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Exploring Polytechnical Teaching Strategies in SABIC Academy and Technical Colleges: A Comparative Causal Study

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ABSTRACT

The study aimed to identify the polytechnical teaching strategies used at SABIC Academy and the Technical Colleges, employing a comparative causal approach. A research questionnaire covering four main axes was utilized: the current use of teaching strategies at SABIC Academy and the Technical College in Riyadh; the impact of these strategies on developing trainees' technical skills; the challenges encountered in using these strategies; and suggestions for improving their implementation. The study sample consisted of faculty members and trainers from SABIC Academy and the Technical College in Riyadh. The results indicated a high level of implementation of teaching strategies in both institutions, with no statistically significant differences between them, and a significant impact on developing trainees' technical skills. The results also revealed notable challenges in implementing teaching strategies, and proposals to improve their use received a high degree of agreement. Based on these findings, the study offered a set of recommendations and suggestions.

Keywords: Polytechnical Teaching Strategies – SABIC Academy – Riyadh Technical College

INTRODUCTION

Technical and vocational education is crucial for developing a country's human resources, as it prepares a skilled workforce with the right knowledge, career orientation, and practical skills. This, in turn, contributes significantly to national development, strengthens the economy, meets labor market needs, and improves living standards. Its importance has made it a focus for countries worldwide, driving progress and economic growth. Global experience shows that societies prioritizing technical and vocational education achieve significant progress, believing in the importance of a skilled workforce, with 45-55% of the population needing to be skilled workers for progress (Al- Swaid, 2019).

The study by Hussein and Abdullah (2023) confirms that technical and vocational education plays a primary and active role in developing human resources, pivotal in boosting productivity and work efficiency. It produces skilled, enthusiastic employees who achieve the best institutional results. Al-Dhuwai and Al-Mutairi (2024) note that technical and vocational education effectively builds a better future for students and society by providing specialized education and developing necessary skills for professional and personal success. These institutions aim to create a creative generation adaptable to labor market changes and lifelong learning.

Believing in technical and vocational education's crucial role in building modern societies and driving development, Saudi Arabia established the Technical and Vocational Training Corporation (TVTC) in 1980. The Kingdom has expanded its programs, aligning them with labor market demands, recognizing it as a national objective and strategic investment supporting Vision 2030. It has encouraged youth enrollment, dispelled negative

perceptions, improved quality, and leveraged global best practices to cultivate innovators capable of creating and building a progressive society (Al-Sharif, 2021).

This commitment has led Saudi Arabia to rank first globally in post-secondary vocational and technical program enrollment, according to the Global Knowledge Index 2022. The index, published by the Mohammed bin Rashid Al Maktoum Knowledge Foundation and the United Nations Development Programme, comprises seven sub-indicators focusing on six vital knowledge sectors (Middle East Journal, 2023). The Kingdom's achievement reflects its leadership's interest in supporting technical and vocational education, qualifying citizens, and developing their skills.

The technical colleges affiliated with the Technical and Vocational Training Corporation (TVTC) are a prime example of the Kingdom's commitment to technical education. This government-run educational institution offers diploma and bachelor's degree programs in technical and administrative fields. Its aim is to equip young people with practical technical and vocational training through applied education, enhancing their professional skills and preparing them for the job market and various sectors, such as technology, industry, and services. This reduces reliance on jobs requiring traditional university degrees (Al-Otaibi, 2018).

Given their importance, these colleges have become noticeably widespread across various cities and provinces in the Kingdom of Saudi Arabia. Student enrollment has also increased, particularly with the availability of training programs that meet labor market needs and initiatives supporting vocational training. These colleges offer diploma programs based on an attendance system and provide the possibility of continuing higher education through bridging programs after graduation.

Another example of the Kingdom's focus on technical and vocational education is the SABIC Academy, which aims to attract talented young Saudi high school graduates. They receive training in English language, technical, and theoretical skills, and pursue university studies both within and outside the Kingdom in specific fields. The Academy also offers an Early Career Development (ECP) program for recent graduates, gaining them a variety of experiences, including on-the-job training, formal learning and development courses, coaching, and informal mentoring. Additionally, they are provided with meaningful work assignments and networking opportunities (Sahnoon, 2022).

For technical colleges and the SABIC Academy to achieve their goals, particularly in developing students' and trainees' technical, practical, and technological skills, appropriate teaching strategies must be employed that consider the nature of these skills. These skills require training and practical application, placing the learner at the center of the educational process, actively participating in learning tasks and activities. Mohsen (2017) emphasizes that teaching strategies in technical and vocational education programs should provide methods, approaches, and mechanisms that develop students' abilities, including:

- Fostering a culture of teamwork
- Encouraging the use of the scientific method in thinking
- Expressing opinions and explaining solutions
- Exploring diverse approaches
- Applying knowledge and skills practically to produce a
- well-rounded graduate.

Among the strategies that many researchers consider important and suitable for technical and vocational education are polytechnical teaching strategies stemming from polytechnical theory, also known as applied theory or the theory of multiple arts. This theory, as Shaovolenko (2015) points out, aims to transform the theoretical aspect into an applied one, rejecting the prevailing division between pure and applied knowledge. This idea emerged through linking education to productive work, due to fundamental changes in the means of production and the evolution of labor.

The polytechnic theory offers a comprehensive vision for linking aspects of the educational process in light of their relationship to productive life. Al-Muntashiri (2022) argues that the polytechnic theory emphasizes the necessity of equipping students with the general principles of social production, professional and technical skills, and engaging them in productive work both inside and outside the school.

The curriculum is divided into two aspects:

1. Application of science and utilization of knowledge for production.
2. Scientific approach combining knowledge and its application for production and development.

Therefore, polytechnic teaching strategies are among the most suitable strategies that can achieve many of the goals of technical and vocational education, because they rely mainly on linking theoretical aspects and concepts to the practical through tangible activities and integrating them with modern production and social work.

Saadeh and Ibrahim (2021) highlight the importance and diversity of polytechnic teaching strategies, including:

- Work-based learning.
- Industry-related workshops.

- Applied projects.
- Problem-solving-based learning.
- Field visits.
- Practical demonstrations.
- Use of modern technologies.
- Presenting real-world problems to enhance critical thinking skills.

The importance of polytechnic teaching strategies is confirmed by research (Androshchuk, 2018; Sandugash et al., 2020; Razouqi & Al-Saoudi, 2020; Al-Qahtani & Al-Qahtani, 2024). These studies show that polytechnic strategies help achieve educational goals like:

- Developing critical thinking & problem-solving skills.
- Encouraging creativity & self-learning.
- Promoting teamwork.
- Addressing individual learner differences.
- Making learning effective, practical & enjoyable.
- Preparing learners for academic tasks & real-life problems.

Based on this importance, the use of polytechnical teaching strategies must be activated in technical colleges and the SABIC Academy; difficulties and obstacles that prevent the achievement of this goal must be overcome, and the successful experiences that employed these strategies must be utilized.

