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Science teachers' perceptions of pedagogical learning theories in relation to their classroom practices

Mohamed A. Shahat [1,2*], Abdullah K. Ambusaidi [3], Khalsa H. AlBahri [3]

[1] Department of Curriculum and Instruction, College of Education, Sultan Qaboos University, Muscat, OMAN
[2] Aswan University, Aswan, EGYPT
[3] Ministry of Education, Sultanate of Oman, Muscat, OMAN

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Abstract

Following up previous studies on the theory-practice gap in science teaching, this study examined teachers' perceptions of pedagogical learning theories and their classroom applications. Using a science teachers pedagogical learning theory survey (STPLTS) consisting of one subscale on theories and another on these theories' relationships to classroom practices–the study was conducted with a nationally representative sample of science teachers (n=350) randomly selected from grade 5 to 10 classrooms in Oman. Results indicated that the teachers had moderate to high perceptions on both subscales of the STPLTS with female teachers' perceptions being significantly more positive compared to male teachers. Perceptions were also more positive for teachers with less teaching experience (1-9 years) compared to those with more experience (≥10 years). Furthermore, teachers with diplomas had more positive perceptions for the second subscale compared to teachers with bachelor's degrees. This study may contribute to the literature on the classroom practices of science teachers in Arab-speaking countries.

Keywords: science teachers' perceptions, pedagogical learning theories, classroom practices

INTRODUCTION

Ormrod (2006) defined pedagogical learning theories (PLTs) as "an organized body of concepts and principles developed to explain certain phenomena" (p. 253), adding that they make it possible to describe mechanisms underlying various principles. Teachers face many difficulties in their teaching if they do not have theory-supported principles or guidelines to guide their classroom practice. However, there is an ongoing theory-practice debate that has been a perennial issue in the field of teacher education research (Tang et al., 2021). In particular, many previous studies have highlighted a gap between pedagogical theory and practice in science teaching (e.g., Guilfoyle et al., 2020; Korthagen, 2010; Rahman, 2018; Shahat et al., 2022c).

A number of educational systems around the world have demonstrated substantial changes over the past few decades, and Oman's education system has experienced particularly significant reforms. In Oman there are separate schools for male and female students from age 10 up. These students are taught by teachers of both genders in both lower secondary schools for grades 5-10 (ages 10-15) and upper secondary schools for grades 11-12 (ages 16-17). As reported in the latest statistical report of the Omani Ministry of Education in 2021 (Ministry of Education-Oman, 2021), class size for public lower secondary schools is, on average, 29 students, and for upper secondary school classrooms it is 28 students (i.e., around 28.5 students per teacher). Assessment practices have seen revolutionary changes following the implementation of a combination of formative and summative assessment strategies (Al-Balushi et al., 2014). The instruction of science for all classes in public schools in Oman is in Arabic, and science teachers have an average of 24 hours of class time per week.

One major reform in science teaching in Oman that began in 2017 to try and meet the 'Oman Vision 2040' goal for students to be more competitive in key areas was to consider utilizing science and mathematics curricula designed by Cambridge University Press (CUP) (Oman Educational Portal, 2020). The Omani Ministry of Education implemented the CUP curricula in classrooms in 2018 to try and bring the science and mathematics curricula up to international standards. It was found, in

✉ m.shahat@squ.edu.om **(*Correspondence)** ✉ ambusaidi40@hotmail.com ✉ Khm.albhri@moe.om

Contribution to the literature

- This study contributes to the science education field by using the STPLTS in an Arab context to shed light on the effect of gender, teaching experience and preparation program on teachers' competence in teaching.
- This study helps to understand Omani teachers' perspectives concerning specific PLTs in relation to their science classrooms that can have an impact on science teaching success and student achievement.
- The study's findings could contribute to the broader literature dealing with science teachers' practices in Arab-speaking countries with similar education systems, and teacher preparation and training programs.

2007, 2011, and 2015, that students were not achieving at a high level in international assessments such as trends in international mathematics and science study (TIMSS). For example, in the recent TIMSS of 2019, the average science scores of Omani eighth-grade students were 457, which was significantly lower than the TIMSS average of 500. As a result, Oman ranked 30th among the 64 participating countries (Mullis et al., 2020). Omani eighth-grade students reported that their science teachers' emphasized science investigations in half the lessons or more with an average score of 458, which was significantly lower than the TIMSS average of 492 for highlighting science investigations. TIMSS 2019 results also showed that, in terms of positive attitudes toward science, Omani eighth-grade students scored an average of 454, which was considerably lower than the international average of 524. Furthermore, a recent research study in Oman identified that one of the weakest aspects of students' performance in TIMSS was their inability to apply their knowledge to new situations and relate science concepts to natural phenomena in their daily lives (Shahat et al., 2022c).

