaya, 2018).

Theme 6: Effect of PCK on Teaching and Learning

The study explored the impact of teachers' pedagogical content knowledge (PCK) on teaching and learning geography, focusing on both teacher and student perceptions. Quantitative data showed that students generally have a positive view of their teachers' PCK, with an overall mean score of 5.08, indicating that students believe PCK significantly influences their learning. The highest mean score (5.43) is associated with students feeling valued when teachers address their learning difficulties, underscoring the importance of teacher-student interaction in supporting learning (Jang, 2010; Mishra & Koehler, 2006). However, the motivation to learn geography scored lower (mean of 4.97), suggesting that teachers could improve their ability to inspire students, aligning with Tuan et al. (2000) and Jang et al. (2009), who emphasise the role of engaging teaching strategies that stimulate student interest.

Qualitative findings align with the quantitative results, with students highlighting the positive effects of teachers' PCK on their learning. They noted that teachers' teaching styles, the use of diverse methods, and the ability to explain complex ideas effectively enhance their understanding and engagement (Uner & Akkus, 2019). Students also value teachers who come prepared and use varied teaching methods, which aligns with Harichandan et al. (2013) and Meyer and Rose (2005), who emphasise the importance of dynamic and multifaceted teaching approaches.

Teachers also perceive a positive effect of their PCK on teaching and learning, as reflected in the overall mean score of 5.23. They emphasised the role of PCK in decision-making, reflection, and student engagement, consistent with Blankman et al. (2015) and Mishra and Koehler (2006). However, the slightly lower score in addressing students' learning difficulties indicates a potential area for further development (Jones & Moreland, 2015).

The study concluded that strong PCK enables teachers to select appropriate teaching

strategies, create engaging classrooms, address learning difficulties, and foster critical thinking and problem-solving skills. Conversely, poor PCK can negatively affect content delivery and student engagement. These findings reinforce the critical role of PCK in effective teaching and learning, as supported by various studies (Jones & Moreland, 2015; Meyer & Rose, 2005; Mishra & Koehler, 2006).

Theme 7: Positive effect of Teachers' PCK on Learning

Teachers' pedagogical content knowledge (PCK) is instrumental in shaping students' learning experiences, with all participants (n=10) acknowledging its significant influence. Teachers with strong PCK can enhance students' understanding by simplifying complex concepts, effectively blending pedagogical strategies, and catering to diverse learning needs (Harlen & James, 1997; Tuan et al., 2000; Jang, 2010). Additionally, PCK contributes to creating a positive learning environment that fosters motivation and engagement, ultimately leading to better academic outcomes (Kultsum, 2017; Harichandan et al., 2013; Sherab & Choden, 2020). Conversely, poor PCK can hinder effective teaching and student engagement, underlining the necessity for continuous professional development to enhance PCK and improve educational outcomes (Reitano & Harte, 2016). This study aligns with existing literature, reinforcing the critical role of PCK in geography education and its impact on teaching quality and student learning.

Theme 8: Benefits of Teachers' Pedagogical Content Knowledge

Teachers' Pedagogical Content Knowledge (PCK) is pivotal in enhancing geography education due to the subject's multidisciplinary nature, which demands comprehensive expertise in both content and pedagogy (Ondigi, 2012; Reitano & Harte, 2016). The study reveals a consensus among both teachers (n=10) and students (n=10) regarding the positive impact of PCK on teaching and learning. The benefits include:

1. Effective Content Delivery: Teachers with strong PCK are adept at blending subject matter expertise with pedagogical strategies, which improves content delivery and addresses student misconceptions (Hong et al., 2018; Meyer & Rose, 2005). This ability to adapt instructions based on students' needs enhances engagement and understanding.
2. Catering to Diverse Learning Needs: PCK enables teachers to differentiate instruction and address diverse learning needs, including identifying and correcting misconceptions. This adaptability helps in meeting varied student requirements and promoting accurate learning (Gipps & Brown, 1999; Jones & Moreland, 2015).
3. Fostering Critical Thinking: Strong PCK empowers teachers to design challenging activities that stimulate critical thinking and problem-solving skills. By using diverse pedagogical strategies, teachers encourage students to analyse data and develop solutions, fostering essential skills for lifelong learning (Williamson & Watson, 2007).
4. Creating a Positive Learning Environment: Teachers' PCK contributes to effective classroom management and a positive learning climate. This environment supports student engagement and motivation, making learning more enjoyable and productive (Harichandan et al., 2013; Jang et al., 2009).
5. Professional Growth: PCK promotes continuous professional development through self-reflection and adaptation of teaching practices. Teachers who engage in reflective practices

are more likely to enhance their teaching methods and professional skills (Uner & Akkus, 2019).

In conclusion, geography teachers' PCK is essential for effective teaching and learning. It facilitates content delivery, addresses diverse needs, fosters critical thinking, creates a positive learning environment, and supports professional growth, benefiting both educators and students.

Conclusion, Limitations, and Recommendations

The study highlighted the critical role of PCK in enhancing teaching and learning in geography classrooms in Bhutan. Both teachers and students acknowledged the positive impact of PCK on content delivery and student engagement. However, challenges such as limited subject knowledge, resource constraints, and inadequate professional development continue to hinder the effective application of PCK. Addressing these gaps is essential to improving teaching quality and student outcomes in Bhutanese secondary schools.

Limitations

The sample size is limited to secondary geography teachers and students from only five regions, potentially excluding the diverse perspectives of teachers and students from other geographical contexts or educational levels. This restricts the ability to generalise the findings to the broader population of geography educators and learners.

Smilary, this study used the mixed-method approach, while comprehensive, relies on self-reported data from surveys and interviews, which may introduce bias. Additionally, the document analysis of lesson plans may not fully reflect the dynamic aspects of classroom teaching. Furthermore, focusing solely on secondary classes (IX to XII) limits insights into the influence of PCK on teaching and learning at lower educational levels.

Recommendations

1. **Expand Sample Size and Diversity**:

   Future research should consider including geography teachers and students from additional regions, as well as schools with varied demographic, cultural, and socio-economic contexts, to ensure a more comprehensive and representative analysis.

2. **Longitudinal Studies**:
   To better understand the impact of teachers' PCK on student learning outcomes, longitudinal studies that track changes over time and across grade levels could be implemented.

3. **Classroom Observations**: Incorporating direct classroom observations as a data collection method would provide richer insights into the practical application of PCK and its impact on teaching strategies and student engagement.

4. **Strengthen Professional Development**: Continuous professional development programmes focused on subject-specific training, particularly in complex areas like GIS, remote sensing, and map projections, should be prioritised to improve teachers' content knowledge.

5. **Enhance Resource Allocation**: Schools should be equipped with the necessary resources, such as updated geography tools and access to technological support, to aid teachers in applying PCK effectively in the classroom.

6. **Promote Collaborative Learning**: Encouraging co-teaching and peer learning among teachers will foster the sharing of best practices and the development of innovative pedagogical strategies.

7. **Focus on Student-Centred Approaches**: Teachers should be supported in adopting more interactive and diverse teaching methods that cater to students' prior knowledge and promote active learning, ensuring PCK is fully utilised for student engagement.

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