Feeling a Problem with Studying:

The awareness of the problem addressed in this study stemmed from several sources, including:

1. Global interest, and Saudi Arabia's interest in particular, in technical and vocational education is focused on it as a strategic investment to support Vision 2030. This investment aims to build a strong and prosperous economy led by national talent, through developing national skills and preparing skilled workers for the labor market. The Kingdom's efforts are evident in the significant expansion of technical education institutions, the establishment of specialized programs and academies that meet market needs, the improvement of the quality of technical training, and the achievement of tangible results in the labor market (Al-Sharif, 2021).
2. Technical and vocational education in many countries falls short of achieving its intended goals, particularly in equipping graduates with practical and technical skills. This is attributed to several factors, including the tendency of some faculty members to prioritize rote memorization over analytical understanding and interpretation. Moreover, the prevalent teaching methods focus on recalling information rather than fostering advanced cognitive abilities, practical skills, and positive attitudes towards technical and vocational education (Al-Sharif, 2021; Eid, 2022; Al-Namla & Bukhari, 2022; Ismail, 2023; Al-Dhawad & Al-Mutairi, 2024; Ezekiel, 2025).
3. The results of the personal interviews conducted by the researcher with faculty members at technical and vocational education institutions revealed a gap between theoretical knowledge and practical application of polytechnical teaching strategies. While faculty members possess theoretical knowledge, they tend to favor certain strategies over others, often neglecting important ones due to the required specialized skills, time, effort, and technological infrastructure. Additionally, the lack of ongoing training, technical support, and incentives for excellence hinder the effective implementation of these strategies.
4. Recommendations from scientific conferences in the field of technical and vocational education emphasize the need to improve graduates' skills to meet labor market demands and achieve competitiveness. Key recommendations include enhancing the learning environment and its facilities to ensure effective training, employing modern training methods and assessment techniques, focusing curricula on practical and technical skills, and leveraging successful experiences in technical and vocational education. These recommendations are based on the 9th Saudi Technical Conference and Exhibition (STCEX 2020): The Future of Training... A Knowledge Economy for Sustainable Development, General Organization for Technical and Vocational Training, Riyadh, March 10-12, 2020; the ALECSO Conference of Ministers and Leaders Responsible for Technical and Vocational Education and Training in the Arab World, Arab League Educational, Cultural and Scientific Organization, December 27, 2022; and the International Scientific Conference: Reshaping Technical and Vocational Education and Training in the Arab World: Innovative Solutions for a Future Based on Emerging Technologies, Cairo University, October 29-30, 2025.

Research Problem:

The problem of the study is the need for a comparative analysis between SABIC Academy and technical colleges to identify polytechnical teaching strategies and their effective utilization to develop graduates' practical and technical skills. The research questions include:

1. What polytechnical teaching strategies should be used in technical and industrial education?
2. What is the current state of polytechnical teaching strategies at SABIC Academy in Riyadh?
3. What is the current state of polytechnical teaching strategies at the technical college in Riyadh?
4. Are there statistically significant differences in the use of polytechnical teaching strategies between SABIC Academy and the technical college in Riyadh?
5. What is the impact of using polytechnical teaching strategies on developing trainees' technical skills at SABIC Academy and the technical college in Riyadh?
6. What challenges hinder the use of polytechnical teaching strategies at SABIC Academy and the technical college in Riyadh?
7. What suggestions can be made to further improve the use of polytechnical teaching strategies in academic and industrial settings?

Study Objectives:

This study aims to achieve the following objectives:

1. **Identifying Polytechnical Teaching Strategies:** Identify effective strategies for technical and industrial education.
2. **Current Use of Strategies at SABIC Academy:** Assess the extent of polytechnical teaching strategies used at SABIC Academy in Riyadh.
3. **Current Use of Strategies at the Technical College:** Examine the use of polytechnical teaching strategies at the Technical College in Riyadh.
4. **Comparison between SABIC Academy and the Technical College:** Identify differences in the use of polytechnical teaching strategies between the two institutions.
5. **Impact of Strategies on Technical Skills:** Determine the impact of polytechnical teaching strategies on developing technical skills among trainees.
6. **Challenges Facing Strategy Implementation:** Identify challenges facing the use of polytechnical teaching strategies in both institutions.
7. **Recommendations for Improving Strategy Use:** Develop proposals to enhance the use of polytechnical teaching strategies in academic and industrial settings.

Significance of the Study:

This study can contribute in the following ways:

First: Theoretical Significance

The study enriches the Arabic literature on technical and vocational education and provides a comprehensive theoretical framework linking polytechnical teaching strategies with the technical skills required by trainees in technical and industrial education institutions.

Second: Practical Significance

- The study provides documented scientific evidence for policymakers in the Ministries of Labor and Education to make informed decisions on developing the use of polytechnical teaching strategies to enhance technical skills among trainees in technical and vocational education institutions.
- The study's findings provide a scientific basis for designing and developing specialized training programs for faculty members in technical and vocational education institutions on using appropriate polytechnical teaching strategies to develop practical and technical skills among trainees.
- The results help technical and vocational education institutions identify strengths and weaknesses in their educational environments and develop specific strategies to improve the quality of the educational environment, serving the practical and technical skills of trainees.
- The study provides scientific measurement tools to evaluate the use of polytechnical teaching strategies in technical and vocational education institutions and their effectiveness in developing technical skills among trainees, supporting continuous review and development of education in these institutions.
- The study offers practical guidelines for curriculum and educational activity developers on integrating technical skills into training activities in technical and vocational education institutions, considering the developmental characteristics of trainees and differences between institution types.

Study Boundaries:

The researcher adhered to the following boundaries in conducting this study:

- **Human Boundaries:** Faculty members and trainees at SABIC Academy and the Technical College in Riyadh.
- **Spatial Boundaries:** SABIC Academy and the Technical College in Riyadh.
- **Temporal Boundaries:** Academic year (2025/2026).
- **Subject Boundaries:** Explaining polytechnical teaching strategies used in SABIC Academy and Technical Colleges.

Study Terms:

Polytechnical Teaching Strategies: Operationally defined as:

A comprehensive set of educational methods and techniques that are flexible and adaptable to diverse learning subjects and learner levels. They are used to deliver scientific content and achieve educational objectives by linking theoretical knowledge with practical experience, stimulating learners' senses, encouraging interactive engagement through innovative methods, and involving them in repetitive practical tasks. The goal is to enable learners to connect the curriculum with society and technological advancements, while enhancing their independence, developing their skills, and meeting their diverse needs in an effective learning environment.

SABIC Academy: Operationally defined as:

An internal education and development platform of SABIC, established in 2012 to prepare and develop leadership competencies of SABIC employees, government officials, university students, and high school graduates, in addition to overseas scholarship programs. It offers specialized courses and training programs in various fields such as strategic leadership, finance, marketing, and manufacturing, combining experiential learning, training, and continuous evaluation, with adaptation to digital learning to meet current needs.

