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Identifying the Relationship between Content Knowledge and Pedagogical Knowledge at the University Level

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***Abstract*:**In recent years, exploring how teachers' mastery of subject content and instructional strategies shapes student performance in higher education has been the key focus. Although much study has been conducted on these aspects in elementary and secondary education, there is still a need for a thorough investigation of their collective impacts in the university setting. This research addresses this deficiency by examining the influence of instructor topic knowledge and pedagogical abilities on student success in higher education. This study uses a casual comparative research design to attain its aims, using a descriptive and quantitative technique. A dataset was obtained from Bahauddin Zakariya University Multan, consisting of 592 individuals who were either university students or staff members. The survey included demographic data and 30 questions that covered the teacher's understanding of the subject matter, teaching methods, and student performance. After being collected, the data were inputted into the Statistical Package for Social Sciences (SPSS) program to conduct statistical analysis. Data analysis included using mean, standard deviation, frequencies, percentages, correlation, and regression analysis. Most instructors overwhelmingly agreed that the level of accomplishment of university students is significantly impacted by the teacher's depth of expertise in the subject matter and their ability to teach effectively. Nevertheless, the regression analysis revealed that the results did not attain statistical significance ($p > 0.05$), indicating a lack of significant influence between instructor subject knowledge, pedagogical abilities, and student accomplishment at the university level. Teachers should talk with their students about lesson design, classroom management, and assessment procedures to improve their teaching effectiveness and student results.

Keywords: Content knowledge, Pedagogical knowledge, Achievement, Higher Education

1. Introduction

Educational research has focused on the importance of teacher subject knowledge and pedagogical expertise in improving student accomplishment at the university level (Amjad 2022, a, b). Teacher topic knowledge refers to educators' extensive comprehension of the subject matter they teach. This comprises a comprehensive range and profound understanding of information, including fundamental concepts, principles, ideas, facts, and problem-solving methodologies (Ong et al., 2024). Teaching effectiveness is strongly linked to a teacher's expertise in the subject matter, which allows for precise and relevant education, promotes student learning, and effectively addresses any misunderstandings or challenges that may emerge in the classroom (Tabbasam et al.,

2023; Tabassum et al., 2024). Multiple studies regularly show a robust correlation between the knowledge teachers possess in their subject matter and the academic performance of their students. Teachers who possess extensive topic knowledge can effectively include students, foster the development of advanced thinking abilities, and adjust their teaching methods to accommodate the different requirements of their students (Hill et al., 2008; Qureshi et al., 2023). On the other hand, those with a poor understanding of the subject matter frequently find it challenging to articulate intricate ideas, recognize typical misunderstandings among students, or provide alternate explanations to facilitate learning (Shafqat & Amjad, 2024).
Teacher content knowledge is often classified into two main dimensions: subject knowledge and student knowledge. Content knowledge refers to the teacher's comprehension of the subject matter, including its organization and the relationships between different concepts or themes. This encompasses fundamental principles, theories, past viewpoints, research approaches, practical implementations within the field, and the broader framework in which the topic functions (Amjad 2020, 2021, 2023, a, b, c). Understanding students' knowledge entails comprehending their learning processes and unique obstacles when obtaining information in a certain area. This includes the user's current understanding, misunderstandings, typical challenges, and successful teaching methods to overcome these difficulties. Teachers who deeply understand their students can predict and address their needs, customize education to accommodate their unique peculiarities, and provide appropriate assistance when required (Rosenshine, 2012).
Efforts to improve teachers' subject knowledge should be ongoing and should include both classroom experience and professional development opportunities. The purpose of assigning topic-specific homework in pre-service teacher education programs is to solidify students' grasp of course material. Nevertheless, studies indicate that these programs often fail to cultivate profound topic expertise, instead prioritizing broad educational methods (Wilson et al., 2001). Continual professional development is crucial for improving teachers' understanding of the subject matter. Engaging in subject-specific seminars, conferences, collaborative lesson planning, and coaching may enhance instructors' comprehension of the subject matter and the teaching methods. Teachers may learn from one another, share materials, and participate in idea exchanges by joining subject-specific professional organizations or communities of practice (Amjad et al., 2024, a, b, c). According to Darling-Hammond et al. (2009), it is crucial to constantly learn and reflect by doing research, analyzing newly published works, and keeping up with developments in the field.
Engaging in reflective techniques, such as critically analyzing student work and thoroughly evaluating instructional materials, enables instructors to discover specific areas to enhance their topic understanding. Pedagogical skills refer to the methods, approaches, and competencies instructors use to assist successful teaching and enhance student learning. The abilities included in this list are lesson design, classroom administration, instructional delivery, assessment, differentiation, and providing an engaging and supportive learning environment. Proficient pedagogical abilities are crucial for successfully communicating subject matter, involving students in significant learning encounters, and addressing the requirements of a varied student population. Research continually demonstrates the importance of having good pedagogical abilities in improving student success and learning outcomes. Efficient teaching methods are linked to higher student involvement, drive, and academic achievement (Hattie, 2008; Marzano, 2007).
Conversely, inadequate educational abilities might result in pupils being disinterested, having a restricted grasp of subjects, and achieving inferior academic results. Teachers with proficient pedagogical abilities strategically design lessons, considering learning objectives, the order in which information is presented, instructional methods, and suitable resources and materials. The individuals guarantee that the educational material complies with the established educational standards and adapt their teaching approaches to meet the diverse needs of students (Tomlinson & Moon, 2013). Skilled teachers use various teaching methods to include students in learning actively. They utilize straightforward and succinct language, precise explanations, and suitable questioning tactics to encourage critical thinking and enhance comprehension. In addition, they use multimedia, interactive activities, and technology to augment the learning process (Puentedura, 2014).
Proficient classroom management abilities empower educators to establish constructive and organized learning settings, cultivating a nurturing and all-encompassing atmosphere that encourages reverence, collaboration, and favorable social exchanges (Özen & Yildirim, 2020). Competent instructors use formative and summative evaluations to track student progress, pinpoint areas of learning deficiency, and provide prompt feedback. These evaluations are based on the learning goals and allow students to showcase their comprehension (Black & Wiliam, 1998). Assessment data guides instructional choices and customizes teaching to address the varied requirements of students. Differentiation tactics modify instructional approaches to accommodate diverse student requirements, preferences, and capabilities. Differentiated teaching includes providing further

