العلاقة بين معرفة المحتوى التربوي ودافعية الانجازوتفضيل الطلاب للفيزياء لدى معلمي العلوم بسلطنة عُمان

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The Relationship Between the Pedagogical Content Knowledge, Achievement Motivation toward Students' Preferences of Physics among Teachers in Oman

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الملخص:

هدفت هذه الدراسة إلى دراسة العلاقة بين معرفة المحتوى التربوي ودافعية الانجاز وتفضيل الطلاب للفيزياء لدى المعلمين بسلطنة عُمان. هدفت الدراسة أيضًا إلى تحديد ما إذا كان دافع الإنجاز يتوسط العلاقة بين المتغيرات المستقلة (فهم طبيعة الفيزياء، وتفضيل الطلاب للفيزياء). تكونت عينة الدراسة من 523 معلماً ومعلمة من معلمي العلوم بالمدارس الحكومية في سلطنة عُمان، وقد تم اختيارهم بالطريقة العشوائية الطبقية للإجابة على أسئلة الدراسة من جميع محافظات سلطنة عُمان. استخدمت الدراسة المنهج الكمي لتحقيق أهداف الدراسة، وتم جمع البيانات باستخدام استبانة تناولت متغيرات الدراسة، كما تم تحليل البيانات الكمية التي تم جمعها باستخدام نموذج المعادلة الهيكلية (*SEM*). توصلت الدراسة إلى عدة نتائج من أهمها وجود علاقات إيجابية مهمة بين فهم طبيعة الفيزياء، ودافعية الانجاز وتفضيل الطلاب للفيزياء. كما أوضحت النتائج أن معرفة المحتوى التربوي أثرت بشكل كبير على تفضيل الطلاب للفيزياء بين المعلمين. بالإضافة إلى ذلك، أظهرت النتائج أن دافع الإنجاز يتوسط العلاقة بين معرفة المحتوى التربوي وتفضيل الطلاب للفيزياء. كما أظهرت النتائج أن خبرة التدريس لها تأثير معتدل كبير على العلاقة بين فهم طبيعة الفيزياء وتفضيل الطلاب للفيزياء، بينما أشارت النتائج إلى أن جنس وتخصص المجيبين ليس له تأثير معتدل كبير على العلاقة بين معرفة المحتوى التربوي وتفضيل الطلاب للفيزياء. واختتمت الدراسة في إيجاد العلاقة بين معرفة المحتوى التربوي ودافعية الانجاز وتفضيل الطلاب للفيزياء لدى معلمي العلوم في تعليم الفيزياء بنجاح. وتوصلت الدراسة إلى أن العلاقة بين متغيرات الدراسة لها مساهمات كبيرة وقيمة في الممارسة النظرية والمنهجية والتعليمية والمعرفية في مجال تعليم الفيزياء. وأوصت الدراسة بعدة توصيات للدراسات المستقبلية في مجال تعليم الفيزياء.

كلمات مفتاحية: معرفة المحتوى التربوي.، دافعية الإنجاز.، تفضيل الطلاب للفيزياء.، معلمي العلوم.، تعليم الفيزياء.

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Relationship Between the Pedagogical Content Knowledge, Achievement Motivation toward Students' Preferences of Physics among Teachers in Oman /

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Abstract:

This study aimed to elucidate the relationship between the Pedagogical Content Knowledge (PCK), and Achievement Motivation (AM) in relation to students' Preferences for Physics (SPP) among teachers in Oman. Additionally, the study aimed to investigate whether Am mediates the relationships between the independent variables. The sample of this study consisted of (523) male and female science teachers from all governorates of Oman. The study followed a quantitative method design and was analyzed using Structural Equation Modeling (SEM). The findings revealed that significant relationships existed between the PCK and SPP. Meanwhile, the gender and specialization of respondents were found to have a significant moderating effect on the relationship between PCK and SPP. This study also concluded that the gender and specialization of the respondents were found not to have a significant moderating effect on the relationship between PCK and SPP. On the other hand, the teaching experience was found to have a significant moderating effect on the relationship between the PCK and SPP. The relationship between PCK and SPP was successfully modelled and represented as the relationship between pedagogical content knowledge and students' preference of physics in Physics Education. The relationship provides significant and valuable contributions to theoretical, methodological, educational practice, and knowledge in the field of physics education research in the Sultanate of Oman. The implications of this study suggest that the relationship can be used to determine the quality of understanding the pedagogical content knowledge based on the teachers' achievement motivation in the students' preference of physics.

