Cybernetic-Based Instruction: An Innovative Learning Model in the Digital Age

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Abstract

Education is both a basic human right and a core element of sustainable development. Sustainable Development Goal 4 seeks to “ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.” With the advancement of technology, enrichment of online educational resources, and the use of the internet, educational institutions worldwide are witnessing a massive trend towards the integration of technology within their education and learning methodology. The fulcrum of the learning process is being altered from teacher-centered, direct instruction to student-centered or active learning. One way to achieve student-centered learning is to make use of technology by incorporating interactive learning, video lessons, and online interaction, where students can take the initiative in the learning process. Cybernetic-Based Instruction (CBI) is a form of self-instruction in which the teacher facilitates and guides the students towards achieving the objectives of the lesson by utilizing the internet as a search tool. CBI is an innovative learning model that leverages digital technologies to enhance the learning experience. It combines principles of cybernetics, which is the study of control and communication in complex systems, with instructional design and educational technology. In the digital age, technology has transformed the way we access and process information. CBI takes advantage of this technological advancement to create a more interactive and dynamic learning environment. It employs various tools and techniques to facilitate learning, such as computer simulations, virtual reality, artificial

intelligence, and data analytics. This review paper explores the concept of CBI as a cutting-edge learning model in the digital age. The rapid advancements in technology have revolutionized the way education is delivered and received. CBI harnesses the principles of cybernetics to create an interactive, personalized, and data-driven learning environment. This paper examines the key features, benefits, and applications of CBI, highlighting its potential to transform education and prepare learners for the challenges of the digital era.

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Introduction

In the digital age, traditional educational approaches are being redefined to align with the evolving needs of learners. Cybernetic-Based Instruction (CBI) emerges as an innovative learning model that capitalizes on the advancements in technology and the principles of cybernetics (Yablonskaya, 2023).

For a long period of time, the teacher has been at the center of the teaching style in medical education, with giving lectures to groups of learners as the main teaching method. However, with the rapid development of the internet, the learning style of learners has changed. Moreover, teaching is no longer limited by time and location. Thus, teachers are able to utilize various teaching modes and appropriate methods (Huang et al., 2020).

Contemporary students are very technologically savvy and have a vast understanding of the latest technological devices. They learn better through visually enriched resources such as smartphones, computers, and the internet (Huang et al., 2020). It is not possible to capture the attention of these students using traditional methods that were used in the past. These traditional methods often lack interactions between teachers and learners and limit learners from actively thinking, thus leading to poor development of their cognitive abilities (Aruna & Thenmozhi, 2014; Huang et al., 2020).

After decades of research focused on teaching and learning strategies, the effectiveness of an “active-learning” model has

been clearly documented. With the advancement of technology and the enrichment of online educational resources, educational institutions worldwide are witnessing a massive trend towards the integration of technology within their education and learning methodology. The fulcrum of the learning process is being altered from teacher-centered, direct instruction to student-centered or active learning. One way to achieve student-centered learning is to make use of technology by incorporating interactive learning, video lessons, and online interaction, where students can take the initiative in the learning process (Halasa et al., 2020).

Lecture or the traditional method of learning is highly dependent on the knowledge base and skills of the teacher, requiring well-organized content preparation and good communication skills (Huang et al., 2020). Cybernetic-Based Instruction (CBI) is a form of self-instruction in which the teacher facilitates and guides students towards achieving the objectives of the lesson by utilizing the internet as a search tool. In the lecture method, students may receive the content by the instructor reading selected traditional books, attending class, and taking notes. On the other hand, CBI enables students to learn through active learning, collaborative learning, greater student independence, and task-based teaching (Aruna & Thenmozhi, 2014).

Modern learning theories, namely constructionism and social constructivism, posit that learning takes place when students are actively involved in their own learning process through social interaction. However, research shows that teaching and learning continue to take place in the traditional way in this information age, despite the need to develop learners' critical thinking skills. This adherence to traditional practices is assumed to be due to instructors being unable to keep up with the pace of advances in pedagogy and emerging technologies (Almodaires et al., 2018).