assistance, stimulating extensions, or alternate routes for learning (Tomlinson, 2014).

Enhancing pedagogical abilities is an ongoing journey encompassing initial teacher education, continuous professional development, introspection, and peer cooperation (Guskey& Yoon, 2009). The impact of instructors' topic knowledge on student accomplishment in higher education is crucial in determining the quality of education. Teachers with extensive knowledge in their subject area benefit students' learning outcomes, level of involvement, and academic achievements. They can give excellent teaching, effectively explain intricate ideas, provide practical illustrations, and establish a link between theory and application, improving students' understanding and involvement (Hill et al., 2005). Teachers with a deep understanding of the subject matter can successfully explain and clarify difficult topics. They offer many viewpoints, analogies, and alternate explanations to cater to different learning styles and correct misunderstandings (Hill et al., 2008). This facilitates the development of robust groundwork and enhances pupils' comprehension of the topic. Teachers' level of topic knowledge directly impacts their capacity to foster higher-order thinking abilities. Teachers with a deep understanding of the subject matter can create and execute teaching methods that promote critical thinking, analysis, synthesis, and assessment (Darling-Hammond, 2017). This promotes cognitive development, problem-solving skills, and enhanced involvement in the subject matter. Research has shown a favorable correlation between the level of knowledge that instructors possess in their subject matter and the academic performance of their students. In their study, Hill, Rowan, and Ball (2005) discovered a positive correlation between the subject expertise of mathematics instructors and the academic progress of students in mathematics at the university level.

In their study, Hill et al. (2008) discovered a positive correlation between instructors' robust topic knowledge and their ability to enhance student success and cultivate conceptual comprehension. These studies emphasize the importance of teachers' expertise in their subject matter in shaping students' academic performance at the university level. Proficient educators with extensive knowledge in their respective fields provide impactful teaching, elucidate intricate ideas, foster critical thinking, rectify misunderstandings, and tailor education to accommodate a wide range of student requirements. At the university level, student success is greatly influenced by pedagogical abilities. The abilities mentioned include designing and delivering education, effectively managing the classroom environment, assessing student learning, and adjusting instructional techniques to accommodate different student requirements (Amjad & Malik, 2024).

Skilled teachers use several methods to actively involve students, including problem-based learning, collaborative learning, and inquiry-based approaches. These techniques encourage students to think critically, analyze information, and apply knowledge (Prince, 2004). These tactics bolster student involvement and lead to a more profound comprehension and enhanced academic performance. Research highlights the significance of teaching abilities in promoting student success at the university level. Proficient educators who use captivating teaching methods, maintain efficient classroom control, adapt instruction to individual needs, provide valuable feedback, and encourage active participation lead to enhanced student performance and academic triumph (Prince, 2004; Marzano & Marzano, 2003).

