

## INFLUENCE OF COMPUTER AIDED INSTRUCTION (CAI) ON STUDENTS' ACADEMIC PERFORMANCE IN WOODWORK TECHNOLOGY

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### Abstract

*This study examined the influence of computer aided instruction (CAI) on students' academic performance in woodwork technology. Computer aided instruction (CAI) are constructivist in nature, hence they promote cognitive development and active learning which in turn enhances performance. Historically, the teaching of woodwork technology has been far from what has been expected. Teaching approaches in woodwork technology have not adopted the computer based learning instructions. Therefore it is important that the teaching of woodwork technology must develop both mental and manual skills in students. However, the study emphasized the significance and benefits of employing CAI computer-aided instruction to improve the instructional process in the teaching and learning of woodwork technology. Furthermore, the benefits of CAI as well as its use for improving students' academic performance in woodwork technology were discussed. Additionally, this paper recommends among others that, for effective teaching and learning activities, the usage of CAI for instructional facilitation for woodwork technology and other vocational and technical subjects/courses should be made mandatory.*

**Keywords:** computer-aided instruction, academic performance and woodwork technology

### Introduction

Educational institutions employ a variety of teaching and learning strategies. These comprise observational techniques, explanatory techniques, and inquiry techniques, project approaches, and concept-based learning (Adeyemi et al., 2012). Nonetheless, the majority of teachers employ teacher-centered approaches, sometimes known as the "chalk and talk" or "banking" form of instruction. These teacher-centered strategies are based on behaviorist theory, which holds that lecturers, teachers, and other educators are the only ones who can truly teach their students. Students were exposed to Pavlov's notion—that people might be conditioned to exhibit certain predicted behaviors—as a result of the behaviorist theory (Burke, 2009). This makes the assumption that students are unable to participate in their own education as teachers were perceived as all-knowing.

Academic performance is an achievement result that shows how well a person performed in relation to particular objectives that were the focus of activities in instructional environments, particularly in schools. Academic performance, according to (Scott's, 2012), relates to how successfully students are completing their assignments and studies. It refers to the academic success of pupils and their ability to manage or complete the many learning tasks assigned to them by their teachers.

In senior secondary schools, technical colleges, colleges of education (technical), and universities that offer technical education, woodworking technology is a vocational subject or course that is taught for the manufacturing of furniture and cabinetry. Woodwork technology places an emphasis on a combination of basic and sophisticated machine operations. It is aimed at transmitting both theory and practical skills.

If one were to examine the topics covered in Woodwork technology, one would see that the course's or subject's goal is to not only provide students with a foundational understanding of the subject, but also to

instill in them the practical skills necessary to foster their own personal growth. The pedagogical approach, which is focused on teachers' methods of transferring facts and concepts of the disciplines, is highly necessary in order to accomplish this. This suggests that instruction in woodworking technology must be efficient and worthwhile.

Nevertheless, since woodwork technology is a practical-oriented course, it will undoubtedly take on a more positive and engaging aspect when it is taught to the students using more up-to-date methods of instruction, such as computer-aided instruction (CAI) or practical methods. As a result, there is a need for an alternative teaching strategy that can help teachers concretize the abstract concepts in the curriculum contents of woodwork technology while presenting lessons.

On the other hand, the current technological revolution has improved the educational system. New opportunities for the delivery of teaching are made possible by the usage and expansion of technology in the classroom (Ochoyi & Ukwumunu 2008). Additionally, Adedamola (2015) noted that educators using technology to improve teaching and learning have grown in number across a range of disciplines, and the approach has been demonstrated to be successful. When used effectively, technology in the classroom can support pedagogy and improve instruction.

Computer technology has been applied to education in a number of ways to enhance the teaching and learning process, such as computer assisted instruction (CAI) and computer managed instruction (CMI). An educational system of instruction known as computer assisted instruction (CAI) involves the use of computers nearly exclusively for instruction. It consists of many computer-based programs that offer interactive training. Computer Assisted Instruction (CAI) is a method of teaching where students are taught a variety of disciplines. The computer is used to interactively convey information and messages to the student through drill, practice, tutorials, and discourse (Imhanlahimi and Imhanlahimi, 2008).

