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Synergistic Intelligent Tutoring System for Enhancing Continuous Assessment Outcomes Among Students with Learning Disabilities

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Abstract: *Continuous assessment remains a cornerstone of effective teaching and learning, particularly among the students with disabilities. However, traditional assessment practices often fail to adequately capture the learning progress of students with learning disabilities due to their limited flexibility, delayed feedback, and uniform evaluation standards. This paper reconceptualises continuous assessment through the lens of Synergistic Intelligent Tutoring Systems (ITS), proposing an adaptive, data-driven, and learner-centered framework for improving assessment outcomes among students with learning disabilities. Anchored in Connectivism Theory, the paper synthesises empirical and theoretical literature to demonstrate how Intelligent Tutoring System can individualise assessment, enhance learner engagement, reduce cognitive load, and promote equity among students with learning disabilities and their counterpart. The study adopts a conceptual and systematic literature review approach to articulate the pedagogical, technological, and assessment-related implications of ITS for education of the student with disabilities. The paper concludes by proposing a synergistic ITS–continuous assessment model capable of transforming assessment practices for learners with diverse needs.*

Keywords: intelligent tutoring systems, continuous assessment, learning disabilities, connectivism

INTRODUCTION

Continuous assessment represents an evaluative approach that monitors a student's academic progress throughout an instructional period, rather than relying solely on final examinations. Advocates for this method contend that ongoing assessment facilitates more consistent tracking of

student development, providing greater opportunities for targeted support, constructive feedback, and corrective interventions within the learning process. Educational assessment serves a critical function by generating actionable feedback that informs instructional decision-making and maximizes learning effectiveness.

The evaluation of student learning yields objective evidence vital to educational planning and policy. Cone and Foster (1991) observed, reliable measurement forms the cornerstone of sound educational decision-making. The consensus among educational professionals highlights the indispensable role of assessment as a foundation for effective learning. However, challenges persist regarding assessment methodologies. For example, there is ongoing debate about the fairness and reliability of assigning a single, hour-long examination at the end of a semester spanning several months as a measure of comprehensive subject mastery. Concerns arise about the adequacy of such assessments for students who may be unwell during the exam or students with disabilities who require alternative forms of evaluation.

Continuous assessment therefore is best understood as a systematic and ongoing process that employs diverse evaluative techniques to build a comprehensive and dependable profile of each student's abilities over time. This cumulative approach integrates varied aspects of a student's performance throughout the learning period, thereby producing a more holistic reflection of their abilities. By maintaining detailed records and providing continuous feedback, continuous assessment seeks to optimize educational outcomes and support the varied needs of all students, including those with learning disabilities who have emotional limitations that may hinder their participation and achievement in conventional educational environments (UNESCO, 2020). The inclusion of students with disabilities in mainstream education is a response to global advocacy for equal access to quality education, as enshrined in the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD, 2006).

This legislative framework emphasizes the removal of barriers and the provision of reasonable accommodations to ensure equitable learning opportunities for all students including students with disabilities. Children with disabilities refer to individuals who experience physical, cognitive, or sensory limitations that affect their mobility, communication, or learning abilities. It is crucial to provide them with equal opportunities and support in an inclusive environment to help them thrive and reach their full potential. Children with disabilities area diverse group of roughly 240 million children worldwide (1 in 10) who experience long-term physical, mental, intellectual, or sensory impairments. These conditions, whether congenital or acquired, interact with environmental barriers such as lack of accessibility or social stigma to limit their full, equal participation in society (UNCRPD, 2006).

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LITERATURE REVIEW: CONTINUOUS ASSESSMENT AND THE INCLUSION OF STUDENTS WITH DISABILITIES

Continuous Assessment (C.A) is an ongoing evaluation approach that employs diverse methods tests, assignments, portfolios, observations throughout a defined instructional period (Denga, 1987; Ainscow, 2020). C.A aims to offer a holistic and nuanced profile of a student's learning progression, surpassing the limitations of summative, high-stakes examinations (Adebowale & Alao, 2008). Its multidimensionality enables educators to track not only academic achievement but also skills development, attitudes, and values over time (Black & Wiliam, 2018). The adoption of the 6-3-3-4 educational system in Nigeria necessitated a shift towards more valid, reliable, objective, and comprehensive evaluation frameworks. Continuous Assessment was conceived as a means of:

- Mitigating the drawbacks of one-time examinations prone to test anxiety and limited coverage.