Combining subject knowledge and teaching abilities is essential for improving student performance at the university level. This article examines the influence of these elements on student achievements, using up-to-date research and emphasizing methods for cultivating and enhancing these crucial teaching skills.

1.1 Research Objectives

1. To assess teachers' opinions of their content knowledge.
2. To examine teachers' impressions of pedagogical knowledge.
3. To determine the correlation between teachers' content knowledge, pedagogical knowledge and students' achievements.
4. To determine the impact of teachers' content and pedagogical knowledge on students' achievements.

1.2 Significance of the Study

This study investigates the influence of teachers' expertise in subject matter and teaching methods on the academic performance of university students. It emphasizes the significance of comprehending these aspects to enhance teaching methods, develop curriculum, and enhance overall educational excellence. The results can guide teacher preparation programs, including focused instruction and coursework to cultivate the skills and abilities of future educators. The research further guides the designing and implementing professional development programs for university professors, specifically focusing on improving their topic knowledge and pedagogical abilities. This can enable faculty members to improve their teaching methods and enhance student performance. The study also offers valuable insights into curriculum design, guaranteeing the harmonization of topic knowledge, teaching methodologies, and intended student outcomes. Faculty members can utilize evidence-based teaching methods that optimize student involvement, interactive learning, and

analytical thinking, thus enhancing student success. The study's results immediately affect student learning and achievement, allowing educators to apply evidence-based strategies that improve student involvement, understanding, and performance. Enhanced student performance can result in increased academic accomplishments, elevated graduation rates, and enhanced readiness for future professional or academic endeavors.

1.3 Theoretical Framework

In order to fully understand the relationship between instructor subject knowledge, pedagogical skills, and student achievement at the university level, researchers may employ many theoretical frameworks in their analysis. Two well-known theoretical frameworks that might direct this study are:

1.3.1 Pedagogical Content Knowledge (PCK)

Shulman introduced a theoretical framework in 1986, highlighting the need to combine subject knowledge with pedagogical expertise. The PCK theory asserts that successful teaching involves both a profound comprehension of the subject matter (content knowledge) and the capacity to convert that knowledge into pedagogically sound instructional tactics. Within the study's framework, PCK offers valuable insights into the impact of the amalgamation of a teacher's topic knowledge and pedagogical abilities on student accomplishment. The framework facilitates the identification and study of certain elements of pedagogical content knowledge (PCK) that enhance student achievements in the university context.

1.3.2 Cognitive Load Theory (CLT)

CLTis a theoretical framework by Sweller (1988) that centers on the mental operations linked to learning and the efficient management of mental strain during the course of study. CLT posits that learning is impacted by the constrained capacity of the working memory and how instructional materials are delivered. Within the study's framework, the Communicative Language Teaching (CLT) theory may provide insight into how instructors' pedagogical abilities, such as their instructional planning and delivery, influence student academic performance. According to the idea, proficient educators can handle the cognitive load by using efficient teaching methods, delivering lucid explanations, and organizing learning activities to promote student comprehension and minimize cognitive overload. The research aims to investigate the interaction and impact of teacher subject knowledge and pedagogical skills on student accomplishment at the university level by combining the Pedagogical subject Knowledge framework and the Cognitive Load Theory. The theoretical framework is a guiding tool for the study design, data collection, and analysis. It provides a perspective to analyze the intricate interaction between the variables involved.

For further theoretical support, the framework may use relevant models and ideas, including social cognitive theory, constructivism, and the principles of effective education. A teacher's subject knowledge and pedagogical talents significantly impact student performance in higher education. These theories help us comprehend the cognitive, social, and motivational aspects that contribute to this relationship. This study employs a theoretical framework combining Pedagogical subject Knowledge with Cognitive Load Theory to comprehensively explain the relationship between students' achievement and teachers' topic knowledge and pedagogical abilities. In order to raise the bar for higher education teaching and learning, the framework makes it easier to study specific components, procedures, and pedagogical approaches that produce better outcomes.