Technical College: Operationally defined as:

A Saudi government educational institution affiliated with the General Organization for Technical and Vocational Training, aiming to qualify high school graduates (both genders) for diploma or bachelor's degrees in various technical fields to meet the needs of the Saudi labor market and build a skilled workforce in technical and professional areas. This is achieved through practical and professional training, curriculum design in collaboration with employers, including academic and applied subjects, ensuring alignment with industry and market needs and competitiveness.

THEORETICAL FRAMEWORK OF THE STUDY:

In light of the objectives of the current study, the theoretical framework addresses two main axes: Technical and Vocational Education in the Kingdom of Saudi Arabia, and Polytechnical Education, which are detailed below.

First Axis: Technical and Vocational Education in the Kingdom of Saudi Arabia

Technical and vocational education is a national objective that the Kingdom of Saudi Arabia has given great attention to, due to its active societal and national role in meeting the kingdom's needs for various technical specializations, and providing the local labor market with its requirements for qualified and specialized human resources, proficient in modern sciences, and possessing the ability to be creative and innovative. This enables them to contribute effectively to building a productive and advanced society, and achieving a prestigious social status.

Definition of Technical and Vocational Education (TVET)

Mulla (2000) defines TVET as a type of post-secondary education that has emerged in response to the technological advancements of the modern world. It is offered by both public and private sectors in most developed countries through institutions such as technical colleges, intermediate colleges, higher technical institutes, and community colleges. TVET focuses on practical application rather than theoretical learning, aiming to prepare qualified personnel capable of working with modern technologies required by various sectors.

Al-Shamsi (2017) describes TVET as a fundamental pillar of the educational system, seeking to prepare and qualify specialized personnel in various technical fields required for comprehensive development in both public and private sectors.

Al-Otaibi et al. (2018) define TVET as a type of formal education provided to all secondary school graduates, enabling them to understand and utilize technology and its applications. It encompasses acquiring necessary skills, behaviors, and professional knowledge to prepare a skilled workforce.

From these definitions, it is evident that technical and vocational education represents a high level of training that equips skilled and specialized human resources with the ability to effectively utilize modern technologies across various sectors. This is achieved through curricula that prioritize practical and applied learning.

The Origins of Technical and Vocational Education in the Kingdom of Saudi Arabia

The inception of technical and vocational training in the Kingdom of Saudi Arabia dates back to an early period, driven by the Kingdom's commitment to developing its workforce in technical and vocational fields and addressing the growing need to equip Saudi youth with relevant skills. To unify technical and vocational training under a single umbrella, Royal Decree No. (30/M) was issued on 10/8/1400 AH, establishing the General Organization for Technical and Vocational Training, which encompasses technical institutes and vocational training centers.

Furthermore, Royal Decree No. (7/H/5267) dated 7/3/1403 AH, endorsed the decision of the Supreme Committee for Education Policy No. (209)/Kh M, dated 29/10/1402 AH, emphasizing the importance of focusing on technical and vocational training at the technical college level to provide additional pathways for higher education in areas of pressing national need.

The royal approval for the Bachelor's program No. (1194)/M, dated 10/6/1409 AH, stipulated that the institution should develop the Technical College in Riyadh and extend the study period to four years to award a Bachelor's degree in Technical Engineering (Al-Shahri, 2021).

The Kingdom has also taken significant strides in promoting technical education and its culture, establishing technical colleges and academies in most provinces. It has focused on reforming and developing its educational programs to encompass technical specializations such as electronics technology, chemical technology, and vocational fields including electronics, communications, mechanics, construction technology, agricultural technology, and agricultural specializations like horticulture, poultry farming, and dairy production. Additionally, it covers vocational skills such as hairdressing, auto body repair, painting, and office equipment maintenance, among others.

The Kingdom has leveraged global best practices in this area to bridge the gap between education and the labor market, enhance students' skills, and prepare them for the job market. It aims to keep pace with and absorb technological advancements by developing training, qualification, education, and retraining processes. These efforts strengthen the ability of the workforce to meet labor market demands, ultimately contributing to sustainable development in line with Vision 2030 (Al-Sharif, 2021).

The Objectives of Technical and Vocational Education in the Kingdom of Saudi Arabia

Mulla (2000) highlights that technical and vocational education in the Kingdom of Saudi Arabia strives to achieve the following objectives:

- Broaden the base of qualified Saudi workforce in diverse technical fields, providing the labor market with highly skilled national technical personnel in areas crucial for the implementation of development projects.
- Establish new avenues for higher technical education, catering to the Kingdom's needs while providing opportunities for secondary school graduates, thereby alleviating the burden on universities.
- Enhance accessibility to higher technical education across various regions, with technical colleges strategically located beyond major cities to serve different areas.
- Provide ongoing education and training for workers in various technical fields, ensuring their skills remain up-to-date and aligned with industry requirements.
- The Technical and Vocational Training Corporation (2020) believes that technical education in the Kingdom aims to achieve the following:
- Contribute to diversifying the Saudi economy and transforming it into a knowledge-based and innovation-driven economy.
- Prepare a generation of skilled and qualified citizens to lead development in the Kingdom, in line with Vision 2030.
- Encourage students to develop self-reliance and collaboration skills through innovative practical projects.
- Encourage students to innovate and develop their entrepreneurial skills to establish their own businesses.
- Ensure that education and training outcomes align with the changing demands of the labor market, in cooperation with the private sector.
- Equip students with the practical and applied skills necessary to succeed in various professional sectors.
- Al-Sharif (2021) believes that there are several objectives for technical education, the most important of which are:

- Accommodate the largest possible number of those wishing to pursue technical and vocational training to contribute to achieving sustainable development.
- Qualify and develop national human resources in technical and vocational fields, according to the quantitative and qualitative demands of the labor market.
- Provide high-quality and effective training programs that qualify trainees for suitable employment in the freelance market.
- Develop the ability to adapt and successfully manage challenges and changes, based on applied research and studies.
- Build strategic partnerships with the business sector to implement technical and vocational programs.
- Raise awareness of the importance of working in technical and vocational fields within the community and provide a suitable environment for lifelong learning.
- Create a safe and motivating work and training environment at the Technical and Vocational Training Corporation.
- Expand advanced training fields that support national plans and participate in technology transfer and development programs.

To achieve these objectives, the current study concludes that technical education requires a sophisticated infrastructure, curricula that keep pace with the labor market, and technically qualified faculty members who focus on practical and technical skills, continuous learning, and developing trainees' capabilities through the use of modern teaching strategies that emphasize trainee activity and effectiveness.

The Importance of Technical and Vocational Education in the Kingdom of Saudi Arabia:

Technical education receives significant global attention due to its crucial role in achieving economic development. This is accomplished by preparing qualified professionals to meet the needs of various development sectors, especially given the rapidly changing skills required by today's labor market.

Al-Swaid (2019) underscores this point, highlighting several international experiences that demonstrate the importance of technical and vocational education. Germany adopted an education-and-work strategy to recover from the effects of World War II, focusing on technical schools that provide academic technical knowledge. Fifty-one percent of young people under 22 enrolled in these schools, leading to significant economic progress and development.