The new CUP science curricula were specifically designed to address these concerns by developing problem-solving skills and assessing the student's performance in various ways in four content areas: *scientific inquiry*, *biology*, *chemistry*, and *physics*. These curricula differ from the previous curricula in Oman by focusing on a more structured approach for teaching and learning and a reference against which students' ability and understanding can be checked. The framework of these curricula provides a solid foundation upon which the later stages of education can be built (Cambridge Assessment International Education, 2018). All these curricula have been translated into the Arabic language and used in Oman since 2018. However, without high-quality instruction offered by science teachers in the classroom, it will not be possible to reach the goals of the curricula (Shahat et al., 2022b). Central to achieving these goals are teachers' practices in the classroom, which are affected by their views or perceptions (Bandura, 1989; Knight, 2015; McGarr et al., 2017; Stolz & Thorburn, 2020; Tang et al., 2019).

The newly adopted CUP curricula requires teachers to efficiently apply PLTs that focus on a student-centered approach. To support and increase student learning, decision makers at the Omani Ministry of Education and educators of science teachers need to know more about teachers' views on the classroom application of PLTs (Kaya et al., 2021). Currently, no study has been conducted in an Arab country such as Oman to determine teachers' perceptions of PLTs to

a) evaluate the success of teacher training and
b) explore teachers' perceptions on PLTs for science instruction.

Therefore, it would be highly beneficial to conduct the science teachers pedagogical learning theory survey (STPLTS) to assess Omani science teachers' acceptance and use of specific PLTs in their science classrooms. This study was conducted in an attempt to understand Omani teachers' perspectives concerning specific PLTs in relation to their science classrooms that can have an impact on science teaching success and student achievement. Although this research is conducted in Oman, its findings could contribute to the broader literature dealing with science teachers' practices in Arab-speaking countries with similar education systems, and teacher preparation and training programs.

Science Teacher Education in Oman

Bachelor program of science teacher education

This program aims to produce science teachers with a strong scientific knowledge base who are able to teach general sciences in lower secondary schools and biology, physics, and chemistry in upper secondary schools. The science teachers' program at Sultan Qaboos University is designed to be completed in four years (eight semesters) (Shahat et al., 2022a).

The total credit hours of the program are divided into three parts: a specialized science component 60%, an educational component 30%, and a cultural component 10% (Public and Private Universities in Oman, 2021). It includes courses focused on various academic disciplines at the College of Science, which provides the candidates with specialized scientific knowledge and a deep understanding of the enquiry-based nature of science (Al-Balushi et al., 2022).

There is cooperation among the different teacher training providers in Oman in the specifications of courses in order to integrate the Cambridge science curricula within schools in Oman (Shahat et al., 2022a). All the courses offered to student teachers focus on

science, mathematics, technology, psychology, and educational foundations. During the later stages of the program, the student teachers are exposed to real classroom situations through which they learn to experiment to determine the effectiveness of the teaching skills they have learned (Shahat et al., 2022a).

In 2016, the BSc in science education at Sultan Qaboos University was recognized by the National Science Teachers Association (NSTA) and accredited by the National Council Accreditation of Teacher Education (NCATE), which is now known as the Council for the Accreditation of Educator Preparation (CAPE). This accreditation offers evidence that the science teacher program in Oman meets high standards in science teaching, and that the reforms related to the teaching and learning of science in Omani schools have borne fruit (Shahat et al., 2022a).

Teacher qualification diploma

After receiving their BSc from arts, science, or technical colleges, there is a final two semester program called the teacher qualification diploma (TQD), which has the aim of preparing science degree holders for teaching. This program focuses on helping student teachers gain pedagogical knowledge while experiencing actual classroom teaching in public schools (Shahat et al., 2022a).

Theoretical Background

This section summarizes the literature that concerns PLTs**.** It can be argued that the choice of PLTs to guide their science instruction is significantly impacted in three facets:

1. the extent of their knowledge of how learning takes place,
2. the factors that affect the students' learning, and
3. the methods available to teachers to develop their teaching (Swennen & Volman, 2019).

We assert that a critical factor influencing all three of these areas is science teachers' views toward PLTs. It has been shown with empirical studies that some science teachers do not utilize PLTs in their classrooms and, because of this, there must be a redoubling of efforts to find techniques to ensure science teachers understand and apply PLTs in their classrooms where appropriate (Wrenn & Wrenn, 2009).

