



JOURNAL OF SCIENCE, TECHNOLOGY AND EDUCATION (JSTE)

**A PUBLICATION OF THE
DEPARTMENT OF SCIENCE,
TECHNOLOGY & MATHEMATICS
EDUCATION (STME),
NASARAWA STATE UNIVERSITY, KEFFI**



**VOLUME
9**

ISSN: 2651-5539

NEED ANALYSIS FOR THE DEVELOPMENT OF A MULTIMEDIA INSTRUCTIONAL PACKAGE FOR TEACHING AND LEARNING OF PUMP OPERATION IN TECHNICAL COLLEGES IN RIVERS STATE

¹Dibia, E. C. and ²Amadi, N. S.

¹Department of Industrial Technology Education, Rivers State University

²Department of Agricultural Education, Rivers State University

Corresponding author: dibiaemmanuelchima@gmail.com

Citation: Dibia, E. C. & Amadi, N. S. (2025). Need analysis for the development of a multimedia instructional package for teaching and learning of pump operation in technical colleges in Rivers State. *Journal of Science, Technology, and Education (JSTE)*; www.nsukjste.com/ 9(32), 448-462

Abstract

This study determined the need analysis for the development of a multimedia instructional package for teaching and learning of pump operation in technical colleges in Rivers State. The study was guided by three specific objectives and three research questions. The study adopted a descriptive survey research design, involving 16 teaching personnel and 93 students of Mechanical Engineering Craft Practice from three technical colleges. Data were collected using a validated questionnaire with an overall reliability coefficient of 0.87 and analyzed using mean. Findings revealed that students prefer interactive and visual learning experiences, including lessons with diagrams, animations, and self-practice exercises. Contextual factors, such as availability of computers and projectors, were

generally favorable, though issues related to power supply and management support for digital learning were identified. The study also identified key content areas essential for the instructional package, including pump types, operations, maintenance, and safety requirements. The study concludes that a multimedia instructional package integrating visual, interactive, and practice-based learning components will significantly enhance students' understanding and skills in pump operation. It was recommended that the provision of adequate digital learning infrastructure, teacher training on multimedia use, and management support for seamless implementation be provided.

Keywords: Need Analysis, Multimedia Instruction, Technical Education, Pump Operation.

Introduction

Technical colleges play a significant role in developing skills, knowledge and attitude needed for smooth transition from school to

gainful employment in the workplace among students. Thus, technical colleges contribute towards socioeconomic development in a nation. (Onatere-Ubrurhe & Ubrurhe, 2024).

In Nigeria, technical colleges are established as part of the institutions through which technical and vocational education and training could be accessed. As stipulated in the Nigerian National Policy on Education, technical and vocational education are meant to provide trained manpower in the areas of applied sciences, technology and business mainly at craft, advanced craft and technical levels. It is also meant to provide the technical knowledge and vocational skills needed for agricultural, commercial and economic development. It is also meant to provide training to impart the necessary skills for self-reliance (Federal Republic of Nigeria, FRN, 2013). Consequently, technical colleges play important role in equipping students with technical skills for gainful employment towards promoting socioeconomic development in Nigeria. Technical colleges offer specialised trade programmes among which is mechanical engineering craft Practice (National Board for Technical Education, NBTE, 2001).

By the curriculum document, Mechanical Engineering Craft Practice designed by the NBTE (2001) as offered in technical colleges has two major programmes. The first is the National Technical Certificate (NTC) in Mechanical Engineering Craft Practice and the second is the Advanced National Technical Certificate (ANTC) in Mechanical Engineering Craft Practice. The ANTC programme in Mechanical Engineering Craft Practice is a one-year programme after finishing the NTC programme and exposes students to machine shop production and maintenance. Typical modules offered are press, jig and fixtures; boring; fitting (millwright) as well as valves, pumps and drives among others. The goal of exposing students to pump, which is the focus of this study, is to equip the students with adequate knowledge of pumps found in industry so that they may be able to install and maintain them. Consequently, the curriculum document stipulates that at the end of the module, students should be able to describe a pump, explain the different types of pumps, their

functions, principles of operation, applications and uses. Students should also gain understanding of the method and system requirements in selecting pumps for use on completion of the module. Furthermore, they should also comprehend the principles and process of packing, sealing, repairing and maintaining pump (NBTE, 2001).

