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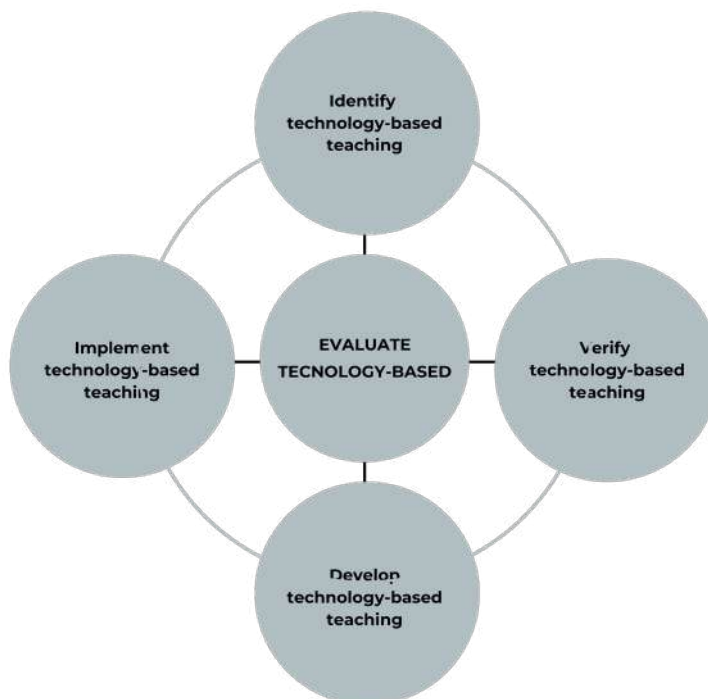
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7.1. Concept Map



The model outlines the stages of planning technology-based teaching during instruction. The first stage involves identifying the types of electronic devices suitable for a particular concept. The teacher then verifies these devices by designing the concept to achieve the instructional objectives and testing the strategies. The next stage is the development of the designed concept, in which the teacher creates guidance for both themselves and the students, and conducts a pilot test. The fourth stage is the implementation phase, where the teacher prepares the learning environment and engages the students. In the final stage, technology-based teaching is evaluated based on the devices used and the students' engagement, with areas for improvement identified.

7.2. Learning Outcomes

It is assumed that the readers of this chapter will be able to achieve the following learning outcomes:

- Define technology-based teaching
- Explain technology-based teaching classrooms
- State the advantages of technology-based teaching
- State the disadvantages of technology-based teaching
- Mention the steps in preparing a technology-based classroom
- State techniques ineffective technology-based classrooms
- Identify dos and don'ts in technology-based teaching

7.3. Concept notes

The shift from conventional to modern teaching and learning methods represents the most effective and optimal use of technology and the vast information at our disposal. Teachers enhance the learning experience by utilising various technologies provided by educational technology companies to increase student engagement. This innovative approach to teaching and learning is more personalised and engaging. When such technology is employed in the classroom, students find learning enjoyable and, most importantly, engaging.

This chapter presents the methods and strategies for navigating teaching and learning in the classroom while employing technology-based pedagogy. It includes definitions and discussions of technology-based teaching, along with its benefits and drawbacks, as well as insights into the teaching environment and technological tools. The chapter also outlines dos and don'ts for technology-based classrooms and effective practices in technology integration. Additionally, it highlights several case studies of classrooms that successfully utilise technology.

7.4. Reflective Questions

Are teachers capable of implementing technology-based teaching pedagogy in their classes?
Can teachers modify their teaching methods to incorporate technology-based pedagogy?

7.5. Introduction to Technology-based Teaching

Technology can be defined as the act of integrating scientific knowledge into the development of machinery and equipment to find solutions for human problems. The effective integration of technological equipment or devices into teaching to impart knowledge to learners is called technology-based teaching. The emergence of technology in the education system has modernised traditional methods of teaching and learning in the classroom, especially in the 21st century. Technology serves as a teacher's tool for effective instruction in this era. Consequently, the pedagogy of technological teaching has advanced significantly in developed countries and globally, including in the United States of America, Finland, Japan, Germany, Canada, the United Kingdom, and Singapore.

Technology-based teaching in the 21st century involves electronic teaching that incorporates computers, the internet, audio and video resources, satellite broadcasts, software applications, video conferencing, chat rooms, smartphones, websites, computer-based instruction, and CD-ROMs during instruction. It utilises computers, the internet, emails, radios, televisions, and projectors in the teaching process. Technology-based teaching adopts a more practical approach. E-learning is also a form of technology-based teaching that enables teachers to connect with learners, near and far, via networks and provide instructions from a distance. Technology-based teaching supports student-centred and authentic learning (Abulon, 2014). Technology has made it possible for individuals interested in education to participate in the learning process, regardless of distance (Sharma, Malhotra, and Chauhan, 2021). Additionally, technology-based learning encompasses platforms such as Zoom, Google Meet, WhatsApp, Google Classroom, MS Teams, webinars, and other technological devices and software for imparting knowledge to learners.

