

3. It enables students to cope with more complex concepts as a result of clearer, more efficient and more visualised and dynamic presentations;
4. Enables a more varied, creative and engaging classroom, i.e., it increases students' engagement through greater classroom interactivity (Winzenried, Dalgarno & Tinkler, 2010);
5. Enables teachers to integrate ICT into their classroom lessons for quality teaching and better comprehension by the students;
6. Ability to create, print, save, share and update what is on the board, including lesson notes, drawings, etc.
7. It fosters collaboration and interaction in class;
8. It motivates students to learn;
9. It enhances the teacher's professional development and adds to his acquired skills and teaching experience;
10. Flexibility and effectiveness in multimedia use;
11. It allows students to absorb information more easily;
12. It allows teachers to create easily and rapidly customised lessons from a range of existing content and to adapt them to the needs of the students in real-time.
13. It allows students to participate in group discussions and enhance cooperative projects.

Challenges of Interactive White (Smart) Board Technology

The challenges facing the adoption of the smart boards include:

1. **Technical know-how on how to use the smart board.** Training and special computer skills such as the creation of power point slides, spreadsheets, graphics, and symbols, are required to learn to use the technology adequately. Both the teacher and the students need to be conversant with the technology and its components to effectively use its features. In addition, it requires prior knowledge and experience in using ICT to fully explore the functionalities and potential of using the technology as a teaching aid. This is dominantly the reason why most Nigerian teachers do not use the technology even when it is available.
2. **The use of smart board technology has introduced some changes to teaching styles and classroom management which some teachers/students might find difficult to adapt.**
3. **Initial setup cost.** The cost to purchase the equipment and set it up and running is quite high, and it is expected for every classroom to have a smart board for inclusive the learning for all the students.
4. **The cost of maintenance is also high compared to the blackboard or the non-smart board.** The smart board is more expensive than the conventional smart boards or projector and screen combined.

5. The increase or overuse of PowerPoint presentations with the smart board can deprive students of engaging in complex thinking and reasoning, i.e., it takes away the cognitive engagement in the classroom from the students.
6. The pace of the classroom teaching sessions is somewhat dependent on the skill and experience of the teacher to use the smart board.
7. It requires electricity to power it. In a country like Nigeria where electric power supply is inadequate, it will require having a standby generator, and an uninterrupted power supply system (UPS).
8. If multiple data entry is allowed, inputs can get jumbled, resulting in on-screen gibberish.
9. If remote access is allowed, some students/users may be tempted to send disruptive messages or draw on the screen (TechLearn, 2019).

Conclusion

From the foregoing review, the smart board is a veritable tool and asset in the classroom. It fosters remote teaching and learning. In addition, it facilitates Internet connectivity for collaborative learning and participation, online conference lectures and supports multimedia content and innovative pedagogy – this makes it ideal for teaching and learning in the face of the COVID-19 pandemic. Furthermore, it enhances students' motivation, improves classroom participation and cooperation, and facilitates easy handling of complex concepts with the help of clearer, more effective and dynamic presentations. However, it is not without challenges including the high cost of procurement, technical support issues, steep teaching/learning curve for teachers and students and technical know-how to operate the device.

Suggestions

The following suggestions were made as a mark of way forward:

1. Schools should organise special training on how to operate the smart board both for the teachers and students to maximize its benefit.
2. Teachers and students are encouraged to be flexible and open to various teaching methods, especially one that incorporates the use of technology for enhanced and qualitative teaching.
3. Considering the cost of procuring the smart board, the school should plan appropriately for setting up the technology and equip each classroom with the baseline technology configuration before purchasing the technology;
4. The school can complement the smart board technology with digital projectors, computers, wireless-enabled tablets and other online video conferencing platforms for remote teaching and learning amidst COVID-19.
5. Teachers should add a session for cognitive reasoning in their lesson plans to develop the thinking faculty of the students as well;
6. Regular power supply: an alternative means of power supply is required to use the Smartboard technology as a result of the epileptic nature of power supply in Nigeria. Rather than depending on the distribution company, institutions can

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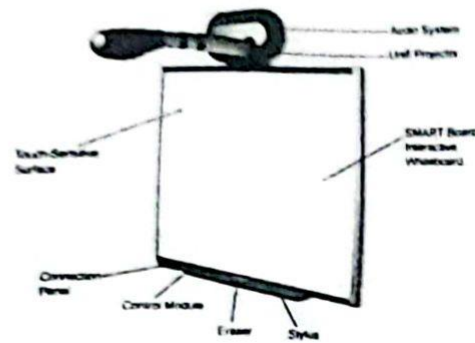


