



MATHEMATICS AND SCIENCE TEACHERS' PERCEPTIONS OF THE FACTORS INFLUENCING TEACHING AND PROFESSIONAL IDENTITY

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Abstract

Professional identity has a significant impact on teachers' interpretation of their different roles and their understanding of how to perform these roles. This study aimed to explore mathematics and science teachers' perceptions of the factors influencing their teacher professional identity within three dimensions: teaching efficacy, teaching profession, and teaching context. Mathematics and science teachers (N = 395) who were teaching in grades 5 to 12 participated in the study. To address the research aims, we administered a questionnaire to gather information on the factors influencing teacher professional identity. The quantitative data on the teachers' perceptions of the factors influencing their teacher professional identity showed that the teaching efficacy dimension ranked the highest, the teaching context dimension ranked second and the teaching profession dimension third. The teachers' perceptions were largely influenced by three main factors: years of teaching experience, gender, and school location. The teachers' responses to the questionnaire's open-ended questions highlighted some issues related to the quality of the professional development programs available to teachers.

Keywords: *teaching professional identity, math teachers & science teachers*

Introduction

The Concept of Identity

The concept of identity is a significant psychosocial factor for studying teachers' personalities. The term *identity* reflects the developing connection in a person where all inner and outer forces converge: the mystery of personality, the nature of humanity, the culture in which an individual was brought up, and lived experiences (Beijaard et al., 2000). Ghanizadeh and Ostad (2016) indicated that identity can be viewed as a "fluid, dynamic, recursive, and discursive process in which statements about actions are translated into statements about states, and vice versa" (p. 831).

In the teaching context, professional identity is defined as a reflection of the developing knowledge of the subject matter that teachers teach, in the many beliefs and values involved in their relationships and interactions with students, and in the efficacy of their teaching practices for students' outcomes (Beijaard et al., 2000; Sener, 2015). Palmér (2016) claimed that teachers' awareness of their professional identity - as it affects their self-motivation, self-organization, and job satisfaction - has an impact on the interpretation of their various roles and on the perception of how to perform these roles. It also influences teachers' actions regarding the design of lesson

plans, the implementation of strategies, the assessment of the learning process to enrich and improve the curriculum, and the communication and collaboration with others (Cyrino, 2016; Dalby, 2017). Chong et al. (2011) argued that understanding a teacher's professional identity is an ongoing process that requires studying the impact of policy and social opportunities on perceptions of quality teaching, examining the influence of school context, and exploring the main factors that impact the individual's sense of professional identity.

Research-Based Theoretical Foundations

Different studies have shown that teachers' professional identity is connected to different individual components such as motivation, confidence, and self-efficacy. Hanna et al. (2020) argued that motivation, self-efficacy, self-image, and task perception are factors affecting teacher's professional identity. Educational programs in particular should be aware of the personal, relational, and contextual factors that can influence the growth of teachers' professional identities. Steinert et al. (2019) claimed that faculty professional development programming can play a critical role in enhancing and strengthening the professional identities of teachers. Van der Wal et al. (2019) indicated that affective appraisal and behavioural responses such as "reflective action, support seeking, help-seeking, and directive action" can help to understand how professional identity tensions impact early career teachers.

Teachers' awareness of their professional identity also has an impact on their interpretation of their various roles and their perception of how to perform these roles, improve the curriculum, and communication and collaboration with others (Ennerberg & Economou, 2021). The studies that have explored the development of teachers' professional identity reveal that the perceptions of teachers regarding their professional identity affect their teaching efficacy, their professional development, their propensity to stay in the teaching profession, and their ability and willingness to enhance their teaching performance and cope with educational change (Chong et al., 2011; Wagoner, 2011; Beijaard et al., 2000). Korthagen (2004) indicated that studying teachers' perceptions of their professional identity may widen researchers' understanding of what enhances the quality of teaching and may add validity to research into the role of teaching pedagogies in enhancing the quality of learning experiences Chong et al. (2011) highlighted the need to study the correlation between the various components that shape individual perceptions of teachers' professional identity, such as knowledge, teaching values, pedagogical practices, and citizenship behaviour.

Ahmad et al. (2019) argued that the concept of teacher professional identity has currently emerged as an important factor and can have a significant effect on teaching and learning outcomes. They add that scholars and researchers should take more consideration to explore and identify factors that have the potential to contribute to professional identity development. Many factors shape professional identities, such as the impact of policy and social expectations, the effectiveness of the school context, and the influence of personal, family, and societal roles (Chong et al., 2011). Ahmad et al. (2019) indicated that studying the development of teachers' professional identities is influenced by the following three considerations:

(1) "the socio-cultural context, which affects teacher beliefs, perceptions, and teaching practices; (2) the nature of teacher learning; (3) general beliefs about the teacher's role and institutional goals; and (4) the different research methodologies that will be applied to conceptualize the complexity and multiplicity of teacher identity" (p. 8).

Cardoso and Costa (2016) also reported that in terms of influencing professional identity and satisfaction with their career, teachers value the role of satisfying personal factors in the profession; however, the researchers reported that crowded curricula and poor working conditions negatively affect satisfaction levels in teachers.

The results of a study by Shaalvik and Shaalvik (2015), which was based on interviews with four retired teachers and thirty in-service teachers, showed that the main challenges and sources of anxiety in the teaching profession were related to "workload and time pressure, adapting teaching to students' needs, disruptive student behaviour, value conflicts and lack of autonomy, teamwork, and lack of status" (p. 184). Gracia et al. (2019) studied the beliefs of 279 technology and science student teachers from 2014-2018 regarding the development of teachers' professional identity and its construction. The results of their study highlighted the importance of the connection between teachers' perceptions regarding their professional identity and the improvement of their pedagogical knowledge and skills linked to socio-educational aspects.