7.6. Technology-based Teaching classrooms

Classrooms are environments where interactions between teachers and students take place. Teachers have the authority to organise their classrooms in a manner that is conducive to effective learning support, healthy cooperation, independent judgement, and choice, allowing learners to adapt, relax, and learn freely. Teachers design

their instruction in such a way that the use of the internet is incorporated. Webinars, Google Classroom, video conferencing, smartphones, Google Meet, animations, online video lectures, Microsoft Teams, Zoom, and digital examinations, among others, are ways of using technology in teaching. All these apps and software facilitate collaboration among students in the classroom and enable teachers to evaluate students' performance with ease (Sharma, Malhotra, and Chauhan, 2021).

Technology-based teaching classrooms provide interactive teaching opportunities for both teachers and students, fostering active participation and healthy cooperation. Convenient technology-based teaching environments will transform the teaching landscape, including teaching styles, content delivery, evaluation methods, and even management approaches. Wherever there is technology, remarkable change is inevitable. Some of these technological tools used in teaching can be discussed below:

Interactive electronic whiteboard (IWB): This whiteboard is an invention that replaces the chalkboard. The advantage of the IWB is that it provides clarity and allows every student, regardless of their position in the classroom, to see what the teacher is presenting. This IWB consists of a computer, projector, and whiteboard.

Social media: This is a platform where teachers and students can disseminate information quickly and efficiently. It has proven useful globally by enabling the sharing of information through WhatsApp, Facebook, Instagram, LinkedIn, Twitter, instant messages, and chat, among others. Teachers use these tools to deliver instructions in the classroom or remotely, receiving instant feedback from students.

PowerPoint Slides: These tools have been used in the education system for decades in institutions of learning. A PowerPoint slide consists of text and audiovisual clips, making it effective for delivering abstract concepts. It is designed colourfully to attract students' attention and is easy to modify.

Animation: Animation is an interactive, technology-based teaching tool that engages students' attention during instruction. It enables students to comprehend concepts easily and removes barriers that hinder their understanding of abstract ideas. It can be played as many times as needed to improve retention. A well-designed animation video can be downloaded to students' smartphones, ensuring continuity of instruction both in schools and at home.

Microsoft Teams: This is an innovative platform that facilitates online chat and video conferencing in educational institutions. Many teachers conduct classes, exams, and homework assignments online. Presentations on the platform are recorded, allowing students to view them at their convenience and catch up on any lessons they may have missed.

Zoom: Teachers use the Zoom app in the classroom to connect with students both near and far. It offers features such as full-screen viewing, simultaneous screen sharing, group chat, whiteboarding, and interaction between the teacher and students. It accommodates as many users as possible.

Google Meet: Google Meet is a free application that does not cost much, except for data. The only way to install it is for the user to have a Google account and a functional email address. It produces a link that enables the teacher to invite students to the class. The teacher can use the link as many times as necessary and with different groups of people.

Google Classroom: This is common in the educational environment. It enables teachers to share information and class materials with students. They can use it on any device, such as computers, phones, tablets, and others. Teachers can interact with students and communicate at any time through this medium.

7.7. Advantages and disadvantages of technology-based teaching

7.7.1. Advantages of technology-based teaching

There are many advantages of technology-based teaching which include the following:

- **Access high-quality, current information:** Having the most recent information available in a classroom setting where technology is used to teach students helps create the best educational experience. To ensure accuracy, teachers might also utilise or direct students towards reliable sources. Both the teacher and students can use hyperlinks, tabs, and accordions to access information about a topic, rather than reading through text sequentially.
- **Gather student performance metrics easily:** The use of technology in the classroom enhances teacher performance. Technology-based strategies may be adopted primarily due to the data advantages they offer when specific learning goals can be achieved more effectively through technological approaches.
- **Students learn technology skills:** The chances for students to acquire technological skills automatically improve when technology is used in the classroom. Teachers can provide exercises that allow students to test and develop their skills.
- **Improved student participation and engagement:** The introduction of technology is a strategy to increase

student engagement, as most students adore it. The teacher uses technology to introduce students to web resources, show short films, utilise interactive software, create digital presentations, and encourage students to produce their own digital content.

- Automate repetitive tasks: Teaching may involve laborious activities such as tracking attendance, monitoring quiz results, and noting completed assignments. Existing technology can assist teachers in preparing courses, evaluating students, grading homework, providing feedback, and managing administrative tasks.

