

HOW HAS A PEDAGOGICAL APPROACH INFLUENCED THE TECHNICAL EDUCATION CURRICULUM? AN ANALYSIS BASED ON THE LITERATURE REVIEW SYSTEM

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Abstract

This study aims to analyse how the role of stakeholders in engineering curriculum development affects learning to help students develop innovative and academic talents in today's technology fields. The method used is based on this literature review study looking for quotes about curriculum development and highlighting the implications of developing an educational curriculum to explore the enabling and limiting factors that influence curriculum development aspects of lesson planning. This analytical study provided important insights into the need for curriculum reform to be carried out with the involvement of policymakers. Therefore, in the field of technical training, and adaptive curriculum transition is necessary to form an educational pedagogy that enables the design of learning concepts.

Keywords: Educational curriculum, Educational pedagogy, Technical curriculum.

1. Introduction

Technical and vocational education is education and training that provides the necessary knowledge and skills for employment [1]. Technical education can be classified as the root of all scientific disciplines. T, referring to broad interdisciplinary knowledge through a comprehensive approach to learning that focuses on technical skills and curriculum [2]. In the current era of Industrial Revolution 4.0, technical education is developing rapidly, driven by technological support with the Internet of Things (IoT), cloud computing, big data, digitization, and robotics aimed at bringing about significant changes in all aspects of society [3]. This is a challenge for the younger generation to take full advantage of all potential future benefits, so technical education is required to nurture innovative talent and science in the field of technology [4, 5]. At present, software technology has developed rapidly and has changed significantly, and has played an important role in the age of the industrial revolution. Hence, a transition to the curriculum is needed to create a workforce that meets industrial needs [1, 6, 7]. Several curriculum studies have been carried out and researched in the world [1, 8, 9]. For example, research conducted in the United States has found that the curriculum landscape needs to be mapped to examine its contribution to education [10]. The curriculum for technical education in Kenya has also looked at the subject curriculum to examine the extent of its implementation in education [11].

In the future, technical education integrates sustainable development that will change the global economic order together with technological advances and innovations [12]. This will have an impact on skill requirements in the labour market and will be a challenge for engineering students. Some researchers have developed a diagrammatic framework of pedagogy influencing education is shown in Fig. 1. According to the Technological Pedagogical Content Knowledge (TPACK) framework, technology tools including hardware, software, applications, information literacy practices, and others are well suited for teaching and guiding students towards a better understanding of the subject matter. Concerning future needs, students must have adequate knowledge through learning experiences directly or indirectly gained from the learning process. Direct learning is the student's learning through practice, observation, and others. In the meantime, indirect learning is done through research reports. This type of learning process is consistent with the philosophical basis of realism, namely "knowledge acquired through personal experience" [13].

Training can only be carried out consistently with clear guidelines for its objectives relevant to the content of the curriculum and effective and efficient method or implementation methods only if carried out on a solid basis. Therefore, before introducing education, educators must first strengthen their educational base [14]. In addition, competency in developing student literacy and developing learning models that provide scientific explanations are effective learning strategies in the context of achieving learning goals [15]. In essence, education is an attempt to humanize man, so educators need to understand human nature as one of the foundations. The concept of human nature adopted by educators will have implications for the concept and practice of education. Therefore, the purpose of this article is to provide a literature review to analyse stakeholder linkages in the development of pedagogical teaching skills that affect the engineering education curriculum to assist students in developing innovative and academic talents in technology.

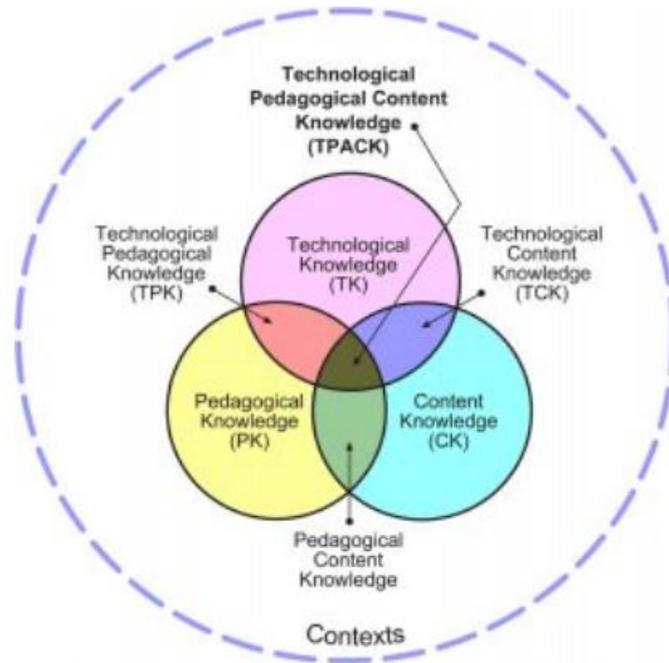


Fig. 1. Diagram showing the impact of pedagogy on education.