Keywords: Pedagogical Content Knowledge (PCK); Students Preference of Physics (SPP); Achievement motivation (Am); specialization; science teachers.

INTRODUCTION

In the modern century, the world has witnessed a wide revolution in the evolution of physical science through its theories and applications to meet the requirements of human life and the human's need to describe, interpret and control natural phenomena and to invest those processes in achieving his needs, meeting the challenges, and making progress in different sectors.

Education is essential to all people and societies, and it defined as the process by which the aspects of the human personality are developed in all its aspects, whether cognitive, emotional, or psychological. When crises emerge in a society, many calls and movements call for the need for reform and renewal for community institutions and activities to move in new directions in response to those crises. The educational system in the world has recognized the importance of the role of the teacher in the educational process. They are keen to provide all the necessary resources for preparing him, including educational and professional qualifications,

as well as pre-service and in-service training, regardless of the state of the schools. Although all these elements are essential, they remain of limited utility if there is a lack of efficient teachers. Therefore, it is necessary to pay attention to the conditions of the teacher and his training and qualifications (Hussein, 2014).

The effectiveness of education lies not in the teacher's personal knowledge, but in how this knowledge is used in class. This was demonstrated in a comparative study of the teachers of the United States and China conducted by Ma (1999) on teachers' understanding of the fundamentals of mathematics in China and the United States in order to investigate the causes of decline US students while Chinese students have passed the Trends in International Mathematics and Science Study (TIMSS) exam for several years. The results of the study indicate that the reason for this decline is related to the understanding of teachers, noting that the understanding of teachers in the United States was superficial compared to the Chinese teachers were more understanding of the mathematics and teaching methods. This is despite the knowledge of teachers in the United States was higher than the knowledge possessed by Chinese teachers. It also showed that each teacher, whether a beginner or experienced, has a degree of this knowledge and affects the amount and type of knowledge the teacher possesses in everything he teaches, how he teaches him, and how effectively he communicates with his students (Mohlouoa et al., 2012).

Generally, many countries, such as the European Union, China, Japan, Malaysia and Thailand, have adopted a new concept in their educational system: "lifelong learning for the teacher". So, in order to make the teachers professional and knowledge-based they must engage in continuously developing professional practice (Siyam, 2014; Al-Khubati, 2003). In view of the Omani Economy 2020 vision, the Sultanate has been keen on developing advanced Omani human resources with capabilities and skills in line with technological development and management of change in all fields, especially the field of education (Ambosaidi & Al-Shuaili, 2010; Issan, & Atari, & Alani, 2007). It may be noted that confirmed by the ' vision of Oman 2040 ' in continuing to focus on the educational system as a whole, starting with the teacher and paying particular attention of the teaching of science (Future Foresight Forum, 2017). Moreover, the Ministry of Education in Oman has focused on scientific subjects, developing them and keeping them in line with the modern orientations in science education.

In the same topic of the nature of physics, the American Association of Physics Teachers (AAPT, 2002), published the basic lines of physics programs in the secondary stage based on the standards of science teaching, pointing out that the physics teacher must possess a strong physics knowledge in the topics of physics. In 2015, the PRAXIS group published standardized tests of the physics skills, concepts, and knowledge that a physics teacher needs to teach physics. The most important topics are mechanics, electricity

and magnetism and their applications, light and sound waves, thermal energy and thermodynamics, modern physics, knowledge of scientific inquiry and methods of research (Educational Testing Services ETS, 2015).

To have excellent students in physics, teachers must know about the nature of physics. Physics education is a basic science that contains many abstract concepts which are difficult for students to understand as these concepts mean fully. Physics is based on the study of behaviour and relations between a wide range of physics concepts and phenomena. By learning physics, students acquire these concepts and attitudes toward physics (Slaughter, Bates, & Galloway, 2012; Bajpai, 2012). Many educators pointed out that one of the most important reasons for students' reluctance to study physics, have no interest, and avoid studying it is the lack of using modern and varied teaching methods (Keller; Neumann & Fischer, 2017). Generally, teaching of physics is no less than being filled with students' theoretical knowledge through memorization. For that, most of teachers and curriculum developers have sought to find new ways to help students understand difficult concepts (Almazidi, 2017; Abdul Hamid, 2015; Cohen, 2013; Droui, 2012; Abasa, 2012; Drake, 2009; Za'ani, 2007). Basically, with given the reality of physics teaching and the disparity between science teachers in general and physics teachers in particular, it is not necessary for a teacher to have a great deal of intelligence or excellence to be successful in teaching and his ability to communicate information to students and communicate effectively with them in academic intelligence and excellence (Za'ani, 2007; Reif, 1995).

