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PROFESSIONAL COMPETENCE OF PHYSICS TEACHERS IN MISAN GOVERNORATE

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Abstract:
This study aims to reveal the level of professional competence among physics teachers in Misan Governorate. To achieve the study objectives, three null hypotheses were formulated:
1. There is no statistically significant difference at the significance level (0.05) between the average scores of the study sample on the professional competence scale and the hypothetical mean.
2. There is no statistically significant difference at the significance level (0.05) between the average scores of the study sample on the professional competence scale according to gender.
3. There is no statistically significant difference at the significance level (0.05) between the average scores of the study sample on the professional competence scale according to years of experience. To achieve the study objectives, the researcher used the descriptive survey method and randomly selected a sample representing the original population, totaling (231) teachers, from physics teachers in the Directorate of Education in Misan Governorate. The researcher relied on a professional competence test consisting of three parts:
The first part is an objective test that measures scientific competence, consisting of (20) multiple-choice questions with four alternatives.
The second part is a scale for personal competence and human relations, consisting of (30) situations.
The third part Three: The Technological Competence Scale consists of (20) items, according to a five-point Likert scale. Its validity and reliability were verified, and the researcher distributed it to the study sample after converting it into an electronic version. The study tool was applied to the study sample of (231) teachers, and the study results were processed using the SPSS program for statistical analysis in social and psychological sciences. The researcher used the following statistical methods: T-test equation for a single sample, for two independent unequal samples in number, one-way analysis of variance, Pearson correlation coefficient, Cronbach's alpha equation, standard deviation, difficulty coefficient, and discrimination power. The study results showed that the individuals of the study sample enjoy a high level of professional competence. The results also showed that the variable of gender affects the level of professional competence, and that years of experience have a significant positive effect on the teacher's competence level, especially those exceeding (15) years. In light of the results obtained, the researcher presented a number of recommendations and suggestions.

Keywords: Professional Competence, Physics, Physics Teacher.

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Introduction

The success of any institution depends on the amount of effort exerted by its individuals and the pattern of managing and coordinating these efforts. The criterion for differentiation in the services it provides is based on the accuracy of the activity determinants required to achieve the goals for which this institution was established. This primarily depends on the level of proficiency and the type of prevailing culture, especially the inclination toward professionally developing personal abilities, which is characteristic of the institution's members.

The professional quality we are discussing cannot be possessed by those working in the field of education unless their preparation meets the level of challenges facing the educational institution. These challenges may be technical, related to educational tasks, or associated with available resources, changes in the roles assigned to them, or population growth, which impacts the educational institution and its capacity, in accordance with the scientific foundations describing the nature of the profession and dealing with the factors of effort and available time. Therefore, the educational institution seeks to prepare teachers with a high level of competence in terms of preparation and in-service training. This matter is considered one of the important topics that education specialists pay close attention to, and it is emphasized by scientific conferences that call for the development of teaching abilities for science teachers in general and physics teachers in particular, such as the First International Conference of the College of Education 2022. Also, numerous local and international studies and study confirmed the low level of competence among physics teachers, including the study by Al-Obaidi (2022), the study by Al-Jubouri (2022), the study by Nassar (2021), the study by Al-Mutairi (2021), and the study by Liu (2025).

Accordingly, the studyer decided to conduct a survey study aimed at determining the level of professional competence among physics teachers in Maysan Governorate. Hence, the problem of the current study emerges in answering the following question: What is the level of professional competence among physics teachers in Maysan Governorate according to gender, years of experience, and academic qualification?

The Importance of Study and the Need for It:

The development whose effects we are experiencing today is the result of conscious planning and great perseverance to effectively accomplish those plans, where the efforts of individuals within specialized scientific institutions have come together, working according to purposeful programs that aim to save effort and time in order to provide quality service thanks to adherence to specific standards. The educational institution is one of these institutions, which previously suffered from significant challenges, the foremost of which is the technological development surrounding us. This requires the presence of a person capable of dealing with it in a way that allows him to harness it to serve him, in order to prepare generations for multiple roles characterized by functionality. This requires adopting a method that allows the institution to select its members at a level compatible with the nature of the goals it wants to achieve and the tasks required. Therefore, it constantly seeks to develop its capabilities by adopting standards that ensure the highest level of efficiency in its work and strives diligently to generalize this level of performance across all aspects of its work through selecting teams that possess high

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levels of academic, scientific, and practical skills, which can be described as professional competence.