2. The Paradigm of Engineering Education

The paradigm of sustainable technical education, which relates to the realization of adaptive and participatory learning needs and requires new methods and tools to demonstrate the relevance of different paradigms in questions of sustainable development [16]. To respond to these challenges, efforts have been made in India to change the paradigm of engineering education, which aims to analyse stakeholder perceptions regarding engineering education in the future. The technical education paradigm should be assessed as students see engineering education positively but at the same time feel concerned about the position of engineering in society [17].

A change or further development of the curriculum should be made to accommodate future needs as planned and to include students, educators, research advances, and regulations in higher education to encourage higher education institutions to change content, learning outcomes, educational environment and assessment methods and curriculum-related learning environments [18-20]. According to other researchers [21], the curriculum to be developed includes the involvement of educators in higher education development activities, the improvement of the higher education system, and the implementation of university practice so that at the end of the training it is expected to improve student learning outcomes.

In theory, there is no universal definition of the term learning [22], but it can be understood that the term learning is a process of change that affects behavior changes, attitudes, the development of knowledge and skills. Learning theory can be divided into four main theories, namely behaviourism, cognitivism, humanism,

and constructivism. According to the theory of behaviourism, learning through interaction and reaction is the change for the better. The three principles of behaviourism, cognitivism, and humanism can be integrated and transformed into components of the lesson, from goals, assessments, materials, methods, teachers, and students, so that the level of preparation for learning can be classified as initial, intermediate, and advanced stages. This is an important consideration when designing a model-based learning curriculum [23]. Meanwhile, an expert on cognitivism, Jean Piaget, expressed his opinion that cognitive development is genetic, but the structure of cognition can change depending on individual skills and efforts. Marin Manolescu [24] tested the theory of cognitivism and behaviourism and promoted the basis of learning in process phases to achieve skills and competence outcomes. Other researchers said the most popular learning theory in technology education is constructivism, an approach to learning that says people are actively constructing knowledge and reality determined by student experience [25]. Various principles related to constructivism can be viewed as theories for teaching and learning, as the central idea of constructivism is that knowledge is not passed from teacher to student but is an active construction process [22]. This implies the idea that constructivists will construct new knowledge for students, and prior knowledge can influence new knowledge that students will develop. This learning experience is very important in a technical context, as the practical knowledge is based on theoretical foundations [26, 27].

Second, another important idea in constructivism is that learning is an active rather than a passive process. The vision of passive teaching sees students as an empty container to be filled with knowledge, while constructivism says that students construct the meaning of learning through active participation in their environment [28]. And the third idea of constructivism is that learning is a social activity or activity. The student world can affect the lives of students such as family, friends, teachers, lawmakers, and others. This social environment plays a central role in terms of constructionism.

Hence, learning can be described as a collaborative process. Although learning is described as a social activity, all knowledge is personal, meaning that each student has a different point of view based on existing knowledge and previous experience. This means that the activities, teaching methods, and lessons can result in different learning for each student as their interpretation of things and ideas may be different [29].

3. Method

Many education providers have endeavoured to align the technical education curriculum to provide innovative technical education that meets the needs of the industry to form an educational pedagogy that includes blueprints for learning concepts and the need for a technical curriculum with social background highlights-economic, sustainability, ethical aspects and entrepreneurship [30]. We conducted a descriptive review explaining the scope of the literature review based on several references [15, 31-35]. The articles were searched from the online literature [36-40]. This is a mapping process used to study research fields before a systematic review is carried out. Scope review does not require detailed data extraction or quantitative data analysis, but scope synthesis is qualitative [31]. In the existing literature, 5 articles were identified by examining the online reference list of citations on curriculum development and the benefits of

curriculum development over the past year, as shown in Table 1. These 5 articles were selected because they have been published in reputable journals and involve the development of an adaptive curriculum that can increase students' confidence to meet the challenges of future technological advances and develop strategies that support industrial progress.