Currently, the topic of professional identity is receiving renewed attention from researchers, particularly in terms of the increasing level of expectations on teachers in different pre-service and in-service communities, along with the changing roles of teachers in schools in response to social forces (e.g., Ennerberg & Economou, 2021, Gracia et al., 2022). The focus on teachers' professionalism in recent studies has moved toward greater emphasis on discussing professional identity and the requirements for its optimization such as strong intellectual abilities, negotiating complex social interactions, extensive specialized preparation, and a supportive social life (Gracia et al., 2022; Steinert et al., 2019). Clarke and Hollingsworth (2002) claimed that improving teachers' professional identities requires changes in teachers' norms, concepts, perceptions, attitudes, knowledge, pedagogical practices, and the quality of student learning outcomes. Tsybulsky and Muchnik-Rozanov (2019) studied the process by which the professional identity of 17 student teachers was shaped while team-teaching science classes using a project-based learning (PBL) approach. The results, based on in-depth interviews as well as reflective reports, showed that the student teachers' professional identity was gradually changed as a result of supervising the PBL sessions and collaborating effectively with their co-teachers. The researchers also claim that identity formation is enhanced through the process of overcoming challenges through reflective social experiences with peers who support their professional and personal growth and enhance their self-confidence. Olsen and Anderson (2007) studied the reasons for entry into the teaching profession and the main factors for staying or leaving the profession 15 new teachers in urban Los Angeles. The findings indicated that teachers' pre-service programs greatly shaped their initial motives for admission. The results also highlighted the need to improve several educational practices inside and outside the classroom, increase receive professional support, and improve workplace conditions in order to strengthen their professional commitments.

Coldwell's study (2017) aimed to explore the relationship between teacher professional development programs and professional identity based on the results of a survey of the perceptions of 500 teachers and interviews with 25 teachers. The results showed that the main factors influencing identity are the quality of professional development programs, the organizational support and school culture, and individual factors such as motivations for engagement in professional development, career stage, and family issues. Symeonidis's (2015) study, which was commissioned by Education International (EI) in the UK, aimed to examine the voices from 73 member organizations in 55 countries in order to understand the main influences affecting teachers' professional identity and promote the teaching profession. The findings from Symeonidis's survey indicated that "teacher status is related to aspects of quality education and, more specifically, to socio-cultural and economic contexts, job security, salaries, and working conditions, teachers' professional development, representation of the teaching profession, professional autonomy, social dialogue, and involvement in decision-making" (p. 10).

Ambusaidi and Al-Balushi (2012) studied the perspectives of supervisors of science, physical education and Arabic education teachers concerning the level of professional identity that they possess. Their study revealed that teachers should have ongoing opportunities for

developing their professional identity through quality professional development programs. In 2017, Ambusaidi and Al-Farei conducted a study to explore the attitudes of 139 randomly selected science teachers in grades 5 to 10. In terms of classroom preparation, facilitating hands-on science lessons, and offering developmentally appropriate interventions the teachers' attitudes toward their teaching practices were strongly positive or positive, and gender and experience were statistically significant factors for the differences in the teachers' attitudes toward teaching science. A problem with these studies according to Ahmad et al. (2019) is that researchers often differ in their interpretation of the concept of teacher professional identity, and their opinions vary regarding how to measure it. These differences occur due to three diverging research approach reasons: first, some researchers are interested in studying the concept of teacher professional identity through teacher self-evaluation of their roles, ideas, and self-concepts in the teaching and learning process; second, others are interested in studying the concept by studying teachers' awareness of their roles, and third, some researchers are concerned with studying the professional identity of teachers by measuring the relationship between teachers' roles and their social life. Since these three research approaches discussed by Ahmad et al. (2019) lead to distinct but complementary insights into professional identity, studying the integration of these aspects may provide new dimensions in understanding this concept and the variables associated with it.

Based on findings from a national study (Ministry of Education [MoE], 2012), the MoE concluded that quality student learning outcomes are dependent upon teachers' skills and meaningful support from school management. Similar findings were obtained from a report that was jointly prepared by the MoE and the World Bank; they found the main difficulties facing the Omani educational sector are how to develop student learning outcomes and enhance the quality of teaching (MoE, 2012). In recent years, the MoE has collaborated in many international studies to evaluate the progress of schools in mathematics and science (e.g., TIMSS 2007; TIMSS 2011; TIMSS 2015); and gauge the quality of education programs for teachers (e.g., the Teacher Education and Development Study in Mathematics (TEDS-M)) in 2008. The results of the studies emphasized the central significance of enhancing schoolteachers' professional knowledge and practices to improve overall students' learning outcomes, and specifically science and mathematics outcomes.

Research Aims and Questions

This research aimed to explore mathematics and science teachers' perceptions of the factors influencing their professional identity as teachers. Hence, two specific research questions were formulated as follows:

- With regard to the dimensions of *teaching efficacy*, *teaching profession*, and *teaching context* - what are mathematics and science teachers' perceptions of the factors that influence their professional identity?
- What are the differences in mathematics and science teachers' perceptions of how the following demographic variables - *years of teaching experience*, *gender*, *school location*, *educational degree*, and *specialized subject* - influence their professional identity?

Research Methodology

General Background

The research adopted a mixed-methods design where both quantitative and qualitative methods were used. The reason for integrating quantitative and qualitative research tools was to obtain a more comprehensive picture of teachers' perceptions regarding the factors affecting their professional identity. The data was collected using a teacher's professional identity scale questionnaire items and an open-ended question. For the quantitative part, participants were given a questionnaire containing Likert scale questions. We used the scale to explore the mathematics and science teachers' perceptions of the factors influencing their professional identity. For the qualitative part, we obtained the data from an open-ended question that focused on exploring teachers' experiences and the impacts of these experiences on their professional identities.