Another reason to support the use of a survey concerning perceptions and applications of theories is connected to two questions which psychologists and education researchers have tried to answer regarding classroom practices guided by theories: "How do teachers perceive their teaching to students?" and "what are the relationships between this perception and a teachers' classroom practices?" As a result of these two foundational questions, many educational theories have emerged to try and explain and improve the process of teaching and learning. These theories are varied in their foundations, principles, and approaches (Stolz & Ozoliņš, 2018). The impetus for this study also draws on Wang's (2012) study, which argued that understanding psychological and educational theories are vital for effective teaching practice. Without these fundamental concepts, such as Tolman's purposive behaviorism, Pavlov's classical conditioning, Guthrie's contiguous conditioning, Skinner's operant conditioning, Hull's systematic behavior theory, or information processing models, it would be difficult for teachers to learn and apply PLTs in the classroom. For instance, they need to understand Gardner's theory of multiple intelligences to deal with students with different intelligence profiles and choose appropriate teaching methods accordingly.

Often, a school setting is viewed as a teachers' real-world situation, and the educational environment future teachers find themselves in while studying at university is considered removed from their real world. Pre-service teachers often experience a shock in schools because the university has not prepared them for the realities of school settings (Guilfoyle et al., 2020). Morrison (2016) highlighted the importance of collaborative partnerships between universities and schools as a way to prepare pre-service teachers for launch of their career.

Several researchers have argued that a real gap exists between theory and practice in teaching (McGarr et al., 2017; Stolz & Thorburn, 2020; Tang et al., 2019). Specifically, they have revealed a significant theory-practice alignment problem between universities and schools (Nolan, 2018). Educational researchers have also discussed the importance of teachers being familiar with different PLTs. For example, Runesson (2015) and Thorsten (2015) suggested that framing the teaching of a lesson within an explicit learning theory can change teachers' effectiveness in the classroom. By formulating a lesson based on a learning theory, a teacher can better help student teachers question their habits and previous experiences by considering the learning needs of learners and identifying targeted goals or learning. Furthermore, learning theory can improve lesson planning by basing it on empirical studies rather than intuition. Some studies have also proposed that student teachers should formulate their own theories and theoretical principles and use these principles as resources for pedagogical design and understanding their own or learners' behavior (Clivaz, 2015; Thorsten, 2015).

Similarly, Biermann et al. (2015) found a positive relationship between student teachers' engagement with the theory-practice link and self-rated teaching skills, suggesting a robust positive relationship between what teachers know or learn from theories and their performance in the classroom. They concluded that when teachers understand the reasons behind why and how they teach, their teaching will develop, and their attitudes toward teaching will be more positive.

However, Pang and Lo (2012) demonstrated the power of variation theory in explaining and predicting the relationship between what takes place in a classroom and what the learners learn. Consequently, they identified ways to improve student learning through promoting professional development in teachers. To close the gap between theory and practice, researchers need to investigate teachers' perceptions of the factors involved. In this regard, Variation Theory provides a unique perspective on learning and teaching (Pang & Lo, 2012). According to this theory, learning involves primarily a qualitative change in how someone experiences something in the world around them. Pang and Lo (2012) emphasized in their study that the learning methods presented to teachers make use of learning theories grounded in peer reviewed research.

There have also been several studies (Clayton et al., 2014; Hennebry-Leung et al., 2019; Knight, 2015; McGarr et al., 2017; Nilssen & Solheim, 2015; Stolz & Thorburn, 2020; Tang et al., 2019) that focused on PLTs and the role of PLTs in classrooms. All these studies used different methods to collect data but mainly depended on surveys of varying formats. Tang et al. (2019) developed a questionnaire and conducted interviews that were used to investigate the relationship between student teachers' engagement with the theory-practice link and their perceived professional competence; they used a questionnaire consisting of two dimensions:

1. the concepts and principles of teaching and PLTs and
2. the relationship between learning and teaching theories and teachers' classroom practices.

In another study, McGarr et al. (2017) collected data to investigate 23 student teachers' views of educational theory using one-to-one interviews, and their results suggested four categories of student teachers (i.e., resisters, embracers, acceptors, and rejecters), who were positioned relative to each other in terms of their application of theory into classroom practice. Clayton et al. (2014) explored theory and practice with student teachers by examining their pedagogical approaches. They also reviewed teacher educators' views). Their findings highlighted the importance of

(a) being aware of theory-practice relationships in teacher education contexts and the factors that influence the student teachers' engagement and understanding and use of the theories, and

(b) being able to judge the most appropriate times, places, and ways to facilitate learning.