- Providing feedback for both teaching adjustment and targeted support for learners.
- Ensuring that all aspects of learning cognitive, affective, and psychomotor domains are encompassed in student evaluation.

However, the focus of this paper is on the categories of students with learning disabilities (LD). Students with learning disabilities are individuals with above-average intelligence who experience significant, lifelong difficulties in acquiring, processing, or expressing information, particularly in reading, writing, math, and listening. These neuro-developmental differences are not caused by low IQ, emotional disturbance, or sensory impairments, but rather by how the brain manages information. In view of the above reasons, the article would explore how Intelligent Tutoring System (ITS) could be used to assist these students. An Intelligent tutoring system provides a platform for students to dive into the depths of various fields of study through a modern platform where both the learning curve and feedback on improvement are clearly visible to the students. With the increase in demand for online-based learning and distance learning, an intelligent tutoring system provides a systematic approach for both students with LD and teachers to collaborate to achieve a unified goal. As the name suggests, an Intelligent Tutoring System is an AI-based learning platform where a human-based course is conducted without human intervention. It provides a personalized learning environment for students with LD.

Traditional Teaching methods involve a single tutor to carry on teaching a varied number of students with specific needs. The teaching materials used in most cases are the same and are used repetitively. This is a difficult situation for students with special needs or students requiring special attention. For an effective intelligent tutoring system, some aspects of the tutoring environment should be considered. The system must be interactive and easy to use, making the system easy and clear to use. The system should be tailored to meet the requirements of a specific topic for all students with learning disabilities. The feedback from the system should be personalized, and the scope of improvement must be highlighted within the feedback of the system.

Multimedia or audio- visual course materials should be available, comprising games, quizzes, as well as coursework that are both enjoyable and interactive. The system must have its own way of monitoring the students with LD and must have the capability to control the pace of learning, taking into consideration any aspect of emotions and any humane situations while conducting the courses. The intelligence of the system should be ever-improving, and it must have its own process of evolving into a better version of its previous self, introducing better features and learning processes while evolving. As a result, the system should be ever-improving based on its previous interactions with the students.

Understanding Intelligent Tutoring System: A Conventional Model

Intelligent Tutoring System, also referred to as ITS, is a computer-based education platform that is designed to provide personalized and effective instruction (Akyuz, 2020), guidance, and feedback to students. The development of ITS is based on some basic learning requirements that date back to 1970 (Alwagdani, 2024). An efficient ITS needs to possess some key aspects that include adaptivity with regard to specific students, interactivity with the learners, a profound feedback mechanism, a domain-specific knowledge base, and intelligent tutoring capability, which ensures a smart way of conveying educational theories to students, a self-paced learning mechanism, and an efficient monitoring assessment. All these characteristics make ITS a better platform for education with respect to conventional learning. Some of the benefits for educators of using ITS in comparison to Traditional Learning methods include providing and devising student-specific content and automated grading. It minimizes the workload for teachers to concentrate more on teaching methods (Lin et al., 2023).

The significance of personalized Learning in ITS has been discussed in research by Akyuz (2020), where the authors reviewed various previous ITS and analyzed uses of Personalized learning in previous ITS systems. The result obtained was a qualitative finding where various ITS were compared based on their architecture. Here, conventional methods and traditional ITS and Meta tutor-based ITS were compared extensively. The results indicate that some important benefits of ITS on personalized learning have been obtained based on accessibility, feedback, and unbiased assessment. A Systematic Literature Review (SLR) model has been proposed in (Alrakhawi , Jamiat, and Abu-naser, 2023), where ITS developed in different fields were discussed having put into the consideration of the connectivism theory of learning is appropriate to this context.

