HND: SCIENCE OF EDUCATION : LEVEL II= SECOND SEMESTER

COURSE TITLE: INTRODUCTION TO EDUCATIONAL TECHNOLOGY (4 CREDITS, 60 HOURS (2 HOURS PER WEEK)

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MODULE III

Technological applications in teaching

Learning objectives

This module aims to help pre-service teachers consider the possibilities for embedding technology into teaching. At the end the module, you should be able to:

1. Understand the role of technology in education.
2. Identify technological applications and resources used in classrooms today.
3. Be aware of how you might embed technology through a range of teaching and learning strategies.
4. Evaluate technological tools to support teaching and learning.
5. Understand possible challenges and barriers you may face as a new teacher using technology.

Introduction

Technology, in one form or another, has always been part of the teaching and learning environment. It is part of the teacher's professional toolbox. In other words, it is among the resources that teachers use to help facilitate student learning.

Technology has changed dramatically over recent decades. The increasing variety and accessibility of technology has expanded the toolbox and the opportunities teachers have to use technology. Computer devices are more powerful and come in different forms, from those that sit on our desks to those that sit in the palm of our hands. The internet connects those devices and connects students to each other in the classroom, through the school and around the world.

Technological devices and networks have changed our schools and classrooms. There now are computers and interactive whiteboards in schools, and schools are connected to each other and the world at higher speeds than ever before. Technology in schools has become mobile, with laptop computers, tablet devices and smartphones now part of the teaching and learning context.

The role of technology in education

Learning with technology has become essential in today's schools. Worldwide, governments, education systems, researchers, school leaders, teachers and parents consider technology to be a critical part of a child's education.

Developing students' knowledge and skills related to ICT in the school years provides an important grounding for later in life. It also provides equity of opportunity, regardless of background. General social commentary and the popular press tend to generalize about young people, their access to and use of technology.

The need to keep pace with society and prepare students for their roles in society are just two reasons to use technology in education. Educators and researchers point to the potential of technology to increase motivation and engagement of learners, cater for different learning styles and improve learning outcomes.

When we talk about technology in teaching and learning, the word 'integration' is often used. The idea of integrating technology into the curriculum came about through a concern that we may have been *teaching about* and *teaching how to use* technology but not addressing how students can apply technology related knowledge and skills. To address this problem, there was a move to integrate technology into each key learning area.

The important role that technology plays in education gives teachers the opportunity to design meaningful learning experiences that embed technology. This is not a new area for teachers; we have always considered the tools and resources that can best support learning activities for students. However, advances and accessibility of technologies have made the possibilities seem almost endless. It is important not to use technology for its sake, but rather to embed technology appropriately. Here, teachers draw upon their expertise and experience in what to teach and how to teach it.

The role and expertise of teachers are critical because teachers are at the front line of designing and delivering the learning experience. It has been well argued that just making technology available in schools does not mean that teachers will make use of the technology, nor will it necessarily be used effectively.

Learning with technological tools

The contemporary curriculum guides teachers to facilitate the development of adaptable and flexible learners who know how to take on new tasks and situations, quickly and easily. Students will need to be good communicators who can competently discuss topics with others and effectively share their ideas in many forms and for different purposes. Students will need to possess excellent collaboration skills and be able to work together with many different types of people, each of whom has her or his own special disciplines and unique ways of learning and working together.

Furthermore, students will need the ability to create in a variety of manners and bring their visions and ideas alive through different types of media. In this section, we discuss the ways in which students can learn to understand, communicate, collaborate and create using different modes of technology, and how teachers can use technology to assist their students in transforming knowledge and skills into products, solutions and new information.

Technology for understanding

How do we learn and remember? This view of learning is the information processing perspective, which considers learning as a change in knowledge in our stored memory. When we pay attention to inputs into our sensory register, these inputs (or information) become part of our working (short-term) memory. If we want to retain this information, it needs to be encoded as schematic into our stored (long-term) memory. Then we need to be able to retrieve this information from our stored memory to use it later.

Teachers can support students to process information by helping them to organize new information, link it to their existing knowledge and use memory aids to retrieve information. Digital learning resources and computer software can be used to facilitate these processes.

Digital learning resources

Digital learning resources support information processing by helping students to develop mental representations through the mix of media elements presented to them. Digital learning resources include content and, sometimes, learning activities. They combine multimedia elements including text, image, video and audio to present information. Research on multimedia

learning have demonstrated more positive outcomes for students who learn from resources that effectively combine words and pictures, rather than those that include words alone.