Figure 5: Interactive (IPBoard)

Appearance of Whiteboard

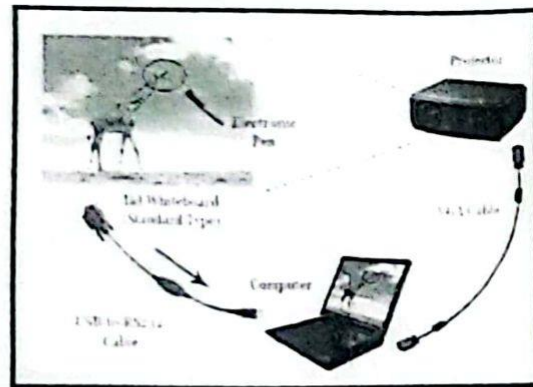


Figure 6: Interactive

(IPBOARD)

Connecting the Whiteboard

Table 2: System Requirements

Configurations	Minimal Configuration	Recommended Configuration
Hardware Configuration	CPU: 2GHz RAM: 2MB	2.0GHz Corei3 or more 8 MB or more
Software Configuration	Windows Vista, Windows 8	Windows 10 or higher



Figure 7a: Installing the Interactive Smart Board Software (Selecting Language S...

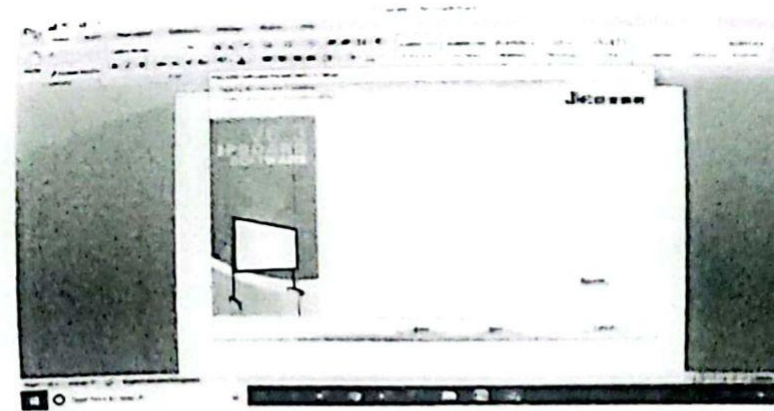


Figure 7b: Installing the Interactive Smart Board Software (Selecting Installation...

Benefits/Advantages of Interactive White (Smart) Board Technology in the COVID-19 Era

The benefits of adopting the interactive white (smart) board technology for teaching in the COVID-19 era include the following:

1. Ability to deliver lectures from remote locations and allow remote students to connect to the same lecture and participate;

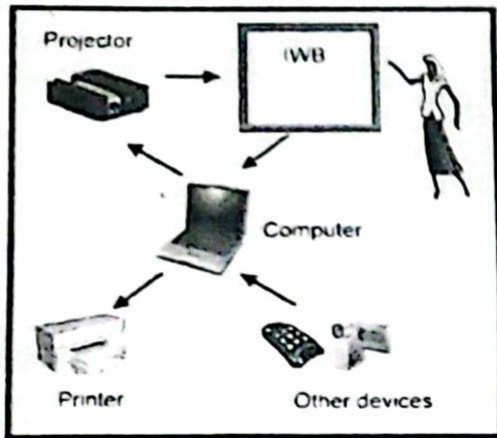
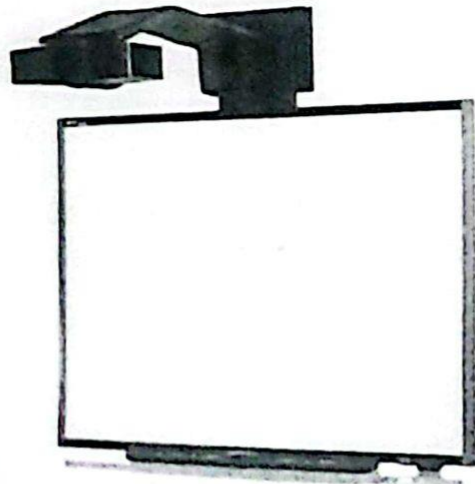