This study is in line with the main objectives of the MoE, which are to enhance the quality of teaching and student learning outcomes. The education system in Oman includes both public (grades 1-12) and private (preschool to grade 12) institutions. Public school education includes two stages, Basic and Post-Basic Education. Basic education (grades 1-10) is divided into two cycles, Cycle 1 (Grades 1-4), where male and female students are taught in the same classes, and the teaching staff are completely female; and Cycle 2 (Grades 5-10), where students of both sexes are taught in separate schools, and in most schools, males teach male students and females teach females. The Post-Basic Education stage is for students in grades 11 and 12 and requires male and female students to study in separate schools. The MoE is interested in achieving high educational standards and developing teaching practices by enhancing the professionalism of teachers. Studying the factors that impact teachers' professional identities has become a significant strategy to enable ongoing educational reforms in terms of teachers' beliefs, attitudes, and pedagogical practices. By studying teachers' needs, expectations, and levels of commitment, this study may offer new insights to help develop teachers' professional identities. In the Omani context, there is a lack of studies on professional identity; therefore, by examining the perceptions of mathematics and science teachers in this study, we hope that a greater understanding may be possible of the main factors that influence teachers' professional identities.

This is the first study in this context that has explored factors influencing teacher professional identity that fall within three dimensions: *teaching efficacy*, *teaching profession*, and *teaching context*. Thus, the findings may lead to a better understanding of the factors that influence teachers' performances on the one hand and to opportunities to evaluate the design and ongoing management within educational institutions on the other.

Sample

For the quantitative data, 395 mathematics and science teachers teaching in public schools were selected according to a convenience sampling method from three educational governorates. Convenience sampling is a type of sampling method to select participants from the target population who meet specific criteria related to geographical proximity, affordable availability, willingness to participate, and the homogeneity of the target population (Etikan et al., 2016). The most well-represented group in the study sample is teachers with more than eight years of teaching experience and those with a bachelor's degree in mathematics or science, as they represent the largest number of the study population. In addition, the schools were selected from three governorates in order to ensure that there was diversity among the participants in terms of their demographic characteristics such as years of experience, academic degrees,

gender, and scientific specialization. Table 1 describes the distribution of our research sample by demographic factors.

Table 1
The Research Sample Demographic Distribution

Demographic Data/ factors		Frequency	Percentage (%)
Years of teaching experience	1-4	55	13.9
	5-8	114	28.9
	> 8	226	57
Gender	Male	131	33.2
	Female	264	66.8
School location	AlBat	164	41.5
	Alda	134	33.9
	Alsh	97	24.6
Educational degree	Bachelor	348	88.1
	Diploma	27	6.8
	Educational Diploma	20	5.1
Specialized subject	Science	194	49.1
	Mathematics	201	50.9

Instrument and Procedures

After obtaining permission from the Oman MoE (the permission number is 2818242062) and the schools' principals, we selected the sample for this study. The data collection process took place in each school during a scheduled meeting. First, the participating teachers were informed before the meeting that a study would be conducted to examine their perceptions of the factors influencing their professional identity. During the interview, the purpose of the study was explained. The importance of their opinions as teachers in understanding the factors affecting their professional identity was also emphasized, and the components of the questionnaire and the response options were clarified. We explained to teachers that an open-ended question provides space to add opinions, suggestions, and other perspectives from their experiences, particularly those related to the teaching profession in general and teacher roles in particular. Then, the research instrument was administered during the meeting.

A questionnaire called the Teacher Professional Identity Scale (TPIS) for measuring teachers' perceptions of the factors influencing professional identity was developed for mathematics and science teachers by investigating several teacher professional identity instruments that had been developed both generally and within the Oman context (Battle & Looney, 2014; Wagoner, 2011). Part one of the scale covered demographic information such as years of teaching experience, gender, school location, educational degree, and specialized subject. Part two consisted of 46 items about in-service teachers' perceptions of the factors influencing their teaching professional identity. The factorial structure of the TPIS revealed three dimensions. The structure of the *teaching efficacy* dimension included 18 items for investigating teachers' perceptions of the factors influencing their lesson plans, strategies, teaching instruments, choice of content, and their students' learning and engagement. Teaching

efficacy is a dimension of self-confidence that refers to teachers' beliefs about their ability to effectively apply teaching tasks necessary to enhance student achievement. It is a self-judgment of competence related to achieving given types of tasks and expected outcomes (Martin, 2016). The *teaching context* dimension included 12 items aimed at understanding teachers' perceptions regarding the teaching environment, the opportunities to participate in professional development programs, and the nature of the interaction between teachers and society. According to Chong et al. (2011) *teaching context* is a dimension that is specific to a school context and is affected by the surrounding environment. They argue it is affected by students, management support, and feedback loops from teachers' immediate working context and helps form teachers' developing identities. Hence, this dimension is linked to social roles within a school (Chong et al., 2011). The *teaching profession* dimension included 16 items for investigating teachers' perceptions of the social status of teaching, the degree of commitment to the teaching profession, and teachers' desire to stay in the teaching profession. The *teaching profession* is a dimension that refers to teachers' attitudes, emotions, and feelings towards teaching, pupils and their educational experiences; and the aspects of work culture that enhance teaching and learning experiences (Martin, 2016).

Forty-six items were used in the final version of the TPIS. Each item consisted of a statement with an accompanying 5-point Likert scale with options ranging from *strongly disagree* to *strongly agree*. The degree of agreement was determined according to the following range of mean score values: 4.210–5.00 for 'very high agreement' (VHA), 3.410–4.209 for 'agreement' (A), 2.610–3.409 for 'undecided or neutral' (N), 1.810–2.609 for 'low agreement' (LA), and 1.000–1.809 for 'very low agreement' (VLA).

The items on the TPIS were written in Arabic when the questionnaire was given to participants. Following this the scale was translated into English by an educational expert specializing in English and then retranslated into Arabic to ensure the overall equivalence of the translation and, in particular, to check for exact equivalence between the vocabulary of the two versions of the scale. With respect to validity and reliability, the researchers checked a number of benchmark criteria for the interpretation of the collected data. The internal consistency coefficients for the scores on the three dimensions, or subscales, of *teaching efficacy*, *teaching context*, and *teaching profession* were respectively 0.93, 0.94, and 0.89, as indicated by Cronbach's alpha. The internal consistency coefficient for the entire scale was 0.95. These values indicate that the TPIS has a high level of reliability. Furthermore, the correlations between the mean of the scale and the means of the dimensions were in the range of 0.72 to 0.89. The content validity of the items was established by presenting them to a group of science and mathematics supervisors who were experts in the areas of mathematics and science education to evaluate the clarity of language and suitability of each item for use with the targeted sample; they also examined the scale for comprehensiveness and relevance to the hypothesis being tested.