Student attention and engagement with these resources helps them to process the information into working memory. When students meaningfully interact with the multimedia information, they encode this information into their long-term memory. This meaningful interaction might involve learning activities within the digital resource itself and/or as a lesson that is created by the teacher. However, not all information presented in multimedia form support learning. For learning to occur, the resources themselves need to be designed using sound educational principles, and need to be purposefully integrated into the learning experience by the teacher.

Educational theory provides direction for both the effective design of the resources and how a teacher can best use those resources with students. Cognitive load theory, developed by John Sweller (1988), tells us that learning resources must be designed to reduce the load on our working memory in order for us to be able to construct schema. Effectively designed digital learning resources:

1. exclude information and activities that are not directly related to schema construction
2. focus on information and activities that directly relate to schema construction
3. clearly identify the complexity of learning materials and experience of learner.

These principles guide teachers in evaluating the digital learning resources that they might want to use with their students. Teachers can assess resources for how directly they cover the topic being taught, how clearly the information is conveyed and how directly activities within the resources support student learning. And teachers can ensure that the lessons they design using these resources are also focused on the topic and take their students' abilities and experience into consideration.

Teachers use digital resources for a variety of purposes and in many ways, including:

- As a way to introduce students to a topic
- As part of a teacher lecture or demonstration
- As a stimulus to group or whole-class discussion
- To provide students with access to different text types
- To engage students in activities that are not possible in the classroom
- To allow students to work at their own pace as a review or extension activity.

Since the development of the worldwide web in the mid-1990s, the ability to create, store and share digital learning resources has expanded exponentially. Globally, significant effort has been put into creating collections, or repositories, of these resources, so that teachers can draw upon them for their lessons.

Let's Consider how digital learning resources can be used in teaching.

Applied Learning Experience 1: Webquests

WebQuests were created as a learning activity not long after the initial development of the worldwide web. A WebQuest is an inquiry based activity that embeds the use of a variety of learning resources – with most being digital learning resources available on the internet. The inquiry activity may take the form of tasks such as a problem to be solved, a position to be taken, a product to be designed or a work to be created. Teachers can create their own WebQuests that address curriculum outcomes and draw upon resources they have identified and evaluated. Or teachers can choose to use a WebQuest that someone else has created. WebQuests have a consistent structure:

Introduction: Orients students to the activity

Task: Clearly and concisely describes the outcome of the learning activity

Process: Lists the steps learners will take to accomplish the task and the digital, web-based and other learning resources that support learners in this process

Evaluation: Provides a rubric to indicate how learners' performance will be assessed

Conclusions: Summarises what students will have covered and learned.

Think about your recent or forthcoming practice-teaching experience. Can you identify a WebQuest that would cover some of the curriculum for the students in this class? Can you create a WebQuest of your own? Could you ask the students in the class to make WebQuests?

Using technology to communicate

A child is not born a user of digital technology, but can learn to become one. It is through a parent, a program, a friend or a teacher that a child learns to use technology. Students are seeing, using and trying media in all aspects of their lives outside of the school context. Teachers can help students draw links between what is happening outside of school and what is happening inside the school. Teachers can use technology within the classroom to model real-world practices. Meaning making occurs when students communicate using multimodal texts.

The Educational theories help us to understand how students learn to make meaning through communication. Vygotsky's (1978) sociocultural theory argues that social interactions can facilitate development of higher-order functions when they take place in cultural contexts. Students learn when they interact and communicate with other learners in a positive environment. Instruction is deemed more effective when it is connected and relevant to the learner. Bandura's (1986) social learning theory also focuses on interaction and communication with others who provide a modelling framework for learners. Here, knowledge, skills and behaviours develop through modelling.

Vygotsky's and Bandura's theories provide teachers with guidance on how to use technology in teaching and learning. Learning occurs within a social environment – we learn by modelling and interacting with others. Technology can be used to facilitate social interaction and communication among learners in class, within a school, between schools and around the world.

In Science, students,

Represent and **communicate** ideas and findings in a variety of ways such as diagrams, physical representations and simple reports.

In Arts, students,

Use a range of **communication** forms (oral, graphic, written) and digital technologies.

Teachers can set a range of communication learning activities for students, including journal writing, speech writing, preparing topic talks, newsletters and debates. Technology can be embedded meaningfully and engagingly into these activities. Communication tools include: word-processing, presentation and publishing software, webpage authoring tools, email and online discussion forums. These tools allow students to communicate their ideas using a range of media elements (text, images, sound, video).