Significantly, CAI activities appear to be at least as cost-effective as and sometimes more cost-effective than other instructional methods, such as teacher-directed instruction and tutoring. Students also learn instructional contents faster with CAI than with conventional instruction alone and retain what they have learned better with CAI than with conventional instruction alone (Mudasiru and Adedeji 2010).

### **Concept of Woodwork Technology**

Woodwork is a form of education and training that is aimed at preparing students to earn a living through application of technology and design (Okwori, 2012). It provides the learner with knowledge and skills to necessitate self-employment and self-reliance. Umar (2014) and Chinonso (2014) views Woodwork as a course aimed at transmitting both theory and practical skills.

Agbo (2000) defined woodwork technology as the kind of education aimed at preparing students to find employment in a field where success is largely reliant on knowledge of technology as applied to contemporary technology and design. And this kind of education, in accordance with

### **Concept of Academic Performance**

Students' academic performance is a concept that has gained increased momentum recently, this is not just because of the increased concern on the performance of students in public examination but because of its importance in the field of education (Sunday-Piaro, 2018).

Academic performance is the degree to which a student successfully completes their assignments and academic work (Scott's, 2012). It is the result of a student's tenacity, diligence, and academic endeavor. Academic achievement was defined by Pandney (2008) as how well students performed in the courses they were taking in school. The students' standing in the class is determined by this. Children can use this as an opportunity to grow academically, develop their talents, and raise their grades.

Olaitan (2017), posited that academic performance is a very important tool with which the success, ability and capability of a student to contribute to the development of a society are measured. This implies that behavior that can be observed at a particular time is what performance measures. Additionally, Bell (2012) defined academic performance as the methods or approaches that students take to manage their studies and the many duties that they are assigned by their teachers. It is the capacity of students to learn, retain information, and convey knowledge either orally or in writing.

Academic performance is the degree to which a student, teacher, or institution has met their short- or long-term learning objectives. It is also defined as performance on task with measures such as comprehension, quality and accuracy of test answers, quality and accuracy problem-solving, frequency and quantity of desired outcomes, time or rate to solution, time on task, level reasoning and critical thinking creativity, recall and retention, and transfer of tasks (Kobaland and Musek, 2011).

### **Understanding of Computer-Aided Instruction (CAI)**

Computer-aided instruction (CAI) is the use of a computer to deliver lesson content through simulations, tutorials, and drill and practice. According to Kyaw, Koki, and Chang (2008), the phrase is used interchangeably with the terms computer-based learning (CBL), computer-based instruction (CBI), and computer-assisted learning (CAL).

Although CAI can relate to the employment of computers in a classroom, it more widely refers to a controlled environment in which computers are employed for educational objectives. Students can work at their own pace and receive personalized feedback directly from computers thanks to applications like CAI. Confusion can be cleared up as it arises with the aid of CAI, and the instructor has access to the students' records and results.

### **Models of Computer Assisted Instruction**

There are two models for designing interactive educational programmes.

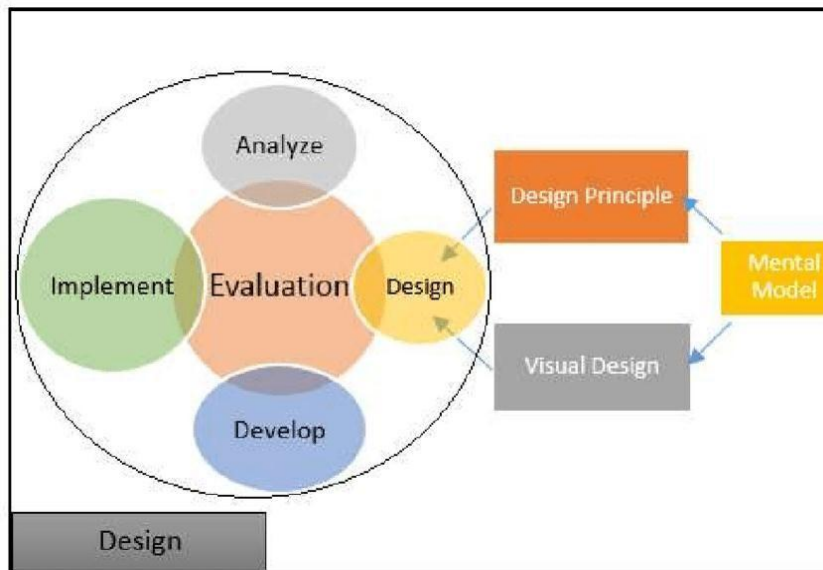
1. Instructional System Design (ISD)
2. Hypermedia Design (HMD)

### **Instructional System Design (ISD)**

Instructional design is where enhancements are infused into the basic lesson structure and made part of it. Instructional design is the systematic approach to the analysis, design, development, implementation, and evaluation of learning materials and activities (Sam, 2013).