The study found that teachers need to examine the theory-practice relationship more closely in their roles. Some factors were identified as influencing, constraining, and/or enabling teaching that considers theory-practice relationships. Nilssen and Solheim (2015), in discussing the experiences of Norwegian student teachers, found that there were three key factors in bridging theory and practice: highlighting the connection between classroom teaching and coursework, the authenticity of the tasks, and future relevance for a teaching career. In a longitudinal qualitative case study, Knight (2014) explored student teachers' conceptions of the relationship between theory and practice in their learning, through three interview phases (before the course, during the course, and at the end of the course), focus groups and whole cohort triangulation, documentary sources (set of reflective diary entries), and an essay (requiring reflection on their practice including their placement experience etc.). Knight's (2014) findings indicated that students were found to be far from naïve as they entered training but identified significant shifts in their understanding of the role of theory. Stolz and Thorburn (2020) examined how the contemporary academic literature and discourse around physical education often assumes that there is a problem with the practices found in the field of physical education. They concluded that the relationship between theory and practice becomes noticeable when a method becomes ineffective or fails, and that this usually triggers an increase in theoretical investigation that inevitably leads to beneficial modifications to practice or practices. Likewise, Knight (2015) investigated student teachers' conceptions of applying learning theories. He concluded that the successful application of theories needed partnerships between universities and schools. As a result of findings such as this, teacher education in countries such as Oman is becoming more school-based through the development of new partnerships (Sulaiman et al., 2018).

To summarize, the current study built on previous studies in formulating a theoretical framework and identifying appropriate factors to include in the STPLTS instrument, including the culture of teacher training, preparation programs for science teachers, and school-based training programs. The present study defines PLT based on the work of Kaya et al. (2021), who argue that learning theories explain how students receive, process, and retain knowledge during learning, and how ways of learning are influenced by cognitive, emotional, and environmental backgrounds and past experience. The current study is built on the idea that PLTs need to be put to practical use in order to help teachers plan and provide effective learning opportunities. Many studies (Bates, 2015; Kaya & Akdemir, 2016; Schunk, 2020; Zhou & Brown, 2015) have suggested that teachers' implicit views on teaching and learning (such as transmissive vs. constructivist views) guide teachers' classroom performance.

Research Questions

The overarching goal of the present study was to explore science teachers' perceptions of PLTs in the

Table 1. Sample statistics

	Teacher's major course		
	Physics	Chemistry	Biology
Teaching experience (more than five years)	43.1% (n=174)	41.8% (n=169)	32.9% (n=133)
Gender (female)	40.1% (n=162)	60.4% (n=244)	48.0% (n=194)
Completed a teacher education program (BSc)	34.2% (n=138)	44.3% (n=179)	21.2% (n=86)

Table 2. Overview of scales for assessing teachers' perceptions of STPLTS

Subscale	Number of items	Reliability (P/C/B)
Principles of pedagogical learning theories	20	0.92/0.90/0.88
Relationship of pedagogical learning theories to teachers' classroom practices	19	0.94/.096/.095

Note. P: Physics; C: Chemistry; B: Biology; & Reliability: Cronbach's alpha

Omani science classroom context by using the STPLTS. Two research questions (RQs) guided the study. They are:

1. **RQ1:** Can the theoretical factorial structure of teachers' perceptions and views be validated empirically?
2. **RQ2:** What is the impact of the following teacher characteristics:
   a. gender,
   b. preparation program, and
   c. years of teaching experience, on teachers' perceptions with respect to the two components of the STPLTS?

METHODS

Design and Sample

A quantitative approach and a cross-sectional design were used in this study (Creemers et al., 2010), which was conducted from September to December 2020. A sample of science teachers voluntarily participated in the study with official permission from the Ministry of Education in Oman.

The sample of teachers in this study was selected from schools using CPU's new science curricula (**Table 1**). Due to the COVID-19 pandemic, the questionnaire was administered to the participants online using Google Forms with the help of supervisors of teachers in 11 regions in Oman. For the study, a large nationally representative sample of science teachers (n=350) was randomly selected from grade 5-10 (10-15 years old) basic education 2 classes.

Survey

The STPLTS was developed by the authors who benefited from their previous study (Shahat et al., 2022b) which focused on creating a scale to assess teachers' perceptions of PLTs. The questionnaire consisted of two subscales–the principles of pedagogical learning theories (PPLT), which has 20 items and the relationship of pedagogical learning theories to teachers' classroom practices (RPLTTCP), which has 19 items. The questionnaire thus consists of 39 items and utilized a 4-point Likert scale ranging from a score of "1" for "strongly disagree" to "4" for "strongly agree". Teachers also answered background questions about their gender, teaching experience (in years), and the preparation program they attended.