At the end of the questionnaire, the teachers were asked to respond to an open question about their perspectives on the factors affecting their work as mathematics or science teachers. This question allows teachers a less constricted opportunity to express their opinions regarding their experiences and factors that have affected their teacher identity during their years of experience as mathematics and science teachers.

Data Analysis

The quantitative data were analyzed using the Software Package for Statistical and Social Sciences (SPSS, 16). After gathering the participants' responses, descriptive statistics such as means and standard deviations were obtained. Additionally, the data were coded based on the following variables: gender, educational qualification, years of experience, and school location. Finally, two independent sample t-tests and a one-way test of variance were performed.

Concerning the qualitative data, in the third part of this study the participating teachers were asked to write about their perceptions of any factors influencing the teaching profession based on their experience. A proportion of 51% of the participants responded to the open-ended question. After recursively examining the data and looking for themes, it was coded. In qualitative data analysis, a code is "a construct that symbolizes and thus attributes interpreted meaning to each individual datum for later purposes of pattern detection, categorization, theory building, and other analytic processes" (Saldaña, 2013, p. 4). Data were initially coded on *teachers' professionalism, factors, and status*. Then, data analysis of the responses resulted in three main categories and associated sub-categories as shown in Table 2.

Table 2
Examples of Categories and Sub-Categories

Teachers' professionalism	<ul style="list-style-type: none"> ● professional development <ul style="list-style-type: none"> • quality programs • opportunities for continuous development • in-service training ● aspects <ul style="list-style-type: none"> • practical aspects • personal aspects • behavioural aspects ● experiences <ul style="list-style-type: none"> • new experiences • exchange experiences
Factors	<ul style="list-style-type: none"> ● workload <ul style="list-style-type: none"> • non-teaching work • school activities • administrative work ● intensity of teaching <ul style="list-style-type: none"> • insufficient time • number of teaching sessions
Status	<ul style="list-style-type: none"> ● community <ul style="list-style-type: none"> • cooperation ● social position <ul style="list-style-type: none"> • teachers' roles • appreciation • motivation • rights

Research Results

Mathematics and Science Teachers' Perceptions

Table 3 shows the teachers' mean scores based on their responses to the items from the three subscales. The range of mean scores is from 3.86 to 4.31. The lowest mean score (3.86) is for the dimension *teaching context*, and in the middle is the dimension *teaching profession* (4.10). The dimension with the highest mean score (4.31) is *teaching efficacy*. The teachers' responses to the questionnaire item statements revealed that within the teacher professional identity subscales of *teaching efficacy, teaching context, and teaching profession*, teachers were in very high agreement or agreement.

Table 3
Descriptive Statistics of the Subscales (Teaching Efficacy, Teaching Context, Teaching Profession)

Professional identity dimensions (subscales)	Descriptive Statistics		
	<i>N</i>	<i>M</i>	<i>SD</i>
Teaching efficacy	18	4.32	0.45
Teaching profession	16	4.10	0.59
Teaching context	12	3.86	0.72

Teaching Efficacy Dimension

The results in Table 4 show that within the dimension of teaching efficacy, the range of mean scores of the teachers' responses is from 4.08 to 4.53, indicating that most of the respondents indicated very high agreement.

The results also show that within the dimension of teaching efficacy, the respondents believe that a) the teaching practices they use with their students help to create a classroom environment that is characterized by mutual respect and support ($M = 4.53, SD = 0.57$); b) they have the ability to convince their students that math and science have practical meaning and value in life ($M = 4.47, SD = 0.65$); and c) they focused on fostering positive student behaviours through their methods of class management and class interaction control ($M = 4.42, SD = 0.65$).

Table 4
Means and Standard Deviations for the 'Teaching Efficacy' Subscale

Item no.	Item	M	SD	Degree of agreement
1	My daily and weekly plans are based on clear and measurable goals.	4.41	0.63	VHA
2	I have the ability to plan well for my lessons at an appropriate time.	4.30	0.71	VHA
3	Learning experiences given to my students reinforce problem-solving skills	4.13	0.68	A
4	I utilize teaching strategies that foster my students' use of higher thinking skills.	4.11	0.70	A
5	The scientific knowledge I provide to my students has implications and connections with real life	4.32	0.69	VHA
6	My students' responses prove their understanding of the ideas and concepts that I teach them.	4.22	0.67	VHA
7	There is a cognitive depth in the scientific content I provide to my students.	4.23	0.67	A
8	Class interaction leads to a continuous discussion between me and my students and between the students themselves.	4.41	0.66	VHA
9	I am keen to provide enough knowledge to my students about formative continuous assessments (their aims, contents, implication procedures, and their effects on students' improvement).	4.29	0.69	VHA
10	I focus on fostering positive behaviours through my ways of class management and class interaction control.	4.42	0.65	VHA
11	The teaching practices I use with my students help to create a classroom environment that is characterized with mutual respect and support.	4.53	0.57	VHA
12	I direct my students' behaviours to develop self-control and self-management among them.	4.38	0.66	VHA
13	My teaching practices focus on appreciating my students' individual differences and achieving comprehensive participation.	4.28	0.67	VHA
14	My teaching practices focus on fostering my students' positive interaction with society and encouraging active citizenship.	4.21	0.72	VHA
15	My teaching plans provide learning chances to my students that enhance their independent learning.	4.08	0.72	A
16	My teaching plans provide learning chances to my students that enhance collaborative learning.	4.24	0.71	VHA
17	I have the ability to convince my students that Math/ Science has meaning and value in practical life.	4.47	0.65	VHA
18	Taking care of all my students is a philosophy I adopt in my lesson planning and teaching.	4.40	0.66	VHA

Note. The items were arranged according to their order in the TPIS; VHA = very high agreement and A = agreement.