The United Kingdom, once a major industrial economic power, experienced a decline attributed to its reduced focus on technical and vocational education. This prompted the UK to enact legislation promoting investment in technical and vocational education programs, resulting in the development of technical colleges, where practical components now comprise 75% of study hours.

Among the studies and research confirming the importance of technical and vocational education is Ayasrah's study (2017), which highlighted that technical and vocational education plays a vital role in driving economic and social life. It serves as a fundamental pillar in developing national assets, combating unemployment, and improving living standards.

Al-Adasi and Al-Issawi's study (2019) indicated that technical and vocational training and education are crucial for countries aiming to boost development, reduce unemployment, and provide a decent life for their citizens. There's a direct correlation between economic growth, lower unemployment, and higher education levels. Additionally, allocating a larger portion of GDP to education directly impacts GDP growth due to its multiplier effect on income generation, workforce absorption, and unemployment reduction.

Al-Sharif's study (2021) emphasized the significance of technical and vocational education in developed countries, with some universities allocating resources to this sector. Technical and vocational training is a social necessity, as exemplified by Japan, where the industrial sector provides approximately 75% of technical and vocational training programs, with the Ministry of Education handling the remainder.

Bhattarai's study (2025) demonstrated that technical education contributes significantly to economic and social development by equipping students with in-demand practical skills, enhancing their employability and ability to address modern challenges like automation and digitalization.

Bruhn's study (2025) highlighted technical education's potential for driving positive social change by imparting necessary technical skills, fostering collaboration, innovation, and adaptability, and shaping a progressive future for individuals and society.

In the Kingdom of Saudi Arabia, interest in technical and vocational education is channeled through the General Organization for Technical and Vocational Training, which was transferred from the Ministry of Labor to the Ministry of Education. The organization encompasses technical academies and colleges and works to align education outputs with labor market needs, developing its study programs accordingly. Technical education is a strategic investment in achieving the Kingdom's Vision 2030, as it develops young people's practical skills to meet

the evolving labor market demands. This contributes to building a strong and sustainable economy, enhancing the national economy's competitiveness, and achieving self-sufficiency in national competencies across various sectors (Hussein and Abdullah, 2023).

Technical and Vocational Education Institutions in the Kingdom of Saudi Arabia:

Technical and vocational education institutions in Saudi Arabia encompass various types of technical colleges (technical, specialized, and international), secondary industrial institutes, architecture and construction institutes, strategic partnership institutes, and private training institutes, all under the supervision of the Technical and Vocational Training Corporation (TVTC). Additionally, there are specialized academies, such as the SABIC Academy. The key institutions are outlined below:

Technical Colleges:

Government educational institutions admitting students' post-secondary school or equivalent. Graduates receive an associate degree after four semesters, equivalent to a diploma. Some technical colleges offer bachelor's degrees in specific programs after eight semesters. The final semester includes practical "cooperative training" in relevant government and private sectors (Al-Qubaisi, 2025).

By 2022, there were approximately 138 colleges with 220,700 students. They offer 19 bachelor's programs, including Architecture and Design Technology, Tourism and Hospitality Technology, Surveying Technology, Communications Technology, Renewable Energy Technology, Manufacturing Technology, Web Development Technology, Cybersecurity, and Applied Manufacturing (Al-Farhoud, 2023).

These programs prepare trainees for self-employment and entrepreneurship, creating jobs by focusing on technical and operational skills and implementing quality and safety standards.

SABIC Academy:

SABIC was founded in 1396 AH/1976 CE as a publicly traded company and is one of the world's leading companies in the petrochemical, iron, and steel industries. Headquartered in the Kingdom of Saudi Arabia, it operates in over 50 countries, including Saudi Arabia, the United States, Europe, and North and South Asia. Its global workforce comprises over 33,000 employees with diverse scientific and practical skills. Saudi Aramco currently owns 70% of its shares, while the remaining 30% are traded on the Saudi Stock Exchange (Al-Ulaywit, 2005).

SABIC has established itself as one of the most sustainable organizations in both the short and long term through implementing best sustainability practices. Sustainability at SABIC is a core management approach integrated into its strategies (SABIC, 2020).

The SABIC Academy Offers Various Programs:

- Early career development programs
- SABIC Operator Training Program
- Higher Institute for Rubber Industries Program
- Saudi Petroleum Services Technical Institute Program
- SABIC Cooperative Training Program
- SABIC Scholarship Program

These programs train diverse groups, including high school graduates, college and university students, outstanding students, and new graduates, in English language and technical skills, with practical training in SABIC subsidiaries (Sahnoon, 2022).

Second Axis: Polytechnical Education:

The world has entered a new era marked by rapid transformations across various life fields since the millennium's start, presenting societies with numerous challenges. To keep pace, educational institutions have needed new systems. This led to various educational models aiming to develop individuals holistically, alter behavior, reveal potential, and positively impact society. One such model is polytechnical education.

The Meaning of Polytechnical Education:

Polytechnical education is an educational system focusing on practical and applied learning. It prepares students for the job market by combining theoretical knowledge with technical skills. This system equips students with practical and technical skills in fields like engineering, technology, and science, often serving as a practical alternative to traditional university education (Abu Khatla, 2005).

Saadeh and Ibrahim (2021) note that polytechnical education is a type of general education focusing on understanding industrial society's fundamental productive forces, such as electrical power, machinery production, chemicals, and agricultural production. It emphasizes school workshops, practical factory and farm experience, studying various sciences, business, and economic planning. This develops well-prepared citizens familiar with scientific foundations and practical aspects of modern production, integrating theory and practice to benefit society.

Awad (2024) defines it as education covering humanities, natural sciences, and scientific studies. It provides learners with information and practical industry and agriculture skills, instilling production-related habits and skills.

These definitions show polytechnical education focuses on productive work benefiting society, linking theoretical and practical knowledge. This enables individuals to acquire productive work skills by applying theoretical learning, serving and advancing society.

The Origins of Polytechnical Education:

Polytechnical education emerged in socialist countries like the Soviet Union, Germany, Hungary, and Romania. The term refers to "multi-technical" education.

Its origins trace back to 18th-century Russia when Peter the Great simplified the Russian alphabet and opened state schools. The system expanded in the 19th century to include peasant schools.

In 1920, the need for vocational literacy led to establishing factory and workshop schools (1921) with four-year programs (Semela & Miethe, 2021).

In 1985, the Communist Youth League proposed reforms, adopted as law on December 2, 1985. The law aimed to:

- Strengthen school-life connections
- Combine school training with work
- Provide industrial practice
- Emphasize polytechnic curriculum content
- Encourage school participation in social life

Village and town school models began in 1958, fully implemented by 1963 (Al-Shahed, 2022).

Polytechnical education spread globally. Current educational policies focus on vocational training to unlock resources, benefiting citizens and states. The goal is to maximize each citizen's potential through diversified education systems, ensuring access to employment and further education, with a tech focus (Rateb, 2020).