2. Design of the Research

Using a casual comparative research design, the study used a descriptive and quantitative approach to accomplish its goals. We contacted Bahauddin Zakariya University Multan for the necessary data for this investigation. Information was collected from teachers and students at BZU using a questionnaire that included a five-point Likert scale. The scale consisted of items rated from "Seldom" to "Always". A rating system based on three points, including the expressions "Higher level, Moderate level, Lower level," was also used for instructors. The findings were derived via a quantitative study of the data. The researcher chose male and female lecturers and students from Bahauddin Zakariya University Multan as the study's population. The instructor population was estimated at 171, although the student count was unspecified.

A simple random sample strategy was used in the data collection procedure. The researcher and supervisor have collaborated to create a structured questionnaire that will be administered to both students and teachers. The researcher and their supervisor collaborated to develop the tool. The two parts of the questionnaire are both concerned with the research topic. An essential aspect to consider in education is the integration of instructors' subject matter competence and instructional skills. Two separate tools were autonomously created, one specifically tailored for pupils and the other for instructors. Two distinct questionnaires have been created, including 30 things for students and 30 items for instructors. Students are asked to rate the things on a

five-point Likert scale, from "seldom" to "always." Part one of the survey was administered using a Likert scale, while part two was administered using a Rating scale.
Mean, standard deviation, correlation, regression, and frequency were only a few of the data analysis methodologies used to carry out the complicated analysis successfully. We put these principles into practice using SPSS (version 22) and Excel (MS).

3. Analysis

Table 1: Statement Analysis of student's Responses

Sr. No	Statements	Mean	SD
1	Your teachers understand the main idea of Subject Knowledge	3.04	1.325
2	Your teachers present the detailed and sequential lesson Plan	3.05	1.188
3	Your teachers convey your lesson confidently	3.24	1.397
4	Your teachers update your Subject Knowledge	3.27	1.281
5	Your teachers relate concepts with everyday life experiences	3.17	1.334
6	Your teachers associate examples with the subject	3.21	1.273
7	Your teachers can cultivate critical thinking skills inside you.	3.17	1.324
8	Teachers can help students define terms correctly	3.02	1.224
9	University resources are available to your teachers	2.95	1.254
10	Your teachers have the capability to provide a concise overview of the lesson at the conclusion of the class	3.14	1.224
11	Prior to instruction, your teachers communicate the learning goals to you	2.83	1.186
12	Your teachers have sufficient competence to formulate the goals of the lesson	3.14	1.310
13	Your teachers have the ability to provide lessons while considering the desired results	3.07	1.249
14	Learning outcomes are assessed by your teachers at the conclusion of each class	3.07	1.311
15	Your teachers can design effective lesson introduction	3.18	1.218
16	Your teachers can plan previous knowledge questions for you	3.13	1.223
17	Your teachers can plan the learning activities	3.15	1.253
18	Your teachers can use audio visual aids	3.07	1.254
19	Your instructors have the ability to create evaluation tasks for you	2.97	1.161
20	Your instructors may design review questions for you to reinforce your understanding of the material	2.84	1.241
21	Your teachers will assess instructional objectives after class	2.90	1.180
22	Teachers have the ability to provide lessons to students via a variety of approaches.	3.09	1.343
23	To facilitate the creation of educational material on the topic being taught	3.07	1.092
24	Teachers has the ability to use a diverse range of teaching methodologies to cater to the needs of various types of learners	2.93	1.183
25	The teacher's voice is clearly heard while delivering the information	3.04	1.245
26	Your instructors suddenly conclude lessons without reiterating crucial elements	3.00	1.201
27	Teachers use group exercises when needed	3.00	1.207
28	Teachers provide guided practice to you	3.14	1.204
29	Teachers use the lecture method along with the discussion method	3.18	1.248
30	Teachers use probing for you	3.19	1.257

Table 1 shows the analysis of teacher effectiveness, based on the provided statements, reveals a mixed perception of their performance across various aspects of teaching. The data suggests that teachers generally reasonably understand their subject knowledge (Mean = 3.04, Std. Deviation = 1.325) and can effectively present detailed and sequential lesson plans (Mean = 3.05, Std. Deviation = 1.188). They are perceived to convey lessons confidently (Mean = 3.24, Std. Deviation = 1.397) and update their subject knowledge regularly (Mean = 3.27, Std. Deviation = 1.281). Teachers also relate concepts to everyday life

experiences (Mean = 3.17, Std. Deviation = 1.334) and provide relevant examples (Mean = 3.21, Std. Deviation = 1.273).