(Barry, 2011) posited that instructional design is where digital learning is harnessed, a teacher's relationship with students is materialized, and learner choice, gamification, and project-based learning are given constructive limits. Instructional Design is focused on the systematic process of learning.

Instructional design aims for a learner-centered rather than the traditional teacher-centered approach to instruction, so that effective learning can take place. This means that every component of the instruction is governed by the learning outcomes, which have been determined after a thorough analysis of the learners' needs.



**ADDIE MODEL OF INSTRUCTIONAL DESIGN**

### **Hypermedia Design (HMD)**

Hypermedia is any interactive media system that permits a user to navigate through hyperlinked information by means of various user-selected paths including such application as interactive websites, electronic catalogues, intranet, interactive e-commerce system CBT and online information services (Barry and Lang 2013).

This definition recognizes that hypermedia technologies include but also pre-date the Web, and the traditions of hypermedia development are longer than usually acknowledged. Notwithstanding these traditions, hypermedia systems development is in many regards different from “conventional” systems development. Chief amongst these differences is its multidisciplinary nature.

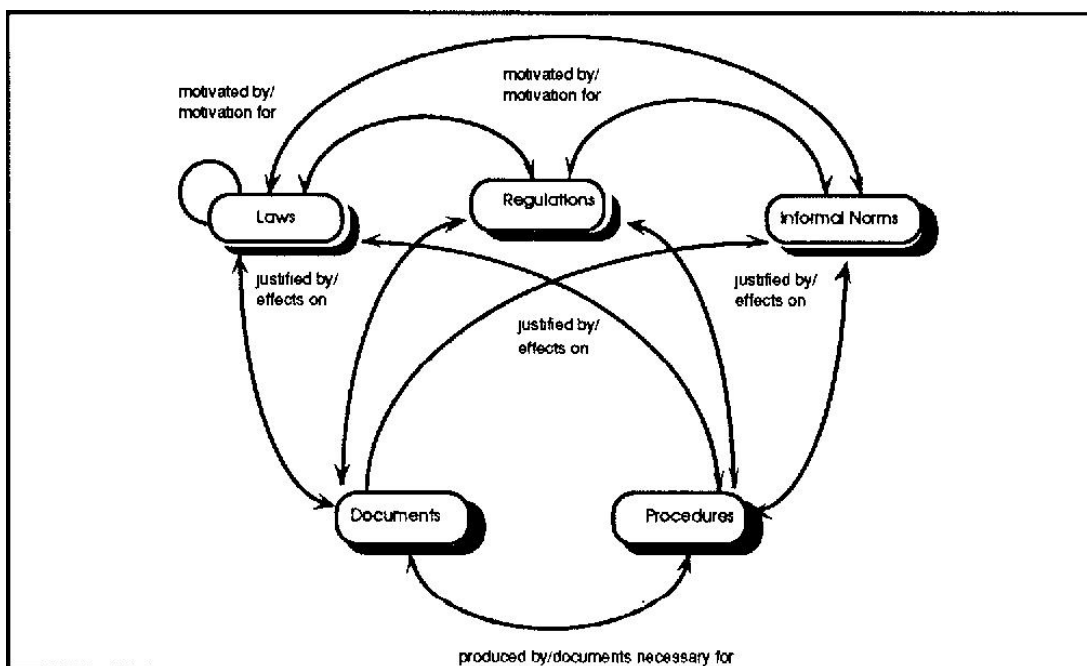


Figure 1. Schema of Entity Types and Application Link Types for a Banking Application.

### Types of CAI Programmes

There are many types of Computer Assisted Instruction Programs. Each of the CAI program is appropriate under different instructional circumstances and therefore takes a different pedagogical approach. Although the beginning of CM was presentation of programmed instruction through computer and initial forms of CAI i.e. tutorials, drill and practice and games were oriented to behaviourist theories of learning.