Figure 1: Topological Interactive Electronic

Diagram of the Smart Board



Interactive Whiteboard
Standard the Interactive

Figure 2: The
Table 1: Accessories of Whiteboard

S/N	Accessories	Description/Purpose	Picture
1	Electronic Pen	The pen is specifically designed	

		for writing on the interactive whiteboard (IPBOARD), with Top-ZIP batteries of 1.5v	
2	USB-RS232 Connecting Cable, 10 meters	The dedicated cables connecting the computer and the interactive whiteboard (IPBOARD)	
3	Interactive Whiteboard (IPBOARD) Install Software Disk	A disk containing the Interactive Whiteboard (IPBOARD) application software	
4	Interactive Whiteboard (IPBOARD) User Guide	User Guide	
5	Installation Hanger (Top and Bottom)	For wall Mounted Installation	
6	Gasket	For balancing the Interactive Whiteboard (IPBOARD) while mounted on the wall	

Figure 3: Accessories of the Whiteboard



Standard Interactive

6. It allows students to work creatively through interactive class activities and present their work in multimedia format during class presentations,
7. It provides new opportunities for individualised and corporate learning experiences,
8. It allows the playing of video and audio lectures for explaining difficult concepts.

In addition, Akbas and Pektaş (2011) advanced other uses of smart board technology to include the following:

- i. Creating new content via capturing or copying pre-existing ones. Copying and pasting contents from other software or sources such as the Internet is possible. Other programs may run simultaneously on the smart board, as such, information contents can be copied therein to be displayed on the board.
- ii. Sharing the contents to other interactive boards connected on a network or through the use of Bluetooth, wireless etc, is possible. In addition, links to other pages can be done; Word, Power Point and Excel files can be used; visuals and graphic packages can also be installed and used; Internet connectivity can also be achieved. According to Jackson (2010) software such as Skype and MSN have the ability to initiate video calls with free, simple and inexpensive webcams on the smart board.
- iii. **Storing of files:** All writing, diagrams and visuals on the smart board can be saved, re-used in other classes or used in future lesson planning, and shared with students. This enhances the retentive capability of the teacher and students.
- iv. **Annotations:** A special pen can be used to add explanatory notes, revise them, or make hyperlinks to other features such as arrows or lines. Different patterns of emphasis can also be used for a word or group of words e.g. colour, bold, movement, italics etc. In addition, the distractive part of the screen has a hideaway feature. These features motivate the students and foster their learning growth and development.

Retention is essential for teachers and learners because they want to recall what they have been taught or what they were taught as the case maybe. Teachers sometimes face difficulties in finding adequate information resources to develop their lesson notes, the Web houses a huge collection of educational resources which are just a click away. Various tools and working environments of smart boards are designed so that teachers may save their materials as projects and re-use or recall them as many times as they need them. Thus, instead of preparing new materials over and over, they can use, revise and update the already existing ones.

Adopting the IPBOARD Interactive Whiteboard (SmartBoard)

The IPBoard is a proprietary interactive smart board described by the manufacturers as "a new generation of the digital educational device that will finally substitute traditional blackboards and chalks". The IPBoard combines edge electronic technologies, software technologies, and Internet technologies. The Interactive IPBoard is PC-based input

equipment, which when connected, to a projector and PC, can do everything from note taking, drawing geometric graphics, editing, printing and storing. The IPBoard is the ultimate technological tool for knowledge creation and is applied for teaching, meeting, remote education and information management. The features of the IPBoard include:

- i. Ability to apply special techniques as well as sophisticated techniques like electromagnetic induction and digital locating to create an interactive environment for teaching and demonstration if operated with PC, projector and special software.
- ii. PCs can be operated with an electronic pen instead of a mouse.
- iii. An electronic pen can be used to write, note, erase, copy, do calculations, etc. The dedicated software is scalable and updateable. It offers functionalities such as partially magnifying objects, searchlight, zooming, editing, screen and customizable template.
- iv. It runs on advanced processing algorithms that guarantee maximum speed as opposed to the slower pressure-sensitive and touch-sensitive versions of the IPBoard.
- v. It boasts low reflection, high wear-proof, accurate focus, excellent contrast and is suitable for a long time watching.
- vi. The panel can endure up to 10 million times of scribing.
- vii. High precision in locating objects and ability to write fine Chinese and English words and also draw fine lines.