In developing critical thinking among students, teachers are rated moderately (Mean = 3.17, Std. Deviation = 1.324). They are somewhat effective in helping students define terms correctly (Mean = 3.02, Std. Deviation = 1.224), although the availability of university resources to teachers is slightly below average (Mean = 2.95, Std. Deviation = 1.254). Teachers' ability to summarize lessons at the end of class (Mean = 3.14, Std. Deviation = 1.224) and share learning objectives before teaching (Mean = 2.83, Std. Deviation = 1.186) shows a variance in effectiveness.

Teachers are competent in framing lesson objectives (Mean = 3.14, Std. Deviation = 1.310) and teaching with an outcome-based approach (Mean = 3.07, Std. Deviation = 1.249). However, measuring learning outcomes at the end of lessons (Mean = 3.07, Std. Deviation = 1.311) and designing effective lesson introductions (Mean = 3.18, Std. Deviation = 1.218) are areas with room for improvement. Planning questions to assess previous knowledge (Mean = 3.13, Std. Deviation = 1.223) and planning learning activities (Mean = 3.15, Std. Deviation = 1.253) are moderately well-executed.

The use of audio-visual aids (Mean = 3.07, Std. Deviation = 1.254) and the ability to design assessment exercises (Mean = 2.97, Std. Deviation = 1.161) show variability. Planning recapitulation questions (Mean = 2.84, Std. Deviation = 1.241) and assessing instructional objectives post-class (Mean = 2.90, Std. Deviation = 1.180) are areas that need enhancement. Teachers' versatility in presenting lessons using various methods (Mean = 3.09, Std. Deviation = 1.343) and developing instructional materials (Mean = 3.07, Std. Deviation = 1.092) are relatively well-rated.

Adapting teaching styles for different learners (Mean = 2.93, Std. Deviation = 1.183) and ensuring voice audibility (Mean = 3.04, Std. Deviation = 1.245) are perceived as average. Ending lessons abruptly without reiterating key points (Mean = 3.00, Std. Deviation = 1.201) and using group exercises when needed (Mean = 3.00, Std. Deviation = 1.207) indicate areas for development. Providing guided practice (Mean = 3.14, Std. Deviation = 1.204), using a combination of lecture and discussion methods (Mean = 3.18, Std. Deviation = 1.248), and employing probing techniques (Mean = 3.19, Std. Deviation = 1.257) are moderately effective strategies observed in teachers.

Overall, the analysis reflects that while teachers demonstrate competence in several areas, specific domains such as resource availability, sharing learning objectives, and the adaptability of teaching styles require further improvement to enhance overall teaching effectiveness.

Table 2. Analysis of Statements on the Use of Teaching Tools

Sr. No	Statements; Content Knowledge	Mean	SD
1	You establish connections between abstract notions and real-life events	4.40	.936
2	You possess the ability to instruct pupils in accurately defining various terms	4.24	.848
3	You have the capability to provide a concise overview of the lesson at its conclusion	4.31	1.059
4	You have a strong sense of assurance in delivering your lecture	4.30	.8885
5	You link the most recent instances with the topic at hand	4.28	.9016
6	You provide a comprehensive and step-by-step lesson plan	4.11	1.104
7	You enhance your understanding of a certain topic	4.10	1.119
8	You possess the capability to cultivate the skill of critical thinking in your pupils	3.77	1.161
9	You comprehend the central concept of the subject topic, including the whole of the lesson	3.63	1.160
10	You have access to a wide range of materials that are accessible at the institution	3.20	1.349
	Pedagogical Knowledge:		
11	Your spoken presentation to the class is clearly heard	4.30	.923
12	There are several methods available for delivering your lecture to your pupils	4.12	.807
13	You provide supervised exercises to pupils to enhance their understanding	4.20	.967
14	You possess the necessary skills and knowledge to formulate the instructional goals	4.20	.843
15	It is possible to assess the educational goals upon completion of the session	4.17	1.011
16	Prior to instruction, you communicate the learning goals to your pupils	4.20	1.074

17	You have the ability to create well-crafted class introductions	4.10	1.090
18	You use collaborative activities as necessary	3.96	1.014
19	You use the lecture approach in conjunction with the discussion method	3.99	.972
20	Learning outcomes are assessed at the conclusion of the class	3.95	.985
21	You possess the capability to create instructional content about the topic being taught effortlessly	3.95	.837
22	You have the ability to create evaluation tasks for pupils	3.94	1.020
23	You may include pre-assessment of students' prior knowledge in your lecture plan	3.99	1.182
24	You may effectively instruct lessons by considering their desired results	3.84	1.209
25	You possess the capability to use a diverse range of instructional methods tailored to the specific needs of various learners	4.00	1.002
26	You can strategize and organize educational tasks	4.00	1.254
27	An interrogative (questioning method) used to engage pupils during class	3.82	1.195
28	Audio-visual assistance may be used	3.86	1.102
29	You have the ability to design review questions	3.68	1.310
30	You quickly concluded the class without reiterating the main themes	2.78	1.296

Table 2 examines statements regarding the utilization of instructional aids, classified into Content Knowledge and Pedagogical Knowledge, together with their corresponding averages and standard deviations (SD).