Table 2 shows an example item for each of the two STPLTS subscales and their reliability using Cronbach's alpha for teachers with physics, chemistry, and biology degrees.

Data Analysis

Teachers' backgrounds, descriptive statistics, and the RQs were analyzed using SPSS AMOS 24 and SPSS 25. Scores for teachers' perceptions were categorized as 3.25-4=high; 2.50-3.24=medium; 1.75-2.49=weak; and 1-1.74=none (Matosas-López et al., (2019). For answering RQ1, we conducted confirmatory factor analyses (CFA) and utilized the Chi-square difference test to compare a two-factor model with a general factor model. To investigate the impact of teachers' backgrounds on their perceptions (RQ2), we used a *t*-test for independent samples. The data set contains no missing data.

RESULTS

Below we present the descriptive results and the answers to the two RQs.

Descriptive Results

Descriptive results are presented using labels based on the criteria of Matosas-López et al. (2019) (**Table 3**).

Table 3. Descriptive results for the two components of the STPLTS

No	Sub-scale items	Teachers' mean scores						R*
		P		C		B		
		M	SD	M	SD	M	SD	
I see learning and teaching theories as…								
1	Consisting of concepts, facts, & principles organized within a valuable and meaningful structure.	3.58	.56	3.58	.55	3.59	.57	.96

Table 3 (Continued). Descriptive results for the two components of the STPLTS

No	Sub-scale items	Teachers' mean scores						R*
		P		C		B		
		M	SD	M	SD	M	SD	
	I see learning and teaching theories as…							
2	Expressing a model to connect principles & ideas and explain how principles & ideas work.	3.48	.59	3.48	.62	3.42	.62	.95
3	Emerging from several factors such as learning desire (learning motivation) & understanding the nature of learning.	3.50	.59	3.45	.64	3.41	.82	.96
4	Explaining how learning occurred.	3.37	.66	3.49	.61	3.37	.66	.96
5	Referring to a set of knowledge related closely to learners, teachers, community/society, & the environment.	3.52	.60	3.55	.56	3.40	.68	.96
6	Forming a framework to interpret the learning of learners.	3.37	.63	3.43	.64	3.51	.58	.95
7	Relying on scientific evidence approved & attested by researchers in the field of education & psychology.	3.44	.67	3.46	.66	3.50	.68	.95
8	Partially focusing on the importance of personal experience & understanding the status of learners.	3.22	.72	3.25	.71	3.36	.65	.96
9	Consisting of a set of laws & principles used for organizing & understanding teachers' teaching practices.	3.52	.60	3.41	.61	3.50	.61	.95
10	Being based on philosophical principles related to learners' internal or external factors.	3.23	.73	3.37	.66	3.39	.68	.95
11	Having principles based on the learner & his/her personal experience in building knowledge & changing behavior.	3.03	.90	3.19	.77	3.08	.89	.96
12	Organizing the learning & teaching process & linking between previous & new knowledge.	3.38	.64	3.47	.63	3.45	.67	.95
13	Providing a scientific framework for teaching & learning strategies.	3.45	.60	3.40	.66	3.56	.62	.95
14	Providing a framework to explain behavior, the source of knowledge, & the acquisition methods for learners.	3.26	.71	3.34	.72	3.30	.83	.96
15	Providing approaches to assess learners' achievement in the educational process.	3.22	.76	3.37	.66	3.33	.72	.95
16	Differing according to the concepts on which they are based & how easily a teacher explains them.	3.24	.74	3.43	.61	3.28	.70	.95
17	Being susceptible to change according to a change of setting (time & place).	3.02	.89	3.09	.89	3.02	.94	.96
18	Being viewed more favorably by teachers according to their previous experiences in teaching.	3.09	.85	3.20	.81	3.11	.92	.96
19	Easier to understand if teachers have read & explored the results of other educational research & studies.	3.15	.85	3.25	.74	3.39	.67	.96
20	Equipping teachers with a complete understanding to explain educational practices.	3.48	.56	3.39	.72	3.49	.64	.95
	Sub-scale PPLT	3.33	.41	3.38	.43	3.37	.39	.96
	I see the role of learning and teaching theories as…							
1	Interpreting classroom practices such as identifying a specific teaching method.	3.25	.78	3.16	.76	3.30	.84	.96
2	Inspiring teachers to use diversified teaching approaches.	3.46	.67	3.45	.72	3.52	.64	.95
3	Supporting teachers in selecting appropriate teaching approaches scientifically.	3.34	.75	3.49	.64	3.47	.64	.95
4	Theories to be acquired by practicing their associated concepts in the classroom.	3.33	.70	3.40	.68	3.33	.80	.96
5	Equipping teachers with the ability to effectively communicate teaching approaches & evaluation methods with their colleagues.	3.33	.68	3.48	.55	3.44	.67	.95
6	Theories for teachers to employ as a part of contemplative or reflective practices.	3.23	.67	3.21	.75	3.25	.74	.95
7	Helping teachers develop/improve their teaching skills.	3.49	.66	3.47	.64	3.52	.58	.95
8	Helping teachers to identify the learning needs of learners.	3.39	.66	3.47	.65	3.45	.72	.95
9	Helping teachers in addressing educational problems that are faced in the field.	3.38	.68	3.46	.70	3.51	.69	.94
10	Contributing to long-term development of teachers' practices in the classroom context.	3.47	.67	3.50	.66	3.50	.63	.95
11	Equipping teachers to understand their practices fully so they can move from (what they do) to (why do they do?).	3.31	.73	3.40	.67	3.46	.72	.95
12	Helping teachers evaluate their own teaching practices & colleagues' practices.	3.27	.73	3.35	.67	3.40	.73	.95
13	Equipping teachers to understand learners' behaviors & address them fully.	3.36	.70	3.43	.64	3.43	.66	.95
14	Helping teachers to identify targeted goals or learning outcomes in learning activities.	3.37	.70	3.46	.65	3.42	.76	.95
15	Helping teachers to adopt standards & norms in selecting educational activities.	3.32	.71	3.47	.62	3.41	.71	.95
16	Helping teachers to achieve the desired objectives in the assessment process.	3.38	.66	3.43	.63	3.46	.71	.95
17	Helping teachers in understanding various types of learners' learning (learning styles).	3.40	.71	3.47	.59	3.47	.61	.95
18	Equipping teachers with knowledge of the different types of feedback, the importance of feedback, & how to use it.	3.34	.75	3.48	.64	3.49	.66	.95
19	Helping teachers to understand previous experiences & link them to practice.	3.43	.67	3.42	.65	3.54	.63	.95
	Sub-scale RPLTTCP	3.36	.49	3.42	.50	3.44	.85	.96