In contrast, they enjoy the admiration of their students and their satisfaction and passion for their participation and good behaviour in critical situations and social relations with their colleagues and students alike. This discrepancy can be attributed to the understanding of the nature of physics and mastery of scientific subject, and diversity in teaching methods (Mohammed, 2013; Mistades, 2008).

As confirmed by some educational research, when physics is made inaccessible to school students, almost always through information overload, they tend to resort to memorization to pass examinations, and this seems to generate negative attitudes towards physics" (Mbajiorgu & Reid, 2006).

1. Problem statement and research questions:

Physics is a core subject in STEM-related fields and a core requirement for future life (Kennedy & Odell, 2014). Generally, several factors make us interested in teaching physics, such as the fact that physics plays an essential role in most scientific and practical fields. Moreover, it is one of the core areas in technical development and other theoretical sciences such as chemistry, geology, mathematics, astronomy, biology, and applied science, including medicine, engineering, and agriculture. In fact, almost everything around us can be described accurately by the laws of physics. Therefore, we need to pay attention to physics education and elements and variables that can help to develop it, such as the PCK. Generally, the science teacher is the

main factor in the educational process, even with the best curricula, books, activities, and educational programs, and the objectives of the educational process are not achieved unless the teacher is highly competent, capable of directing students' to learning of science, science teacher has good knowledge about PCK (Mohammed, 2015).

In addition, some previous studies such as Al Janabi (2016), Buabeng, Conner, & Winter (2015), PhysTEC (2014), Mohammed (2013), Belgon (2011), Ornek, Robinson, & Haugan (2008), Koponen, Mantyla, & Lavonen (2004), and Reif (1995), indicated that students face difficulty in understanding physics for some reasons. Among them is the low level of mental development and common misconceptions among students, which basically depend on the teacher's approach to education and focus on scientific laws and mathematical treatments without interest in conceptual treatments. This may be due to the teacher not understanding the nature of the subject he is teaching or lacking enough knowledge of PCK (Von Korff et al., 2016). Overall, this leads to students' reluctance to choose the subject of physics, even at the tertiary education level. The observation was confirmed by previous studies related to the lack of understanding of the teacher to PCK (Karısan, Senay, & Ubuz (2013), Etkina (2010), and the study of Angel, Ryder, & Scott (2005)).

In the Sultanate of Oman, the results of many local and international evaluation studies of the reality of science education revealed the existence of some problems threatening the achievement of objectives. The most important of the results is the reluctance of students to study physics to a greater degree than their reluctance to study other branches of science (Ministry of Education, 2008). In the same context, the results of Trends in International Mathematics and Science Study TIMSS in the academic years 2011 and 2015 indicate the existence of a lack of understanding of physics among students, as indicated by the report TIMSS, 2015 (Ministry of Education, 2015). Students in Oman were ranked 41st in the academic year 2011 and ranked 37th in 2015 out of 48 countries participating in the international study. Altogether, the report of TIMSS, 2011 and 2015 explained that the reason for the low achievement in science is the weakness of students' skills in physics knowledge and in understanding the physics concepts and nature of physics and their attitudes towards physics (Almazidi, 2017).

On the other hand, the results of the seventh session of the International Study TIMSS 2019 indicate that students of the Sultanate of Oman were able to achieve the international average (500 points) and higher in science. However, the performance of the students of the Sultanate of Oman increased slightly compared to the results of the sixth session of TIMSS 2015. Overall, the proportion of students below the low level fell from 55% in 2011 to 39% in 2015 and then 37% in 2019 (Ministry of Education, 2021).

Considering that, there is a need to elucidate the relationship between Pedagogical Content Knowledge (PCK) and Achievement Motivation (AM) in relation to students' Preferences for Physics (SPP) among teachers in Oman. Therefore, this study aimed to answer the following questions:

Question 1- Is there a significant relationship between the pedagogical content knowledge and the students' preference of physics?

Question 2- Does achievement motivation mediate the relationship between the pedagogical content knowledge and students' preference of physics?