These skills and knowledge are essential for students who aspire for career in different industrial sectors where pump operations are useful, such as manufacturing, petroleum, agriculture and other technical sectors of the economy. For example, in the oil and gas industry, pumps are used for pumping oil, sludge and mud. In the manufacturing industry, pumps are used for pump fluids to aid production of goods. In the agricultural industry, pumps are used in irrigation process. Furthermore, pumps are used in wastewater treatment plants as well as in electrical power generation sector (Linn, 2022). In addition, students are supposed to have knowledge and understanding of different pumping systems such as water pumping system, high velocity

pumping system, solid pumping system and gas pumping system among others (NBTE, 2001).

A pump is a machine designed to move liquid through a piping system with the aim of increasing the pressure of the liquid, using numerous energy transformation mechanisms (Volk, 2014). Pumps are of different types.

These include: rotary pump, centrifugal pump, reciprocating pump and gear pumps among others (NBTE, 2001). Each of these pumps has its particular application. The rotatory pumps are used for pumping fluids with or without solid contents; fluids with low to high viscosity; fluids that are thixotropic and dilatant in nature; shear sensitive fluids; abrasive; non-lubricating and lubricating fluids; aggressive, adhesive and toxic fluids. Centrifugal pumps utilises centrifugal force to pump fluids from a lower to a higher level (Kashyap, 2024). Reciprocating pumps are pumps that capture a moving fluid in a cavity and then discharges a fixed quantity of the fluid through mechanical pressure (Milton Roy, 2024). A gear pump utilizes the meshing

of two gears (a drive and a driven gear) to move fluids (Murata, 2021).

For students of Mechanical Engineering Craft Practice in technical colleges, knowledge and skills in the pumps prepares them for employment in different industrial sectors such as agriculture, manufacturing, oil and gas as well as other industrial sectors that utilize pumps for moving fluids in work operation. A critical aspect of students' preparation for employment is exposure to practical and hands-on activities to enable them gain requisite skills (Thapa, 2024). This is particularly very important for students of Mechanical Engineering Craft Practice who are primarily prepared for work after graduation. To be successful in exposing students to practical and hands-on activities, there must be adequate provision of instructional facilities. For example, to teach and learn about pump operation, there should be available demonstration pumps of different types which teachers and instructors can use for teaching to help students acquire prerequisite knowledge and skills in pump

operation to get them prepared for employment.

Statement of the Problem

Teaching and learning in technical colleges currently face significant challenges, including limited practical exposure, inadequate instructional resources, and traditional teaching methodologies that often fail to engage students effectively (Nwineh, 2013; Nwosu & Okorie, 2019). These limitations restrict students' ability to develop comprehensive understanding and practical competencies in pump operation and maintenance. Multimedia instructional packages offer innovative approaches to technical education, providing interactive, engaging, and flexible learning experiences (Clark & Mayer, 2016). These comprehensive educational tools integrate various media elements such as videos, animations, simulations, and interactive modules to enhance student comprehension and skill acquisition in complex technical subjects. The need for a multimedia instructional package in teaching pump operation is imperative,

given the current limitations in technical education delivery. Such an innovative approach can address existing pedagogical gaps, provide immersive learning experiences, and develop students' practical skills more effectively than traditional instructional methods (Berk, 2009).

Purpose of the Study

The purpose of this study was to conduct a need analysis for the development of a multimedia instructional package for teaching and learning of pump operation in technical colleges in Rivers State. The specific objectives were to:

1. find out learners' needs for the development of a multimedia instructional package for teaching pump operation in technical colleges in Rivers State.
2. determine the context needs for the development of a multimedia instructional package for teaching pump operation in technical colleges in Rivers State.
3. ascertain the content needs for the development of a multimedia instructional

package for teaching pump operation in technical colleges in Rivers State.

Research Questions

The study was guided by the following research questions

1. What are the learners' needs for the development of a multimedia instructional package for teaching pump operation in technical colleges in Rivers State?
2. What are the context needs for the development of a multimedia instructional package for teaching pump operation in technical colleges in Rivers State?
3. What are the content needs for the development of a multimedia instructional package for teaching pump operation in technical colleges in Rivers State?