Note. P: Physics; C: Chemistry; B: Biology; Mean score: 3.25-4 high; 2.50-3.24 medium; 1.75-2.49 weak; 1-1.74 none (Matosas- López et al., 2019); & *Cronbach's alpha for the whole sample

Table 4. Bivariate correlations between components of teachers' perceptions and their background characteristics

Variables	Teaching experience	Gender	Preparation program
PPLT	-.140**	.345**	-.063
RPLTTCP	-.196**	.291**	-.127*

Note. **p<.01 & *p<.05

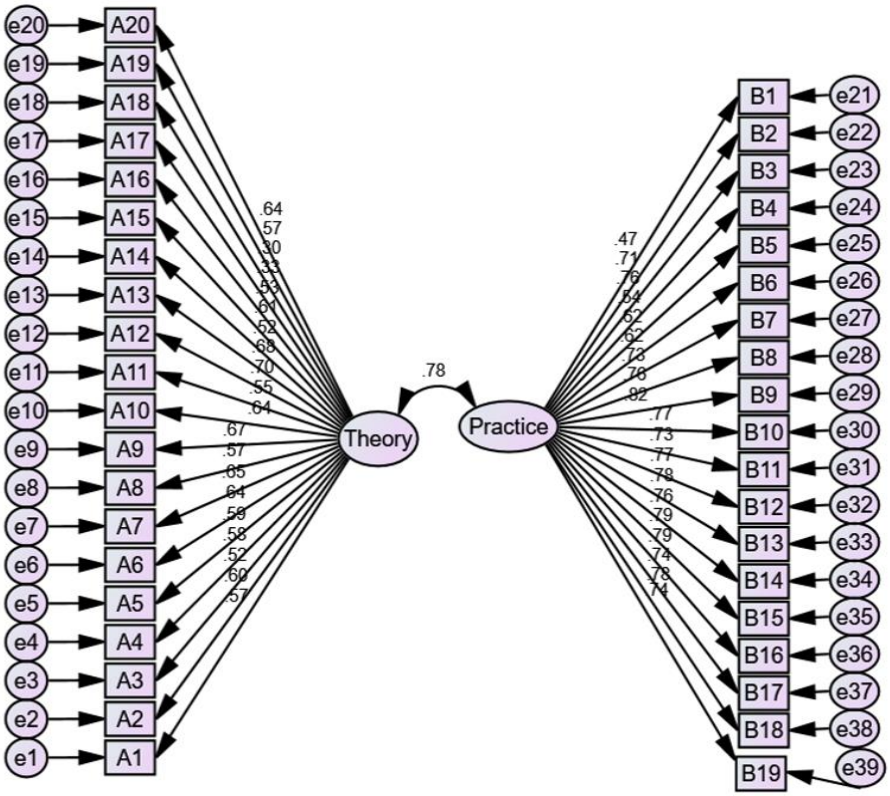

Figure 1. Two-factor model of components of teachers' perceptions of PLT (*p<.05; χ^2=1606.304 [df=701, p=.00]; CFI=.90; & RMSEA=.06)