Within the Content Knowledge area, instructors demonstrate a notable proficiency in connecting theoretical ideas with practical occurrences, as seen by the highest average score (M = 4.40, SD = .936). Additionally, they exhibit expertise in defining different concepts (M = 4.24, SD = .848) and delivering succinct lesson summaries at the end of their lectures (M = 4.31, SD = 1.059). In addition, instructors have high confidence in presenting lectures (M = 4.30, SD = .8885) and are skilled at linking previous examples to the current subject (M = 4.28, SD = .9016). Nevertheless, the evaluation indicates that thorough lesson preparation (M = 4.11, SD = 1.104) and improving comprehension of a subject (M = 4.10, SD = 1.119) received significantly lower ratings. The development of critical thinking skills among students (mean = 3.77, standard deviation = 1.161) and comprehension of the main instructional concepts (mean = 3.63, standard deviation = 1.160) received rather low scores. However, the element with the lowest rating is the availability of diverse resources (mean = 3.20, standard deviation = 1.349).

The whole class audibly perceives instructors' oral lectures within the Pedagogical Knowledge area, achieving a high grade (M = 4.30, SD = .923). The presence of several approaches for delivering lectures (M = 4.12, SD = .807) and the inclusion of supervised activities to improve comprehension (M = 4.20, SD = .967) are also highly regarded. Teachers have a high skill level in developing instructional objectives (M = 4.20, SD = .843) and evaluating educational objectives at the end of each session (M = 4.17, SD = 1.011). The act of communicating learning objectives prior to teaching (M = 4.20, SD = 1.074) and creating well-prepared class introductions (M = 4.10, SD = 1.090) exhibits a moderate level of effectiveness. The use of collaborative activities (mean = 3.96, standard deviation = 1.014) and the integration of lecture and discussion approaches (mean = 3.99, standard deviation = .972) provide comparable results. The evaluation of learning outcomes at the end of the class (M = 3.95, SD = .985) and the development of instructional material (M = 3.95, SD = .837) both obtain reasonable scores.

The capacity to construct evaluation tasks (mean = 3.94, standard deviation = 1.020), incorporate pre-assessment in lesson preparations (mean = 3.99, standard deviation = 1.182), and educate with intended outcomes (mean = 3.84, standard deviation = 1.209) are scored moderately. The use of various instructional approaches customized to meet the specific requirements of learners (M = 4.00, SD = 1.002) and the capacity to plan and structure educational activities (M = 4.00, SD = 1.254) demonstrate a considerably elevated level of proficiency. The use of interrogative techniques to include students (M = 3.82, SD = 1.195), the provision of audio-visual aids (M = 3.86, SD = 1.102), and the creation of review questions (M = 3.68, SD = 1.310) are considered to have lower ratings. The act of concluding courses without restating the primary topics yields the lowest results, with a mean of 2.78 and a standard deviation of 1.296.

The data suggests that instructors possess high confidence and proficiency in conveying educational material and implementing teaching methods. Nevertheless, additional improvement is needed in areas such as the growth of critical thinking skills and the accessibility of instructional materials to boost the overall effectiveness of teaching.

Table3. Correlation between Content Knowledge and Student's achievement

Correlation		**PK**	**CK**	**CGPA**
PK	Pearson Correlation	1	-0.13	-.006
	Sig.(2-tailed)		0.001	.893
CK	Pearson Correlation	-0.13	1	-.021
	Sig.(2-tailed)	0.001		.612
	N	592	592	592
CGPA	Pearson Correlation	-.006	-.021	1
	Sig. (2-tailed)	.893	.612	

The correlation between PK and CK is modest and negative, having a correlation value of -0.13. The p-value of 0.001 signifies a statistically significant connection between PK and CK. This implies a meaningful linear association, although weak and negative. The link between PK and CGPA is very small, having a correlation value of -0.006. The p-value of 0.893 indicates that there is no statistically significant association, suggesting that there is no meaningful linear link between PK and CGPA. The correlation between CK and CGPA is extremely poor, having a correlation value of -0.021. The p-value of 0.612 suggests no statistically significant evidence to support a meaningful linear association between CK and CGPA.