The results in Table 4 also reveal teachers have a very high agreement with the statement 'Taking care of all my students is a philosophy I adopt in my lesson planning and teaching' ($M = 4.40, SD = 0.66$). There was also very high agreement with the statement 'My daily and weekly plans are based on clear and measurable goals' ($M = 4.41, SD = 0.63$), and for 'I have the ability to plan well for my lessons at an appropriate time' ($M = 4.30, SD = 0.71$). Very high agreement was also obtained for item 5 'The scientific knowledge I provide to my students has implications and connections with real life' ($M = 4.32, SD = 0.69$), and item 9 'I am keen to provide enough knowledge to my students about formative continuous assessments (their aims, contents, implication procedures, and their effects on students' improvement)' ($M = 4.29, SD = 0.69$).

Regarding the student engagement sub-category within the teaching efficacy subscale, the respondents were in very high agreement with the statement 'Class interaction leads to a continuous discussion between me and my students and between the students themselves' ($M = 4.41, SD = 0.66$). They also very highly agreed that their teaching practices focused on appreciating students' individual differences and achieving comprehensive participation ($M = 4.28, SD = 0.67$).

Teaching Profession Dimension

Table 5 shows the mean scores and standard deviations for the items in the *teaching profession* dimension. The range of mean scores was from 3.30 to 4.54. The respondents were mostly in agreement with the questionnaire statements and most of the responses were in the "very high agreement" range.

Table 5
Means And Standard Deviations for the 'Teaching Profession' Subscale

Item no.	Item	M	SD	Degree of agreement
1	The educational and teaching experiences I acquired from teachers' preparation institutions were sufficient to foster my initial steps in teaching practices.	3.94	0.90	A
2	I believe that teaching has a distinguished and preferable status in society	3.81	1.19	A
3	I chose the teaching profession because it was the only available chance to me in university education.	3.46	1.29	A
4	Being a teacher gives me feelings of achievement and continuous giving.	4.22	0.96	VHA
5	Being a teacher allows me to build social relationships with my colleagues.	4.28	0.83	VHA
6	I love teaching.	4.18	0.98	A
7	If I were given the chance to choose another profession, I would choose teaching again.	3.57	1.35	A
8	Teaching profession provides me with continuous opportunities for cognitive development.	4.05	0.99	A
9	My career as a teacher fulfils my passion for knowledge provision and building students' personalities.	4.27	0.84	VHA
10	The teaching profession, in its nature, involves high values (sacred message, sincere giving, struggle...).	4.53	0.68	VHA
11	One of my responsibilities as a teacher is reinforcing my students' strengths and treating their weaknesses.	4.54	0.63	VHA
12	I have future visions to improve my teaching practices and upgrade my subject learning.	4.35	0.79	VHA
13	I have the desire to acquire new knowledge and skills that improve my teaching performance.	4.41	0.76	VHA
14	I have the ability to retain my motivation to teach regardless of the difficulties I face in students' learning.	4.21	0.82	VHA
15	One of my future goals is to foster my students' positive attitudes toward my subject.	4.39	0.69	VHA
16	Financial allocations of the teaching profession are sufficient to provide a good standard of living for teachers.	3.30	1.25	N

Note. The items were arranged according to their order in the teaching professional identity scale; VHA = very high agreement, A = agreement, and N = undecided or neutral

The results in Table 5 show that within the *teaching profession* dimension, there was a very high agreement with the statement 'One of my responsibilities as a teacher is reinforcing my students' strengths and treating their weaknesses' ($M = 4.54, SD = 0.63$). They also had very high agreement with item 11 which stated that 'the teaching profession, by its nature, involves high values—sacred messages, sincere giving, struggle, and so on' ($M = 4.53, SD = 0.68$). The results also indicated that the respondents have a desire to acquire new knowledge and skills that improve their teaching performance (item 13) ($M = 4.41, SD = 0.76$) and have future visions to improve their teaching practices and upgrade student learning in the subject (item 12) ($M = 4.35, SD = 0.79$).

The respondents also pointed to the role of the teaching profession in allowing them to build social relationships with their colleagues (Item 5) ($M = 4.28, SD = 0.83$) and providing them with continuous opportunities for cognitive development (Item 8) ($M = 4.05, SD = 0.99$). The environment in schools should be such that there is an exchange of knowledge and experiences between teachers resulting in new classroom practice and developmental perspectives. Professional identities - based on personal values, previous beliefs, and experiences - are considered to be continuously evolving and develop through ongoing experiences and contexts. The respondents 'very highly agreed' with the statement that 'being a teacher gives them feelings of achievement and continuous giving' (Item 4) ($M = 4.22, SD = 0.96$). So, it would seem that teachers' professional identities are strengthened and developed in work environments where colleagues interact together and dynamic professional development programs are available in schools.

The respondents were undecided or neutral about the item 16 'financial allocations of the teaching profession are sufficient to provide a good standard of living for teachers' for which their mean score ($M = 3.30, SD = 1.25$) was much lower compared with all other items over the three dimensions. Hence it would seem that the improvement or decline in salaries and working conditions over the years has had a proportionate impact on teacher status.

Teaching Context Dimension

Table 6 shows the mean score and standard deviations for the teachers' perceptions of the factors influencing their teacher professional identity in the dimension of *teaching context*. The results show that within the teaching context sub-scale, the range of mean scores was from 3.54 to 4.06. All of the responses were in the 'agreement' range.