Applied Learning Experience 2: Blogging

Journal writing has long been an activity utilised in the primary classroom. Journal writing allows students to reflect on what they are learning and how they are learning. This traditional, notebook-and-pencil activity can become digital when word processing software is used. Or it can go online as a blog. Blogs (a short form of the weblog) are personal journal websites on which a user can type an entry, add images, video and links to other websites. Readers of a blog usually can post comments.

For primary school students, the use of blogs have been found to be an engaging and effective way to promote writing skills, particularly when student peers provide feedback to the blog's writer. It is exactly this feedback and sharing mechanism that makes the blog different to the traditional journal. In the notebook-and-pencil version, the contents of the journal are private to the student, apart from the teacher and whomever the student decides to share the journal with. With the blog, access can be provided to the teacher, the class, the student's parents and the world.

Search the internet for 'primary school blog' and scan a few of the results. Can you see differences in school blogs, teacher blogs and student blogs? What are some of the topics that teachers are getting their primary school students to write about on their blogs?

Lessons that introduce new forms of technology that students can use to communicate, facilitate their ability to transfer technology skills from one tool to another and to apply those skills to communicate in different modes and genres. This supports the development of the 21st-century skills called for today – adaptability, flexibility and engagement. Media-sharing sites allow users to communicate with each other by uploading videos, photos and other multimedia.

Applied Learning Experience 3:Multimedia presentations

Peter loves a screen. It does not matter if it is a television, iPad, video console or computer screen. He loved to be engaged with technology. At school, since kindergarten, Peter has had to build some form of communication skill. Usually, this is in the form of a news report, topic talk or project presentation. In primary 3, it was suggested that students could use Microsoft PowerPoint to present a few slides while they were doing their presentations. Peter found this very easy, and by primary 4 became quite bored with the software. Peter's mother found a few different iPad applications ('apps') and suggested Peter try them. Peter settled on Skitch and added text and drawings to the photo he chose to use for his presentation. Peter was engaged for hours, doing something that he loved while learning at the same time.

Peter's teacher had not seen Skitch before. She asked the school's technology support officer to install it on the school's iPads and then asked Peter to teach the class how to use the app. She thought it would be a great app to use for the class's next creative arts lesson.

New computer software and mobile device apps are released all the time. Many are free for educational purposes. Search for some education software and app review sites. How could a teacher involve students in reviewing, learning about and teaching each other new software?

Collaborative learning with technology

Collaborative learning is typically understood to be a situation in which two or more students work together to search for understanding or meaning, or to solve a problem. Students might work together to make meaning by creating an artifact or product. Collaborative learning is an important learning strategy for educators to teach and to use in their classrooms. It improves student knowledge by combining strengths, sharing responsibilities and learning from one another, which brings together many opportunities for enriching knowledge. In these learning experiences, students work together towards a common goal and, through the process, depend on each other for their experiences and knowledge.

Collaboration is also deep-rooted in Vygotsky's theory of learning. He believed that there is a natural social nature of learning and this is reflected in group-based learning. Vygotsky proposed the notion of the zone of proximal development (ZPD), which in essence is the difference between a learner's independent ability and what can be accomplished cognitively with guided support from others who are more knowledgeable. This means that teachers have an important role in facilitating and scaffolding collaborative learning.

There are also more contemporary interpretations of Vygotsky's ZPD, such as Lave and Wenger's (1991) theory of situated learning, which argues that learning is most effective when it is co-constructed in the context in which it is to be applied. This means that situated learning favours collaborative learning activities that are carried out in authentic environments, with pedagogical strategies that model authentic, real-world tasks.

In the past, collaborative learning took place mainly in face-to-face situations, whereby students worked together while sitting at a table in a classroom, or perhaps working as a group in a learning centre. However, now, with technology in our classrooms, collaborative learning is also possible through many different means or modes, such as online discussion groups, interactive platforms and online classroom environments. These environments allow students to work together on group projects; publish on wikis and blogs; solve problems; on discussion boards, have debates and study teams; in online classrooms; and participate in other activities in

cooperative ways. Students are working together in teams and using computer tools and resources to search for information, to publish results and create products.

Perhaps the most common form of collaborative learning in the classroom environment is the group writing experience. Classroom teachers are using technological tools such as wikis, blogs and classroom webpages to post school news and short stories. Structured collaborative activities using these kinds of tools encourage students to form ideas, share thoughts and write together.