Objectives of Polytechnical Education

Polytechnical education integrates theoretical learning with practical experience. Its objectives include:

- Equipping learners with the fundamental branches of modern production.
- Providing learners with the general scientific principles of social production.
- Equipping learners with professional and technological skills.
- Engaging learners in productive work (Abu Khatla, 2005).

Additional Objectives:

- Enabling learners to actively participate in production.
- Developing various aspects of learner growth.
- Encouraging learners to participate in teamwork.
- Instilling a love of science, work, discipline, and order.
- Making productive work a primary source of knowledge.
- Developing learners' inclinations, aptitudes, and personal talents.
- Encouraging learners to innovate and acquire scientific research skills (Al-Shahed, 2022).

The Polytechnic Approach has two Main Forms:

- Applying science and harnessing knowledge for production.
- A scientific approach combining knowledge and application, serving production, development, and applied methodologies (Al-Juhani, 2020).

Teaching Strategies

Al-Hamdiyat (2021) indicates that polytechnic education is based on the principle of eliminating the dichotomy between theory and practice, making productive work a primary source of knowledge. Teaching strategies focus on both manual and intellectual objectives, linking knowledge with application. These strategies include:

- Learning by doing.
- Organizing ideas to solve problems.

Al-Juhani (2020), Al-Zahrani (2022), and Wilson (2023) indicate that teaching strategies focus on linking theory and practical application through:

- Organizing the curriculum to include integrated theoretical and practical units.
- Using workshops and projects to apply scientific concepts in real-world contexts.

Teaching Strategies

Al-Juhani (2020), Al-Zahrani (2022), and Wilson (2023) indicate that teaching strategies focus on linking theory and practical application, by organizing the curriculum to include integrated theoretical and practical units, and using workshops and projects to apply scientific concepts in real-world contexts. Some key concepts include:

- **Practical Demonstrations:** A visual presentation by the teacher or learners to illustrate a scientific fact or concept.
- **Modeling:** Imitating or simulating a person or thing to create an example or replica.
- **Project-Based Learning**: Learners apply scientific concepts to create something practical.
- **Guided Exploration:** The teacher guides learners to discover facts and relationships independently.
- **Problem-Solving:** A systematic approach to identifying, analyzing, and solving problems.
- **Simulation:** Creating a model or replica of a real or virtual system without actual experimentation.
- **Collaborative Learning:** Learners work together in diverse groups to achieve shared goals.
- **Blended Learning:** Combining digital media and direct interaction between teacher and learners.

In light of the foregoing, it can be concluded that:

- Technical education holds a prominent and significant position globally in achieving economic development by preparing qualified professionals to meet the needs of various development sectors.
- Polytechnic theory incorporates diverse and varied teaching strategies to align with the needs of society and learners, taking into account individual differences, learner characteristics, inclinations, and abilities.
- These teaching strategies keep pace with innovative ideas and local and global trends toward productive education, thereby enabling learners to develop the technical skills necessary for the future.
- The application of polytechnic theory and its diverse teaching strategies aligns with the objectives of technical education curricula in the Kingdom of Saudi Arabia, which utilizes multidisciplinary experiential learning methods aimed at enhancing the skills of future graduates to build an advanced society.

STUDY METHODOLOGY

The subject and variables of the study dictate the choice of methodology. The descriptive-analytical method is used to accurately describe phenomena, expressing them qualitatively and quantitatively, to understand their relationships and diagnose aspects. This approach supports existing practices or informs changes (Issawi, 2002, p. 37). The current study employed this method to examine faculty members' and trainers' opinions on teaching strategies at SABIC Academy and the Technical College in Riyadh.

The comparative causal method was also used, which is one of the most important scientific methods, as it is used to prove the causal relationship between independent and dependent variables. It aims to determine whether an independent variable has an effect on a dependent variable, by comparing two or more groups of individuals or phenomena that differ in the independent variable. It is based on extracting similarities and differences in the phenomena, events, behaviors, or relationships studied in order to conduct comparisons or contrasts between them (Majthoub, 2023).

1. **The Study Population**
   Al-Assaf (2012) defined the study population as the comprehensive group of individuals, objects, or phenomena under investigation, to which research findings are generalized. The study population serves as the basis from which the study sample is drawn. The current study population comprised faculty members, trainers, and trainees in technical and vocational education institutions in Riyadh.
2. **Study Sample**
   This refers to a subset of the study population selected using a specific method to conduct the study, with the results generalized to the original population (Abdul Salam, 2020). A random sample of 30 faculty members and trainers from SABIC Academy and the Technical College in Riyadh was selected as the main study sample.
3. **Data Collection Methods:** The study employed two types of data: primary and secondary.

- Primary data were collected using a questionnaire, which was structured into several sections aligned with the research questions and objectives. Each section aimed to address a specific research question or fulfill a particular objective. Additionally, descriptive data were utilized to substantiate the findings and provide a more in-depth examination of the phenomenon under investigation, leveraging various methodologies and approaches.
- Secondary data: The researcher conducted interviews with the study sample and experts in teaching methods and technical and industrial education. The researcher also reviewed books and research studies related to the use of teaching strategies, as well as other relevant references deemed scientifically enriching to the study.

Research Instrument: The researcher developed a questionnaire aimed at revealing the reality and challenges of using teaching strategies at SABIC Academy and Riyadh Technical College. The questionnaire design involved several stages as follows:

Initial Questionnaire Preparation: The researcher designed the questionnaire based on the study's topic, objectives, and the nature of the required data. After reviewing relevant literature and studies recommending the use of teaching strategies in industrial and technical education, and highlighting their effectiveness in developing trainees' technical skills, the researcher compiled these strategies and their implementation challenges into a single instrument. An initial draft of the questionnaire was prepared, comprising four sections.

Questionnaire Sections

The reality of using teaching strategies at SABIC Academy and Riyadh Technical College.

- The impact of teaching strategies on the level of technical skills mastery among trainees at SABIC Academy and Riyadh Technical College.
- The challenges facing the use of teaching strategies at SABIC Academy and Riyadh Technical College.
- Proposals to improve the use of teaching strategies in academic and industrial environments.

Determining Response Alternatives for the Research Instrument

The Likert scale was used to facilitate the interpretation of results and determine the level of teaching practices. The practice scores on the questionnaire items were classified into four levels:

- Always (4 points)
- Often (3 points)
- Sometimes (2 points)
- Rarely (1 point)

To determine the length of the scale categories, the range was calculated by subtracting the lowest value from the highest value (4 - 1 = 3), then dividing it by the number of instrument alternatives (3 ÷ 4 = 0.75). Thus, the length of the categories became as shown in the following table:

Table (1): Distribution of Categories According to the Scale Used in the Study Instrument

Practice Level	Mean Range
Always	4,00-3,26
Often	3,25-2,51
Sometimes	2,50-1,67
Rarely	1,75-1,00

Procedures for Questionnaire Validation

After the researcher completed preparing the general outline of the questionnaire content, which included all the previously mentioned steps and procedures, it was printed in its initial form to enter the standardization phase.

