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Challenges of Implementing Vocational and Technical Education (Engineering and Industrial Specializations) in Schools in the Sultanate of Oman

School Principals' Perspectives and Proposed Solutions

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Abstract
This study investigates the challenges associated with implementing vocational and technical education, specifically engineering and industrial specializations, at the post-basic education level in the Sultanate of Oman, from the perspective of school principals. It also explores proposed solutions to these challenges and examines whether perceptions differ significantly across the Muscat and North Al Batinah governorates. A descriptive survey methodology was adopted, using a structured questionnaire administered to all school principals (N=10) overseeing relevant programs in the two regions. The findings highlight three primary challenges: limited financial support for program implementation, delays in adapting student affairs regulations to suit vocational specializations, and a lack of educational media to raise student awareness. Suggested solutions included enhancing awareness campaigns, updating and enforcing student affairs regulations and evaluation systems, and establishing digital platforms for grade monitoring and reporting. No statistically significant differences were found between the two governorates in terms of perceived challenges. The study suggests implementing more awareness programs, providing clearer information about educational and job options in vocational areas, establishing better rules through educational websites, creating digital tools to track progress, and offering financial or material rewards for students, teachers, and school leaders.

Keywords
vocational and technical education, engineering and industrial specializations, schools in the Sultanate of Oman

INTRODUCTION

Countries around the world strive to build visions that inspire society and individuals to achieve a qualitative leap in the performance and accomplishments of state institutions across various fields, the most important of which is education. Al-Sammar (2024) emphasizes that education quality is among the foremost concerns of modern societies, as nations work to enhance their educational systems to ensure sustainable development. Thus, strategic planning and vision-setting play a central role in directing educational policies toward achieving desired objectives. In the Sultanate of Oman, the government has adopted Oman Vision 2040 as a pathway to keep pace with local and global changes, navigate challenges, and leverage available opportunities to foster economic competitiveness, social well-being, growth stimulation, and service development in all sectors (Vision Document, 2020). The vision consists of several pillars and priorities, with "Education, Learning, Scientific Research, and National Capabilities" ranking highest among them. It focuses on equipping graduates of the educational system with competitive capabilities, potential, competencies, and skills to meet the productivity levels required for building a knowledge-based economy (Oman Vision 2040 Follow-up Unit, 2024).

Business Administration and Information Technology specializations were introduced in the 2023/2024 academic year across four schools in the Muscat and North Al Batinah Governorates (Al-Sariri, 2025). The vocational and technical education track was further expanded in the 2024/2025 academic year by adding engineering and industrial specializations. This aims to provide students with the vocational skills and knowledge necessary for entering the labor market and qualifying them for higher education. These efforts are implemented in collaboration with industrial and economic sectors, training institutions, and through partnerships to leverage their expertise in delivering vocational and technical programs (Ministry of Education, 2024). The Ministry of Education also plans to extend the program to other governorates and introduce new specializations linked to the energy sector and other economic fields, such as solid-structure maintenance, engineering maintenance, mechanical manufacturing engineering, occupational safety, health, and environmental practices (Oman Vision 2040 Follow-up Unit, 2024). Al-Asmari and Al-Shaman (2024) highlight that vocational and technical education offers diverse pathways, including business, entrepreneurship, economics, information technology, and engineering and industrial specializations. Its goal is to enhance students' skills and prepare them for the labor market or higher education, enabling them to gain specialized knowledge in their chosen fields. Given the novelty of this initiative in Oman and its significance, this study aims to explore the challenges of implementing vocational and technical education tracks in Omani schools from the perspective of school principals and proposes solutions to address them.

PROBLEM STATEMENT

Attention to human capital is one of the most important priorities of development plans in the Sultanate of Oman. The basic education stage has focused on providing basic educational needs, including knowledge, information, and skills, and on acquiring values and attitudes that enable learners to continue their education. In light of this, attention has been given to implementing educational paths and providing students with more educational options that align with their interests, desires, and abilities. This is emphasized by Oman Vision 2040, the philosophy of education in the Sultanate of Oman, and the National Education Strategy 2040 (Ministry of Education, 2024). In light of this, the vocational and technical school education system was adopted, according to a plan approved at the beginning of the 2023/2024 academic year. In light of the radical changes and transformations the world is witnessing in various aspects of life, businesses, jobs, and labor market needs have also changed. A study by Zidan (2021) indicated that labor market requirements necessitate possessing integrated skills and qualifications. Obtaining academic degrees is no longer sufficient, as some degrees are for specializations that are no longer in demand, are in very low demand in the labor market, or were only available for a specific period. The researcher believes that these changes necessitate the addition of new educational tracks at the school level to prepare a generation capable of keeping pace with the changes around it and possessing the required knowledge and skills. Despite many countries' interest in developing the school education system and adding diverse educational tracks, educational institutions face challenges when implementing these tracks. Al-Shalhoub (2019) pointed to several challenges, including student fragmentation, particularly as it is difficult for students to choose the appropriate track, and the relationship between the secondary stage and post-general education stages, whether universities, the military sector, vocational education, or other educational stages. Al-Arifi's study (2022) also indicated that the implementation of the secondary school track system faces moderate challenges, most notably the lack of clarity regarding the volunteer assignment mechanisms required for graduation, as well as the ambiguity of university admission policies for secondary school track outcomes. This study also highlights the lack of a specialized academic advisor to guide students in choosing the appropriate track. In light of this, and given the Sultanate of Oman's recent experience in implementing vocational and technical tracks, and the limited number of studies conducted in this field, and in order to bridge the research gap, this study examines the challenges of implementing vocational and technical education in schools in the Sultanate of Oman from the perspective of school principals and ways to overcome them. It aims to answer the following questions:

1. What challenges hinder implementing vocational and technical education in Omani post-basic schools, according to principals?
2. How can challenges to implementing vocational and technical education in Omani post-basic schools be overcome, according to principals?
3. Are there significant differences in principals' views on implementation challenges by governorate?

LITERATURE REVIEW

Study Terminology

The study included the following terms and concepts:

Vocational and technical education "is a two-year program of education that aims to develop students' knowledge and practical skills in vocational and technical specializations, according to their interests and desires. The curriculum consists of basic, elective, and specialized subjects to prepare students for the labor market and enable them to continue their studies at the higher education level" (Ministry of Education, 2024, p. 2). Engineering and Industrial Specializations: A group of specializations that began implementation in the 2024/2025 academic year in partnership with the Oman Energy Association (OPAL) as a strategic partner representing the energy sector. These specializations consist of six specializations: Mechanical Manufacturing Engineering and Engineering Maintenance, Solid Structures Maintenance, Occupational Health and Safety, Welding and Metal Forming, and Lifting and Lowering Operations (Ministry of Education, 2025).

Procedural Definitions

1. *Vocational and Technical Education*: An educational system designed to provide alternative pathways and specializations aligned with students' interests and abilities, equipping them with the knowledge and skills required either for advanced studies or direct entry into the labor market within engineering and industrial fields. Implemented across 10 schools in the Governorates of Muscat and North Al Batinah beginning in the 2024/2025 academic year.
2. *Challenges*: A collection of administrative, material, and technical difficulties, obstacles, and barriers encountered by school principals overseeing the implementation of vocational and technical education (engineering and industrial specializations) in Omani schools. These challenges are quantified through principals' responses to purpose-designed questionnaires.

Theoretical Framework

Vocational and Technical Education: As societies evolved, so did industry, commerce, communications, and economic thought. Educational institutions played an important role in keeping pace with these developments. Traditional education no longer met the needs of individuals and society. Hence, the need for new vocational and technical paths emerged. Al-Muqaddadi and Al-Zahrani (2023) define vocational and technical education as "a systematic path that students follow during the second and third years of secondary school, in accordance with their inclinations, abilities, and aptitudes. This systematic path prepares them psychologically, emotionally, cognitively, and performance-wise, producing highly qualified educational outcomes for entry into the labor market in both the public and private sectors, beyond secondary school, or for continuing their education to contribute to the advancement, prosperity, and renaissance of society" (p. 6). Al-Nawaishah (2022) believes that vocational education is "a field of formal education that students enroll in upon completion of basic education. Through this program, students enroll in a specialty such as agriculture, hospitality, industry, home economics, and health. They receive education in two areas (theoretical and practical) and are prepared to enter the labor market within the field in which they specialized during their vocational education" (p. 11). The Ministry of Education in the Sultanate of Oman (2025) indicated that vocational and technical education aims to provide students with professional knowledge and skills, prepare graduates capable of competing in the labor market, provide an attractive environment that enhances entrepreneurial skills and promotes partnerships with economic sectors, and reinforces community awareness of the importance of vocational and technical education.

It is worth noting that the Center for Measurement and Evaluation has prepared a general document for evaluating student learning for grades 1-12. The document explains that the vocational and technical education system applies a two-semester system, and that students' results in core and elective subjects are calculated by finding the average student performance over the two semesters as the final result for the academic year. Specialization subjects are calculated according to the system followed for each specialization (Center for Educational Measurement and Evaluation, 2024). The researcher believes that vocational and technical education is an educational system that allows students to study various specializations not found in the general education system. This system is characterized by a high level of skill in vocational and technical specializations, with the goal of preparing students for the labor market and higher education. This includes engineering, tourism, marketing, information technology, health, arts and design, welding, and agriculture, thus aligning school education outcomes with modern requirements. The Importance of Vocational and Technical Education: The nature of the skills required to enter the labor market has changed, and so have the needs of the world. Therefore, countries are seeking to diversify their educational offerings to meet these needs. In light of this, vocational and technical education must be designed to align with its specific objectives. The Ministry of Education in the Sultanate of Oman (2024) indicates that vocational and technical education has characteristics that distinguish it from general education, as it contributes to building partnerships with economic sectors and meeting students' interests and desires, with a focus on academic skills, a diversity of specializations and fields, and preparing students to enter the labor market. It also provides flexibility in enrolling in various higher education tracks.