Connecting the PC to the IPBoard

The IPBoard can be connected to the PC in several ways (standalone or networked) and can be extended to provide desired functionalities. The first step is to install the dedicated software through the Install Shield contained in the CD-ROM. This takes up to 30 minutes depending on the system specification and the operating system used. On one hand, a standalone connection can be adopted for the Interactive electronic smartboard. This involves connecting the Smartboard through the serial/USB port while the projector is plugged into the video interface. Additional functionalities can be added by connecting a digital camera to the USB and plugging the printer using USB connectors for seamless printing. A hard disk drive can be used as storage for saving files. On the other hand, the IPBoard can be linked to the standalone computer through Internet technology. This allows project contents on the smart board at a remote location in real-time.

2. A high-definition digital projector;
3. A computer system;
4. The smartboard software package and learning resources
5. Optional peripherals include CD-ROM, flash drives, Internet connectivity, etc.

The above-listed components are needed to get the smartboard up and running. The high-definition digital projector displays the activities on the computer screen on the smart board interface. Unlike a normal projector screen, the smart board is touch-sensitive; it allows users to interact with the information being displayed on the board using an electronic pen (stylus) i.e., the user manipulates the objects on the computer system through touching, moving, writing, drawing or scrolling on the smartboard. Consequently, the smartboard captures the inputs of the user and transfers them as inputs to the computer system running the smartboard software. The connection between the computer, smart board and projector can be done either wirelessly or via cable connection.

According to TechLearn (2019), there are three different kinds of smartboard technologies, namely;

1. **Resistive Membrane:** These smart boards have a soft, flexible surface similar to vinyl consisting of two pieces of resistive material separated by a small gap which creates a touch-sensitive membrane. They can be drawn using fingers or a special stylus that can represent pens of different colours via software selection. Movement is tracked by detecting the pressure of the stylus object on the surface. The co-ordinates correspond to the area on the computer monitor.
2. **Electro-Magnetic technology:** These smart boards are similar to traditional non-smart boards in that they have a hard surface and can be drawn on with normal pens or markers. To work interactively, they require special battery-driven pens that emit a small magnetic field detected either by the frame of the smart board or by a grid of fine wires embedded beneath the surface of the board.
3. **Laser Scanners:** These smart boards have a hard writing surface with infrared laser scanners mounted in the top corners of the board that detect pen movement. To work interactively they require special felt pens, each of which has a uniquely encoded reflective collar that the lasers used to register its colour and position.

The software used for the smart board allows a range of activities, including those that can be used without the use of the board (e.g., projecting presentations and short films, writing, and erasing the board) as well as activities unique to this technology (Manny-Ikan & Dagan, 2011). For example:

1. **Drag and drop:** an item on the board that can move in various directions.
2. **Hide and reveal:** an item located on top of others can be removed.
3. **Highlighting:** a clear colour that can be placed on top of writing.
4. **Animation:** items can be spun, change the size, and moved in a pre-determined direction.

5. **Storage and recall:** unlimited storage and quick recall of material.
6. **Feedback:** when touching a particular item, there is visual or auditory feedback.

Examples of software used for manipulating the smart board are Groupboard, Open-sank More, Doceri, and ezTalks.

Technical Know-How by LIS Educators

Five central skills needed by LIS Educators to adequately use the smart board technology for teaching and learning are:

1. **Information skills (literacy):** Skills that relate to the ability to gather, edit, analyse, process, and connect information;
2. **Higher order thinking skills:** In particular, problem-solving, critical thinking, and creative and entrepreneurial thinking;
3. **Communication and cooperation skills:** The ability to work in a team, and to belong to various communities;
4. Skills to use technological tools, despite the feeling that young people know how to do this; and;
5. **Learning skills:** In particular, the development of autonomous learning (Manny-Ikan & Dagan, 2011).

In essence, there is a need for technical, pedagogical, methodical and communication training to leverage creativity by library and information science educators while using the smart board technology (Sarsa & Soler, 2011).

Uses of Smart Board Technology for Continuing LIS Education amidst COVID-19 Pandemic

Schools and higher institutions across the world are utilising this innovation to resuscitate teaching and learning as well as encourage correspondence and collaborative learning amidst the COVID-19 pandemic. Smart boards offer a scope of devices that make videoconferencing simpler, which makes it ideal for virtual learning during the COVID-19 period. They can bolster multimedia content including text, pictures, and sound and video, which make presentations more interesting (EzTalks, 2019). The uses of smart board technology for continuing LIS education amidst the COVID-19 pandemic include the following:

1. It enables virtual teaching and learning from various remote locations. It facilitates remote lecture delivery and allows remote students, especially the disabled, to participate in the class discussion amidst the COVID-19 pandemic;
2. It allows connection to a huge amount of information resources on the Internet;
3. It allows the creation of handwritten text, drawings, concepts, and maps on the go, all of which can be saved for posterity and retention;
4. It facilitates sharing of knowledge to students within and outside the classroom;
5. It caters more effectively for visual impaired students and other students with special needs;

board software often includes easy-to-use charts, polls, and graphs, including a virtual versions of traditional classroom aids like rulers, compasses or protractors. They can also play various types of media and provide educators with interactive lessons for their students.