Connectivism Theory of Learning

Connectivism has been called a learning theory for the 21st century. But, other than its relatively recent introduction as a theory of learning, what makes Connectivism so useful and relevant to the modern student and educators? Critically, Connectivity Learning Theory makes effective use of technology, which is an essential tool for learning, particularly among Generation Z students and future generations. Connectivism also places a strong emphasis on the ability to find and sift

through information in order to conduct reliable research. The Connectivism learning theory and the Connectivity approach of learning are relatively new concept that has emerged in response to the changing landscape of education in the digital age. This approach is based on the idea that knowledge is distributed and that learning occurs through the connections that individuals make with others and with information. The purpose of this study is to examine the theoretical foundation, key principles, and practical implications of Connectivism in education of the students with learning disabilities.

Connectivism is a learning theory that emphasizes the importance of social networks and technology in the learning process. Developed by George Siemens and Stephen Downes in 2005, Connectivism suggests that knowledge is distributed across networks and that learning involves the ability to recognize and navigate those networks. Connectivism posits that knowledge is not only acquired through traditional means, such as textbooks or lectures but also through online communities, social media, and other technological platforms. According to the theory, learning is an ongoing process of exploration and discovery, and it occurs both within and outside formal educational institutions. Connectivism also suggests that learners must be able to critically evaluate the information they encounter in order to discern what is reliable and relevant. The ability to make connections between different sources of information and knowledge is also critical, as it enables learners to construct new knowledge and adapt to new situations. Critics of Connectivism have argued that the theory places too much emphasis on technology and social networks and overlooks the importance of other factors such as motivation, individual differences in learning styles, and the role of the teacher.

However, proponents of the theory argue that Connectivism represents a new and innovative approach to learning that acknowledges the changing nature of knowledge and the importance of technology in contemporary society.
Overall, Connectivism provides a valuable perspective on learning in the digital age,highlighting the importance of social networks and technological tools in the learning process. By embracing the principles of Connectivism, learners can acquire the skills and knowledge they need to navigate a rapidly changing world and continue to learn throughout their lives.

Connectivism is a learning theory that emerged in the early 21st century as a response to the increasing complexity and interconnectedness of the digital world. The theory posits that learning is a process of making connections between concepts, ideas, and experiences, and that these connections are facilitated by technology and social networks. This paper will explore the principles of Connectivism, its applications in the 21stcentury, and its implications for the future of education of the students with learning disabilities. The applications of Connectivism in the 21st century are vast and varied. With the advent of the internet and social media, learners have access to information and resources, and can connect with others around the world to share knowledge

and ideas. Online learning platforms, have made education more accessible than ever before and have created new opportunities for learners to connect with educators and other learners around the world.

Connectivism has also been used to design new models of learning that are more student-centered and collaborative. For example, the flipped classroom model, in which students watch lectures online and use classroom time for group work and discussion, is based on the principles of Connectivism. The model allows learners to take control of their own learning, and to collaborate with others to create new knowledge and understanding. The implications of Connectivism for the future of education are significant. As technology continues to evolve, learners will have access to even more information and resources, and will be able to connect to other learners.

Connectivity learning, or connectivism, is a theory that offers a framework for understanding learning in the digital age (Lin, Huang and Lu (2023). It acknowledges the central role of technologies and social networks in modern education, providing learners with access to diverse resources and distributed knowledge (Alam, 2023). Connectivism has significantly influenced online and lifelong learning (Mukhlis et al., 2024), particularly through social media platforms that enable learners to share personal experiences and knowledge anytime and anywhere (Tight, 2020). Connectivism has significantly influenced online and lifelong learning (Mukhlis et al., 2024), particularly through social media platforms that enable learners to share personal experiences and knowledge anytime and anywhere (Tight, 2020). The theory emphasises the importance of connections and networks in knowledge acquisition, as information is distributed among networks (Alam, 2023).

Consequently, effective learning requires learners to navigate, connect, and synthesise information from multiple sources (Adediran, and Salako., 2025). Most studies rely on qualitative designs and literature reviews (Olusanya., 2023). For instance, Alam (2023) describes connectivism as a paradigm in which knowledge is distributed among the networks of people, technologies, and communities. In addition, O'Brien et al. (2020) propose a metaliterary model that positions metacognition as a key element in enhancing connectivity learning in Massive Open Online Courses (MOOCs). Connectivism represents a learning theory specifically developed for digital age educational contexts, diverging significantly from traditional behaviorist, cognitivist, and constructivist learning theories by revealing contemporary teaching and learning practices within technology-enhanced educational environments (Plueger, 2024). Connectivism emerged as a contemporary learning theory developed specifically for 21st-century contexts due to rapid digital transformation and technological integration (Alam, 2023). This theoretical framework explicitly supports systematic technology integration into comprehensive teaching and learning processes.