However, due to the sophistication of computer languages, any type of CAI can now be modified in accordance with any theoretical framework, so no longer is any type of CAI simply tied with a particular learning theory. The following types of CAI software have been referenced and described by Poole (2007), Cox (2005), Geisert and Futrell (2005), Maddux, Johnson and Willis (2007), and Bitter and Pierson (2009):

- Drill and practice
- Tutorials Instructional
- games
- Information retrieval systems
- Simulations
- Micro worlds
- Cognitive tools for learning
- Productivity Tools Communication
- Tools Integrated learning system
- (ILS)Problem solving

**Drill and practice:** Packages for drill and practice provide methodical reinforcement of ideas that have already been learnt. They are built on exchanges of questions and answers and ought to provide the student with useful feedback. Games may be incorporated into drill and practice programs to boost motivation. Drill and practice are frequently used to boost a student's performance's speed or accuracy. Students can solve issues or respond to questions using drill practice software and receive feedback on their accuracy. It is a crucial method of learning for developing fundamental knowledge and intellectual abilities, such as word

usage, spelling, sentence composition, and number sense. The building blocks of higher order intellectual activity are these abilities.

Good Drill and practice software is typically associated with behaviourism, because students are commonly given 'stimuli' (questions), and they are required to make responses to the stimuli, and then receive some sort of reinforcement. (Hsu, Chen & Hung; 2000; Roblyer & Edwards, 2000; Poole, 2004; Geisert and Furtell, 2005; Maddux, Johnson and Willis 2007).

**Tutorials:** Tutorials are used to educate fresh ideas and procedures. The student is given the material in a systematic manner. Worked examples are typically included in tutorial software, which also offers the learner the chance to gauge their comprehension through questions, responses, and feedback. Based on the student's activities, intelligent tutoring systems can provide remedial feedback and modify their presentations to the student. The program keeps track of progress based on the outcomes of the quiz that either has the user review previous content or move on to new material. An excellent tutorial presentation is engaging, comprehensive, sensitive to the user's capabilities, and it offers timely feedback. User engagement and persistence depend heavily on interactivity (Cox 2005; Poole 2007; and Roblyer 2000).

**Instructional Games:** By incorporating game rules into learning activities, instructional games are a type of courseware designed to boost motivation. Drill and practice or simulation courseware can be similar to educational games, but because of the fun and competition they foster, educational games have a different meaning for students. Because of the challenge of the competition and the possibility of winning, students anticipate an enjoyable activity when they know they will play a game (Roblyer and Edwards, 2008). Role-playing is frequently used in some simulations that are intended to be games, according to Ugwu (2008). In these simulations, the program focuses on how the learner interacts with the model as well as the underlying model.

**Information Retrieval Systems:** Information retrieval systems allow learners to browse or search for information as needed and preserve knowledge in a systematic manner. Online databases, structured information systems like dictionaries and encyclopedias, as well as hypertext and hypermedia reference systems are among them.

**Simulations:** Simulations represent an experiment, a real-world or made-up circumstance. The simulation's setting could be a business proposal, a lab experiment, or an animation of a chemical factory in operation. A simulation emphasizes discovery and exploration learning. There may be more than one way to complete the activity; there isn't always a single right or set answer. Through direct manipulation of the factors in the model in a computer simulation, students have the chance to explore and uncover linkages. Alessi and Trollip (2008) identified two primary categories of simulations:

**Those that teach about something Those  
that teach how to do something**

These two main types are further classified into four categories i.e. physical process, procedural and situational simulations.

**Micro Worlds:** Micro worlds use the computer to create a problem solving environment and are derived from the work of the cognitive psychologist Jean Piaget. Seymour Papert, for example, introduced the Logo language into schools to encourage children to learn about mathematics in a Math land micro world.

**Cognitive tools for learning:** Cognitive tools for learning are based on the constructivist principle that learners need to construct their own understanding of new concepts. These tools give the learner a way (often graphical) of representing their understanding of new knowledge and concepts and how they relate to existing knowledge and concepts. Expert systems and authoring tools can also be used in this way, allowing the learner to present his/her understanding in a way that can be accessed by other learners.