Teachers generally showed moderate to high perceptions of STPLTS items. Teachers from all majors (physics, chemistry, and biology) had high perceptions regarding the principles of PLTs in teaching science. They also had high perceptions of practicing PLTs in their classrooms.

Table 4 shows bivariate correlations between components of teachers' competence based on PLTs and their background characteristics.

Factorial analysis of two components of teachers' perceptions of STPLTS (RQ1)

The results of exploratory factor analysis showed that the eigenvalues of the first and second factors (subscales) were about 46% of the total variance. The results of confirmatory factor analyses confirmed the multifactorial structure of components of the STPLTS. The resulting two-factor model and the corresponding model fit indices are illustrated in **Figure 1**.

Intercorrelations between the factors were allowed with coefficients within a range of values (-.43<r<.82).

Influence of teacher characteristics and two components of teachers' perceptions of PLTs (RQ2)

Gender differences: The results in **Table 5** showed statistically significant gender differences between the mean scores for teachers' perceptions on the PPLT and RPLTTCP subscales of the STPLTS. The t-test results, t(348)=-6.85, p<.05, revealed that female teachers' perceptions of the principles of PLTs were significantly more positive than those of male teachers. In addition, the results showed statistically significant gender differences between the mean scores of teachers on RPLTTCP dimension. The t-test results, t(348)=-5.66, p<.05, revealed that female teachers' perceptions of principles of PLTs were also significantly higher than those of male teachers.

Teaching experience: Analysis of variance (**Table 5**) showed a significant main effect of teaching experience on the two subscales of the STPLTS: for PPLT, t(348)=3.09, p<.05; and for RPLTTCP, t(348)=3.90, p<.05. The perceptions of PPLT were higher for teachers with less teaching experience (1-9 years) than those of teachers with more experience (≥10 years).

Table 5. Means, standard deviation, and t-test values for teachers' perceptions of STPLTS (sub-scales by gender, teaching experience, and preparation program)

Variable		Sub-scale	n	M	SD	df	t	Cohen's d**
Gender	Male	PPLT	175	3.22	.44	348	-6.85*	0.72
	Female		175	3.50	.33			
	Male	RPLTTCP	175	3.26	.57	348	-5.66*	0.60
	Female		175	3.55	.37			
Teaching experience	1-9	PPLT	125	3.45	.33	348	3.09*	0.35
	≥10		225	3.31	.45			
	1-9	RPLTTCP	125	3.54	.36	348	-3.90*	0.52
	≥10		225	3.32	.55			
Preparation program	TQD	PPLT	56	3.42	.35	348	1.17	0.18
	BSc		294	3.35	.42			
	TQD	RPLTTCP	56	3.55	.40	348	2.39*	0.39
	BSc		294	3.37	.52			

Note. *p<.05; **d≥0.1 is small; d≥0.50 is medium; d≥0.8 is large (Cohen, 1988)

Preparation program: Analysis of variance (**Table 5**) showed no significant main effect of preparation program on the RPLTTCP, t(348)=1.17, p>.05; but there was a significant main effect of preparation program on the PPLT, t(348)=2.29, p<.05. Teachers with a TQD had higher perceptions of RPLTTCP compared to teachers with only a BSc degree.

DISCUSSION

Against the backdrop of recent education reform initiatives in Oman, this study aimed to explore teachers' perceptions of the principles of PLTs and their application within the classroom. In general, the results indicated that teachers showed moderate to high perceptions of STPLTS items, and high perceptions of the total mean scores of the subscales (PPLT and RPLTTCP) regardless of their characteristics. These results could be explained on the basis that all teachers in our sample had the same training on teaching methods, assessment, and global best practices from the Specialist Institute for Professional Training of Teachers at the Ministry of Education regardless of gender, teaching experience, or preparation program. In addition, all these teachers teach the same CUP curriculum, so they are all asked to follow the same guidelines and suggested methods of teaching. Another reason could be that all teacher preparation programs in Oman have courses in educational psychology and teaching methods that include PLTs to some degree (ECO, 2020; Oman Educational Portal, 2019). However, our findings were in line with those of Rahman's (2018) study, in which teachers commented that classroom assessment practices did not appear to have been covered extensively in their instruction.