Boochever (2025) indicates that vocational and technical education has witnessed a broad revival amidst the culture of university for all, offering a more balanced vision of career preparation alongside university readiness, preparing students for a range of post-secondary educational opportunities. At the same time, efforts have been made to increase students' preparation for and access to higher education through enrollment in university courses in high school, an experience known as dual learning. The researcher believes that vocational and technical education takes into account individual differences among students due to their differences in abilities, attitudes, and motivation. Therefore, it provides various specializations that contribute to developing their attitudes and inclinations and providing them with the knowledge and skills that enable them to enter the labor market or higher education institutions. It also creates a general orientation among school students towards new horizons that are compatible with the next stage and the state's needs for new specializations and contributes to creating a partnership between public schools and the training sector in private institutions.

Implementing Vocational and Technical Education in the Sultanate of Oman

Vocational and technical education in the Sultanate of Oman has begun in four schools in the Muscat and North Al Batinah Governorates as part of the 2023/2024 academic year curriculum. A pilot program was implemented for 200 male and female students in the eleventh grade. The program was implemented at Hafs bin Rashid Boys School, Nusaybah bint

Ka'b Girls School, Halima Al Sa'diya Girls School, and Ka'b bin Barsha Boys School. Several preparatory meetings were held between the Ministry of Education, school administrations, and partners at the Modern College. Upon completion of the twelfth grade under the BTEC system, students receive two certificates: The General Diploma in Vocational and Technical Education and the International BTEC Certificate, recognized by Pearson International. After completing the General Diploma, students can pursue a bachelor's degree at higher education institutions in the following specializations: Business Administration, Marketing, Human Resources, Financial Affairs Management, International Management, and Retail Management (Al Nahdi and Al Buraiki, 2023). In the 2024/2025 academic year, a new group of specializations was introduced in cooperation with economic sectors. Private training institutions, given their extensive experience in offering various vocational and technical programs, have partnered with the Oman Energy Association (OPAL) as a strategic partner representing the energy sector. Specializations in mechanical manufacturing engineering, engineering maintenance, steel structures maintenance, occupational health and safety, welding, metal forming, and lifting and lowering operations have been included (Ministry of Education, 2024).

The vocational and technical education system is being implemented for post-basic education students from grades 11 to 12 in a number of schools in the governorate, as defined by the Ministry of Education's plan. The goal is to develop school education in line with local and global trends, the requirements of higher education institutions, and the needs of the labor market. This will contribute to achieving Oman Vision 2040 and its aspirations by equipping students with knowledge, skills, and capabilities in vocational, technical, and industrial fields. This diversifies educational paths and promotes this type of education (Al-Khawaldi, 2024). Based on the study variable, the researcher reviewed a group of studies, which were organized in descending order from newest to oldest. Bau et al.'s (2025) study aimed to gain a deeper understanding of students' feelings toward the information engineering major, the challenges of attracting Indonesian high school and vocational students, and formulate an effective strategy to encourage them to choose this path. The researchers used a descriptive approach using questionnaires that included high school and vocational school students. The results of the sentiment analysis of high school students revealed that 44.5% expressed positive feelings, indicating that academic and job opportunities were the main motivators. The sentiment analysis of vocational school students revealed that 37% expressed positive feelings, with priority given to practical skills and industry readiness. The study recommends that the focus should be on presenting job opportunities and developing technical skills, as well as promoting practical and academic skills, industry partnerships, and job readiness.

The study of Al-Balshy (2024) aimed to enrich educational literature by presenting a systematic review of the philosophy governing career planning for secondary school students in light of the Fourth Industrial Revolution, demonstrating its impact on the career paths of secondary school students, and proposing a package of mechanisms to support secondary school students in planning their future career paths. The study adopted a descriptive approach to achieve its objectives, as a questionnaire was designed and sent to a sample of 307 principals, deputies, and teachers of secondary schools in Damietta Governorate. The study reached a set of policies that secondary schools should adopt to help their students plan for future career paths, which were based on three axes: enhancing students' self-development to achieve future professional empowerment, facilitating the requirements for obtaining future professions, and providing the necessary culture about future career paths and the variables affecting them. The study addressed the challenges that prevent secondary schools from achieving these mechanisms, including: the weak capacity of secondary schools with their current resources and chronic problems to implement all these procedures, as well as the separation of curricula and teaching methods in secondary schools from local and global variables and the impact they have had on professions.

The study by Al-Nawaisheh and Al-Rashaydeh (2024) also aimed to reveal the role of secondary schools in the Southern Jordan Valley District in directing students towards vocational and technical education (BTEC) from the teachers' perspective, and the relationship of this to some demographic changes. To achieve this, a questionnaire was developed and applied to a sample of (255) male and female teachers from public secondary schools in the Southern Jordan Valley District. The results showed that the sample members' assessments of the role of secondary school principals in directing students towards vocational and technical education were high across all areas. The field of "school environment" came first, followed by the field of "school policies," then the field of "teachers," the field of "students," and finally the field of "partnership with the local community." The results showed no statistically significant differences at the level of $\alpha \leq 0.05$ attributable to the effect of variables (gender, years of experience, and specialization) on the sample members' assessments. In light of this, the study recommended holding periodic meetings with the local community, given the importance of enhancing students' orientation towards vocational and technical education.