Table 1. Implications of educational curriculum development.

Source	Issue	Method	Conclusion
Li et al. [15]	curriculum development related to learning materials as an effort to support social service non-profits	By taking a sample of 557 students from 24 classrooms in 12 different schools. Data were analysed using stratified mixed linear regression model analysis. Teaching strategies for teacher support in developing student literacy were identified based on observations of notes in the field	Generate business and marketing strategies, internal organizational dynamics and anticipate possible impacts arising from social enterprises. Therefore, students need to be prepared effectively for curriculum advancement so that there is a collaboration between social work for practice and contemporary social work leadership
Perry and Lubienski [32]	examines the factors that shape adaptive curriculum offerings	Interviewed 17 different school leaders and obtained information regarding the implementation of the curriculum in their respective schools	It is found that marketization dynamics coupled with curriculum offerings give students access to maintain their reputation and competitive advantage in the education market
Ahmadi et al. [33]	designing a literacy curriculum using a dialogue education approach	The qualitative inquiry method was applied by means of focus group interviews with pre-service teachers, 12 face-to-face interviews with a panel of experts, and a qualitative survey with 228 practical teachers	Concluding that the curriculum is very important in order to adequately prepare teachers to meet the literacy needs of future generations
Swanson et al. [34]	choose an integrated curriculum model to raise the standards of	The teacher observed a higher potency in students after the 2-year intervention through professional	With an integrated curriculum model strategy, students can build self-confidence and strive with

Source	Issue	Method	Conclusion
	students who will graduate	learning that was correlated with changes in beliefs and practices.	confidence and strength in learning
Dutt et al. [35]	Teacher development mentoring and collaboration through student interaction in a professional context	Conduct qualitative research to explore teacher experiences by conducting semi-structured interviews that focus on participants' experiences in developing face-to-face teaching and preparation materials, the effectiveness of support, the benefits and challenges of new approaches to recommend for further improvement. Interviews were recorded, transcribed, and analysed through thematic analysis	Collaboration allows teachers to discuss with peers and other educators with experience in teaching practices and consider alternative, active learning approaches use good educational frameworks to support learning

Curriculum development issues related to learning materials, assessing the factors that make up the adaptive curriculum offering, designing literacy curriculum, choosing an integrated curriculum model, mentoring and collaborating teacher development through student interaction in a professional context are strategic steps that need to be prepared effectively for the progress of learning future so that it can anticipate the dynamics of education for future generations. This clarity is important because as educational developers we may be involved in some ongoing curriculum projects. Some researchers [41] classify the factors that support and limit curriculum development in Table 2. This is important because it is related to curriculum project involvement.

By looking at Table 2 as a dialogic resource for learning planning, we can plan curriculum development that contributes to educational development and is viewed as a complex process in a given context so that other development factors can be discussed explicitly [42]. Technical educators try to conceptualize and demonstrate curriculum development using different concepts concerning existing constraints, since, as mentioned at the beginning of this article, curriculum development is at the heart of technical education. The institutional support to ensure the implementation of the curriculum reform is an important foundation for the implementation of curriculum competencies of technical education when reviewing the development of the conceptualization of pedagogical teaching competencies for educators and the perception of learning.

Table 2. Supporting and limiting factors for curriculum development.