Literature Review

A Smart board is a large interface that combines some of the features of a computer system and digital projector to facilitate interactive content for learning instructions and ICT engagement. Smart board has a large interactive touch-screen, hence the name smart board. Unlike the traditional whiteboard which only allows writing with a marker, the smart board allows users to create content, save content for future uses, share content with other connected devices or online and allows updates (National Centre for Technology in Education, 2009). The smart board can be seen not only as a teaching aid but as a resource-hub that allows educators to exploit various resources and technologies at the same time and in one place (Majzlik, n.d.). A Smart board can also be described as a touch-sensitive teaching and learning device that is used in connection with a computer and a digital projector. Similarly, Lewis (2009) cited in Majzlik (n.d.) opined that a smart board is a touch-sensitive board that is connected to a computer and a projector and displays the content of the computer screen. Furthermore, it allows the computer contents/objects to be controlled and manipulated by touching the projection on the board, unlike a conventional projector. The Smart board is the most effective classroom teaching board compared to its predecessors. According to Akbaş and Pektaş (2011), the smart board will gradually replace the traditional black and non-interactive white boards which were years back considered indispensable.

Smart board supports multimedia which makes it an innovative teaching and learning aid in the 21st century. It has an interactive interface or screen which allows an instructor to write using a styluses pen, finger or computer mouse, a camera to capture images, audio and video player, flash player, power point enabled and software which provides other functions like a computer system displayed on a large screen for all students in a class to view. This technology can mix two or more media types, for example, audio files could be linked to the words displayed on the screen so that students can hear pronunciation or a video or animation could be added for demonstration for a qualitative teaching and enhanced classroom interaction (Gosain, 2016). Similarly, Akbaş and Pektaş (2011) indicated that a smart board operates by connecting a computer system, a projector and a touch screen electronic board. At the core of the smart board lies a touch screen board which teachers and students write to experiment, draw, solve, and erase applications such as visual experiments, animations and graphics. Other peripherals such as electronic microscopes, multimedia materials, videos, data tables, CD ROM, or Internet connectivity may be explored depending on the software programs used by the smart board (Miller, Glower and Averi, 2005).

It should be added that smart board technology facilitates multiple means of representation and it also supports various ways of expressing multimedia. Photographs can be zoomed in and out, sound recording can be stopped and started, video files can be edited into a relevant snippets, text can be manipulated and many more ways to deal with the multimedia contents are offered by the smart board software. Another interesting feature of this technology is the ability to connect to the Internet on the go. This gives access to a pool of multimedia resources on the web for richer classroom instruction (Gosia, 2016). Smart board enhances knowledge creation, processing and sharing of ideas through word processing, presentations, databases, spreadsheets, and designs. In addition, the board provides a playback mechanism to review previously displayed, stored, recorded or retrieved contents.

Types of Smart Board Technology

There are two types of smart boards used as teaching aids; interactive and non-smart boards. The later denotes the dry-wipe board (Teheran, 2019). It resembles the traditional wood-like blackboard but with a white background and rigid surface used for writing with the aid of a marker. The advancement of this technology over the blackboard is the ability to clean written text quite easily and efficiently and write conveniently with a marker without chuck dust spreading over the body. This type of smart board is static and does not allow saving, retention (playback) and interaction with it, hence it is non-interactive. The second type of smart board technology is interactive, hence the name 'smart boards'. This type of smart board technology is touch-sensitive, it allows the creation of contents, sharing of knowledge, retention of ideas employing saving the contents for future retrieval and interaction with the objects (text, symbols, diagrams, maps, videos, audios). These features foster the intellectual growth of students, hence an absolute teaching aid for library and information science education (National Centre for Technology in Education, 2009). The smart board is the electronic version of a dry-wipe board on a computer that enables students in a classroom or remote locations to view what the teacher, presenter, or fellow student writes or draws. This type of smart board technology requires prior knowledge and technical know-how on how to use Information and Communication Technology (ICT) for both the teacher and students.