Question 3- Does gender moderate the relationship between the pedagogical content knowledge and students' preference of physics?

Question 4- Does specialization moderate the relationship between the pedagogical content knowledge and students' preference of physics?

2. Study hypotheses:

The hypotheses were formulated as follows:

Hypothesis 1- The pedagogical content knowledge has a significant effect on the students' preference of physics.

Hypothesis 2- Achievement motivation mediates the relationship between the pedagogical content knowledge and students' preference of physics.

Hypothesis3- Gender moderates the relationship between the pedagogical content knowledge and students' preference of physics.

Hypothesis4- Specialization moderates the relationship between the pedagogical content knowledge and students' preference of physics.

2.1. Definition of terms:

The following terms were commonly used in this study:

- *Pedagogical Content Knowledge (PCK):* A set of rules that contribute to the empowerment of teachers and enhance their perception of the educational process, including all elements of the educational process, such as students, content, teaching methods, teaching methods, and evaluation (Hallala, 2018), in this study included Knowledge of the Goals of Teaching Physics, Knowledge of the Physics Curriculum, Knowledge of the Learner's Characteristics, and Knowledge of Context (Whitt, & Abigail, 2016:13). It will be expressed by the degree that the science teacher will obtain in the specialization of physics by answering a questionnaire. The Dimensions used by Al- Ramahi & Rawagah (2018); (Von Korff et al., 2016), and Siyam (2014) in their studies will be adapted to the purposes of this study.

- *Students' Preference of Physics (SPP):* A set of responses of the individual emotionally accepting or refusing physics and its applications to life (Almazidi, 2017). The statements in the questionnaire adapted from several studies, such as Almazidi (2017) and Ibrahim & Saleh (2011) in their studies will be adapted to the purposes of this study.
- *Achievement motivation (Am):* the extent to which an individual is prepared to achieve his personal and cognitive goals to accomplish the work assigned to him in his field of specialization (Al-Dafry, 2021). And Al-Adwan and Al-Rababaah (2018) defined achievement motivation as: Strive for success and accomplish tasks at a high level and efficiency.
- *Specialization:* The main specialization of a science teacher (physics, chemistry, and biology) (Mebley, 2010).

2.2. Study objectives:

The general objective of this study is to identify the significance of pedagogical content knowledge (PCK), achievement motivation, and students' preference for physics from the perspective of science teachers. Additionally, this study intends to study the moderating effects of possible variables on the construction, which may develop teachers' views of students' Preference for Physics.

3. Research Methodology:

The study was meticulously designed and executed, following a quantitative method and employing Structural Equation Modeling (SEM) for analysis. Quantitative approaches, which utilize statistical techniques, are commonly used to test or validate theories, identify study variables, and establish relationships between variables in questions or hypotheses. The study also provided a robust instrument for the pre-test and pilot tests, ensuring the thoroughness of the research methodology.

Sample of the study:

Table 1 shows the study sample based on the gender variable in each governorate.

Table 1. Sample of the study.

No	Governorate	Gender		Total
		Male	Female	
1	Muscat	44	46	332
2	Al-Batinah North	40	31	349
3	Al-Batinah South	47	22	227
4	Al-Dakhlya	31	21	291
5	Al-Sharqiah South	23	34	156

No	Governorate	Gender		Total
		Male	Female	
6	Al-Sharqiah North	20	24	157
7	Al- Buraimi	11	17	49
8	Al-Dhahirah	22	24	147
9	Dhofar	16	10	234
10	Al-Wusta	12	9	41
11	Musandam	9	10	30
	Total	275	248	523

4. Theoretical Framework:

Based on one of the essential aims of physics teaching is to provide the learner's knowledge and scientific culture and link him to the world in which he lives and to the realities of its environment, and his daily life and interests for feel the value of what he learns that leads to increases his motivation and its tendencies, scientific trends and preferences grow. In this context, the Federal Commission responsible for the Development of Science Education in the United States of America has considered that one of the essential aims of teaching science is the preparation of a scientifically educated citizen (Ghassan, 2020).