**Productivity Tools:** Productivity tools include applications such as word processors, spreadsheets, databases, graphics, desktop publishing and presentation packages. Whilst these tools are not specific to Learning Technology, if used within a pedagogical framework, they can support learning by enhancing the quality of the learning process and by improving student productivity. For example, word processing encourages drafting, reflection and editing and removes from the student the chore of having to re-write any written submission. Spreadsheets can promote a structured approach to problem solving and enable the student to spend more time on the task in hand rather than on routine or lengthy calculations. Databases can be used to help students, as well as staff, to organize information related to their courses and to develop their information handling skills.

**Communication Tools:** Computer-mediated communication takes several forms including electronic mail, electronic conferencing, video conferencing and the World Wide Web. These tools allow learners to share ideas and information, to cooperate, to collaborate on joint work and can also be used for submission and publication of students' assignments and of tutors' comments on students' work.

**Electronic Mail:** (e-mail) is an asynchronous communications medium, not requiring the recipient of a message to be co-ordinate in time or place with the sender. Further, e-mail can be used one-to-many, as well as one-to-one. These characteristics are helpful in maintaining communications between tutor and student, tutor and students and among students since they overcome constraints of distance and time.

### Characteristics of CAI Programmes

The field of CAI is intriguing because of its many distinctive characteristics. Its suitability for distance learning is one of its most advantageous features. Before microcomputers were the norm, distant learning was primarily carried out using PI or the US mail system, with telephone interaction as a backup (Jonassen, 2000). Contrarily, CAI offers frequent, timely communication with the instructor and up-to-date feedback. Repeating tutorials as often as necessary allows students to progress at their own speed.

According to Sansanwal (2000), CAI can be used with more pupils than a regular classroom could accommodate. Individuals with disabilities now have access to resources that were previously unavailable thanks to CAI and web-based education. Intelligent computer-assisted instruction (ICAI) is computer-programmed to adjust to each student's unique learning needs. It gathers data on the student's prior knowledge of a subject and learning objectives, then builds a user profile based on this information. After that, it can customize itself to each pupil. The distinctive feature of web-based education is that it allows instructors and/or students to instantly contact with one another from any location in the world over the Internet. You can get the instructor's feedback right away. Some other unique qualities of CAI include:

**Individualization:** A computer software can offer a variety of learning paths that are suited to each learner's needs (Stelberg, 1991). Students discover a variety of courses to take; each student chooses a path based on his or her needs, including prior subject knowledge, aptitude, interest, and intellectual potential. The use of a game format can increase motivation, foster fantasy, and keep learners' interest. With the use of illustrative animation, dynamically producing images, and interspersing voice explanations, concepts can be conveyed in tutorials. Simulations can offer fresh perspectives on relationships and events that would not be possible otherwise.

**Remediation Options:** After examining student responses, the computer can change educational strategies and customize them to account for individual variances. The order of instruction is decided by the student's performance history records. In one kind of remedial program, the instructor runs a computer program to assess the student's cognitive style, achievement level, and capacity for learning.

The instructor selects student-specific content in accordance with the diagnosis. By utilizing branching method and/or incorporating hyperlinks to give text, pictures, or any other sort of material for remediation, computer assisted training applications can quickly provide corrective measures.

**Graphics and Sound:** Graphic representation plays an important role in instruction. In addition to pictures, computer graphics also include the use of screen formatting features such as arrows, boxes and illustrations to emphasize the concept. This nonverbal mode of instruction helps to build comprehension in areas that are difficult to teach by other instructional techniques. Sound in a program can prompt, focus, or "reinforce" students and thus enhance instruction. At a more sophisticated level, some CAI programs include speech synthesizers that produce words or sentences. Synthesizers are especially applicable with software for the very young or handicapped users. Computer graphics and sound infuse movement, excitement and animation into a program.

**Self-pacing:** Self-pacing lets students proceed at a pace appropriate for their individual learning levels. Students using self-pacing can control the time allowed to solve a problem as well as the rate of presentation; they can spend several weeks with remedial material or skip an entire lesson. When they feel ready to be tested on the specific material, they can choose the testing cycle. Self-pacing can help to individualize instruction for those students who have used the program before or have prior knowledge of the subject. Self-pacing can be combined with self-placement testing, which directs the student to an appropriate beginning point and to an optimal instruction rate.