Education, as an integrated system, is concerned with its institutions providing the best services to society, especially those related to education. This is the primary goal that an educational institution strives to achieve, aiming to reach a satisfactory level in preparing and training students in a way that enables them to carry out their life activities at a professional level consistent with the successful education they have received. This cannot be accomplished unless there are staff members who possess a high level of skills, enabling them to deal with the continuous developments around them and to absorb sudden and rapid changes, which requires preparing staff with high efficiency and precise skills to fulfill this role.

The university is one of the educational institutions that form the fundamental pillar upon which cultural and technological transformation in the modern era relies. Its role is no longer limited to memorization and rote learning; rather, it has become the main driver of knowledge production and technology localization by adopting flexible strategies capable of accommodating rapid knowledge advancement and successive technological revolutions, transforming technical challenges into sustainable developmental opportunities (Al-Shammari, 2023).

This is evident in the educational institution's ability to balance the development of its smart infrastructure with the formulation of educational outcomes that accurately align with the changing needs of the labor market, as confirmed by UNESCO reports on the necessity of creating clear guidelines for the use of e-learning platforms and artificial intelligence in study and education (UNESCO, 2023).

Creating a suitable learning environment is achieved by investing in the available capabilities and developing them to form an environment that nurtures digital innovation, as technological development requires educational institutions to transition to the concept of a smart university, which allows students to interact directly with emerging technologies as part of their daily study, contributing to personalized learning and increasing academic achievement (Brown & McCormack, 2023).

The matter does not stop at physical resources but extends to investing in human capital through continuous professional development programs for teaching staff to ensure their ability to lead this digital transformation effectively and efficiently, and periodically updating curricula to ensure that academic content does not become outdated in the face of the massive flow of information (Selwyn, 2022).

Additionally, there is a focus on meeting the requirements of the labor market by addressing the traditional skills gap through more innovative and dynamic mechanisms. Reports from the World Economic Forum indicate that the nature of jobs is changing radically, requiring high analytical and technical skills (World Economic Forum, 2023). This is accompanied by a trend among universities to adopt flexible educational pathways that allow curricula to be shaped with a forward-looking vision, taking into account future jobs and ensuring the graduation of personnel capable of adapting to professions that have not yet emerged, which enhances the

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flexibility of the economy and its ability to compete internationally (Othman, 2024) (Wheelahan & Moodie, 2021).

Due to the continuous updates that occur in curricula from time to time, this curricular development must be accompanied by additional development of the educational staff in order to raise their professional competence, which qualifies them to perform effective educational roles that contribute to the transfer of the knowledge contained in the curricula efficiently and competently.

Accordingly, physics teacher preparation programs are continuously subject to comprehensive review as mentioned, and this matter falls under the importance of physics, considering that it represents the theoretical and practical foundation for every technological leap humanity has witnessed, starting from the laws of thermodynamics that sparked the industrial revolution, to quantum mechanics that paved the way for the era of semiconductors and supercomputers (Al-Otaibi, 2023). The development in materials physics and nanophysics is what enabled the emergence of renewable energy technologies and smartphones, making physics the language of global development and a measure of nations' progress in the fields of industry, defense, and medicine (National Study Council, 2021).

In light of this development, the role of the physics teacher is no longer limited to conveying rigid mathematical equations, but has transformed into a 'facilitator of innovation' and a translator of complex phenomena into practical solutions. The modern role of the teacher is to enhance students' scientific inquiry skills and connect physical concepts to contemporary life applications such as the Internet of Things and artificial intelligence (Zhai et al., 2021). He is also responsible for instilling critical thinking and the experimental method, which contributes to developing an analytical mindset in the student, enabling him to understand and effectively deal with the technological future (Al-Shammari, 2023).

To keep up with the accelerating gap between academic content and technological development, the need has emerged for specialized development programs focusing on 'technological pedagogy.' Recent studies indicate that professional development programs for physics teachers should include training on virtual labs and computer simulation techniques that allow students to experience physical phenomena that may be difficult to apply in reality (He et al., 2023). The importance of 'STEM' programs (Science, Technology, Engineering, Mathematics) is also highlighted, as they integrate physics with programming and engineering skills, enhancing the teacher's ability to meet the requirements of the Fourth Industrial Revolution (UNESCO, 2023).