Table 6
Means and Standard Deviations for the of 'Teaching Context' Subscale

Item no.	Item	M	SD	Degree of agreement
1	The school working environment is stimulating, supportive and safe.	3.81	0.95	A
2	The school provides opportunities for collaboration and exchanging experiences between colleagues.	4.05	0.85	A
3	The work environment gives me the chance to express my professional development needs.	3.75	0.98	A
4	My school gives me continuous and various chances for professional development.	3.77	0.96	A
5	My school gives me sufficient time to meet my professional development needs.	3.54	1.01	A
6	I received professional development programs that helped me to improve my teaching practices and gain good knowledge.	3.77	1.01	A
7	My school trusts me in presenting my teaching knowledge and experiences and sharing them with my colleagues.	4.03	0.91	A
8	The professional development programs that I received had good content quality and directly connected with the teaching profession's requirements.	3.79	1.01	A
9	I communicate well with my students' parents in regard to their children's learning and dealing with their problems.	3.95	0.90	A
10	I make good efforts to communicate with the school social worker and the administration to help my students with their personal and family problems and their learning difficulties.	3.94	0.94	A
11	My school evaluates my teaching quality based on my students' grades in the evaluation tools.	3.71	0.93	A
12	My school evaluates my teaching quality based on the types and quality of learning experiences I provide to my students.	4.06	0.80	A

Note. The items were arranged according to their order in the teaching professional identity scale; A = agreement.

The results in Table 6 show that the respondents, within the dimension of *teaching context*, thought that their schools evaluated their teaching quality based on the types and quality of learning experiences teachers provided to their students (Item 12) ($M = 4.06$, $SD = 0.80$). The results also showed that teachers' believe schools have a role in providing teachers with opportunities for collaborating and exchanging experiences between colleagues (Item 2) ($M = 4.05$, $SD = 0.85$), that schools trust teachers in presenting their teaching knowledge and experiences and sharing them with their colleagues (Item 7) ($M = 4.03$, $SD = 0.91$), and that the school working environment is stimulating, supportive, and safe (Item 1) ($M = 3.81$, $SD = 0.95$).

The respondents also agreed with the statements that their school has a role in offering them continuous and various chances for professional development (Item 4) ($M = 3.77$, $SD = 0.96$), and sufficient time to meet their professional development needs (Item 5) ($M = 3.54$, $SD = 1.01$). It is not surprising then that teachers agreed with item 6 'I received professional development programs that helped me to improve my teaching practices and gain good knowledge' ($M =$

3.77, $SD = 1.01$). They also agreed with item 8 that the professional development programs that they received had good content quality and directly connected with the requirements of the teaching profession ($M = 3.79$, $SD = 1.01$). It would seem that professional development opportunities are one of the more direct influences on the development of teacher professional identity. Moreover, teacher education and professional development initiatives with a focus on content knowledge and teaching methods must play a large role in teaching efficiency and learning quality.

Regarding teachers' communication with stakeholders, the respondents agreed with the item 9 statement 'I communicate well with their students' parents and society's institutions in regard to their children's learning and dealing with their problems' ($M = 3.95$, $SD = 0.90$). They also indicated that they made good efforts to communicate with the school social workers and the administration to help their students with their personal and family problems and their learning difficulties (Item 10) ($M = 3.94$, $SD = 0.94$).

Factors Influencing Teachers' Professional Identity

In this study, it was assumed that factors such as years of experience, gender, grade level taught, educational degree, and specialized subject would influence teachers' perceptions of their professional identity. It is hypothesized that there are significant differences (at $\alpha \leq 0.05$) in teachers' perceptions according to these variables. The results of a Shapiro-Wilk's test ($p > .05$) showed that data collected for the afore mentioned variables were approximately normally distributed. Using a one-way analysis of variance (see Table 7 and Table 8), we attempted to find differences in teachers' perceptions of their teacher professional identity in terms of the total identity scores on the questionnaire. The results showed that there were statistically significant differences at the 0.05 level in teachers' perceptions for the *years of teaching experience*, *gender*, and *school location* variables. However, it appeared that the mean scores did not differ significantly at the 0.05 level for the *educational degree* or the *specialized subject* variables. Through multiple comparisons, the results showed that for *school location*, the mean scores of "AlBat" and "Alsh" were significant. The results also showed that for *years of teaching experience*, the mean scores between "1-4" and "> 8" and the mean scores between ""1-4" and "5-8" were significantly different (Table 9).

Table 7
Means and Standard Deviations for the Demographic Variables

Factors		<i>N</i>	<i>MS</i>	<i>SD</i>
Years of teaching experience	1-4	55	3.91	.51
	5-8	114	4.11	.48
	> 8	226	4.12	.49
	Total	395	4.09	.49
Gender	Male	131	3.94	.48
	Female	264	4.16	.49
	Total	395	4.09	.49
School location	AlBat	164	4.14	.49
	Alda	134	4.10	.46
	Alsh	97	3.98	.55
	Total	395	4.09	.49
Educational degree	Bachelor	348	4.09	.50
	Diploma	27	4.16	.39
	Educational Diploma	20	4.03	.59
	Total	395	4.09	.49
Specialized subject	Science	194	4.04	.49
	Mathematics	201	4.13	.50
	Total	395	4.09	.49

Table 8
One-Way Analysis of Variance for the Demographic Variables

Factors		SS	df	MS	F	p	EZ
Years of teaching experience	Between Groups	2.01	2	1.01	4.12	.017	.021
	Within Groups	95.63	392	.244			
	Total	97.64	394				
Gender	Between Groups	4.17	1	4.17	17.54	.001	.043
	Within Groups	93.47	393	0.24			
	Total	97.64	394				
School location	Between Groups	1.655	2	0.83	3.38	.035	.017
	Within Groups	95.99	392	0.25			
	Total	97.64	394				
Educational degree	Between Groups	.219	2	.109	.44	.645	.002
	Within Groups	97.42	392	.25			
	Total	97.64	394				
Specialized subject	Between Groups	.79	1	.79	3.14	.075	.008
	Within Groups	96.85	393	.25			
	Total	97.64	394				

Table 9
Multiple Comparison (Post- Hoc) Of the 'School Location', and 'Years of Teaching Experience' Variables