### **Using computer-aided instruction (CAI) to raise students' academic performance in woodwork Technology**

According to studies, the methods employed to instruct students have a significant impact on their academic performance. Many studies have been carried out employing technology-based resources that support students' active participation and are capable of enhancing their capacity for thought and problem-solving. For institutions, computer-based instruction is preferable to the traditional teaching approach (Khirwadkar, 2011). As previously said, using CAI in addition to traditional training has the potential to result in more achievement than using traditional instruction alone. The level of retention may also be higher with CAI than with conventional approaches, and students can absorb instructional materials more quickly with CAI.

Marr (2011) claimed that CAI could raise students' motivation. Additionally, research has shown that students who use computers are more successful and eager to learn, compared to those who use some traditional methods (Wishart, 2008). Contrary to traditional teaching and learning approaches, CAI is beneficial for all student levels, including those with special needs.

According to Ivers (2008), employing computer instructions can provide students the chance to learn and put their newfound skills to use in the actual world, which is a benefit that conventional teaching techniques do not offer. According to the International Society for Technology in Education (2009), teachers who switch from traditional learning environments to new learning environments encourage active learning, higher level thinking, collaborative learning, and multimodal stimulation. Online contact and a broader knowledge base can both be provided via computer-assisted training. The context is presented during computer-assisted training, which aids students in maintaining their focus (Becker, 2009).

Khirwadkar (2011) did research on the creation of a CAI chemistry package for pupils in standard 6 science utilizing the Baroda Indian Government Science and Technology Board (GSTB) Syllabus. The results of the study demonstrated that the software program created for teaching three units of the GSTB's grade 6 chemistry textbook was more efficient than teacher-centered techniques in terms of student accomplishment and time. It also demonstrates that factors like IQ, academic ambition, and attitudes were discovered to have an impact on the academic success of children in the experimental group.

Woodwork as an applied science and technical course requires intensive practice in order to ensure that students properly comprehend the skills embedded in it. Chikasanda et al. (2011) pointed out the lack of research to study instruction approaches in technical education is a major challenge. The impact of woodwork as a subject in our day-to-day lives is largely dependent on the skills that teachers have (Umar, 2014).

However, emphasis should be placed on the mode of teaching woodwork technology practical aspects of woodwork other than theory as it provides skills that promote self-reliance in individuals. In this regard, the use of computer-aided instruction in woodwork technology becomes very vital as it will promote students' performance. This agrees with the position of Okwo (2008) that, the use of computer makes learning of science, technology and mathematics faster and easier as well as consequently made learning effective, efficient and fun.

The need for using computer-aided instruction (CAI) in woodwork technology is quite necessary as this approach will expose learners to self-learning which helps them process and retain knowledge without the help of another person. Alade (2011), posited that there is need to shift teaching of technical courses from traditional didactic technology to approaches that are constructivist in nature where learners are expected to construct knowledge from their experiences.

### **Conclusion**

This study through related literature has revealed that computer - aided instructions (CAI) will influence students' performance in woodwork technology if used as a means of teaching the subject/course.

Computer aided instruction (CAI) becomes an essential mode of instruction especially when there is absence of modern woodwork technology equipment and machines needed to teach the required skills. CAI through simulations, pictures and videos helps students learn the use of woodwork tools and machines.

Additionally, many studies have indicated that students who learn sciences and technology subjects through CAI outperformed the group that learn through traditional approach in content acquisition, knowledge interpretation, application of concepts and principles and analytical skills. Likewise, some studies have also reported the success of CAI in many other fields.

The study finds that, compared to traditional teaching methods, computer-assisted instruction has a stronger potential for enhancing students' learning and performance in woodwork technology. The advantage of computer-assisted training over the traditional teaching approach appears to be related, among other things, to the concept's realistic style of display and the students' participation in realistic activities. Thus, it can be said that computer-assisted instruction has the potential for better and more efficient student learning, which will ultimately lead to increased academic success.

### **Recommendations**

Based on the related empirical studies, the following recommendations were made:

1. For effective teaching and learning activities in woodwork technology and other vocational and technical subjects/courses, computer-aided instruction (CAI) should be adopted for instructional facilitation.
2. Effective training in the creation and application of CAI in the teaching profession should be made available to all educators.
3. Every idea that calls for the application of unique teaching techniques, such as CAI, should be identified and expressly stated to be supported by such a learning package.
4. Particularly in science and technology-based disciplines and courses, the incorporation of technology-based teaching methodologies ought to be made mandatory.

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