The connection between physics and development inevitably passes through the gateway of the qualified teacher; without a teacher possessing updated technical skills, physics will remain a theoretical science distant from the realities of the market. Investing in programs to develop the skills of physics teachers is a direct investment in the technological strength of the state and its ability to innovate and compete globally.

The researcher believes that keeping educational institutions up to date with technological advancements is not an option but an existential necessity that requires the integration of efforts between the academic sector, the government, and the private sector. Success in this path

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depends on transforming from a closed educational system to an open system of continuous learning that focuses on innovation and technological readiness by enhancing technological capabilities and closely linking them to market requirements. This can be achieved by having human resources with technological skills capable of instilling this culture in learners' minds, especially those who are being prepared for the profession of teaching science in general and physics in particular, according to performance criteria described as professional competence that qualifies them to perform their roles in the best possible way, saving time and effort in achieving the required learning objectives.

The importance of the current study lies in its focus on directing the attention of specialists in the field of physics teacher preparation toward a professional approach that requires performance competence to transform physics education from a rigid academic context into a driving force for sustainable development and digital innovation, theoretically and practically, as follows:

Theoretical Importance: The theoretical importance lies in providing an intellectual foundation that links science, technology, and education through the following points:

1. It highlights the foundational role of physics in the development witnessed by the world, considering it the theoretical reference for all industrial and technological revolutions (from thermodynamics to quantum mechanics and nanotechnology).
2. Developing the concept of teaching physics and the role of the modern physics teacher, and transitioning the teacher's cognitive role from a transmitter of information and memorizer of scientific laws to a facilitator of innovation and analyst of complex phenomena.
3. Keeping up with modern global trends that call for the integration of artificial intelligence and the STEM methodology in the teaching of physics.
4. Consolidating the concept of professional competence instead of teaching competencies and formulating a theoretical framework that links academic, scientific, and procedural skills as an inseparable package in the preparation of educational staff.

Practical Importance: The practical importance is manifested in the procedures and desired outcomes of the study through:

1. Updating curricula and the educational environment and transitioning towards the smart university, using virtual labs and simulation programs to bridge the gap between theory and practice.
2. Aligning with the labor market by designing flexible educational pathways that ensure the graduation of cadres capable of occupying future jobs and dealing with technologies that have not yet emerged.
3. Continuous professional development and providing practical mechanisms to train teaching staff in "technological pedagogy" to ensure the continuity of their competence in the face of information flow.
4. Improving educational outcomes and raising students' achievement levels by linking physics with contemporary life applications, making learning more functional and productive.

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The Objectives:

The current study aims to:

1. Identify the level of professional competence of physics teachers.
2. Identify the differences in the level of professional competence of physics teachers according to gender and years of experience.

Study Hypotheses:

To achieve the study objectives, the following hypotheses were formulated:

1. There is no statistically significant difference at the significance level (0.05) between the mean scores of the study sample on the professional competence scale and the hypothetical average.
2. There is no statistically significant difference at the significance level (0.05) between the mean scores of the study sample on the professional competence scale according to gender.
3. There is no statistically significant difference at the significance level (0.05) between the mean scores of the study sample on the professional competence scale according to years of experience.

Study boundaries:

The current study is determined by the following boundaries:

1- Spatial limitation: Public schools under the General Directorate of Education in Misan Governorate (Governorate Center).
2- Temporal limitation: Academic year 2024–2025.
3- Human limitation: Physics teachers working in public schools under the General Directorate of Education in Maysan.

Definition of terms:

Professional competence: Defined by:

1. (Yaqub, 2016) "It is the sum of knowledge, experiences, acquired behaviors, and practice in a specific professional context in order to perform a specific job efficiently and effectively; competence is linked to individual capability (mental and physical) and is activated by personal motivation" (Yaqub, 2016: 57).
2. (Muhammad, 2022): Professional competence means the teacher's ability to utilize his knowledge, skills, and emotions in an integrated manner to achieve effective educational performance reflected in the quality of teaching and professional productivity (Muhammad, 2022: 415).
3. (Al-Zuhairi et al., 2023): Professional competence is defined as the set of knowledge, skills, and attitudes possessed by an individual that enables him to perform his job duties efficiently and effectively according to professional quality standards and work requirements (Al-Zuhairi et al., 2023: 1075).