Validity and Reliability Procedures

- ***Face Validity:*** The questionnaire was presented in its initial form to a group of expert judges specializing in curriculum, teaching methods, measurement, and evaluation. They were requested to provide their opinions on the clarity of the statements, their appropriateness for what they were intended to measure, identify any ambiguous or complex statements, and suggest suitable modifications to develop the research instrument.
- ***Exploratory Application:*** After considering the judges' opinions and making the required adjustments, the questionnaire was applied to a group of faculty members and trainers (n=10). The results showed that the questionnaire was appropriate and had a high degree of clarity.

- ***Reliability Calculation:*** The reliability coefficient of the questionnaire was calculated using the Cronbach Alpha Method. The calculated reliability coefficient value was (0.86), which is considered high. The following table shows the reliability coefficient values for the study instrument axes.

Table (2): Reliability Coefficients for Questionnaire Dimensions and Their Correlations

S. N	Dimensions	Reliability Coefficient
1	- Actual use of teaching strategies	0,87
2	- Impact of teaching strategies on trainees' technical skills mastery level	0,85
3	- Challenges of using teaching strategies	0,85
4	- Proposals for improving the use of teaching strategies	0,88
- Questionnaire as a whole		0,86

From the previous table, it is evident that the dimensions of the questionnaire have high and statistically acceptable reliability coefficients**.**

Construct Validity of the Questionnaire: Construct validity was established by determining the correlation between the scores of the pilot sample on the questionnaire items and the total questionnaire score (internal consistency coefficient). This was done by calculating Pearson's correlation coefficients between the questionnaire items and the total questionnaire score. The following table illustrates this:

Table (3): Pearson's Correlation Coefficients to Measure the Internal and Construct Consistency Validity of the Study Instrument

S. N	Domains	Correlation Coefficient	Significance Level
1	1. Reality of Using Teaching Strategies	0,890	Significant
2	2. Impact of Teaching Strategies on Trainees' Technical Skills Mastery Level	0,810	Significant
3	3. Obstacles and Challenges of Teaching Strategies	0,760	Significant
4	4. Proposals for Improving the Use of Teaching Strategies	0,814	Significant
	Questionnaire as a Whole	0,821	Significant

The table indicates that all the domains of the study instrument achieved a statistically significant correlation at a significance level of (0.01) with the total score of the questionnaire, which confirms the internal and construct consistency validity of the study instrument.

After verifying the questionnaire's validity, reliability, and the clarity of its instructions, it was formulated in its final form. It included three main domains, each with four options corresponding to its statements: (always - often - sometimes - rarely). Accordingly, the questionnaire became ready for application.

Statistical Methods Used

The Statistical Package for the Social Sciences (SPSS) was used to analyze the collected data, and the following statistical methods were employed:

- Frequencies and percentages
- Arithmetic mean
- Standard deviation
- Pearson correlation coefficient
- Cronbach's alpha test to calculate the reliability of the research instrument.

Study Results, Discussion, and Interpretation

This section presents the findings of the current research, obtained through statistical data analysis, with the aim of answering the research questions. It then discusses and interprets these findings in light of the theoretical framework and previous research and studies. **The details are as follows:**

1- **To answer the first question, which states: "What are the teaching strategies that should be used in technical and industrial education?"**

The researcher followed the following procedural steps:

- Reviewing the objectives of technical and industrial education in the Kingdom of Saudi Arabia.
- Examining previous research and studies that focused on polytechnic education.

- Reviewing educational literature related to polytechnic education and identifying its requirements and strategies.
- Consulting experts and specialists in the field of teaching strategies.

In light of the above, the researcher prepared a preliminary list of (19) teaching strategies, which were included in a questionnaire to solicit the opinions of experts on determining their suitability and importance of application in technical and industrial education. The questionnaire was presented to a group of specialized experts in curricula, teaching methods, and technical and vocational education to ensure its validity and the accuracy of the formulation of the teaching strategies and their operational definitions.

The percentage of importance for each strategy was calculated by assigning one point if the strategy was deemed suitable and zero if it was not, for each expert individually. The points obtained by each strategy were then summed up across all experts. Accordingly, a strategy was accepted at a consensus level of 75% or higher.

Based on the results of the analysis of the experts' opinions and suggestions, the final list comprised (13) teaching strategies, namely: (Project-based learning, Problem-solving, Cooperative learning, Guided inquiry, Workshops and practical training, Brainstorming, Blended learning, Dialogue and discussion, Peer teaching, Modeling and simulation, Guided imagery, Concept maps, and Flipped learning). These strategies received an approval rate of (75%) or higher, indicating that they are all suitable and should be applied in technical and industrial education.

In light of the results of analyzing the opinions and suggestions of the experts, the final list included (13) teaching strategies, namely: (Project-based learning, Problem-solving, Cooperative learning, Guided inquiry, Workshops and practical training, Brainstorming, Blended learning, Dialogue and discussion, Peer teaching, Modeling and simulation, Guided imagery, Concept maps, and Flipped learning), where these strategies received an approval rate of (75%) or higher, and all of them are suitable and should be applied in technical and industrial education.

To answer the second question, which states: "What is the reality of using teaching strategies at Sabic Academy in Riyadh?" The arithmetic means and standard deviations of the research sample's responses were calculated, using teaching strategies at Sabic Academy in Riyadh, and the results are as shown in the following table:

Table (4): Arithmetic Means and Standard Deviations of the Research Sample's Responses on the Reality of Using Teaching Strategies at Sabic Academy in Riyadh

S. N	Strategy	Arithmetic Mean	Standard Deviation	Rank
1	Project-based learning	3,51	0,750	3
2	Problem-solving	3,45	0,841	4
3	Cooperative learning	3,30	0,680	7
4	Guided inquiry	3,35	0,924	6
5	Workshops and practical training	3,55	0,812	2
6	Brainstorming	3,39	0,656	5
7	Blended learning	2,85	0,901	11
8	Modeling and simulation	3,15	0,714	8
9	Concept maps	3,02	0,911	10
10	Dialogue and discussion	3,60	0,716	1
11	Flipped learning	2,65	0,913	13
12	Peer teaching	3,10	0,566	9
13	Guided imagery	2,70	0,783	12
Axis as a whole		3.20	0,874	Often

The following is evident from the previous table:

- The reality of using teaching strategies at Sabic Academy in Riyadh indicates a practice level of (often) for those strategies, with a mean score of (3.20) and a standard deviation of (0.874).
- The results revealed that the "Dialogue and Discussion" strategy ranked first in terms of practice, with a mean score of (3.60) and a standard deviation of (0.716). When trainers were asked about how to use this strategy and its steps, it was found to be a verbal strategy that allows verbal interaction between two or more trainees. The discussion may be between the trainer and the trainees, or it may be among the trainees themselves under the supervision and guidance of the trainer. It was found to be the highest strategy, and this may be due to the importance of this strategy in stimulating curiosity and exploration among trainees. When a trainee feels that their voice is heard, they begin to ask questions and explore the topic more deeply. Through dialogue and discussion, trainees learn how to analyze information, evaluate it, and reach

informed conclusions, in addition to improving listening and speaking skills and expressing ideas clearly and proficiently.