4.1. Relationship between pedagogical content knowledge and science teaching:

Pedagogical studies and scientific research have argued the relationship between Pedagogical content knowledge and materials teaching. In science education, the educational literature agreed to define the components of pedagogical content, as divided by Magnusson, Krajcik, and Borko (1999) into several axes: (a) knowledge of the science curricula, including knowledge of the goals and objectives of the curriculum of science. It is meant to plan for teaching science and includes knowledge of specific scientific content. (b) knowledge of the science subject learner, including knowledge of the needs of the science subject learner and subjects in which students find it difficult. (c) knowledge of teaching strategies, including science teaching strategies, in terms of presentation methods and educational activities. (d) Knowledge assessment of science subject, consisting of the dimensions that are evaluated in learning science and methods of evaluating science.

Unfortunately, Wilson, Shulman, and Richerd (1987) referred to science teachers facing a difficult challenge in the teaching process, as teaching any subject is a complex knowledge activity, and it requires that the teacher employ knowledge from multiple fields. In the same context, that knowledge was referred to by

Shulman as the "pedagogical content knowledge". Fortunately, the current study found through research in literature and previous studies regarding knowledge of pedagogical content that the knowledge of pedagogical content for teachers has occupied a wide area of interest for researchers and educators in all aspects of education in general and science education in particular since the eighties of the last century. Educationally, given the importance of pedagogical content knowledge, Smith & Neal (1989) considered it as a criterion for assessing a teacher's success in teaching.

In addition, some science teachers believe that physics topics are very challenging to teach because of their abstract nature. Indeed, the current study found this might be due to the teacher's understanding of the nature of pedagogical knowledge of the content (PCK) of the subject that they are teaching.

4.2. The relationship between preference and physics teaching:

Previous studies in pedagogical literature have indicated that there are preferences for individuals in regulating excitement, making preference synonymous with cognitive style (Ottom, 2004). In general, everyone has a cognitive preference for everyday information and attitudes, and their understanding of the sensory thrills they deal with reflects their way of thinking and their emotional and social motivations. The results of some studies in the field of physics education, such as Ghassan, 2020; Almazidi, 2017; and Ambosaidi, Al-Afifi, 2004 pointed out that there is an apparent deficiency in the implementation of some modern strategies based on individual or collective practical experimentation aimed at gaining students positive trends towards physics and helping to develop students' physics knowledge. Additionally, the studies noted that the reason for this is the need for more tools and devices to perform experiments experience in practical terms only, and students are required to make conclusions only.

Thus, the student needs to acquire the required physics skills. That leads students to lose a proper understanding of the direction of physics, and that perception goes from class to class. In considering modifying and adapting teaching methods and strategies to meet students' needs, educators should reflect on these needs and desires by considering individual differences in general capacities and teaching methods and strategies.

4. 3 Relationship between teachers' high motivation and teaching practices:

Physiologically, the achievement motivation is one of the most important in the field of work. It works to increase the individual's performance and productivity in various fields and activities. The economic growth of any society is only a result of achievement, as the boom and fall in economic growth are linked to

the high and low levels of such motivation per capita (Al-Rudiniyah, 2017). The teaching profession is considered one of the most essential jobs that lead society to advancement or decline. Thus, it requires the teacher to have the motivation to perform his professional duties with confidence, mastery, and sincerity. A teacher's success in performing his or her career depends on his or her ability and competence to possess and use teaching skills effectively in different educational situations away from other professional pressures. Many researchers point out that the motivation of the teacher is one of the most critical factors that play a significant role in the individual's ability to provide the best in his work, with Al-Rudiniyah (2017), Yildiz & Kilic (2021) indicating the seriousness of a positive relationship between the teacher's level of motivation and his performance in the classroom and teaching. Previous studies have confirmed that a highly motivated teacher is persistent in carrying out his or her work in spite of the difficulties he or she may face. The teacher also takes a significant amount of time to work and offers creative ideas and unlimited activities. In addition, the Al-Dafria (2021) study confirmed that a highly motivated teacher contributes to the development of educational plans, cares for students as individuals and works to develop their abilities in all fields. The teacher who is motivated towards his work devotes considerable time and effort to his students, colleagues, and school.

The present study suggests the need to strive to increase the teacher's motivation in order to achieve the internal desire for self-success. This will help the teacher develop his knowledge of the developments in the curriculum that he taught to students and keep abreast of the scientific knowledge related to the subject's contents.