Table 4. ANOVA

Model		**Sum of Squares**	**Df**	**Mean Square**	**F**	**Sig.**
1	Regression	0.050	2	0.025	0.200	0.819[b]
	Residual	66.757	589	0.113		
	Total	66.807	591			

a. Dependent Variable: CGPA

b. Predictors:(Constant),CK, PK

The ANOVA findings show that the model, which incorporates instructors' Content Knowledge (CK) and Pedagogical Knowledge (PK), does not meaningfully explain students' variability ($F(2,589) = 0.200, p = 0.819$). Consequently, the research found that CK and PK do not substantially impact students' academic achievement, as shown by their CGPA.

Table5. Teachers' Pedagogical Knowledge and Students' Achievements

Coefficients[a]						
Model		**Un-standardized Coefficients**		**Standardized Coefficients**	***t***	**Sig.**
		B	Std. Error	Beta		
1	(Constant)	3.450	0.078	0.350	44.231	0.000
	PK	0.015	0.034		0.429	0.668

a. Dependent Variable: CGPA

The regression analysis indicates that no significant relationship exists between Teachers' Pedagogical Knowledge (PK) and students' Cumulative Grade Point Average (CGPA). While the intercept is statistically significant, suggesting a baseline CGPA of 3.450, the coefficient for PK is not significant (t(589)=0.429,p=0.668). Therefore, it can be concluded that PK does not significantly predict CGPA in this model.

Table 6. Teachers' Content Knowledge and Students' Achievements

Coefficients[a]						
		Un-standardized Coefficients		Standardized Coefficients		
Model		B	Std. Error	Beta	T	Sig.
1	(Constant)	3.450	0.078	-0.420	44.231	0.000
	(CK)	-0.014	0.026		-0.550	0.583
Dependent Variable: CGPA						

The regression analysis indicates that no significant relationship exists between Teachers' Content Knowledge (CK) and students' Cumulative Grade Point Average (CGPA). While the intercept is statistically significant, suggesting a baseline CGPA of 3.450, the coefficient for CK is not significant (t[589]=−0.550,p=0.583). Therefore, it can be concluded that CK does not significantly predict CGPA in this model.

3.1 Findings

Q.1 What is university educators' perspective on instructors' topic knowledge?

The analysis of the research above questions regarding teachers' perception of content knowledge indicated that the majority of university teachers strongly agreed that teachers possess the ability to update their knowledge, connect concepts to real-life experiences, offer up-to-date examples related to the subject matter, and provide a summary of the lesson after class. In addition, instructors can develop a well-designed lesson introduction to enhance students' comprehension of the lesson.

Q.2 What is the perspective of university professors about teachers' pedagogical knowledge?

Based on the analysis of the study question, the results indicate that most university professors strongly believe that it is crucial to guarantee the audibility of the lesson's oral delivery, use diverse techniques for students, and create group activities. Furthermore, assessing the instructional goals and learning outcomes at the end of the class using either probing inquiry or recapitulation testing is crucial.

Q.3 What is university students' perspective onunderstanding topic knowledge?

An analysis of the research question regarding teachers' content knowledge perception revealed that a significant majority of university students strongly agreed with the statements that teachers assist students in understanding lessons by relating them to real-life experiences and providing subject-specific examples. Additionally, it was found that teachers summarize the lesson at the end of class to ensure students' comprehension.

Q. 4 What is the perspective of university students about pedagogical knowledge?

Most university students agreed that it is important for teachers to be able to clearly articulate their ideas, that they should plan lessons ahead of time, that students should be asked thoughtful questions to gauge their progress, and that using visual and auditory aids can pique their interest in the class. Using item analysis, we examined the research question about educators' pedagogical expertise.

Q.5 How does topic understanding correlate with students' academic performance at the university level Hypothesis?

The research suggests that instructors' Content Knowledge (CK) does not substantially influencestudents' academic success, as assessed by their Cumulative Grade Point Average (CGPA) at the university level. A negative coefficient indicates a little negative correlation; however, this correlation is not statistically significant. Teachers' Content Knowledge (CK) does not substantially influence students' academic accomplishment (CGPA) at the university level.