- The results also showed that the "Flipped Classroom" strategy ranked last in terms of practice, with a mean score of (2.65) and a standard deviation of (0.913). The reason behind the low use of the flipped classroom strategy by trainers may be due to the increased time and preparation required, or the lack of clarity of this strategy for some trainers. This strategy is an educational approach that employs technology to record a video explaining the content of learning topics and then publish it to trainees online. Trainees listen to it anywhere outside the classroom, and then apply what they have learned inside the classroom, thus exchanging roles, such as sending a trainer an engaging educational video on a technical topic for the next session.

To answer the third question, which reads, "What is the reality of the use of teaching strategies in Riyadh Technical College?" the arithmetic means and standard deviations of the research sample's responses regarding the use of teaching strategies in Riyadh Technical College were calculated, and the results are as follows:

Table (5): Arithmetic Means and Standard Deviations of the Research Sample's Responses Regarding the Reality of Using Teaching Strategies at Riyadh Technical College

S. N	Strategy	Arithmetic Mean	Standard Deviation	Rank
1	Project-based learning	3,40	0,699	4
2	Problem-solving	3,70	0,814	1
3	Cooperative learning	3,28	0,752	6
4	Guided inquiry	3,30	0,650	5
5	Workshops and practical training	3,60	0,917	2
6	Brainstorming	3,18	0,656	7
7	Blended learning	2,63	0,925	10
8	Modeling and simulation	2,80	0,910	9
9	Concept maps	2,65	0,890	11
10	Dialogue and discussion	3,43	0,804	3
11	Flipped learning	2,53	0,740	13
12	Peer teaching	3,05	0,606	8
13	Guided imagery	2,60	0,746	12
Axis as a whole		3.08	0,780	Often

The following is evident from the previous table:

The actual use of teaching strategies at Riyadh Technical College was found to be at an "often" level, with a mean score of 3.08 and a standard deviation of 0.780.

The results revealed that the "problem-solving" strategy ranked first in terms of implementation, with a mean score of 3.70 and a standard deviation of 0.814. The faculty's interest in using the problem-solving strategy may stem from the nature of the technical college and its aim to graduate professionals capable of addressing technical problems and finding appropriate solutions. This strategy relies on framing the lesson topic as a problem or question that piques the trainees' interest and motivates them to engage in various educational activities to reach a solution. These activities include gathering and classifying information, carefully observing factors related to the problem, conducting experiments, and analyzing and interpreting results. This fosters a spirit of inquiry and trains them in scientific thinking.

The results showed that the flipped classroom strategy ranked last in terms of implementation, with a mean score of 2.53 and a standard deviation of 0.740. This may be attributed to the challenges of implementing this strategy in technical colleges, including trainees' lack of interest in advance preparation and the lack of necessary technological tools.

Faculty members also face difficulties in preparing content and activities, requiring additional time and effort outside of their official duties, in addition to some faculty members' lack of technical expertise.

This finding aligns with the studies conducted by Al-Namlah and Bukhari (2022), Ismail (2023), and Al-Dhawad and Al-Mutairi (2024), which demonstrated that technical colleges place significant emphasis on practical teaching through programs focused on skills required by the labor market. Consequently, faculty members concentrate on various applied teaching strategies.

To address the fourth research question, "Are there statistically significant differences between SABIC Academy and Riyadh Technical College in the use of teaching strategies?" the Independent Samples T-Test was employed.

Table (6) Significance of differences in the degree of use of teaching strategies between SABIC Academy and Riyadh Technical College

Variable	Institution	Arithmetic Mean	Standard Deviation	T-value	Significance Level
Teaching Strategies	SABIC Academy	42,70	6,90	0,290	Not Significant
	Riyadh Technical College	41,20	7,08		

The table shows no statistically significant differences in all items and the overall score of the questionnaire in the use of teaching strategies by both SABIC Academy and Riyadh Technical College, where the T-value was (0.290), which is not statistically significant.

The researcher attributes this result to:

- SABIC Academy and Riyadh Technical College are similar in their focus on practical training and preparing trainees for the job market, as both aim to provide graduates with specific technical and technological skills. They also share the importance of the applied curriculum and linking the educational process to industry and its needs, and thus there is a convergence in their use of teaching strategies.
- The curriculum content is organized in SABIC Academy and Riyadh Technical College in a way that helps trainees master the basic theoretical principles and modern production practices, and then link learning topics to the productive society's requirements and needs, and this makes there is a great convergence in the use of teaching strategies in both institutions.
- Both institutions seek to attract outstanding talents from trainers and faculty members, while ensuring their support with training programs and professional development in the field of teaching and curriculum updates.
- Both institutions are keen to renew the educational curricula according to the needs of the job market and global trends in technical and industrial education; to achieve excellent education capable of graduating human resources capable of achieving development and competition.
- These results are consistent with the findings of studies by Al-Otaibi (2018); Al-Suwaid (2019); Al-Shehri (2021); Sahnoun (2022), where technical and industrial education institutions converge in their interest in encouraging faculty members and trainers to employ teaching strategies based on experimentation, practical application, and educational technology; to achieve their desired goals in the best possible way, although this requires more training, improvement, and activation from them.

To answer the fifth question, which reads: "What is the effect of using teaching strategies on developing the technical skills of trainees at SABIC Academy and Riyadh Technical College?", weighted arithmetic means and standard deviations were calculated to determine the impact of teaching strategies on developing the technical skills of trainees at both SABIC Academy and Riyadh Technical College. The following table illustrates these results:

Table (6) Arithmetic means and deviations for the statements of the second axis: The effect of using teaching strategies on developing technical skills among trainees at the SABIC Academy and the Technical College in Riyadh

S. N	Dimension	Arithmetic Mean	Standard Deviation	Score	Rank
1	1. Teaching strategies contribute to achieving many of the educational goals of technical and industrial education institutions	3,70	0,810	High	2
2	2. Teaching strategies contribute to developing trainees' skills in using digital technologies and their various applications.	3,52	0,780	High	3
3	3. Teaching strategies equip trainees with data analysis, project management, and problem-solving skills.	3,40	0,813	High	6
4	4. Teaching strategies develop trainees' analytical thinking, research, and exploration abilities.	3,28	0,915	High	7
5	5. Teaching strategies contribute to integrating theoretical and applied education.	3,88	0,904	High	2
6	6. Teaching strategies engage the trainee's various senses, thus enhancing the quality of their learning.	3,25	0,690	High	8

7	7. Teaching strategies make trainees more effective and engaged in various learning tasks.	3,47	0,714	High	5
8	8. Teaching strategies equip trainees with the practical skills that qualify them for the job market.	3,50	0,840	High	4
Total axis score		3,51	0,815	High	

The table above clearly shows that the use of teaching strategies significantly impacts the development of technical skills among trainees at SABIC Academy and Riyadh Technical College. The overall score for the dimensions of this axis was high, with a mean of 51.3 and a standard deviation of 0.815. The current study suggests that this impact of using teaching strategies is largely due to the nature of these strategies, which are derived from polytechnical theory. These strategies are based on the active participation of learners, provide them with fundamental knowledge and digital skills, familiarize them with the use of machinery, develop their abilities, offer them opportunities to choose and diversify their work, and enable them to keep pace with the digital age and participate in the general principles of social production. This aligns with the findings of studies by Razouqi and Al-Saoudi (2020), Sandgasch & et.al (2020), Al-Zahrani (2022), and Al-Shahed (2022).