Our results also revealed that female teachers' perceptions of PPLT and RPLTTCP were significantly higher than those of male teachers. We argue that there was a gender difference because, according to some national studies in Oman (e.g., Shahat et al., 2022c), female teachers are generally more engaged with their students. Likewise, they were keener to develop their teaching skills by attending in-service training workshops. These characteristics were reflected in their student's achievements, with female students outperforming male students in international studies such as the TIMSS in grade 8 (Al-Balushi et al., 2014). In cycle 1 (grades 1 to 4), boys and girls are taught in the same classes and the teachers in these grades are usually female. However, male and female students are taught in separate schools in cycle 2 (grades 5 to 10) and post basic education (grades 11-12) and the teachers can be male or female. These results aligned with those of Kuwait, a neighboring country of Oman, where the TIMSS results indicated that Kuwaiti girls outperformed boys (Al-Mutawa et al., 2021). However, our results contradicted those of a study concerning gender differences by Beijaard et al. (2000), who found that relatively more male than female teachers perceived themselves as having good pedagogical content knowledge.

Moreover, our results indicated that PPLT and RPLTTCP perceptions were higher for teachers with less teaching experience (1-9) than those with more experience (≥10). This is perhaps because teachers with less experience retained the knowledge about PLTs they gained during their more recent study at Teacher Preparation Institutes compared to those with more teaching experience (Hughes, 2005). However, these results contrasted with those of other studies (Guerriero, 2014; McMillan, 2003), which revealed that more experienced teachers had a better understanding of PLTs and used them more in classroom practices.

As for the effect of the preparation program, the results indicated no statistically significant differences between teachers who studied at different programs in their perceptions of the principles of learning theories. However, teachers with a TQD had higher perceptions of RPLTTCP. We argue that this may be because the TQD pre-service preparation program was a one-year intensive course, allowing them to delve deeply into

theories and apply them in practice; in addition, these student teachers had more motivation to teach because they were predominantly female.

Limitations and Conclusion

One major limitation of this study is that the data collection was carried out at one single point in time in Oman using a cross-sectional design. We recommend conducting further research in Oman and other Arab countries to investigate how perceptions of learning theories correlate with teacher effectiveness and student engagement in classroom learning. Possible further research would involve a training intervention study focused on instructing teachers to use the STPLTS to improve their knowledge of learning theories and classroom outcomes. Another limitation in this study is that the teachers' knowledge of learning theories was assessed by using a self-report measure. We recommend conducting a future study using qualitative methods such as observations and interviews.

To conclude, the sample in this study was randomly selected from the five regions in Oman, and, therefore, it is thought that the findings should be a good reflection of similar teacher performance in most areas of Oman. To be able to generalize the results to other countries with the same culture and conditions, we recommend replicating the study on a larger sample of teachers in various levels of schools in different countries. We believe that the large and representative sample size is a strength of this study. The survey was both valid and reliable for measuring the Omani science teachers' perceptions regarding STPLTS. The results showed that teachers viewed their ability in using the theories in the two STPLTS subscales in a positive light. The results also revealed the medium influence of teachers' gender, teaching experience, and preparation program on their perceptions of learning theories and how they relate to their teaching practice, as indicated by the STPLTS.

Implications for Research and Teaching

This study contributes to the science education field by using the STPLTS in an Arab context to shed light on the effect of gender, teaching experience and preparation program on teachers' competence in teaching. One contribution of this study is its demonstration of the suitability of the Arabic version of the STPLTS in the Oman context. The STPLTS can help assess the competence of teachers in teaching in elementary, lower, and upper secondary schools in Oman and possibly other countries. An additional theoretical aim of this study was the detailed description of the two subscales of the STPLTS. These two subscales can be used as a single diagnostic scale for education officials in Oman to identify strengths and weaknesses in teacher training programs regarding PLTs, which might help science teachers, or teachers in general, to receive more effective training. This might influence teacher training and help improve confidence among student teachers related to the application of learning theories. Based on the developed STPLTS, peer or self-assessment could also be used by teachers to show the weaknesses of their performance in teaching using learning theories, which could result in better practices in classroom teaching. Another insight from this study is that male teachers might need more in-service training to improve their practices in the classroom. This is important for achieving good classroom interactions and, subsequently, ensuring good quality science instruction in Omani science classes.

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