Q.6 What is the influence of instructional expertise on students' academic performance at the university level, and what are the proposed hypotheses?

The research suggests that instructors' Pedagogical Knowledge (PK) does not substantially influence students' academic success, as assessed by their Cumulative Grade Point Average (CGPA), at the university level. A positive coefficient indicates a minimal positive correlation. However, this correlation lacks statistical significance. Teachers' Pedagogical Knowledge (PK) does not substantially influence students' academic accomplishment (CGPA) at the university level.

4. Results

i. This document presents a discussion of significant discoveries.The demographic study gathered data from Bahauddin Zakaria University Multan. The research study included participation from both male and female teachers and students representing several departments and faculties within BZU Multan.

ii. Subject and pedagogical knowledge were identified as factors based on the item analysis. Lesson objectives, evaluating instructional objectives, using diverse teaching methods, organizing activities, creating assessment exercises, using teaching aids, actively participating in the learning process, conducting review exercises, and pedagogical knowledge were the fundamental components. These components were the meat and potatoes of the variables.

iii. The teacher survey results showed that most respondents agreed with the assertions about the importance of topic and pedagogical expertise in determining college students' final grades.

iv. The student questionnaire examination indicated a low level of consensus with the questions, as well as the observation that some students disagreed with the assertions about their subject knowledge and pedagogical expertise.

v. Based on the students' replies, the regression analysis showed that the results were above the significance level of 0.05. This suggests that no discernible relationship exists between the students' degree of expertise in the subject matter, their understanding of teaching methods, and their academic performance at the university level. The results of this research have confirmed the acceptance of the null hypothesis, which posits that there is no significant relationship between a teacher's subject knowledge, pedagogical expertise, and student accomplishment at the university level.

5. Discussion

This research at the university level investigated the correlation between instructors' teachers' subject knowledge (CK), their understanding of effective teaching methods, and their pupils' academic achievement. Ball et al. (2008) examined how mathematics teachers' competence affected their students' performance in the classroom.The results indicate that instructors with a strong grasp of subject knowledge and understanding how to teach that subject were more successful in improving students' mathematics learning outcomes. Both subject matter and pedagogical topic expertise were applicable in this situation. Teachers' degree of topic understanding is crucial for enhancing student accomplishment. Research done by Hattie (2009) examined the elements that impact student achievement and found effective teaching strategies to be significant contributors to student learning. The strategies used were providing prompt feedback, formative assessment, and promoting cooperative learning. Based on this study, which investigates the strategies instructors use to help students learn, it would be advantageous for students' success if teachers discuss their methods of assessing and evaluating their progress.

The Schwille and colleagues (2007) experiment found an association between teachers' comprehension of historical topics and students' academic success. The study results indicate a strong correlation between the instructors' degree of subject matter expertise and their pupils' academic success. This study investigated the hypothesis that there is a positive correlation between instructors' subject understanding and students' success at the university

level. The topic competence of their professors significantly influences pupils' accomplishments. The authors of this study set out to determine if there was a connection between university students' performance in the classroom and their teachers' pedagogical and content knowledge (CK). Educators' content knowledge is their in-depth familiarity with the subject matter they are entrusted to educate. To be an expert in one's field, one must have a wealth of factual knowledge and conceptual understanding and a deep and abiding understanding of the subject's theory and its applications.

Ball et al. (2008) investigated how mathematics teachers' competence affected their students' performance in the classroom. The findings show that mathematics education benefits from teachers who are well-versed in both the subject matter and the best teaching practices. Both subject matter and pedagogical topic expertise were applicable in this situation. Teachers' degree of topic understanding is crucial for enhancing student accomplishment. Research done by Hattie (2008) examined the elements that impact student achievement and found effective teaching strategies to be significant contributors to student learning. The strategies used were providing prompt feedback, formative assessment, and promoting cooperative learning. Based on this study, which investigates the strategies instructors use to help students learn, it would be advantageous for students' success if teachers discuss their methods of assessing and evaluating their progress.

6. Conclusion

The majority of instructors strongly believe that the topic knowledge and pedagogical understanding of professors significantly impact students' progress at the university level. Based on regression analysis, with a significance level higher than 0.05, it was found that the results were predicted. This suggests that instructors' subject expertise and pedagogical knowledge do not correlate with their students' academic achievement in university. The current study's findings do not provide evidence to reject the null hypothesis, which contends that students' performance in college is unrelated to their degree of subject knowledge or familiarity with effective teaching methods.

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