The study of Al-Muqaddadi and Al-Zahrani (2023) also aimed to reveal the role of educational tracks in the secondary stage in preparing students for the labor market, and to highlight the role of educational track teachers in the secondary stage in this. It also aimed to reveal the obstacles that prevent the preparation of students of educational tracks in the secondary stage for the labor market from the perspective of educational supervisors, and to test a set of variables that could affect the supervisors' responses. To achieve these goals, a questionnaire was constructed and distributed to (96) male and female supervisors, and a set of results were reached, the most prominent of which are: the presence of a high level of agreement on the role of educational tracks in the secondary stage in preparing students for the labor market from the perspective of educational supervisors, the presence of a high level of agreement on the role of educational track teachers in the secondary stage in preparing students for the labor market, and the presence of a high level of agreement on the obstacles that prevent the preparation of students for the labor market from the perspective of educational supervisors.

Al-Arifi's study (2022) aimed to identify the challenges facing the implementation of the developed tracks system for the secondary stage from the perspective of school leadership supervisors and principals and vice principals of secondary schools affiliated with the Tabuk Education Department. The study followed a descriptive survey approach, and the study tool was a questionnaire. A sample of (159) school leadership supervisors and principals and vice principals of secondary schools affiliated with the Tabuk Education Department was applied. The results showed that the study sample's responses regarding the challenges facing the developed tracks system for the secondary stage were represented by the lack of clarity in the mechanisms of volunteer tasks required for graduation, the ambiguity of the policy of collective acceptance of secondary stage track outputs, and the lack of a specialized academic advisor to guide female students to choose appropriate tracks. The most prominent development proposals from the perspective of the study sample were the establishment of training courses and workshops for all categories, the development of school readiness, and the establishment of a strong infrastructure for the tracks system.

The study by Al-Maimouni and Bonyan (2022) aimed to identify the reality and obstacles to implementing the Pathways Program for the secondary stage in meeting the needs of the Saudi labor market, in accordance with Vision 2030, from the perspective of school principals. To achieve the study objectives, the descriptive approach was used, and a questionnaire was constructed as a tool for collecting data. It was applied to a sample of (60) school principals. The study concluded with several results, the most prominent of which are: There is strong agreement among the study individuals on the existence of obstacles to implementing the Pathways Program for the secondary stage in meeting the needs of the Saudi labor market. The most prominent of these obstacles are: the large number of teaching and administrative burdens placed on the teacher, the lack of a comprehensive and clear teaching plan related to the educational pathways system, the weakness of the equipment and facilities that serve students in the educational pathways system, and the lack of qualification of teachers and supervisors in line with the aspirations of the educational pathways system.

Arar and Abdullah (2020) conducted a study that aimed to present a proposed vision for amending the secondary education system in Palestine, in light of standardizing the professional tendencies scale, according to gender variables and the level of academic achievement, on a sample of (1478) male and female students from the tenth grade, using the analytical approach. The results indicated the achievement of the factorial structure and alpha stability coefficients, reapplication and exploratory factor analysis, which showed the presence of eight factors that explained 76% of the total variance. The results of the standardization of the scale concluded that secondary education should be divided into three tracks: the scientific track, which includes the health, industrial, agricultural and technological branches; the literary track, which includes the humanities, Islamic law, leadership and business; and the applied track, which includes hotel, beauty, fashion and tailoring. This division will contribute to modifying the inferior view of vocational education on the one hand, and increasing demand for vocational branches on the other hand. The study recommended issuing the second education law, to include amending the secondary education system and adopting the results of vocational inclinations as a criterion alongside academic achievement for distributing students among the branches of the tenth grade (scientific, literary and applied).

The study by Kovalchuk et al. (2022) aimed to comprehensively describe the rise and fall of vocational education in Indonesia, including its history, development, opportunities, and challenges. It used a qualitative approach. This study used policy documents and related research works, and analyzed the results. The study results were obtained from a sample of 44 principals, 152 teachers, and 202 students. This is a purposive sample to gain a deeper understanding of vocational education. Interviews, observation, documentation, and questionnaires were used. The results showed that the Indonesian government changed the ratio of upper secondary schools to vocational schools from 70%:30% to 30%:70%. The establishment of new schools was not balanced with the feasibility study, which led to difficulty for graduates to get a job, as the curricula were theoretical and less relevant to the labor market. In addition, 74% of students felt bored while learning, and the facilities and teachers were insufficient. The study recommended implementing strong support from the industry so that vocational education graduates have the competence according to the needs of the labor market.

Observation on previous studies

The current study shares similarities with previous studies in its discussion of the vocational and technical education system in schools. We will outline the similarities and differences between the current study and previous studies as follows:

- In terms of objective, the current study aligns with the study by Al-Arifi (2022) and the study by Al-Maimouni and Bunyan (2022), which aimed to identify the reality and obstacles to implementing the Pathways Program for the secondary level in meeting the needs of the Saudi labor market. The study also sought to identify the challenges facing the developed Pathways System for the secondary level in the Kingdom of Saudi Arabia and ways to improve it from the perspective of female educational leaders.
- Regarding methodology, the current study agrees with previous studies that adopted a quantitative approach, such as Bau et al. (2025); Al-Balshi (2024); Al-Nawaisheh (2024); Al-Muqaddadi and Al-Zahrani (2023); Al-Arifi (2022); Al-Maimouni and Bunyan (2022), and Arar (2020). However, the current study differs from the study by Kovalchuk et al. (2022), which relied on a qualitative approach.
- In terms of the study sample, which includes school principals, the current study aligns with Al-Balshi (2024); Al-Maimouni and Bunyan (2022); and Al-Arifi (2022), all of which incorporated school principals in their samples.