Methodology

The study adopted a descriptive survey research design with a population of 16 teaching personnels and 93 students of Mechanical Engineering Craft Practice from

the three technical colleges that offer Mechanical Engineering Craft Practice in Rivers State. The teaching personnels comprises 11 teachers and 5 instructors. The instrument for data collection comprised a questionnaire titled, “Need Analysis for Multimedia Instructional Package Questionnaire (NAMIPQ)”. It consisted of three sections with a total of 25 items, used to elicit data on learner needs, context needs and content needs for the development of the multimedia instructional package for teaching and learning pumps. The instrument was validated by three experts. One from the field

of measurement and evaluation and the other two from Mechanical Technology. The instrument was subjected to internal consistency reliability test and Cronbach Alpha was used to calculate the reliability coefficient in SPSS. This yielded reliability coefficient of 0.81 for the first section used to elicit data for learner needs, 0.85 for the second section used to elicit data for context needs and 0.78 for the third section used to elicit data for content needs. The instrument had an overall internal reliability coefficient of 0.87. Frequency count and mean were used for analysing data gathered.

Result

Research Question 1: What are the learners’ needs for the development of a multimedia instructional package for teaching pump operation in technical colleges in Rivers State?

Table 1: Learner’s need for Multimedia Instructional Package

S/N	Learners’ needs in Pump Operation	SD	D	A	SA	N	M	S.D.	RMK
1	I am able to learn using computer.	43	12	25	5	85	3.09	1.02	A
2	I am able to learn using mobile phone.	37	13	32	3	85	2.99	0.98	A
3	I like lessons presented with notes, images, diagrams to aid understanding.	40	33	8	4	85	3.28	0.83	A
4	I like when lessons have self-practice exercises.	52	12	16	5	85	3.31	0.98	A
5	I like lessons that have real world application.	20	34	7	24	85	2.59	1.14	A
6	I like lessons to be interactive.	52	16	13	4	85	3.36	0.91	A
7	I have pre-knowledge about pumps	18	35	8	24	85	2.55	1.12	A

The result in Table 1 shows the learner's needs for the development of a multimedia instructional package for teaching pump operation in technical colleges in Rivers State. The mean values for using computers (M = 3.09) and mobile phones (M = 2.99) indicate that most students agree that they can learn using these digital tools. However, their ability to learn using mobile phones is slightly lower than computers. The result showed that lessons with notes, images, and diagrams (M = 3.28) and interactive lessons (M = 3.36) are highly preferred by learners. This implies that visual and interactive content should be a key feature in

the instructional package. Lessons with self-practice exercises (M = 3.31) are also highly rated, meaning students value hands-on learning opportunities. Lessons with real-world applications received the lowest mean value (M = 2.59), indicating that while important, it is less prioritized compared to other instructional needs. The mean value for pre-existing knowledge about pumps (M = 2.55) is the lowest among all items. This suggests that most students do not have prior knowledge of pump operation. This highlights the need for foundational lessons before advancing to complex topics.

Research Question 2: What are the context needs for the development of a multimedia instructional package for teaching pump operation in technical colleges in Rivers State?

Table 2: Context need for Multimedia Instructional Package

S/N	Context' needs in Pump Operation	SD	D	A	SA	N	M	S.D.	RMK
1	There are available computers to use for the multimedia learning of pumps.	7	5	3	1	16	3.13	0.96	A
2	There is assurance of availability of projectors for use anytime the need to use the multimedia package arises.	8	4	2	2	16	3.13	1.09	A
3	Teachers will be able to use the multimedia package for teaching.	6	7	2	1	16	3.13	0.89	A
4	There is readily available means of power supply when the need for using computer applications arises.	5	8	1	2	16	3.00	0.97	A
5	There is management support for free access to utilisation of computers for teaching and learning.	4	7	4	1	16	2.88	0.89	A

The result in Table 2 shows the context needs for the development of a multimedia instructional package for teaching pump operation in technical colleges in Rivers State. The result shows that Availability of Computers for Multimedia Learning ($M = 3.13$). The mean value suggests that teachers generally agree that computers are available for use. However, some level of disagreement exists, which may indicate that access is limited or inconsistent. Availability of Projectors ($M = 3.13$). The result shows that the teachers agreed that projectors are available for use when needed. Teachers' ability to use the multimedia package ($M = 3.13$). This is an indication that the teachers believe that they will be able to use the multimedia package for teaching, but again,

the presence of some disagreement highlights potential gaps in teachers' technical skills or confidence in using multimedia tools. Availability of power supply had mean ($M = 3.00$). This shows that power supply for running multimedia applications is generally available, but with some challenges. This could indicate frequent power interruptions, which might affect the seamless use of the instructional package. Management support for free access to computers had a mean ($M = 2.88$). This has the lowest mean value, which suggests that access to computers for learning is not fully supported by management. This could indicate restrictions, inadequate infrastructure, or limited resources, which might hinder effective implementation of the multimedia instructional package.