Administrations of institutions of higher learning across the globe are challenging their respective faculties to incorporate this relatively new model into their classrooms. Some academic disciplines have embraced this approach to instruction with enthusiasm, while others, including nursing and midwifery disciplines, seem more cautious in moving towards adoption (Aruna & Thenmozhi, 2014).

Literature Review

Cybernetic-Based Instruction (CBI) is an important feature of web-based learning, based on the principles of self-learning. This situation requires existing educational programs to be evaluated in line with these qualities and outcomes (Şenyuva & Kaya, 2014). CBI, an emerging trend in teaching, is considered a variation of the flipped classroom and smart classroom. Instead of providing traditional in-class lectures, the concept of CBI allows students to search the internet for the content and objectives of the lesson, while the teacher serves as a facilitator (Baron & Africa, 2015). Student-centered learning is at the core of CBI, with the teacher's main task being to highlight the lesson's content and moderate student responses, rather than delivering lectures. CBI creates an environment where the student is the focus and provides an opportunity for students to develop higher-order thinking with guidance from the teacher and support from peers. Instead of relying on traditional in-class lectures, CBI shifts the focus to the student's active role in searching for and discovering content and learning objectives on the internet, while the teacher assumes the role of a facilitator.

CBI leverages the vast resources available online to promote self-directed learning. Students are encouraged to explore relevant content and educational materials online, fostering autonomy and responsibility in their learning process. The internet becomes a valuable tool for accessing information, conducting research, and engaging with diverse learning materials. The core principle of CBI is student-centered learning. The instructional focus shifts from a teacher-centered approach to empowering students to take ownership of their learning journey. By actively participating in the discovery of knowledge, students become more engaged, motivated, and invested in their education.

CBI shares similarities with the flipped classroom and smart classroom models. In a flipped classroom, students access instructional materials outside of class, allowing for more interactive and collaborative activities during class time (Halasa et al., 2020). CBI takes this concept further by emphasizing student-led content exploration through internet-based resources. Additionally, the smart classroom aspect of CBI involves using technology to facilitate learning and enable personalized experiences.

In CBI, the teacher's role shifts from being the primary source of information to that of a facilitator and guide. Instead of delivering lectures, the teacher focuses on directing students towards relevant resources, highlighting key concepts, and moderating class discussions. The teacher's role becomes more interactive, fostering meaningful dialogue and critical thinking. With the teacher's guidance and peer support, CBI provides an environment conducive to the development of higher-order thinking skills. Class time is dedicated to engaging discussions, problem-solving, and activities that promote deeper understanding and application of knowledge.

Theoretical Foundations of Cybernetic-Based Instruction

The theoretical foundations of Cybernetic-Based Instruction (CBI) draw upon principles from cybernetics and educational technology. CBI leverages these foundations to create an innovative learning model that optimizes the educational process in the digital age. Below are the key theoretical foundations of CBI.

Cybernetics

Cybernetics is not a new invention, but its potential for application has not been exhausted even after nearly seventy years since its origin. It started with the idea of automation and control in electrical and mechanical systems but later extended to biological, social systems, and learning systems (Kumar Grover, 2016). At the core of CBI lies the field of cybernetics, which studies systems and their control mechanisms. Cybernetics explores the principles of feedback, regulation, communication, and self-organization in complex systems. These concepts are applied to the design of instructional processes and learning environments to create dynamic and adaptive learning experiences.

Educational Technology

Educational technology is a field of study that investigates the process of analyzing, designing, developing, implementing, and evaluating the instructional environment and learning materials to improve teaching and learning (Bhar, 2018). Educational technology is instrumental in the implementation of CBI. It encompasses a wide range of digital tools and platforms that enhance the learning process and enable innovative instructional methods.