5. Research instruments:

The questionnaire was the main instrument used to achieve the study's objectives. The researcher developed and designed the questionnaire based on the study's questions and objectives, taking advantage of the theoretical framework and previous studies relevant to the study's topic, which were studied and reviewed comprehensively to support the instrument. The study instrument consists of two parts. The first section (Demographic background) included general information on sample individuals according to study variables related to the demographic background of the participants, such as (gender, governorate, and specialization). The second section included 50 items that clarify the relationship between Pedagogical Content Knowledge, Achievement motivation and students' preference of physics.

6. Results and discussion:

6.1. Statistical processing

This study analyzed statistical data using Structural Equation Modeling (SEM). Statistically, SEM can simultaneously examine the relationship between a set of constructs represented by several variables while accounting for measurement error. SEM has two methods: (1) covariance-based SEM and (2) Partial least square SEM. In addition, a structural equation model (SEM) was developed, and the maximum likelihood estimation of path analysis was applied to investigate whether it is a significant determinant of the NOP and SPP. In SEM, the Model fit should be examined using multiple fit indices (Collier, 2020; Kabakci, 2018; Arbuckle, 2009; Blunch, 2008).

6.2. Invariance Tests

Since this study focuses on moderating the structural model with two (Gender, Specialization) categorical variables, Configural, Metric, and Scalar invariance tests were conducted. Kline (2015) argued that multi-group confirmatory factor analysis (MGCFA) is one of the most popular strategies for examining measurement invariance. Therefore, CFA evaluates whether the hypothesized measurement model fits the data well. Moreover, the MGCFA could precisely compare the measurement model across groups. The three typical phases of measurement invariance testing are as follows. (Kline, 2011; Vandenberg, Lance, & Lance, 2000). The results of the invariance tests for each group are presented in Tables 2 and Table 3.

6.3. Tests of Measurement Invariance Across Gender Groups

Table 2. Results of measurement invariance test across Gender groups

Model	$\chi 2$	Df	CFI	RMSEA	Model compassion	$\Delta\chi 2$	Δdf	p
Model 1: Configural invariance	3415.925	2278	0.953	0.031	---	---	---	---
Model 2: Metric invariance	3481.197	2328	0.953	0.031	M 1 vs. M 2	65.273	50	0.072
Model 3: Scalar invariance	3541.102	2378	0.952	0.031	M 3 vs. M 2	59.905	50	0.159

Note, N = 523; Male n = 263; Female n = 260.

Table 2 displays the fit indices for the models that tested measurement invariance. In comparing the fit of hypothesized models, chi-square tests and goodness-of-fit indexes (CFI, RMSEA) are used. As shown in Table 2, the initial model assessed configural invariance. The model fit of the Configural invariance had an adequate fit ($\chi 2$ (df) = 3415.925 (2278), CFI 0.953, and RMSEA = 0.031), indicating that the model is configurable invariant. Testing full metric invariance (Model 2) yielded an acceptable fit, the compassion results between Model 1 (Unconstrained) and Model 2 (Metric invariance) show that the chi-square increase is not significant ($\Delta\chi 2$ (df) = 65.273 (50), $p > 0.05$). The full scalar invariant model (Model 3) accepted as the chi-square increase is not significant ($\Delta\chi 2$ (df) = 59.905 (50), $p > 0.05$). Thus, the measurement model meets the criteria for metric invariance across gender as well.

6.4. Tests of Measurement Invariance Across Specialization Groups

Table 3. Results of measurement invariance test across Specialization groups

Model	$\chi 2$	df	CFI	RMSEA	Model compassion	$\Delta\chi 2$	Δdf	p
Model 1: Configural invariance	3514.299	2278	0.950	0.032	---	---	---	---
Model 2: Metric invariance	3581.286	2328	0.949	0.032	M 1 vs. M 2	66.987	50	0.055
Model 3: Scalar invariance	3639.927	2378	0.949	0.032	M 3 vs. M 2	58.641	50	0.188

Similar to tests of measurement invariance across Gender groups, the initial model assessed configural invariance. The model fit of the Configural invariance had a good fit ($\chi 2$ (df) = 3514.299 (2278), CFI 0.950, and RMSEA = 0.032), indicating that the model is configurable invariant. Testing full metric invariance (Model 2) indicated an acceptable fit. The results show that the chi-square increase is not significant ($\Delta\chi 2$ (df) = 66.987 (50), $p > 0.05$). The full scalar invariant model (Model 3) accepted as the chi-square increase is not significant ($\Delta\chi 2$ (df) = 58.641 (50), $p > 0.05$). Thus, the measurement model meets the criteria for metric invariance across Specialization groups as well.