Research Question 3: What are the content needs for the development of a multimedia instructional package for teaching pump operation in technical colleges in Rivers State?

Table 3: Content need for Multimedia Instructional Package

S/N	Learners' needs in Pump Operation	SD	D	A	SA	N	M	S.D.	RMK
1	Students should be able to identify types of pumps	3	9	2	2	16	2.81	0.91	A
2	Students should have knowledge of the operations of pumps.	8	5	1	2	16	3.19	1.05	A
3	Students should have knowledge of the functions of pumps.	6	7	2	1	16	3.13	0.89	A
4	Students should be knowledgeable of system requirement in selecting pumps for usage.	6	7	1	2	16	3.06	1.00	A
5	Students should be knowledgeable of the component parts of pumps.	5	6	4	1	16	2.94	0.93	A
6	Students should be knowledgeable of the applications of pumps.	4	8	3	1	16	2.94	0.85	A
7	Students should have knowledge of the requirements for designing simple pumps.	2	9	3	1	16	2.80	0.82	A
8	Students should have knowledge of the procedure for constructing simple pumps.	2	10	3	1	16	2.74	0.77	A
9	Students should have knowledge of the procedure needed for installation of pumps.	1	11	3	1	16	2.68	0.71	A
10	Students should demonstrate knowledge of the procedure followed in maintenance of pumps.	1	10	3	2	16	2.63	0.81	A
11	Students should demonstrate knowledge of the procedure followed in repair of pumps.	2	9	4	1	16	2.75	0.77	A
12	Students should be knowledgeable of the safety requirements in handling pumps.	6	5	3	2	16	2.94	1.06	A
13	Students should be able to perform simple force calculations related to pumps.	3	10	2	1	16	2.94	0.77	A

The result in Table 3 shows the content needs for the development of a multimedia instructional package for teaching pump operation in technical colleges in Rivers State. The result shows mean values are higher than 2.50 for all the items. This is an indication that all listed content areas are needed by students. This is evident by knowledge of pump operations with mean (M = 3.19); Functions of pumps with mean (M = 3.13); System requirements for selecting pumps with mean (M = 3.06); Identification of pump types with mean (M = 2.81) Knowledge of pump components with mean (M = 2.94); Applications of pumps with mean (M = 2.94); Safety requirements in handling

pumps with mean ($M = 2.94$); Performing force calculations related to pumps with mean ($M = 2.94$); Design requirements for simple pumps with mean ($M = 2.80$); Procedure for constructing simple pumps with mean ($M =$

2.74); Installation procedures with mean ($M = 2.68$); Maintenance procedures with mean ($M = 2.63$); Repair procedures with mean ($M = 2.75$).

Discussion of Findings

Research question one sought to find out learners' needs for the development of a multimedia instructional package for teaching pump operation in technical colleges in Rivers State. The result of research question one showed that the students agreed that they: are able to learn effectively using a computer as well as a mobile phone, enjoy lessons that include notes, images, and diagrams because they help them understand the concepts better. They also agreed that they like lessons that provide opportunities for self-practice exercises and those that demonstrate real-world applications of what is being taught, prefer lessons that are interactive and engaging. Finally, they agreed that they had some prior knowledge about pumps. This finding aligns with Olele and Ukoha (2020),

who found that technical college students in the South-South region of Nigeria demonstrated increasing comfort with digital learning tools, particularly computers in laboratory settings. The preference for interactive lessons suggests that learners benefit more from engaging and participatory content, which should be incorporated through animations, simulations, and interactive quizzes. Self-practice exercises allow learners to apply theoretical knowledge in practical contexts, reinforcing their understanding of pump operation.

This result suggests that in developing the multimedia instructional package for pump operation, computers should be used as the primary learning tool, while ensuring mobile compatibility for flexibility. Also, rich visual content (images, diagrams, and animations)

should be incorporated to align with learners' preference for multimedia-enhanced learning. In addition, the package should integrate interactive features, such as quizzes, virtual simulations, and self-practice exercises, to improve engagement and retention. Further, the content should be structured progressively, starting with fundamental concepts before introducing real-world applications. Furthermore, students' knowledge gaps should be addressed by including introductory lessons before advancing to technical topics.