Research gap

The study identifies a notable research gap owing to its narrow emphasis, concentrating only on the obstacles and suggesting solutions for the implementation of vocational and technical education, particularly engineering and industrial specialisations, from the viewpoint of school administrators. The study was limited to a specific demographic: school principals overseeing these programs in two governorates (Muscat and North Al Batinah) in Oman during the 2024–2025 academic year. Consequently, extensive insights into the national execution of vocational education, encompassing the perspectives of educators, learners, and policymakers from various locations, remain unexamined, suggesting that there must be more thorough and inclusive study. The current study is distinguished by its unique objective, spatial, and temporal limitations.

RESEARCH METHODOLOGY

This section outlines the procedures followed in this study, including a description of the methodology used, the identification of the study population, the study's structure, the steps taken to ensure validity and reliability, and the statistical methods employed for data processing and analysis.

Method and Procedures

Given the nature of the study, its objectives, research questions, and the information sought, the descriptive survey method was employed to achieve the study's goals and address its research questions. Saad (2021) highlights that the descriptive survey method is one of the most important and widely used approaches across various scientific disciplines due to its effectiveness in gathering extensive data and information about the phenomenon under investigation, as well as its capacity to interpret and clarify theoretical frameworks.

The researcher determined that this method is well-suited for identifying the challenges of implementing vocational and technical education in schools in the Sultanate of Oman from the perspective of school principals, as well as exploring potential solutions to overcome these challenges. Additionally, the study focuses on a recent and specific sample of schools.

Study Population and Sample

The study population consisted of all school principals implementing vocational and technical education (engineering and industrial specializations) in the Sultanate of Oman during the 2024/2025 academic year. These schools are located in the governorates of Muscat and North Al Batinah. The sample included (10) male schools, with no female schools represented, as these specializations are designated exclusively for male students. The study was conducted using a comprehensive sample, encompassing all members of the target population.

Table 1 Distribution of Sample Members across the two Governorates (Vocational and Technical Education - Engineering and Industrial Specializations)

Governorate	Number of females	Number of males	Total	Percentage
Muscat	0	5	5	%50
North Al Batinah	0	5	5	%50
Total	0	10	10	%100

Study Tool

Based on the nature of the data and the methodology used in the study, the researcher found that the most appropriate tool for achieving the study's objectives was the questionnaire. Alian (2024) defines it as one of the most common tools in descriptive research. It is a card containing a set of items that can be distributed according to dimensions or axes and applied to the study community or a representative sample. The purpose is to collect data and then convert participants' responses into quantitative (numerical) data, which can be easily analyzed using appropriate statistical tests and statistical equations, or using specialized software. This facilitates interpretations and recommendations, thereby achieving the study's objective. The study tool was constructed by consulting previous literature and studies related to the study topic, such as the study by Al-Arifi (2022) and the study by Al-Maimouni et al.(2022).

Scoring Criteria for the Study Tool:

The five-point Likert scale was adopted to score the study tools, assigning each item one of its five scores (strongly agree, agree, neutral, disagree, strongly disagree), represented numerically (1, 2, 3, 4, 5), respectively. The aforementioned scale was adopted for the purpose of analyzing the results, calculating the category length by subtracting the highest value from the lowest value (5-1=4). To obtain the category length, the range was divided by the highest value in the levels (4/5=0.8). The resulting score (0.8) was then added to the lowest value among the levels, which is 1, to determine the upper limit for the first category, equal to (0.8+1=1.8). This process resulted in finding the remaining values to determine all levels of the questionnaire, and the scale shown in Table (2) was adopted to interpret the study results.

Table 2 Statistical criteria used to interpret the results of the study tool items

Lower and upper limits of the five-point Likert scale	
Grade (Level)	**arithmetic mean**
Very high challenge	4.21-5
High challenge	3.41-4.20
Moderate challenge	2.61-3.40
Low challenge	1.81-2.60
Very low challenge	1-1.80

The validity and reliability of the study tool (questionnaire) were verified through multiple procedures that ensure accuracy and reliability, as follows:

Apparent Validity: To ensure the questionnaire's ability to adequately measure the study variables, apparent validity was adopted by presenting the tool, after its preparation, to (9) referees from among academics, Ministry of Education employees, and educational leaders. They evaluated the items in terms of their relevance to the study topic, their clarity, and their linguistic and scientific formulation. The referees' comments were taken into account, and the items were modified according to their recommendations, enhancing the validity of the tool.

Validity of Questionnaire Items: The corrected Pearson correlation coefficient was used to measure the correlation of each item with the total score of the scale, using the SPSS statistical analysis program.