The Cybernetic Theory

Wiener (1948) defined cybernetics as “a flexible, self-adapting mechanism capable of storing information and changing its responses according to the changing environment in which it is placed.” Cybernetic theory views an individual as a feedback system that generates activities to detect and control specific stimuli in the environment. It analyzes the intrinsic mechanisms by which control is established and sensory feedback is maintained. The theory’s focus is on dynamic feedback and self-regulation. All systems include at least three basic elements: input, process, and output (Wiener, 1948).

1. The input unit: This unit provides a process through which materials or information enter the system.
2. The process unit: This unit acts on the materials or information to modify them in any way.
3. The output unit: This unit consists of a technique for discharging the processed results from the system. The output is referred to as feedback.

Key Features of Cybernetic-Based Instruction

- Interactive Learning: CBI encourages active participation and engagement from learners. It provides interactive learning materials and simulations that allow students to explore concepts, apply knowledge, and receive immediate feedback. This hands-on approach promotes a deeper understanding of the subject matter.
- Personalized Learning: With CBI, learners can receive personalized instruction tailored to their individual needs and preferences. Adaptive learning systems can analyze learner data, track progress, and adjust the content and pacing accordingly. This personalized approach helps students learn at their own pace and focus on areas where they need improvement.
- Real-World Applications: CBI emphasizes the application of knowledge to real-world scenarios. It enables students to solve authentic problems and challenges, simulating real-life situations. This practical approach enhances students’ critical thinking, problem-solving, and decision-making skills.
- Continuous Assessment: CBI integrates ongoing assessment and feedback mechanisms. It allows instructors to monitor student progress in real-time, identify areas of difficulty, and provide timely support. Additionally, learners can track their own progress and identify areas where they need to improve.
- Collaborative Learning: CBI facilitates collaboration among learners and encourages peer-to-peer interaction. Online platforms and tools enable students to collaborate on projects, engage in discussions, and share knowledge and resources. Collaborative learning fosters communication skills, teamwork, and social interaction, even in remote or online learning environments.

- Data-Driven Instruction: CBI leverages data analytics to inform instructional decisions. By collecting and analyzing data on learner performance, engagement, and behavior, instructors can gain insights into the effectiveness of their teaching strategies. This data-driven approach enables continuous improvement and optimization of the learning experience.
- Lifelong Learning: CBI promotes lifelong learning by fostering self-directed and autonomous learning skills. It equips learners with the necessary digital literacy and information management skills to navigate the ever-evolving digital landscape. CBI encourages a mindset of continuous learning and adaptability, preparing students for the challenges of the future.

Benefits of Cybernetic-Based Instruction

- CBI encourages active learning and engagement among students as they are involved in the search for information and content. This hands-on approach fosters a deeper understanding of the subject matter.
- By allowing students to explore content at their own pace and according to their interests, CBI supports personalized learning experiences, catering to diverse learning styles and preferences.
- CBI provides opportunities for peer collaboration and discussion during class time, promoting teamwork and communication skills.
- Leveraging the internet, CBI expands the pool of resources available to students, granting them access to a wealth of information and perspectives.
- CBI promotes active learning and engagement among students by involving them in interactive activities, simulations, and real-world applications. This makes learning more meaningful and relevant. The dynamic and interactive nature of CBI captures students' attention, fostering a deeper understanding of the subject matter.
- With CBI, students receive immediate feedback on their performance and progress.
- CBI empowers students to take ownership of their learning journey. By encouraging self-directed learning and resource exploration, students develop valuable research skills and become more independent learners, better equipped for lifelong learning.
- CBI can be cost-effective for educational institutions in the long run. While there may be initial setup costs, once established, digital resources and online platforms can be reused, reducing the need for continuous investment in physical materials.

Conclusion

Cybernetic-Based Instruction presents a groundbreaking and learner-centered approach to education in today's digital era. It harnesses the power of technology and the principles of cybernetics to enhance interactivity, personalization, real-world application, assessment, collaboration, data-driven decision-making, and lifelong learning. CBI has the potential to transform education by providing dynamic and engaging learning experiences that equip students with the skills they need to thrive in the digital age.

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