Research question two sought to find out the context needs for the development of a multimedia instructional package for teaching pump operation in technical colleges in Rivers State. The result of research question two showed that the respondents agreed that there are available computers that can be used for the multimedia learning of pumps. They also agreed that there is assurance of the availability of projectors for use whenever the need to use the multimedia package arises. Furthermore, the students agreed that teachers

would be able to use the multimedia package effectively for teaching. They equally indicated that there is a readily available means of power supply when there is a need to use computer applications. Finally, the respondents agreed that there is management support for free access to the utilization of computers for teaching and learning purposes. This finding aligns with Ogunleye (2020), who reported that Nigerian technical colleges have increasingly invested in computer laboratories over the past decade. However, the presence of some disagreement parallels Adamu and Ibrahim's (2019) observation that while computers might be physically present in many technical institutions, the student-to-computer ratio often remains inadequate, limiting effective access. This finding suggests an improvement from earlier studies such as Nwoke et al. (2018), who reported severe shortages of projection equipment in technical colleges across South-Eastern Nigeria. This result corroborates Etuk and Samuel (2021), who found that technical college teachers in Rivers State expressed

confidence in their ability to adopt new teaching technologies, though they also identified the need for specific training. The current finding, however, contrasts with Danjuma and Adamu's (2022) study, which reported significant technophobia and resistance to technological integration among technical education instructors, particularly those with more years of teaching experience.

The finding regarding power supply availability ($M = 3.00$) highlights a critical infrastructural challenge. The result indicates that power supply for running multimedia applications is generally available, but with significant challenges. This aligns with the findings of Okoye and Okonkwo's (2020) that inconsistent electricity remains one of the most significant barriers to technology integration in Nigerian educational institutions.

The finding that management support for free access to computers had the lowest mean value is particularly concerning for the

implementation of any multimedia instructional package.

Collectively, these findings suggest that while basic technological infrastructure exists in technical colleges in Rivers State, significant challenges remain in ensuring consistent access, reliable power supply, and supportive institutional policies. The development of a multimedia instructional package for pump operation must therefore account for these contextual realities.

The findings also highlight the importance of stakeholder engagement beyond teachers, particularly targeting institutional management to secure necessary support for implementation.

Research question three sought to find out the content needs for the development of a multimedia instructional package for teaching pump operation in technical colleges in Rivers State. The result of research question three showed that the respondents agreed that students should be able to identify the different types of pumps and have adequate

knowledge of their operations and functions. They also agreed that students should be knowledgeable about the system requirements in selecting pumps for specific uses and be familiar with the component parts and applications of pumps. Furthermore, the respondents agreed that students should have knowledge of the requirements for designing and constructing simple pumps as well as the procedures for installing them. They also indicated that students should demonstrate knowledge of the maintenance and repair procedures of pumps. In addition, respondents agreed that students should be aware of the safety requirements involved in handling pumps and be able to perform simple force calculations related to pump operations. This aligns with Akpan and Johnson's (2021) assertion that foundational operational knowledge forms the cornerstone of effective technical education in fluid mechanics. System requirements for selecting pumps and identification of pump types were also agreed as suitable content by the teachers.

Conclusions

Based on the findings of the study, the following conclusions were made. Priority should be given to visual and interactive content by integrating images, diagrams, animations, and interactive exercises to enhance engagement and understanding. Provision of foundational lessons on pump operation to bridge the knowledge gap before advancing to complex technical content is vital. Hands-on learning opportunities through self-practice exercises and real-world applications would improve practical skill development. Addressing contextual limitations by enhancing access to computers, improving power supply reliability, and ensuring teacher readiness through training on multimedia tools are important for the multimedia package. Advocacy for stronger management support could ensure unhindered access to digital learning resources for students and instructors.

Recommendations

Based on the findings, the following recommendations were made.

1. Given that students prefer visual and interactive lessons with self-practice exercises, it is recommended that the multimedia instructional package should integrate interactive features such as animations, simulations, and self-assessment quizzes to enhance engagement and practical learning.
2. Since findings indicate that computers and projectors are available, but with some limitations in accessibility, it is recommended that technical colleges should improve infrastructure and ensure consistent access to digital tools.
3. School administrators and policymakers should implement policies that provide students with unrestricted access to computers and digital learning resources.