Another collaborative activity is group exploration or problem solving, whereby students work together to discover a place or environment, or to understand a topic. This can be done using an online environment. Some education-specific, virtual worlds have been constructed to allow students to work together to develop their understanding of a topic. For example, Quest Atlantis is an online world that uses a videogame metaphor for upper primary and junior high school students to work on educational 'quests' with other students and mentors.

Other tools that support collaborative learning include discussion boards, which can be used to encourage students to have discussions and debates. Teachers are using websites such as Folder Share, Stickam, Talk and Write, Tikiwiki and Google Docs and Spreadsheets. Using technology for collaboration allows students to engage in conversations and learn together synchronously or asynchronously, no matter where they may be attending school.

Creating with technology

As 21st-century learners, students are expected to be able to create a multitude of products in the school environment. The creation of new ideas can be exemplified through stories, maps, projects, games, journals and much more.

Literacy: Creating texts

[Students] *learn to use a range of* software programs including word processing software, *selecting purposefully from a range of functions to communicate and* create *clear, effective, informative and innovative texts*. [our emphasis]

Literature: Creating literature

[Students] learn how to use personal knowledge and literary texts as starting points to create imaginative writing in different forms and genres and for particular audiences. Using print, digital and online media, students develop skills that allow them to convey meaning, address significant issues and heighten engagement and impact.

The ability to create is at the peak of Bloom's (1994) taxonomy of higher-order thinking. For 21st-century students, creativity is an important focus. Perhaps one of the most innovative ways to use technology in the classroom is for students to create original texts. Teachers and students can choose from a range of software and websites, such as Prezi or Wikispaces.

Using technology to create texts provides students with many opportunities. Students can gain confidence in their writing skills by learning to use tools such as spell check and increase their vocabulary by using a thesaurus tool. Scaffolding takes place through models and how-to videos online to guide students through the writing process. Students can plan their creative writing concept-mapping tools to brainstorm their storyline. There is plenty of opportunity for students to review each other's work and use tools such as track changes in Microsoft Word to edit each other's creative writing. Students can also receive feedback from teachers once they post their work on a blog or wiki.

Using technology to create artifacts and products allows learners to demonstrate creative thinking and their construction of knowledge. Learners of all ages can apply their existing knowledge to generate new ideas and create products as a means of expression.

Applied Learning Experience 5: Making news today

'News' has always been a part of the primary school classroom. It is a strategy to support students to identify and explain the important events of their lives and the world around them. Technology provides the opportunity for students to tell the news in multimedia formats. In the 'Making News Today' project, students worked in groups to create a one minute, 20-second video news story about an important event or issue in their school or school community. The student groups identified, researched and scripted their story. They filmed the story using video cameras and edited the footage using video editing software. They shared their stories on the project website. The class teacher guided the news process by providing feedback on the idea, and assessing and approving the script and final product. The research associated with this project showed that students were engaged in their learning and were motivated by the opportunity to be self-directed. Students who did not have experience with video cameras or video-editing software learned the necessary skills by trial-and-error and/or peer teaching. The students were able to analyze their final news stories and identify strengths in how they

represented their story as well as how they could improve – all students wanted the chance to tell their story again or tell another story.

What is clear from this project is that the teacher has an important role to play in teaching students how to identify and evaluate the information that they use to develop their story.

Applied Learning Experience 6: Slowmation

Creating a slowmation is a way for students to explain a concept or process by designing and making a stop-motion animation that is played slowly, at two frames per second. In a slowmation, the learner (or group of learners) plans how to explain the concept or process through a series of images. These images are then stitched together to make the animation. A voice-over narration helps to explain the concept or process.

Evaluating technology for teaching and learning

Teachers evaluate all kinds of materials that they use for teaching and learning.

There are many similar considerations when evaluating technological tools, and some criteria that are unique. Some criteria and questions teachers might ask themselves when evaluating educational software, applications and resources are listed below. How relevant each of these considerations is depends on the form of the technology; for example, a digital learning resource or software that might not include instructional content.

Age/year level:

• Is the application appropriate for the age and year level of the students?

• Is the reading level of the text and type of media appropriate?

Curriculum links:

• Are there links between the content/functions of the application and the expectations of the curriculum?

• Are the content and examples relevant to the curriculum?

• Will this help teach the curriculum in new or different ways?

Instructional content:

• Is the information accurate, complete and current?

• Are sources reliable?

• Does the content encourage higher-order thinking?

• Is the content culturally appropriate? Does it present multiple perspectives?