Supporters		Restrictions
<ul style="list-style-type: none"> • Culture of engagement, agency • Common vision, guiding principles • Open to change 	Contexts and culture: What characterizes faculty participation?	<ul style="list-style-type: none"> • Fear, mistrust • Perception expectations are unreasonable • Unproductive/destructive meeting behaviors • Top-down leadership/direction
<ul style="list-style-type: none"> • The prepared, groundwork laid • Positive belief in commitment of others • Accreditation or quality assurance requirements 		
<ul style="list-style-type: none"> • Committees with defined goals • Clear leadership • Realistic deadlines • Steady pace, regular time is made for work • Guiding documents • Access to data • Authentic consultation 	Structures and resources: How is the work organized?	<ul style="list-style-type: none"> • Lack of clarity • On again, off-again activity • Turnover of key contributors • Poor reporting, tracking • Work in isolation • Single worker or outsourcing • Short timeliness during busy periods
<ul style="list-style-type: none"> • Student learning • Faculty engagement • Meaningful data • Stakeholder consultation 	Attention and focus: What gets discussed?	<ul style="list-style-type: none"> • Teaching commitments • Premature concern with detail • Critique of methodology • Frustration with process
<ul style="list-style-type: none"> • Leveraging existing strengths, learning from experience • Alternatives, options, ways to improve • Alignment in curriculum 		<ul style="list-style-type: none"> • Preoccupation with replicating a peer program • Premature concern with detail
<ul style="list-style-type: none"> • Non-threatening, neutral persona • Respect for context, concern, individuals • Prompting questions • Anticipating needs 	ED Contribution: How do EDs participate?	<ul style="list-style-type: none"> • Unresolved, unexpressed concerns • Introducing unnecessary complexity • Use of educational jargon
<ul style="list-style-type: none"> • Timely response to needs • Providing data analysis and interpretation 		<ul style="list-style-type: none"> • Lacking disciplinary credibility • Misplaced expectations on faculty • Failing to pick up on interpersonal nuance

4. Result and Discussion

Based on the technical education paradigm and the articles in the data set above, we then analyse to find the significance of this literature review study. There are two research questions from the review, namely: (1) How does the curriculum influence student learning? (2) What is the role of stakeholders in engineering education curriculum design? Regarding the first question, all authors above agree that curriculum development can encourage learning and also observe the potential of students, which in turn can produce learning strategies to develop the literacy of future generations effectively. Moreover, several factors supporting and inhibiting curriculum development have been described. Supporting factors include faculty participation in terms of vision, accreditation requirements, and learning quality assurance.

Insightful teaching resources, document guides, and complete data access are also other supporting factors for curriculum development. The faculty's role is to guide on improving the skills and knowledge of the teaching materials through training, workshops, seminars, and also provides up-to-date reference books, internet networks, online journals. In addition, the faculty must be able to encourage the degree program to formulate a superior curriculum and uniqueness of the degree program according to the vision, mission, goals, and objectives of the institution and to assist the degree program in the preparation of highly competitive curriculums in the fields of science and technology. The curriculum developed and implemented in the faculty also relates to the guidelines and standards of academic quality.

One of the keys to the success of education management is the involvement of stakeholders in an educational institution. Education stakeholders can be classified into internal and external stakeholders. Internal stakeholders consist of teachers, students, parents, and school administrative staff. While external stakeholders consist of organizations outside the school such as government, social institutions, communities, course and training institutions. They have an important role in making teaching policies. For example, teachers can look at education policies and use them to improve learning methods. Things that can be done are (1) Delivering learning materials, (2) Preparing learning methods, (3) Preparing daily learning curriculum (4) Making daily, monthly and yearly lesson plans. Meanwhile, parents can help facilitate students to get the best education by (1) Supporting student education in schools, (2) Funding student education, (3) Facilitating students' educational needs.

As an external stakeholder, the government's role is also very important, including (1) Providing adequate educational facilities, (2) Creating a good curriculum by adjusting the geographical conditions of a region, (3) Supporting efforts to improve the quality of education by organizations or individuals, (4) Conducting quality improvement programs for educators and teachers, and (5) Providing school operational assistance. As external stakeholders as well, school staff and employees are expected to work together to discuss with each other the rules of education in schools and disseminate information about education. It aims to improve employee performance and overcome problems that occur. Likewise, with educational professionals. They can provide new advice about education today and its future potential. By collaborating between internal and external stakeholders, it is hoped that will minimize barriers to curriculum development and will result in better quality education.

5. Conclusion

An important finding from this study is the need for collaboration between stakeholders to draw the best ideas for curriculum development related to educational pedagogy. Not surprisingly, curriculum studies are an important part of education because they can produce various impacts in learning that support students to be competitive in anticipating future technological developments and the curriculum can also prepare teachers adequately to meet the literacy needs of future generations. In addition, an adaptive approach also needs to be designed to anticipate curriculum development that changes according to developing problems and conditions. Given this complexity, we recommend that the development of educational curriculum involve policymakers to take an important role and be equipped with knowledge of the factors that influence the development of curriculum concepts to align future engineering education needs as planned to foster innovative talents and science in technology.

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