Factors	School Location	School Location	M.D	S.E	p
School Location	AlBat	Alda	.04	.06	.78
	Alsh	.16	.06	.04	
	AlBat	-.04	.06	.78	
	Alda	.12	.07	.18	
	Alsh	AlBat	-.16	.06	.04
	Alda	-.12	.07	.18	
Years of teaching experience	1-4	5-8	-.19	.09	.06
	> 8		-.21	.07	.02
	5-8	1-4	.19	.08	.06
	> 8		-.01	.06	.97
	> 8	1-4	.21	.07	.02
	5-8		.01	.06	.97

It has been shown that acquiring a professional identity as a teacher is not a one-size-fits-all endeavour as teachers do not always need or desire to reach the same degree. The acquisition

of professional identity as a teacher is not related to age but rather is linked to a set of interrelated and complementary factors. The professional identity of teachers is about their sense of self and it mediated through a) the roles they play inside and outside school, b) the acquisition of knowledge, skills, and educational competencies, and c) their level of commitment to the values and ethics of their profession.

Teachers' skills and competencies develop during their classroom practice and through attending professional development programs. As a result of the many social, economic and other factors impacting the teaching profession, as well as the ongoing evolution in educational approaches, researchers have found that inexperienced teachers may need time and specific opportunities to perform their professional roles effectively. As a result, there may be differences in how teachers view their professional identity depending on their years of experience teaching and the conditions, culture and access to training at their institution.

Results of the Open Question

The qualitative data analysis of the responses to the open question resulted in the following main themes: lack of quality professional development programs, workload and time pressure, and unsatisfactory status of the teaching profession in society.

Lack of quality professional development programs

Professional identity affects the development of teachers' self-efficacy and professional development; and also impacts teachers' ability to deal with educational challenges, and embed creativity in their teaching practices. In this study, 41 mathematics and science teachers wrote that the professional development programs they received in schools lacked certain practical aspects. They highlighted a need for programs that feature new approaches in the field of teaching as well as applications of new technical and interactive teaching tools to enhance teaching practices. Responses included the following: "*The teacher must obtain opportunities for training and continuous development and provide him with scientific programs which are related to the content of the curriculum and be in keeping with the new technology*" (October 10, 2018, science teacher with 3 years of experience); "*I hope that the MoE offers training opportunities and courses for teachers and sent [them] to other countries to benefit from the experiences of other teachers*" (October 28, 2018, science and mathematics teacher for grades 1 to 4 with 2 years of experience); "*holding workshops within the school between teachers of one subject to exchange experiences and teaching methods*" (October 7, 2018, science and mathematics teacher for grades 1 to 4 with 3 years of experience); "*providing quality training opportunities for teachers with an applied nature through which new ideas are presented regarding how to deal with individual differences between students*" (October 7, 2018, science teacher with 2 years of experience).

Taking the respondent's comments into consideration, teacher preparation programs need to be developed in a way that enables them to offer high-quality professional preparation courses that are easily accessible for all instructors. The programs should focus on enhancing the professional values and attitudes teachers possess, not just their scientific and pedagogical training. The responses also highlighted the need to pay attention to the psychological and career guidance services on offer in various teacher education institutions to help student teachers to maximally develop their professional identity and overcome the problems involved with of choosing a profession and transitioning into work life. In addition, teacher education institutions should extend the necessary support to teachers to overcome the difficulties they face in work.

Workload and time pressure

Fifty respondents elaborated on the non-teaching workload required in schools as a negative aspect of their job. They also pointed to 'time constraints' as a challenge they faced in their teaching experiences. They stated that the packed curriculum and the insufficient time to achieve all identified learning goals as the main reasons for feeling time pressure in their job. Some examples regarding this issue from respondents are as follows: "*Teaching should be separated from school activities and administrative work*" (October 4, 2018, science teacher with 3 years of experience); "*The number of teaching periods is large, which is a source of pressure and a barrier between the teacher and creativity*" (October 4, 2018, science teacher with 3 years of experience); "*The administrative work overload must be eased so that the teacher can give the teaching profession his attention*" (October 7, 2018, science and mathematics teacher for grades 1 to 4 with 3 years of experience); "*In fact, the high number of periods of teaching, the multiplicity of curricula we teach, and the variety of evaluation methods we apply are the most difficult challenges facing us*" (October 7, 2018, science teacher with 3 years of experience); "*School activities and paperwork have become a burden on the teacher that hinders his efforts in planning for the curriculum and thus reduces his efforts for students' learning*" (October 14, 2018, science teacher with 12 years of experience).

The participating teachers suggested reducing the number of teaching sessions for each teacher to give him opportunities for self-directed professional development in order to improve learning outcomes for students. For example, one of the participants stated,

"We need a lot of work to raise the efficiency of teachers, shorten the curricula, and pay attention to the quality rather than the quantity, and finally we need to provide a supportive and attractive learning environment for the students and the teachers" (October 14, 2018, mathematics teacher with 3 years of experience).

Another one said, "*The teacher should focus on the requirements of the teaching profession only without other burdens on him, such as doing administrative work and organizing school activities*" (October 14, 2018, science teacher with 12 years of experience). Another participant suggested that teachers' performances could be developed by "*reducing the teacher's quorum of classes and accompanying work and reducing the number of pupils in the classroom helps the teacher to develop his teaching performance*" (October 20, 2018, mathematics teacher with 3 years of experience).

Status of the teaching profession in society

Fifty-nine respondents highlighted the importance of enhancing the position of teachers in society by respecting their rights and supporting them to accomplish their teaching tasks. The teachers also pointed to the importance of cooperation between the members of the community, the MoE, schools, and the parents of students to aid the teachers' in their roles. Comments related to status in society included the following: "*strengthening the position of the teacher socially is the first step in building a school that is capable of providing qualified outputs*" (October 14, 2018, science teacher with 2 years of experience); "*The teacher should be appreciated, respected by all, motivated by professional advancement, honored and given all his rights*" (October 21, 2018, science teacher with 3 years of experience); "*We need to appreciate the efforts of the teachers in the field, from school principals and the MoE, especially for experienced teachers*" (October 9, 2018, science teacher with 3 years of experience).