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The researcher agrees with Al-Zuhairi et al. (2023) in defining professional competence and defines it operationally as: the ability of the physics teacher to integrate the knowledge, performance and technological skills, and personal abilities they possess, which enables them to transform complex physics concepts into innovative teaching practices according to specific goals with high efficiency while teaching physics. It is measured operationally by the level of performance achieved by the teacher according to the study tool adopted for this purpose.

Chapter Two: Theoretical Framework and Previous Studies

First: The Concept of Professional Competence

The concept of professional competence is considered one of the modern concepts that has received wide attention in educational and administrative fields, due to the rapid scientific and technological developments that have made it necessary to prepare human resources professionally, enabling them to adapt to the requirements of modern work. Human beings have become the core of the production and educational process, which has led to increased interest in developing professional competencies through continuous education and training (Al-Badri, 2011:225). Professional competence is defined as a set of knowledge, concepts, skills, and attitudes that guide an individual's behavior and enable them to perform their work with a degree of mastery and efficiency, using the least possible effort, time, and cost. It can be measured through specific standards or performance indicators (Al-Ahmad, 2005:242). In the educational field, a teacher's professional competence represents a fundamental factor in the success of the educational process, as the teacher is responsible for nurturing students, guiding them, and developing their intellectual and social abilities, rather than merely transmitting information and knowledge. Therefore, teacher competence is considered one of the most important factors on which the effectiveness of the educational system depends (Abdel-Gawad and Mustafa, 1993: 203).

The Competency-Based Teacher Preparation Movement:

Interest in professional competencies in the educational field emerged during the 1950s and 1960s when education researchers began focusing on measuring the outcomes of the educational process according to specific performance standards. This was in response to criticisms directed at the educational system due to the low level of educational outcomes and the weak performance of some teachers. This led to the emergence of the Competency-Based Teacher Education movement, which focuses on identifying the teaching competencies required for teachers and training them in these competencies before and during service (Hamdan, 1984: 163).

This trend has spread in many countries, and educational institutions have adopted it due to the positive results it has achieved in raising the level of teachers' instructional performance. This trend is based on training the teacher in a set of skills, knowledge, and attitudes that enable them to perform their work efficiently and effectively (Al-Fatlawi, 2003: 32). International organizations such as UNESCO have also contributed to spreading competency-based teacher

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preparation programs in developing countries with the aim of developing education and improving its outcomes (Nashwan & Abdul Rahman, 1990: 12).

Areas of Professional Competence for Teachers:

Teacher professional competence includes a set of areas related to their personality and their scientific and educational performance. Among the most important of these areas are the following:

1. Personal Competence: Personal competence refers to the set of personal and ethical qualities and traits that a teacher should possess, such as justice, honesty, integrity, emotional stability, dedication to work, and the ability to bear responsibility. This competence is considered the foundation of a teacher's success in their work, as students are greatly influenced by the teacher's behavior and personality (Al-Aqeel, 1996: 217).
2. Human Relations Competence: This is represented by the teacher's ability to establish positive human relations with students, colleagues, school administration, and parents, contributing to the creation of a learning environment based on cooperation and mutual respect, which helps improve the learning process and increase students' motivation toward studying (Abdel Hadi, 2002: 230).
3. Scientific Competence: This means the teacher's mastery of the subject they teach, possessing a broad scientific culture, and the ability to employ appropriate teaching methods to explain the subject matter in a clear and engaging way. A scientifically skilled teacher is more capable of achieving the objectives of the educational process (Morsy, 2001: 203) (Al-Hashani, 2016: 194).
4. Technological Competence: Technological competence refers to the teacher's ability to use educational technology and modern teaching aids in the teaching process, such as computers, the Internet, and multimedia, as well as designing, using, and evaluating educational materials, which contributes to improving the teaching and learning process (Bani Doumi, 2010: 446).

Types of Professional Competencies of the Teacher:

The teacher's professional competencies can be classified into several types, the most important of which are:

1. Cognitive Competence: This includes the knowledge, information, and mental skills necessary for the teacher's performance in various areas of their work.
2. Emotional Competence: This includes attitudes, values, and tendencies associated with the teaching profession.
3. Performance Competence: This includes the teaching and practical skills that the teacher exercises inside the classroom.
4. Productivity Competence: This refers to the impact of the teacher's performance on students' achievement and educational growth.
5. Assessment Competence: This refers to the teacher's ability to use different assessment methods to measure students' learning.