Engaging and interactive:

• Will the learner(s) be actively involved in using the tool?

• Is feedback provided? Is the feedback appropriate and meaningful?

Assessment:

• Are assessment tasks included, or can the teacher develop relevant assessment tasks that link to the use of the tool?

Flexibility:

• Can all aspects of the tool be integrated easily into classroom activities?

• Can the tool be used for multiple curriculum units?

Media:

• Does the medium used support or distract from the learning activity?

Usability:

• Is the tool easy to use and intuitive?

Technical considerations:

• Does the tool work consistently?

• Are there special technical requirements for using the tool? Does the school have access to those requirements?

Support materials:

• Does the tool have multiple forms of help (manuals, context-sensitive help, and tutorials)?

• Are teaching support materials or online resources available to help a teacher embed the tool into lessons?

Challenges and barriers

This module has presented the opportunities for using technological tools in teaching and learning. However, it is true that not all teachers are embedding technology into their teaching. A significant body of research has investigated why this occurs. The barriers to using technology in the classroom are many and include, among others, resource limitations, teacher knowledge and skills, and teacher attitudes and beliefs.

Some resource barriers are being overcome with an increasing number of computers and software applications and faster, more reliable networks in schools. But teachers tend not to use

technology if they become frustrated when it does not work properly or when there is a lack of technical support in their school. Teachers also report having limited time to review and learn about new technology tools that they can use in their teaching.

Teacher knowledge and skills are important factors in the use of technology in the classroom. Lack of specific technological skills is a common reason teachers give for not using technology. However, those teachers who take the opportunity to build skills through professional development activities are much more likely to integrate technology into their teaching than those who do not.

But teachers realise that the knowledge and skills they need to be able to use technology in the classroom goes beyond understanding what functions are under the menu items and what buttons to click. Using technology effectively to promote student learning means thinking about effective learning strategies and effective classroom management.

Teachers are faced with challenges and barriers all the time. Technology's place in society causes teachers to consider the implications for them in their role as educator and as lifelong learners themselves. The constant challenge for teachers is to draw upon their continually developing knowledge and skills about what to teach and how to teach. Technology is just one, but an important consideration in that equation.

Summary

The pace of technological change in society and in schools has been exponential and will continue to be so. Teachers are using ICT to support their role in providing students with structure and advice, monitoring their progress and assessing their accomplishments. When students use technology to conduct research projects, analyse data, solve problems, design products and assess their own work, they work with others to create and communicate new knowledge and understandings. This chapter has presented a range of tools and a range of teaching and learning strategies. These strategies are based on theories of learning that allow teachers to provide different experiences for their students. Technology is changing all the time and what we know about how to use that technology effectively is developing continuously. As a future teacher, you will continue to develop your understanding and practice regarding the use of technology to help your students learn effectively.

Extension

Discussion questions

Consider the following problems and explore and discuss possible technology based solutions that could be utilised to support the students and the teachers in each scenario.

1. Ms Stein's class 6 class is addicted to texting. They are supposed to be studying *Charlie and the Chocolate Factory* as their novel for this term. How could Ms Stein engage these 11-year-olds and help them relate to the work of Dahl?

2. Mr Messing's class 5 students enjoy collaborative learning, but can be very busy and noisy. Some students in the class have special learning needs, including quite a few with Attention Deficit Hyperactive Disorder (ADHD), who are highly distractible. Students find it difficult to sit quietly at their desks and concentrate on writing tasks. How can Mr Messing help his class to develop writing skills?

3. Ms Bickley is trying to engage her class 5 students in learning about the cultures of Indigenous Cameroonian, but has little knowledge on the topic as a non- Indigenous person. Ms Bickley wants to find a way to engage her students and help them to build awareness. What suggestions do you have for her?

4. There never seems to be enough time for students to write everything down in Mr Coulson's class 6 History course. Is there a way that Mr Coulson could enable his students to learn the course material without having to write everything down?

Essay topic

Imagine a primary school classroom in the year 2050. Describe and explain what the classroom looks like. Provide support for your classroom. Some things to consider:

• What does the classroom space look like? Consider its shape and size. What kind of furniture and resources are in this space?

• Who is involved in teaching? What are they doing?

• How are students learning?

• What kind of technology is being used and how?

Research project practice

Choose a Key Learning Area or curriculum document of your choice. Identify research that has been conducted in this learning area in terms of the kind of technology that has been used to teach the subject matter. What does the research say about:

- teaching practice
- student engagement in learning
- learning outcomes?