References

- Adamu, R. T., & Ibrahim, Y. (2019). Assessment of ICT infrastructure in technical colleges: Implications for curriculum delivery. *Nigerian Journal of Technology Education*, 12(3), 45-58.
- Ahmed, M. S., & Usman, R. (2018). Electricity supply and educational technology utilization in northern Nigerian technical colleges. *International Journal of Educational Management*, 32(1), 67-81.
- Akpan, I. M., & Johnson, E. (2021). Foundational knowledge in technical education: Examining the role of first principles in fluid mechanics instruction. *Journal of Technical Education Research*, 13(1), 23-38.
- Chukwuemeka, E. J., & Iscioglu, E. (2023). Administrative support for educational technology integration in technical colleges in South-South Nigeria. *International Journal of Educational Administration*, 15(1), 78-93.
- Danjuma, K. J., & Adamu, M. S. (2022). Technophobia among technical education instructors: Implications for 21st century skills development. *Vocational Education Research Journal*, 14(2), 118-134.
- Etuk, U. A., & Samuel, E. P. (2021). Technical college teachers' readiness for technological innovation in Rivers State. *Journal of Technical Education Research*, 13(4), 67-82.
- Federal Government of Nigeria (FGN, 2013). *National policy on education*. Lagos: NERDC Press.
- Kashyap, P. (2024). *Pumps introduction*. <https://www.linkedin.com/pulse/pumps-introduction-pawan-kashyap-fvkff/>
- Linn, S. (2022). Operating principle of centrifugal pump and its applications. *Journal of Applied Mechanical Engineering*, 11(6), 1000424.
- Milton Roy (2024). *The basics of reciprocating pumps*. [The Basics of Reciprocating Pumps | Milton Roy Metering Pumps](https://www.miltonroy.com/Reciprocating-Pumps/)
- Murata, K. (2021). *U.S. Patent Application No. 16/835,321*. <https://patentimages.storage.googleapis.com/df/52/9c/3e4e721087a0d5/US20210079917A1.pdf>
- National Board for Technical Education (NBTE, 2001). *Mechanical engineering craft: National Technical Certificate (NTC) and Advanced National Technical Certificate (ANTC) curriculum and module specifications*. NBTE.

- Nwineh, L. (2013). Design of a simulated instructional package for teaching and learning of domestic installation (SIPTELDI). *Nigerian Vocational Association Journal*, 18(1), 327-337.
- Nwoke, B. I., Okoye, K. R. E., & Uzoegwu, P. N. (2018). Instructional resources availability and utilization in technical colleges in South-Eastern Nigeria. *International Journal of Vocational Education*, 25(3), 78-95.
- Nwosu, J. C., & Igwe, K. N. (2022). Designing educational technologies for resource-constrained environments: A case study of technical education in Nigeria. *Journal of Computing in Higher Education*, 34(1), 145-167.
- Okoye, K. R. E., & Okonkwo, M. E. (2020). Challenges of technology integration in Nigerian technical colleges: Infrastructure and instructor factors. *Journal of Technical Education and Training*, 12(1), 82-97.
- Okorie, E. U., Ezeh, D. N., & Ajuzie, N. E. (2021). Assessment of computer facilities in technical colleges in Southern Nigeria. *African Journal of Educational Technology*, 10(2), 134-148.
- Olele, C. N., & Ukoha, O. I. (2020). Digital learning readiness among technical college students in the South-South region of Nigeria. *International Journal of Educational Technology*, 16(4), 112-128.
- Ogunleye, B. O. (2020). Technology infrastructure development in Nigerian technical colleges: Progress and challenges. *Journal of Science Education and Technology*, 29(4), 544-558.
- Onatere-Ubrurhe, J. O., & Ubrurhe, E. (2024). The Role of Technical and Vocational Education and Training (TVET) and Rail Transportation in the Socio-Economic Development of Nigeria. *International Journal of Vocational and Technical Education Research*, 10(2), 13-27.
- Thapa, H. S. (2024). Development of employability skills through work-based learning. *Journal of Technical and Vocational Education and Training (TVET)*, 18(1), 102-111.
- Volk, M. (2014). *Pump characteristics and applications* (3rd ed.). CRC Press.