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6. Sequential Competence: This refers to the teacher's impact on students' cognitive, emotional, and social development (Al-Harqi, 1994: 76).

Sources of Deriving Professional Competencies:

The professional competencies of the teacher are derived from several sources, including ready-made competency lists, educational studies and study, task analysis of the teacher, observation of outstanding teachers' performance, analysis of curricula content, study of students' and society's needs, and the opinions of experts and specialists in the educational field (Abdul Rasheed, 2011: 173).

Standards of Quality for Professional Teaching Practice:

There is a set of standards through which the teacher's professional competence can be judged, and the most important:

• The teacher's mastery of the subject matter they teach.
• Their ability to plan for teaching.
• Their use of modern teaching methods.
• Providing a learning environment that stimulates learning.
• Building positive relationships with students, colleagues, and parents.
• Developing critical thinking and problem-solving skills in students (Hajjaj, 2014: 139).
• Teacher competence can also be evaluated according to three main criteria:
• Evaluating competence based on student achievement.
• Evaluating competence based on the teacher's performance in the classroom.
• Evaluating competence based on the learners' behavior and educational activity (Al-Sheikh et al., 1989: 93-95).

It is clear from the foregoing that the professional competence of the teacher represents one of the most important factors affecting the success of the educational process, as the quality of education depends on the extent to which the teacher possesses personal, scientific, educational, and technological competencies. Moreover, preparing teachers based on competencies is considered one of the modern educational trends aimed at improving teacher performance and raising the level of education. Therefore, it has become necessary to develop teacher preparation and training programs according to professional competence standards to achieve quality education and keep pace with scientific and technological developments. The current study aims to reveal the level of professional competence among physics teachers according to the components of professional competence adopted by the researcher in its three domains: professional, personal, and technological, based on the assumption that their scientific competence is realized according to the academic preparation in which the teachers were engaged during their studies and graduation, as well as the continuous training courses for applying the approved curriculum through a representative sample, which will be described later along with the study community and procedures.

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Second: Previous Studies

Local and Arab Studies

1. Study (Al-Jabouri, 2025): This study aimed to measure the level of professional competence and job performance, and to identify the correlational relationship between them among teachers in Salahuddin Governorate. It followed the descriptive correlational approach to achieve the study's objective. The studyer used the Professional Competence Scale (prepared by the studyer) and the Job Performance Scale, applied to a sample of 240 teachers working in high schools in Iraq, selected randomly. The study reached several results, including that teachers possessed a high level of professional competence, and there was a strong positive correlation between teacher competence and their actual job performance. (Al-Jabouri, 2025: 45-68)
2. Study (Bani Doumi and Al-Atoum, 2022): The study aimed to reveal the extent to which teachers practice professional competencies and to determine the impact of variables (qualification, experience, courses) on the level of this practice. To achieve the study's objective, the researcher chose the descriptive survey method and selected a sample of 320 teachers from science teachers in Irbid Governorate, Jordan. The study tool applied was a questionnaire consisting of 45 items distributed across 5 domains. After processing the study data using arithmetic means, standard deviations, one-way ANOVA, and Scheffe test, it was found that the degree of practicing competencies was at a 'moderate' level. The results showed statistically significant differences attributed to the variable of experience (in favor of long experience) and in favor of those who had attended training courses (Bani Doumi, Al-Atoum, 2022: 401-418).
3. Study (Abdul Rahman, 2024): The goals that the study sought to achieve were to identify a list of qualitative professional competencies (physical) required for high school physics teachers by developing a training program based on self-learning strategies to develop these competencies and to measure the impact of the proposed program on developing the cognitive aspect of competencies among teachers, as well as measuring the program's impact on improving the actual teaching performance of teachers in laboratories and classrooms. The researcher used the experimental method and chose the two-group design, with the sample consisting of 60 teachers, divided into 30 experimental and 30 controls. The researcher prepared a teaching performance observation card and a cognitive competencies test, applied the tools after the experiment ended, and processed the study data using appropriate statistical means: Wilcoxon test, Eta squared for measuring effect size, and Black's adjusted gain equation. The results showed the superiority of the experimental group that studied with the proposed program over the control group in the teaching performance observation card and the cognitive competencies test. (Abdul Rahman, 2024: 89-124)
4. The American Study: (Smith, 2023 & Williams): The study aimed to investigate the relationship between the use of virtual laboratories and the level of self-efficacy, as well as to identify the challenges teachers face when integrating digital simulations. Using a descriptive-correlational approach, the study examined this relationship in a sample of (85) high school physics teachers. They were asked to provide their opinions according to the digital self-