7. Physics Education Contribution :

The present study contributes to the teaching of physics in all respects and includes the teacher, student, and curriculum. The study discussed special topics in physics education, such as the nature of physics, physics education objectives, strategies, and methods of teaching physics as a method of problem-solving, investigating, collaborative work and practical experimentation, acquiring critical thinking skills, practical skills, and methods of evaluating physics education.

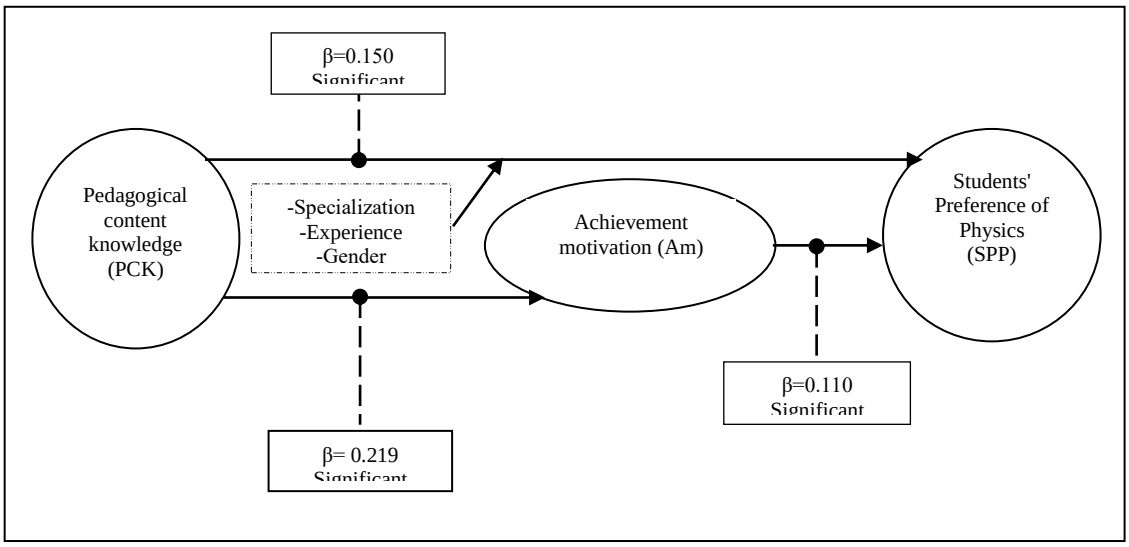
In addition, the current study is interested in providing what is needed to prepare and develop physics education workers. More importantly, the study makes clear contributions to the beliefs and opinions of physics teachers as well as physics students. In addition, the current study contributes to the teaching of physics by assisting the physics teacher in how identifying the characteristics of students and helping them guide them in choosing scientific subjects for their learning by developing teachers' knowledge of the nature of physics and the nature of the content he teaches to his students, which contributes to increasing the achievement motivation of the physics teacher to present his material in a clear and understandable scientific manner that encourages students to accept physics study.

8. Conclusions:

In this study, the results obtained from the data analysis revealed that significant relationships existed between the pedagogical content knowledge and the student's preference for physics. Meanwhile, based on the quantitative result, the gender and specialization of respondents were found to have a significant moderating effect on the relationship between the pedagogical content knowledge and students' preference of physics. In contrast, the teaching experience was found not to have a significant moderating effect on the relationship between the pedagogical content knowledge and students' preference of physics. This chapter also concluded that the gender and specialization of the respondents were found not to have a significant moderating effect on the relationship between the pedagogical content knowledge and students' preference of physics. In contrast, the teaching experience was found to have a significant moderating effect on the relationship between the pedagogical content knowledge and students' preference of physics.

The current study produced the relationship between the pedagogical content knowledge (PCK) and Achievement Motivation (AM) in relation to students' Preferences for Physics (SPP) among teachers in Oman, as in Figure 1.

Figure 1. The relationship between the pedagogical content knowledge and students' preference of physics.



9.

Recommendations:

Considering the above, the present study recommends also:

The present study recommends that attention be paid to the professional development of physics teachers during service through their in-service training. The current study considers in-service training to be one of the most important engines for the development of the educational process since it depends on the teacher to apply the curriculum and implement the newest developments in education. All that can only be done by training the teacher to use what is new in his field of specialization and its nature, as well as in standards and strategies.

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