Table 3 Corrected Pearson correlation coefficient between each item of the scale related to the challenges of implementing vocational and technical education (engineering and industrial specialties)

Paragraph	Correlation coefficient	Paragraph		Paragraph	Correlation coefficient	Paragraph	Correlation coefficient
1	0.555	6	0.568	11	0.644	16	0.402
2	0.751	7	0.559	12	0.707	17	0.601
3	0.822	8	0.226	13	0.249		
4	0.689	9	0.594	14	0.307		
5	0.657	10	0.740	15	0.231		

Table (3) shows that all items are strongly interrelated, with item coefficients greater than 0.20 and ranging between 0.231 and 0.822, indicating that the items are valid and reliable for measuring their intended purpose.

Internal Construct Validity:
To ensure the internal consistency of the items, the internal consistency coefficient (Cronbach's alpha) was calculated for the entire study instrument.

Table 4 Cronbach's alpha coefficient values for the scale as a whole

Cronbach's alpha	Number of paragraphs	Cronbach's alpha
Overall stability	17	0.899

It is noted from Table (4) that the Cronbach's alpha coefficient for the scale as a whole reached 0.899, which represents a very high reliability value.

Study Procedures
Following the construction of the study instrument in its initial form, it was reviewed by a panel of experts to verify its validity and reliability. Subsequently, data were collected, processed, and analyzed to derive results.
To accomplish the study objectives and examine the collected data, various appropriate statistical methods were employed using the Statistical Package for the Social Sciences (SPSS). Internal consistency was assessed using Cronbach's alpha, while test-retest reliability was measured via Pearson's correlation coefficient.
Statistical analyses, including arithmetic means, standard deviations, frequencies, and percentages, were employed to answer the study questions.

Results related to the first question
To address the first question: “What challenges hinder implementing vocational and technical education in Omani post-basic schools, according to principals?”
Descriptive statistics including means, standard deviations, and estimation were employed. The results are presented in the following table.

Table 5 Challenges Facing the Implementation of Vocational and Technical Education (engineering and industrial specializations)

n	Paragraph Number	Standard Deviation	Average	1	2	3	4	5	Paragraph	Degree of challenge
				Strongly disagree	Disagree	Neutral	Agree	Strongly agree		
				Repetition						
1	15	0.42	4.8	0	0	0	2	8	Limited financial support for schools offering engineering and industrial specializations	Very High Challenge
2	8	0.67	4.7	0	0	1	1	8	Delayed adaptation of student affairs regulations to match the application of engineering and industrial specializations at schools	Very High Challenge
3	17	0.71	4.5	0	0	1	3	6	Difficulty transporting students from their residences to institutes due to the large number of residential areas	Very High Challenge
4	13	0.53	4.5	0	0	0	5	5	Inadequate educational media in educating students about engineering and industrial specializations	Very High Challenge
5	6	0.84	4.4	0	0	2	2	6	Increased burden on the administrative staff	Very High Challenge
6	2	1.06	4.3	0	1	1	2	6	Difficulty preparing school schedules in schools offering engineering and industrial specializations	Very High Challenge
7	12	0.99	4.1	0	1	1	4	4	Some students' abilities are not compatible with engineering and industrial specializations	High Challenge
8	11	0.88	4.1	0	0	3	3	4	Students' reluctance to choose engineering and industrial specializations	High Challenge
9	9	0.99	4.1	0	0	4	1	5	Negative perceptions of engineering and industrial specializations among students	High Challenge
10	14	1.05	4	0	1	2	3	4	Insufficient school resources, in terms of the number of classrooms, are inadequate to meet the needs of engineering and industrial specializations at schools	High Challenge
11	1	1.23	3.8	0	2	2	2	4	Increased class load for some core and elective subject teachers as a result of the implementation of engineering and industrial specializations at schools	High Challenge
12	5	1.34	3.7	0	3	1	2	4	Increased student density in some academic sections after students were distributed according to choices	High Challenge
13	7	1.26	3.6	0	3	1	3	3	Difficulty coordinating with institutes on matters related to student affairs	High Challenge
14	4	1.08	3.5	0	3	0	6	1	Increased professional pressure on core and elective subject teachers to complete the curriculum as a result of the reduction in the number of classes in core subjects Electives for engineering and industrial students	High Challenge
15	3	0.97	3.5	0	2	2	5	1	Increased academic pressure on engineering and industrial students due to reduced classes in core and elective subjects	High Challenge
16	10	1.07	3.4	0	2	4	2	2	Difficulty adapting to engineering and industrial specialties	High Challenge
17	16	1.35	3.4	0	4	1	2	3	Lack of buses allocated to engineering and industrial students	High Challenge

It is clear from Table (5) that the arithmetic means of the challenges ranged between (4.8-3.4) out of 5 points, and they were arranged according to the mean and standard deviation in descending order from highest to lowest, where 6 paragraphs were rated as a very large challenge and eleven paragraphs were rated as a high challenge. Paragraph

No. (15), which states (the limited financial support provided to schools applying engineering and industrial specializations), ranked first with an arithmetic mean of (4.8) and a standard deviation of (0.42). Paragraph No. (8), which states (the delay in adapting the student affairs regulations to the application of engineering and industrial specializations in the school), ranked second with an arithmetic mean of (4.7) and a standard deviation of (0.67). This was followed by Paragraph No. (13), which states (the inadequacy of educational media in educating students about engineering and industrial specializations), with an arithmetic mean of (4.5) and a standard deviation of (0.53). The last two places were occupied by the paragraph stating (the small number of buses allocated to students of engineering and industrial specializations), with an arithmetic mean of (3.4) and a standard deviation of (1.35), and the paragraph (the difficulty of students adapting to engineering and industrial specializations), with an arithmetic mean of (3.4) and a standard deviation of (1.07).