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efficacy scale and the technological teaching practices questionnaire. The study showed a strong positive impact of technology use on teacher self-efficacy, where virtual laboratories contributed to increasing teacher self-efficacy by 42%, enhancing teachers' confidence in explaining complex physics topics, and reducing the knowledge gap among students in abstract subjects such as nuclear physics. (Smith, 2023:12-19 & Williams)

5. Study by Förtsch, 2024 & Dorfner: The study aimed to analyze the structure of professional knowledge among physics teachers by tracking its development over time. It examined the interactive relationship between content knowledge (CK) and pedagogical content knowledge (PCK) and determined the extent to which teachers can transform abstract physics concepts (such as Newton's laws) into simplified instructional models, as well as the effect of accumulated teaching experience on the quality of lesson planning. The researcher s used a descriptive-analytical method (longitudinal study) on a selected sample of 115 physics teachers with different levels of experience in Germany. They were tested with written assessments to measure content knowledge (CK) and pedagogical content knowledge (PCK). The study concluded that professional pedagogical competence mainly depends on the strength of scientific content knowledge, and experience alone is not sufficient to develop competence without updating scientific knowledge. (Förtsch, 2024 & Dorfner)

Chapter Three: Study Methodology and Procedures.

This chapter includes a description of the study population, sample, and the measurement tools used, as well as the procedures followed during the study, its method, and how its statistical data were processed.

First: Study Methodology: The stage of determining the study method comes at the beginning of the study procedures, as each method has its designs. In fact, everything that follows the step of selecting the study method consists of steps that come subsequently and are based on it. Accordingly, the researcher chose the descriptive survey method as the methodology to be followed to achieve the study's objective (Abu Nahiyah, 2004: 103).

Second: Study Population: It includes all individuals, things, or persons who form the subject of the study problem, that is, all elements related to the study problem which the researcher seeks to generalize the study results on (Abbas et al., 2011: 217). The study population consists of (890) physics teachers who are currently serving in the General Directorate of Education in Misan for the academic year (2024-2025).

Third: Study Sample: The study sample is a subset of the study population and represents the elements of the original population in the best possible way. It retains all the characteristics of the original population so that it can represent that population, allowing the results of that sample to be generalized to the entire population (Abbas et al., 2011:218). The studyer chose the study sample randomly, comprising 231 physics teachers, representing 20% of the study population, as shown in Table (1).

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Table (1) Study sample according to gender and years of experience

Total	15year or more	10years	5years	Years of experience / Sex
145	40	60	45	male
86	22	38	26	female
231	62	98	71	total

Fourth: Study Tool: Tests play an important role in educational and social study because they provide quantitative data characterized by an acceptable level of validity, reliability, and objectivity. The researcher prepared a professional competence test consisting of three areas.

• The first domain covers scientific competence and measures the knowledge of physics teachers in teaching skills and appropriate teaching methods. It consists of 30 multiple-choice items.

• The second domain measures personal competence and human relations. It consists of 30 situations in which the examinee is asked to express their opinion on a five-point scale according to the Likert scale, where each alternative is assigned a specific score.

• The third domain measures technological competence. It consists of 20 items in which the examinee is asked to express their opinion on a five-point scale according to the Likert scale, where each alternative is assigned a specific score.

Validity of the tool: The researcher verified the validity of the test in two ways:

1. Face validity: Face validity was verified by presenting the test to a group of experts and adopting an 80% agreement rate to accept the items.

2. Construct validity: This was verified by administering the test electronically to a pilot sample of 100 teachers. Pearson correlation coefficient was used to ensure the internal consistency of the scale items, thereby confirming the validity of the test.

Statistical analysis of the professional competency test items: Through a set of important statistical indicators

• Item difficulty index: It is the percentage of those who were unable to answer correctly, and the higher the difficulty index, the easier the item, and vice versa (Kawafha, 2010: 149). The difficulty indices of the items ranged between (0.26 – 0.71), which is within the acceptable range in achievement tests (0.20 – 0.80) according to the measurement and evaluation literature (Awda, 1998: 297).