Other advantages are as follows:

- Technology tools can assist teachers with time-consuming administration.
- Assessment data can guide teachers on what topics to focus on or which students need additional assistance.
- Studies show an increase in student engagement with the use of technology.
- Tools such as Google Docs can be used for student collaboration.
- Resources such as video, animations and simulations can enhance learning (Future teachers, 2022).

7.7.2. Disadvantages of technology-based teaching

The disadvantages of technology-based teaching include the following:

- Faster but less memorable learning: Devices and learning apps operate at a pace faster than the human mind's rate of learning. When studying, students may skim over certain concepts or omit details that add texture and depth. Educational technology specialists recommend that teachers adjust media use to slow down the learning process, allowing for more rumination and reflection.
- Technology can be distracting: Students will inevitably become distracted when using devices like computers and tablets in the classroom. Some misbehaving pupils will attempt to utilise technology for amusement rather than its intended utility.
- Less direct social interaction: Another point of concern is how social interaction appears to be diminishing due to technology. When using technology, students interact and communicate verbally with their teachers and one another less frequently. Face-to-face communication is entirely absent from online education.
- Integrating technology is often time consuming: The role of a teacher may become significantly simpler in the future thanks to technology, but that time has not yet arrived. Planning effective lessons using digital technology instead of conventional approaches can be difficult and time-consuming.

Other disadvantages are:

- Some technology can be used by students to cheat on exams.
- New technology is expensive, and budgets at most schools are constrained.
- Students can turn off their cameras in a virtual lesson and disconnect from the class.
- The internet is distracting to some students.
- Training is required for both teachers and students. (Future teachers, 2022).

7.8. Preparing a technology-based classroom

Computers, specialised software, network-based communication systems, and other hardware and infrastructure are examples of technology resources. Some classrooms have been utilising technology for decades (McNulty, 2021). Consider the discrete calculators commonly found in science or mathematics classes, or the overhead projectors that some teachers mastered. Modern educators have a wide range of options at their disposal. Most classrooms are now equipped with data projectors or smartboards as standard, and teachers also have laptops for lesson planning and creating presentations. If permitted by school policy, teachers may use smartphones or clickers to gauge the class's mood (Kouser & Majid, 2021). They can quickly assess whether their students have grasped a concept by conducting a test or poll. To facilitate online research and utilise tools like Google Classroom, several schools have established Wi-Fi networks and purchased Chromebooks (Zinger, Tate & Warschauer, 2017). At the more complex end of the spectrum, teachers can conduct scientific experiments or interactive simulations to demonstrate how an engine functions. Additionally, to assist with class administration, some educators have adopted learning management systems and online assessment platforms. For those comfortable with the recording process, lessons can be transformed into podcasts or videos that students can use as a reference for revision.

Technology-based classrooms can be prepared in various ways, some of the examples are:

- Gamification of learning
- Online field trips
- Student feedback.

- Producing digital material
- PowerPoint or Google Slides
- Online grading programs or assessments
- Online classroom calendar
- Classroom Tablets
- Communication
- Online platforms or resources
- Social media
- Models and simulations
- Online mind maps
- Listserv
- Collaboration
- Free educational resources or Open Educational Resources (OERs),
- Learning management systems (LMS)
- Digital portfolios (McNulty, 2021).

7.9. Techniques in effective technology-based classrooms

Approaching a digital pedagogy that is not technocentric - A fundamental principle of effective teaching in technology-based classrooms is recognising the role of the teacher in the teaching and learning process. For example, a PowerPoint presentation serves as a tool that supports the teacher in implementing the lesson plan effectively, while the use of video or film stems from a more learner-centred approach, incorporating activities such as peer discussions or informal assessments. Therefore, the film resource should be actively integrated into the teaching and learning approach (Kouser & Majid, 2021; Schoemann, 2013).

A Digital Pedagogy in Context

School Context - School and class infrastructure will rarely allow for a fully digital classroom (Mukuni, 2019). Therefore, an integrative approach to technology in the classroom is vital. This integration balances recent digital technological advances, technology from the 1990s and early 2000s, and older educational technology that is still prevalent in many schools. When considering the use of technology in the classroom, it is essential to assess the degree to which the technology is backwards compatible or whether adapters are readily available. For example, computers and projectors that are compatible with both HDMI and VGA are preferred when developing classroom infrastructure.

Learner Context - Teachers in effective classrooms should be informed by a context-based approach towards technology that considers the teacher, learner, and curriculum when incorporating technology-infused pedagogy. This affords the teacher the opportunity to consider whether they or the learners fall with respect to digital native, digital immigrant, or digital refugee.