The results of this study are consistent with Al-Arifi's (2022) study on some challenges, such as (the inadequacy of educational media in educating students about engineering and industrial specializations), which ranked first, compared to third in the current study. The challenge (the limited financial support provided to schools implementing engineering and industrial specializations), which ranked fifth, compared to first in this study.

Results related to the second question

To answer the second question, which states: "How can challenges to implementing vocational and technical education in Omani post-basic schools be overcome, according to principals?"

The statements were coded, and the frequency and percentage were calculated as follows:

Table 6 Ways to overcome the challenges of implementing vocational and technical education (engineering and industrial specializations) at the post-basic education level in schools in the Sultanate of Oman, from the perspective of school principals

n	Field	n	Phrases (according to responses)	Percentage	Repetitions
1	Awareness and introduction to the professional and technical path Activating student affairs and evaluation regulations Awareness and introduction to the professional and technical path Activating student affairs and evaluation regulations	1	Increase awareness and direct technical connections with relevant institutes.	33.32%	8
		2	- Disseminate the culture of engineering and industrial specializations in the community through social media platforms so that all members of society are informed about this path and aware of its negatives, positives, and challenges.		
		3	- Increase awareness and educate students and their parents about engineering and industrial specializations.		
		4	- Increase media education about specializations and post-specializations, as well as increase the number of specialized doses to match the qualifications students are expected to pursue.		
		5	- Clarify the future of students after the twelfth grade.		
		6	- Raise awareness and adopt the system for the better.		
		7	- Reassure parents about their children's future.		
		8	- Initial preparation to identify the locations where the system is implemented, so that it aligns with the interests and desires of students and their parents, based on their cultural and financial status.		
2	Awareness and introduction to the professional and technical path	1	- Activate the educational portal for all windows to monitor students, whether in the student affairs regulations or the assessment.	16.67%	4
		2	- Complete the activation of the educational portal for institutes to monitor reports and grades and the student affairs regulations.		
		3	- Establish a regulation regulating procedures for dealing with students.		
		4	- Resolve the problem of connecting students to the educational portal, especially with regard to student affairs.		
3	Activating student affairs and evaluation regulations	1	- Providing incentives for students on the vocational track, such as creating a suitable environment for them to work or continue their studies at higher education institutions after completing their approved school hours.	12.5%	3
		2	Granting students a cash and in-kind reward, while ensuring future specializations in universities		

			and the labor market.		
		3	Providing financial and moral support to both teachers and students.		
4	Providing human resources (teachers and specialists) Linking specializations to the labor market	1	Providing educational administrative staff to manage the school day at institutes, such as social, psychological, and administrative specialists to monitor student affairs, such as attendance, absence, and daily situations.	12.5	3
		2	Providing a cadre of teachers and specialists.		
		3	Providing human and material resources in schools to enable them to implement engineering specializations within the schools themselves.		
5	Increasing admission opportunities to higher education institutions	1	Linking these specializations to employment.	8.33%	5
		2	Directly linking the workforce to establish a communication network with the number of students expected to graduate and the methods for attracting them to the labor market.		
6	Providing buses	1	Increasing the chances of students being accepted into engineering and industrial specializations at higher education institutions, along with further clarification of admission policies at higher education institutions.	4.17%	1
7	Providing space for vocational and technical education students	1	Providing buses designated for vocational track students from the institute to their residences.	4%	1
8	Providing human resources (teachers and specialists)	1	Providing a single location that brings students together to study core subjects and study technical and industrial specializations.	4%	1
9	Modify school days	1	Changing the school days to be consecutive days at school and institute so that the student can focus on education instead of the mental distraction in the current system, for example (Sunday/Monday) at the institute and (Tuesday/Wednesday/Thursday at school) or vice versa.	4%	1
			Total	**100%**	**24**

We note from Table No. (6) the demand of school principals for awareness and introduction to the program, as phrases in this area were repeated (8) times, representing (33.32%) of the total responses. This indicates the importance of awareness. One school principal indicated: “Spreading the culture of engineering and industrial specializations in society through social media programs so that all members of society are aware of this path and know its negatives, positives, and challenges.” Another principal also indicated “Increasing media education about specializations, and beyond specializations, as well as increasing specialized doses to match the qualifications that students are expected to pursue.” The current study agreed with Al-Arifi (2022), who indicated that implementing the tracks system requires education and awareness among all elements of the educational process, in order to ensure the success of the transition from traditional secondary school to tracks. It also agreed with the study of Al-Maimouni and Bunyan (2022), which recommended working to increase awareness of the importance and objectives of the tracks system for the secondary stage. The second-ranked topic was the activation of student affairs and assessment regulations.