• Discrimination index: This refers to the ability of the item to distinguish between high and low ability individuals, and only items with good discrimination are retained (Al-Muhasnah & Mahidat, 2013: 87). The discrimination indices ranged between (0.24 – 0.65), which are good indices since the acceptable limit is (0.20) or more (Al-Sayyid Ali, 2011: 201).

• Effectiveness of alternatives: In multiple-choice questions, alternatives are required to be attractive to low-level individuals, selected by at least 5% of the examinees, and chosen more by the lower group than the upper group (Al-Jalabi, 2005: 75). The results showed that all alternatives met the effectiveness conditions.

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Instrument Reliability: It was calculated using the Cronbach's alpha equation to measure the internal consistency of the items. The reliability coefficient reached (0.81) for the achievement test and (0.79) for the personal and technological competency scale, indicating that the test enjoys a high and acceptable level of reliability (Hassan, 2006: 10).

Fifth: Statistical Methods:

The study data were processed using the Statistical Package for the Social Sciences (SPSS) program for social and psychological sciences, where the studyer used the following statistical methods in the procedures of his study and analysis of its results:

1. Pearson correlation coefficient
2. One-sample t-test
3. Independent samples t-test
4. One-way analysis of variance
5. Cronbach's alpha equation
6. Weighted mean

Chapter Four This chapter includes a comprehensive presentation of the study results that have been reached according to its objectives and the verification of the validity of its hypotheses, with a scientific interpretation of the study results and their discussion according to theoretical data and the outcomes of previous studies, as well as the conclusions reached by the researcher and the recommendations and ideas that the researcher has extracted, which she considers worthy of attention and has included in a set of proposals. First: Presentation and interpretation of results: The study results will be presented and interpreted according to the sequence of the study objectives and hypotheses as follows:

1. To verify the validity of the first hypothesis, which states that: There is no statistically significant difference at the 0.05 significance level between the mean scores of the study sample on the professional competence scale and the hypothetical mean. The researcher calculated the arithmetic mean of the scores of the study sample members, which amounted to (186.275), and the standard deviation (21.470). After using the one-sample t-test, the calculated t-value was (15.067), which is greater than the tabulated value (1.98) and is statistically significant at the 0.05 significance level and a degree of freedom of (230). Which indicates that the physics teachers (the study sample) possess a level of professional competence higher than the hypothetical average, as shown in Table (2).

Table (2) The calculated t-value for the responses of the study sample individuals on the professional competence test

Level of significance	T-values		Degree of free	hypothetical mean	standard deviation	SMA	sample	Professional competence
	The schedule	Calculated						
sign	1.98	8.620	230	15	5.977	18.388	231	**Scientific**
sign	1.98	18.066		90	7.126	98.455		**Personality and human relations**
sign	1.98	17.149		60	8.367	69.432		**Technology**
sign	1.98	15.067		165	21.47	186.275		**Total**

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The researcher suggests that physics teachers likely possess a high professional competence, which is due to the nature of physics as a subject that is difficult for learners. This difficulty forces physics teachers to adopt understanding as a method of teaching physics instead of memorization, and to use problem-solving as a way of thinking in addressing physical phenomena. In turn, this requires possessing scientific thinking skills, relying on experimentation to explain physics concepts, as well as employing technology extensively in educational practices with a significant variety in assessment methods. These skills represent the core of professional competence. This result is consistent with the studies of Al-Jubouri (2025) and Wiliams & Smith (2023).

2. To verify the hypothesis which states that there is no statistically significant difference at the significance level (0.05) between the average scores of the study sample on the Professional Competence Scale according to the variable of gender (males, females), the researcher calculated the arithmetic mean of the responses of the male participants in the study sample on the Professional Competence Scale, which amounted to (179.363) with a standard deviation of (11.544). The arithmetic mean for females reached (171.721) with a standard deviation of (8.976). After using the t-test for two independent samples, the calculated t-value was (5.084). When compared to the table value of (1.98) at a significance level of (0.05) and degrees of freedom (229), it was found that the calculated value is higher, which indicates the presence of a significant difference. Accordingly, we reject the null hypothesis and accept the alternative hypothesis, meaning that there is a difference between the responses of the study sample on the Professional Competence Scale according to gender. That is, the members of the physics teachers study sample who are male have higher professional competence than females, as shown in Table (3).