Classroom Context - Ensuring equal access to technology within the classroom allows for effective learning (NETP17, 2017). All learners should engage with the same level of educational technology. The wider community and home context should also be considered when setting assessments or evaluating eBooks, particularly regarding the availability of technology in those contexts. Assessments should align with the minimum levels of technology available at home to avoid disadvantaging or advantaging learners based on their technological access.

Designing Assessment for the 21st century Learner - Assessment aimed at engaging the 21st-century learner is best designed using ICT technology. Digital tools play a role in creating informal assessments that are most suitable for learners classified as digital natives. Learners can be demotivated by assessments that do not appear professional and modern in design, as well as by traditional textbooks. The integrative approach aims to provide learners with access to both e-books and hard copies of textbooks available in the classroom.

Class Administration for the Digital Pedagogue - Computerising all administrative tasks will save essential time and allow for a greater focus on teaching and learning. Paperless communication of reports to parents can be further automated using newer school systems, such as ADAM. The Google Education Suite is useful for storing reports, moderating assessments, and keeping attendance records. Google Drive offers the advantage of backing up documents on a server, preventing unexpected losses of files.

7.10. Dos and don'ts in technology-based teaching

Pre-lesson preparations - Technology-integrated pedagogy must involve testing the technology used in the classroom immediately prior to the lesson to ensure its functionality during the session.

Ensuring equal access to technology for learning – Teachers should render the technology for teaching and learning in the classroom homogenous. Some flexibility should be allowed in the home environment but not to the extent of advantaging any group of learners. As such, a teacher should be highly aware of the infrastructure needs for their classroom and lessons and what is available.

Notes for using digital resources - Videos and films should have subtitles whenever possible. This supports the spoken word with the written word and helps learners follow the video material. Films should serve as an interactive aspect of a lesson, rather than simply being played during it.

Notes on using PowerPoint Presentation software - PowerPoints should be employed judiciously. First and foremost, a teacher should own a PowerPoint remote to teach more authentically. The remote allows the teacher to bring aspects of the presentation to the learners' immediate attention. PowerPoints should only contain a skeleton and summary of points.

7.11. Case Studies in technology-based teaching

At Silverstream (South) Primary School, teacher Andrea Robertson employed hydroponics as a context for developing students' understanding of technical systems. The students created their own hydroponics systems, investigated common items as technological systems, and enjoyed a field trip to a hydroponics farm. Through their work in the hydroponics unit, the students learned that a technological system converts an input into an output. They were able to identify the elements of a hydroponic system as well as its advantages.

Given that Andrea knew the owners of Saddle View Nurseries, a nearby hydroponic farm, it was clear that using hydroponics as a framework would enhance students' understanding of technological systems. It was evident that the students needed to interact with various technological systems to gain a thorough understanding. Andrea created a draft unit plan, contacted the hydroponics farm to inquire about the possibility of a field trip, and collected and created teaching resources.

A technical system comprises multiple connected components that operate together to achieve a specific goal without the need for additional human designers. Technological systems transform, store, convey, or control resources, energy, and/or information for a particular purpose. To construct their own systems, students must understand the following concepts: input, output, transformation, and control; "black box"; redundancy and dependability; and operating parameters.

The terms input, output, and transformation were introduced to the children alongside several simple systems. The children then selected one of these systems, sketched it in their books, and gave it a name. The popcorn maker was frequently chosen, likely because it was the easiest to comprehend. Andrea then presented the concept of hydroponics as a technological system.

She stated, "When I showed them photographs of hydroponics units, I found that not one child was at all aware that plants could grow without soil." "My own class's response was interesting." Andrea began building on her students' developing understandings by utilising a range of teaching strategies. Some of the children were starting to grasp the idea that there are many different kinds of systems.

7.12. Reflective answers

Are teachers capable of implementing technology-based teaching pedagogy in their classes?

Teachers can utilise technology-based teaching pedagogies in their classes to a certain extent. However, they encounter a number of obstacles that limit their potential. To fully realise this potential, teachers require better support through technology-based professional development. Additionally, promoting positive attitudes towards using technology in the classroom should be an essential goal of this training.

Effective implementation of technology-based pedagogy also necessitates funding that ensures an even playing field for both instructors and students. Therefore, teachers can successfully apply technology-based pedagogy in their classes when they receive proper encouragement and training.

Can teachers modify their teaching methods to incorporate technology-based pedagogy?

Under the correct conditions, teachers can adapt their teaching strategies to include technology-based pedagogy. For a teacher, switching entirely from their traditional pedagogy to one based on technology in a short period of time would be very difficult. Teachers must gradually integrate technology into their lesson plans. This would assist in bridging the gap between the known and the unknown. The teacher can add more components of a technology-based pedagogy as more technology is successfully deployed. It is essential that teachers receive direction and assistance throughout this process.

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