6- To answer the sixth question, which reads: "What challenges face the use of teaching strategies at SABIC Academy and Technical College in Riyadh?", the arithmetic means, standard deviations, and relative importance scores were calculated for each item in the questionnaire, as well as for each of the four dimensions. To facilitate the presentation of the results for this question, the results for the dimensions of the questionnaire were reviewed, and the following table shows the ranking of the dimensions according to the degree of challenge.

Table (7) Arithmetic means and deviations for the statements of the third axis: Challenges facing the use of teaching strategies at the SABIC Academy and the Technical College in Riyadh

S. N	Dimension	Arithmetic Mean	Standard Deviation	Score	Rank
1	Challenges related to the nature of teaching strategies	3,240	0,713	High	1
2	Challenges related to the nature of the educational content	3,175	0,850	High	2
3	Challenges related to the trainee	3,080	0,820	High	3
4	Challenges related to the trainer	3,781	0,808	Medium	4
Total axis score		3,069	0,797	High	

It is evident from the previous table that the challenges facing the use of teaching strategies at SABIC Academy and Technical College in Riyadh were high, as indicated by the overall score for the four dimensions, where the arithmetic mean reached (3.069), and the standard deviation was (0.797).

It is observed that the challenges related to the nature of teaching strategies ranked first among the challenges facing the use of teaching strategies at SABIC Academy and Technical College in Riyadh, with an arithmetic mean of (3.240) and a standard deviation of (0.713). The challenges related to the nature of the educational content ranked second, with an arithmetic mean of (3.175) and a standard deviation of (0.850). The challenges related to the trainee ranked third, with an arithmetic mean of (3.080) and a standard deviation of (0.820). The challenges related to the trainer ranked fourth, with an arithmetic mean of (2.781) and a standard deviation of (0.808).

This is attributed to the nature of teaching strategies, which require a lot of time, effort, and skill in planning, implementation, and integrating theoretical and practical aspects, focusing on scientific skills, and making the learner the center of the educational process. This is consistent with studies that addressed teaching strategies, such as Rateb (2020), Al-Shahid (2022), and Bruhn (2025).

To address question seven, "What suggestions would enhance the use of teaching strategies in academic and industrial environments?", the arithmetic mean, standard deviation, and relative importance score were calculated for each statement in the questionnaire's third section: "Proposals to increase the effectiveness of applying teaching strategies in academic and industrial settings." The results are presented in the following table:

Table (8) Arithmetic means and standard deviations for the statements of the fourth axis: Proposals to enhance the use of teaching strategies in academic and industrial settings

S. N	Dimension	Arithmetic Mean	Standard Deviation	Score	Rank
1	Challenges related to the nature of teaching strategies	3,470	0,815	High	3
2	Challenges related to the nature of the educational content	3,756	0,717	High	2
3	Challenges related to the trainee	3,841	0,757	High	1
4	Challenges related to the trainer	3,320	0,840	High	4
Total axis score		3,531	0,813	High	5

The table shows that participants agreed on the proposals that would improve the use of teaching strategies in academic and industrial settings. The overall mean score for this axis was 3.531, with a standard deviation of 0.788. The proposals were ranked as follows:

1. First: Integrating teaching strategies into educational curricula (mean: 3.841, standard deviation: 0.757).
2. Second: Equipping academic and industrial environments with the necessary resources (mean: 3.756, standard deviation: 0.717).
3. Third: Training faculty members and trainers on teaching strategies and their importance in education (mean: 3.470, standard deviation: 0.815).
4. Fourth: Training trainees on teaching strategies in education (mean: 3.320, standard deviation: 0.840).
5. Fifth: Directing scientific research to highlight the impact of teaching strategies in education (mean: 3.270, standard deviation: 0.813).

The researcher posits that teaching strategies are a potent tool for achieving many objectives of technical and industrial education. These strategies enhance learner engagement in learning and training activities, effectively bridging the gap between theoretical knowledge and practical application. To this end, it is imperative that trainers and trainees in both academic and industrial settings receive training on the effective utilization of these strategies. Furthermore, institutions should be equipped with the requisite tools and resources, and scientific research should be directed towards conducting further studies on the implementation and development of these strategies. These recommendations are consonant with the findings of studies conducted by Rateb (2020), Wilson (2023), and Al-Qahtani and Al-Qahtani (2024).

STUDY RECOMMENDATIONS:

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

- Enhancing the efficiency of the educational process in technical and vocational education institutions in terms of both inputs and outputs. This includes curricula, facilities, learning strategies, and trainer preparation, in alignment with the goals and aspirations of the Kingdom of Saudi Arabia.
- Organizing workshops and training programs focused on empowering faculty members in technical and industrial education institutions to utilize learning strategies, aiming to improve trainees' performance and develop their technical skills.
- Leveraging the experiences of developed countries that have successfully implemented the polytechnical (applied) theory in technical and industrial education.
- Focusing on the continuous professional development of faculty members in technical and vocational education institutions, considering contemporary developments in effective teaching and learning approaches and strategies.
- Ensuring flexibility in the curricula of technical and industrial education institutions to incorporate necessary modifications when required to address the changes and challenges of the modern era, which necessitate those educational institutions keep pace with them.
- Highlighting the importance of integrating work values and ethics into the curricula of technical and industrial education institutions to foster positive attitudes among trainees towards work and its significance in societal advancement and progress.
- Strengthening the connection between the theoretical aspects of the curricula of technical and industrial education institutions and their practical application, clarifying the relationship between them through practical activities, training, and the application of learning strategies.

- Enhancing the relationship between different technical and industrial education institutions, as well as between them and labor market institutions, to provide trainees with opportunities to acquire skills and knowledge in real-world work environments.
- Expanding both the quantity and quality of specialized technical and vocational programs that meet the needs of the labor market, thereby fulfilling the aspirations of the Kingdom of Saudi Arabia and the goals of its Vision 2030.

Study Proposals:

In continuation of the current study, the researcher suggests the following avenues for future research:

- Development of a framework to enhance the adoption of learning strategies by faculty members in technical and vocational education institutions.
- Assessment of faculty job performance at Technical College and SABIC Academy: A comparative analysis.
- Artificial intelligence-based training program for faculty members to develop their skills in utilizing learning strategies in technical and vocational education.
- Evaluation of learning outcomes for trainees in technical and vocational education institutions, focusing on the impact of learning strategies.
- Investigation of trainees' perceptions towards teaching and learning strategies, methods, and techniques employed in technical and vocational education institutions.
- Comparative evaluation of technical skills proficiency among graduates of Technical College and SABIC Academy.

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