Smartboards can be standalone touch-sensitive computers used independently to create, edit, present and share content, or an integral part used in conjunction with a project to manipulate the content or objects in a computer. According to Wikipedia (2019), the first smart boards were designed and manufactured for use in the office. They were developed by PARC around 1990. This board was used in small group meetings and round-tables.

Components of the Smart Board

The smartboard comes with associated devices or components such as:

1. The smartboard itself;

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Abstract

The outbreak of the novel coronavirus (also known as COVID-19) and the resulting lockdown of various schools and high institutions have necessitated the government and management of institutions to reinvent their mode of teaching and learning. Onsite lectures are now being delivered online on the Internet for innovative and continuing education amidst the outbreak of the pandemic. Moreover, advancement in the field of the Internet of Things (IoT), as espoused in the 4th Industrial Revolution has ushered various smart technologies that library and information science Educators can leverage, for innovative and continuing education amidst the COVID-19 pandemic. One of these smart technologies is the smart or interactive board. This study aims to explore the application and use of interactive smart board technology, stand-alone or networked, for innovative and continuing library and information science education amidst the COVID-19 pandemic. The requirements for the technology comprise the interactive board, a computer system which consists of appropriate software, overhead high-definition (HD) projector, electric pen and uninterrupted power supply system (UPS). The procedure involves knowledge creation with the aid of a Microsoft Word processing application which is processed into presentations using Microsoft PowerPoint software. The study further explored the features of this system which include remote or virtual delivery of lectures, collaborative teaching and learning, video conferencing, class replay, self-archiving and the ability to connect to the Internet to access a vast amounts of resources. Challenges facing the adoption of the technology were identified and appropriate suggestions were proffered.

Keywords: 4th Industrial Revolution (4th IR), COVID-19, Education, Library and Information Science, Smart Board.

Introduction

The birth of the 4th Industrial Revolution (4th IR) was ushered by the emergence of several technologies including Artificial Intelligence (AI), robotics, virtual reality, cloud computing, quantum computing, 3D printing, big data and the Internet of Things (IoT) for smart technology development. Although IoT is in its infant stage, the progress made in the development of smart homes, smart cars (or autonomous vehicles) and other smart technologies such as the smartboard, is gaining widespread application in many industries and professions including education. Today, we have smart classrooms where lectures are delivered from remote locations, and students' sign up to join the class from different parts of the world through their PCs and mobile phones, overcoming the barrier of geographical location. This incredible innovation is making learning more interesting. Also, it is paving the way for globalized learning and cross-cultural integration of knowledge and intelligence for sustainable education.

The emergence of smart technologies is transforming the educational setting, methods of teaching and learning, including the ability to manipulate digital technologies for educational purposes, for a more efficient, effective, convenient and student-centred pedagogy. Advancement in the field of IoT has necessitated the integration of smart technologies into classrooms for more enhanced and qualitative teaching and learning activities (Garba & Attahiru, 2018). The appropriate use of this technology in education can help schools respond to the diverse needs of students in a timely and adequate manner, regardless of geographical barriers. Technology is at the centre of almost every aspect of our lives and has transformed many systems by making them more efficient, organized and creative (Giannikas, 2016). Today, the use of smart technology in education has become fundamental with the outbreak of the novel coronavirus (COVID-19) and subsequent lockdown of various institutions. Various institutions across the world are transforming their mode of teaching and learning to adopt smart technologies for the virtual delivery of lectures amidst the COVID-19 pandemic. Hence, a veritable tool for innovative and continuing library and information science education in the face of the COVID-19 pandemic.

Smart board technology is one of the strands of IoT in education. Succinctly, a smart board, also known as an interactive whiteboard, is an interactive display in the form of a whiteboard that reacts to user input either directly or through other devices (Haugh, 2017). Smart boards have been used as a way for people can share messages, present information, and engage in collaborative brainstorming and idea development. As a tool for collaboration and cooperative learning, the smart boards can connect to the Internet and instantly digitise tasks and operations (Rouse, 2017) The technology behind smart boards varies between large format screens with a standalone system or a chip and combinations of video projectors or smart projectors that use a tablet and other devices with drivers for user interaction. The smart board can be operated either infrared or resistive touch, magnetic or ultrasonic pen. As writing and optical character recognition is now digitized, keyboards are in most cases unnecessary. Smart

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leverage solar and/or inverter technology as a source of power for the knowledge-sharing system. In the same vein, the government should address the problem of erratic power supply more seriously through research and development of alternative sources of renewable energy.

7. Proper Maintenance: A maintenance schedule should be set up for the facilities to prolong their lifespan.

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