This phrase was repeated four times, representing a percentage of 16.67%. One school principal indicated: "Activating the educational portal for all student monitoring windows, whether in the student affairs or assessment regulations." Another principal indicated: "The existence of regulations regulating procedures for dealing with students." The current study agreed with Al-Arifi's study (2022), where the study sample proposed "updating the Noor system and educational platforms before the start of the school year and implementing the system". Through attending several meetings with specialists from the Ministry of Education, the Directorate General of Education in Muscat Governorate, and principals of schools implementing the vocational and technical education system (engineering and industrial specializations), and in the presence of representatives of institutes and the private sector, some challenges were discussed, such as the shortcomings of the media and educational role, the importance of activating the educational portal for student affairs regulations, and completing the assessment process windows.

The challenge of buses was also discussed, given that residential areas are far apart and it is difficult to gather students directly from residential areas to institutes. Results related to the third question:

To answer the third question, which states: "Are there significant differences in principals' views on implementation challenges by governorate?”

The Mann-Whitney U test was used, as it is suitable for comparing two independent groups in the absence of a normal distribution, in addition to the small sample size. The results are as shown in Table (7).

Table 7 Mann-Whitney U test to find differences in the estimates of the study sample members based on the governorate variable

Governorate	Number of managers	Average overall rating	Standard deviation
Muscat	5	3.98	0.51
North Al Batinah	5	4.07	0.59
Mann-Whitney U test results	U = 10		P = 0.690

From Table (7), the results showed that the average general assessment of school principals in Muscat Governorate was (3.98) with a standard deviation of (0.51), while the average general assessment in North Al Batinah Governorate was (4.07) with a standard deviation of (0.59). Although the average in North Al Batinah Governorate was slightly higher, the results of the Mann-Whitney U test between the two governorates indicated a U value of 10 and a probability value of (P-Value = 0.690). Since the probability value is greater than the significance level of 0.05, the difference between the two averages is not statistically significant. Therefore, there are no statistically significant differences between the assessments of principals in the two governorates regarding the challenges of implementing vocational and technical education (engineering and industrial specializations). This indicates the similarity of monitoring challenges for school principals regardless of the governorate in which they work.

The current study is consistent with the study by Al-Nawaishah (2024), which showed no statistically significant differences at the level of ≤0.05 attributable to the effect of the gender variable on individuals. The researcher believes that the reason for the lack of differences between the two governorates is that education in the Sultanate of Oman follows a centralized system, which contributes to providing the same conditions and material and human resources across the governorates. Furthermore, the schools selected for the vocational and technical education track (engineering and industrial specializations) are schools with approximately the same conditions in terms of student density, students' socioeconomic status, proximity to the schools, and other largely similar conditions.

SIGNIFICANCE OF STUDY

The study's importance stems from both theoretical and practical aspects, as follows:

Theoretical Importance: The study enriches the theoretical literature with concepts and terminology related to vocational and technical education (engineering and industrial specializations) in general, serving as a resource for researchers and interested parties. It will also open avenues for further independent studies related to the subject and contribute to the knowledge base in Arab and Omani libraries.

IMPLICATIONS OF THE STUDY

- It reveals the challenges of implementing vocational and technical education (engineering and industrial specializations) from the perspectives of school principals implementing the program. This helps educational leaders identify these challenges and develop solutions for future program expansion.
- This study can benefit school principals and officials in the Sultanate of Oman by enhancing their understanding of vocational and technical education, its pathways, and its relationship to the labor market, thereby enabling them to achieve the goals of the educational process efficiently and effectively.
- The study provides officials in the Ministry of Education and its affiliated directorates with findings necessary to design professional development programs for school principals and teachers in the Sultanate of Oman. These programs can be delivered by the Specialized Institute for Vocational Teacher Training and training centers in the educational governorates, focusing on vocational and technical education pathways and their role in economic diversification.
- It is hoped that the current study will offer an overview of the challenges in implementing vocational and technical education (engineering and industrial specializations) and strategies to overcome them. This will inform officials at the Ministry of Education and its affiliated directorates, enabling them to provide the necessary support for this type of education.
- The study will contribute to developing a vision for innovative ideas that enhance and improve the program.

RECOMMENDATIONS

In light of the findings, the researcher recommends the following:

- Intensify awareness and publicize vocational and technical tracks (engineering and industrial specializations) and clarify opportunities in higher education institutions and the labor market.
- Activate the student affairs regulations on the educational portal and create a digital mechanism for institutes to monitor grades and prepare reports.
- Provide material incentives (cash or in-kind) to students, school administrations, and faculty.
- Provide human resources at institutes to offer social and psychological support and monitor student affairs, such as attendance, absence, and daily situations.
- Coordinate with higher education institutions and the labor market to provide admission opportunities for students (engineering and industrial specializations), while informing students of these opportunities, how to utilize them, and the admission requirements.
- Provide the necessary number of school buses for students (engineering and industrial specializations) to prevent students from being late to school, institutes, or returning home.
- Challenges of implementing vocational and technical education (business administration and information technology) from the perspective of school principals in the Sultanate of Oman.
- Analyzing the gap between vocational and technical education curricula and labor market requirements in the Sultanate of Oman.

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