Table (3) The calculated t-value for the responses of the study sample on the Professional Competence Test according to gender (males, females)

Level of significance	**T-values**		**Degree of free**	**standard deviation**	**SMA**	**No.**	**sample**
	The schedule	**Calculated**					
statistically functional	1.98	5.084	229	11.544	179.363	145	**Male**
				8.976	171.721	86	**female**

The researcher attributes this result to the fact that, although the academic preparation programs for physics teachers are similar for both genders across most academic institutions, and although training opportunities during service are equally available to them to enhance their competence, males demonstrate higher professional competence than females. This is due to their ability to transform their multiple skills into good educational practices aimed at achieving intended learning objectives, their ability to communicate among themselves and exchange experiences on one hand, and individual competition to achieve higher success rates, which enhances their desire to continuously develop knowledge, expertise, and skills on the other. This leads to physics teachers excelling in the level of professional competence. This result

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aligns with the studies of Bani Domi and Al-Atoum (2022) and Al-Jabouri (2025) to verify the validity of the hypothesis stating that there is no statistically significant difference at the 0.05 significance level between the average scores of the study sample on the professional competence scale according to the variable of experience.

The studyer calculated the value of the one-way analysis of variance for the professional competence scale among the groups according to the variable of years of experience. It is evident from Table (4) that there are significant differences between the three groups of the professional competence scale according to the levels of the experience variable (1-5 years, 6-15 years, and 15 years or more), as shown in Table (4).

Table (4) One-way analysis of variance for the three groups according to years of experience (5 years, 10 years, 15 years or more) in the professional competence test for the individuals of the study sample.

Level of significance	**F-values**		**Average of squares**	**Sum of squares**	**Degree of free**	**Source of variation**
	The schedule	**Calculated**				
There are significant differences between the groups	3.150	5.835	236.291	472.582	2	Between groups
			40.489	9231.626	228	Within groups
				9704.208	230	Total

It can be seen from Table (4) that there are significant differences among the three groups in professional competence according to years of experience (5 years, 10 years, 15 years or more) among the study sample individuals. To determine the direction of the differences in favor of any of the three groups according to statistical significance, the Least Significant Difference (L.S.D) method was used, which showed that the significant differences are in favor of the third group, representing years of experience of no less than (15) years.

The researcher attributes the reason to the fact that teaching experience has a significant effect on increasing professional competence; this is because it is an environment full of experiences and exchange of opinions within the educational community, as well as extensive reading and teaching of the material, which helps in memorizing the material and being creative in it. Moreover, the longer the years of experience, the more the teacher participates in seminars and in-service training courses aimed at raising the level of professional competence. This result is consistent with the study by Bani Doumi and Al-Otoum (2022) and the study by Förtsch (2024) & Dorfner.

Second: Conclusions

1. Physics teachers (the study sample individuals) possess a high level of professional competence (scientific, personal, and technological) in teaching physics.
2. The gender of the physics teacher affects the level of their professional competence.

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3. There is a statistically significant difference in the level of professional competence according to gender (male, female) in favor of males.
4. Years of experience play an important role in enhancing the teacher's professional competence, particularly those with more than 15 years.

Third: Recommendations

1. Increasing the level of academic qualification for physics department students to raise their professional competence in line with rapid technological changes, especially applications that assist in the educational process, such as educational platforms, digital laboratories, and augmented reality.
2. Ensuring the organization of effective educational courses that contribute to raising teachers' professional competence and training them on how to translate it into effective teaching practices.
3. Educational institutions should provide suitable conditions and infrastructure that help physics teachers perform their educational roles effectively.
4. Adopting professional competence as a criterion to determine desirable teaching practices, assess the competence level of teachers, and classify them for the purpose of involving them in developmental courses.

Fourth: Proposals

1. Conduct a study entitled 'Evaluation of Physics Teacher Preparation Programs in Faculties of Education According to Professional Competency Areas.'
2. Design an enrichment program to develop the professional competencies of physics teachers according to the programmatic academic accreditation standards for the group of faculties of education.
3. Conduct a study to determine the professional competency level of university professors specialized in physics.
4. Conduct a study to determine the requirements for teaching physics according to the STEM approach.

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