Fifty respondents made suggestions of possible ways to enhance the status of the teaching profession and help teachers improve learning outcomes for students. Based on the

responses, practical recommendations that can be grouped into three main categories have been formulated:

- Offer a stimulating and supportive school environment for teachers and students by providing educational tools with modern technological facilities and reduce the number of students in classes.
- Strengthen teachers' professionalism by opening channels of cooperation between them and community members and institutions, and through promotions and rewards.
- Provide effective professional development programs for teacher educators that are designed to ensure cohesive, comprehensive and integrated training support.

Discussion

The results showed that the respondents credited the role of the teaching profession in allowing them to build social relationships with their colleagues and providing them with continuous opportunities for cognitive development. The environment in schools should be such that there is an exchange of knowledge and experiences between teachers that results in new classroom practice and developmental perspectives. Professional identities - based on personal values, previous beliefs, and experiences - are considered to be continuously evolving and develop contextually through ongoing experiences. The respondents showed 'very high' agreement with the statement 'being a teacher gives them feelings of achievement and continuous giving'. Therefore, it would seem that teachers' professional identities are strengthened and developed in work environments where colleagues interact together, and dynamic professional development programs are available in schools.

The results also showed that due to the many ongoing social, economic and policy changes impacting the teaching profession, not to mention the ongoing evolution in educational approaches, inexperienced teachers need substantial time and specific support to perform their professional roles effectively. As a result, there may be differences in how teachers view their professional identity depending on their years of experience teaching and the conditions, culture, and access to training at their institution.

Teacher professional identity has an impact on teachers' practices in multiple ways as it promotes self-regulation, self-motivation, and adaptation in the learning environment. The professional identity of teachers shapes their sense of themselves and is impacted by the roles they play inside and outside the school; the knowledge and skills they acquire; and their commitment to the values and ethics of their profession. In order for teachers to maintain their professional standing and remain in the profession, their personal growth alongside their professional growth must be supported, and they should be encouraged, through financial and social support, to take on executive roles.

Teachers' personal and professional experiences throughout their in-service education play a crucial role in shaping their professional identities and have a significant effect on what kind of teachers they are to become. Hsieh (2016) argued that teachers' personal experiences, approaches to reflection on teaching performance, and periodic evaluations of the quality of their teaching practices are the factors which most affect the development of their teacher professional identity. In turn, Hsieh argues that this identity has a profound influence on how teachers' teach curricular content. Teachers' professional identity, with its philosophy and foundations, represents a reference point upon which teachers' roles and responsibilities are based.

Offering teacher education programs that help teachers maintain positive perceptions, attitudes, and actions, as well as encourage them to be independent and take responsibility to solve problems and face challenges can greatly improve their professional identity. Guskey (2002) pointed out that teachers need ample opportunities for developing their pedagogical practices

and knowledge and reflecting on their teaching performance. Clarke and Hollingsworth (2002) claimed that improving teacher identity requires self-reflection on knowledge, perceptions, beliefs, and attitudes in order to harness them to improving student learning outcomes. In order to improve teachers' professional identity, all education stakeholders should (a) provide high-quality teacher education, teacher professional development programs, and supportive career environments; (b) improve salaries and working conditions; and (c) ensure teachers' involvement in decision-making and promote their positive representations and status in society (Symeonidis, 2015).

The quality of education outcomes is closely related to enhancing teachers' positions in their work environments and in society. There is an important relationship between the concept of professional identity and the development of socio-educational knowledge and methodology. Teachers' identity is shaped by the social and cultural contexts that affect their beliefs, perceptions, and teaching practices. Teachers' identity also affects society indirectly through their performance in the classroom and their relationships with students in teaching and learning situations. Hsieh (2016) described several factors affecting the formation and development of teacher professional identity, including personal factors (e.g., experiences as students, experiences as new teachers, and self-perceptions of the work environment), factors associated with teacher education programs (e.g., teacher education programs in universities), working environment conditions or political contextual factors (e.g., isolation versus cooperation), as well as factors related to performance evaluation, evaluation methods and accountability that allow measurable quality teaching.

Conclusions and Implications

To sum up, the results showed that within the dimensions of *teaching efficacy*, *teaching context*, and *teaching profession*, teachers' had positive perceptions of their teacher professional identity (very high agreement or agreement). The results showed that there were significant differences in teachers' perceptions of their teaching profession for the factors *years of teaching experience*, *gender*, and *school location*. However, it appeared that there were no significant differences in teachers' perceptions of their teaching profession for the factors *educational degree* and *specialized subject*. Moreover, qualitative data analysis of the open-ended question confirmed that mathematics and science teachers thought there were main three main categories of factors influencing their professional identity: lack of quality professional development programs, workload and time pressure, and the unsatisfactory status of the teaching profession in society.

Our research has revealed several internal factors impacting teachers' identities such as personal experiences, beliefs, values, and teaching aptitude. Additionally, this study has explored environments, including work environments and the wider community, which impose conditions under which teachers develop a strong sense of what it means to be a teacher. Although the study highlighted some very useful points about math and science teachers' professional identities, it also had some limitations. We focused specifically on investigating the factors that influence teacher professional identity, bearing in mind that other theoretical approaches may also be suitable for revealing the perceptions of science and mathematics teachers. Also, conducting the study in only 3 out of 11 educational governorates, and using a self-report questionnaire and one open-ended question could limit the generalizability of our conclusions. Therefore, we suggest using multiple approaches to get a more accurate and detailed perception of teacher identity and the factors affecting it. Since teacher professional identity is a continual process that is influenced by complex social, individual, and contextual factors, future research will need to achieve the following:

- explore the interrelationships between the main factors that influence teacher professional identity.
- explore teacher professional identity with a larger sample of teachers.
- link teacher professional identity with actual classroom practices via observation.
- compare the professional identities of pre-service and in-service teachers.

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Declaration of Interest

The authors declare no competing interest.

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