Contemporary Educational researchers have outlined the features and benefits of practising connectivism in curriculum implementation (Alam, 2023; Peter & Ogunlade, 2024). This concept refers specifically to systematic variation in knowledge sources, information perspectives, and educational viewpoints (Mukhlis et al., 2024). Through connectivism applications, diverse digital platforms, varied opinions, different experiential backgrounds, and multiple perspectives from teachers, learners, and educational stakeholders receive acknowledgment and integration (Alam, 2023). Educational researchers maintain that diversity within connectivism frameworks enables subjective and continuous learning processes, systematically enhancing learning as an ongoing developmental process rather than discrete instructional events (Plueger, 2024; Alam, 2023). It posits that knowledge is no longer stored in the minds of individuals, but rather created and accessed through connections (Salako, and Adediran, 2025).

Implications of Intelligent Tutoring Systems (ITS) for the education of students with learning Disabilities.

Intelligent Tutoring Systems (ITS) provides specialized, data-driven support for students with learning disabilities by offering highly personalized instruction, immediate feedback, and customized pacing. These systems adapt to individual learning speeds and needs, reducing cognitive load and improving engagement and; Specifically,

Personalised Learning Pathways: ITS has the capability to tailor content and instructional methods to match a student's specific disabilities.

Immediate Feedback: ITS can show instant feedback that can correct errors immediately without the anxiety associated with traditional classroom evaluation, which is vital for students with learning disabilities.

Adaptive Pacing and Scaffolding: Can break down complex tasks and adjust the difficulty level in real-time, preventing frustration and cognitive overload.
Targeted Remediation: Has the capability to identify precise knowledge gaps and provide specific exercises, allowing students to master foundational skills.

Increased Motivation: Enhance motivation and self-esteem for struggling learners.
Reduced Cognitive Load: ITS, helps students manage mental effort, which is critical for those with cognitive disabilities.

CONCLUSION

Intelligent Tutoring Systems (ITS) have emerged as a sustainable and transformative innovation in contemporary education due to their significant contributions to teaching, learning, and assessment processes. Their capacity to provide immediate, personalised, and data-driven feedback enables timely instructional adjustments by teachers while simultaneously supporting students with learning disabilities in monitoring and improving their academic progress. For students with learning disabilities, ITS offer adaptive learning pathways, flexible pacing, and supportive feedback mechanisms that address individual cognitive needs and reduce learning barriers. Consequently, Intelligent Tutoring Systems represent a viable and enduring approach to enhancing inclusive teaching and continuous assessment practices, ensuring that learning environments are more responsive, equitable, and effective for all learners irrespective of their disabilities.

Recommendations

1. Intelligent Tutoring Systems should be adopted as an effective instructional approach to support the learning needs of students with disabilities in order to provide personalized instruction, immediate feedback, and adaptive learning pathways to make them suitable for addressing diverse learning challenges.
2. Students with learning disabilities should be adequately guided and trained on the effective use of Intelligent Tutoring Systems. This will enhance their confidence, engagement, and ability to maximize the benefits of the technology for improved academic performance.
3. Teachers, special educators, and support staff should receive continuous training on how to integrate Intelligent Tutoring Systems into classroom instruction. This will ensure effective supervision, monitoring, and alignment of ITS use with curriculum objectives.
4. Educational institutions should provide the necessary technological infrastructure, including reliable internet access, appropriate devices, and technical support, to ensure the smooth implementation of Intelligent Tutoring Systems for students with disabilities.
5. Educational policymakers should develop clear policies that promote the inclusion of Intelligent Tutoring Systems in special and inclusive education programmes. Such policies should emphasize accessibility, equity, and sustainability.
6. Regular assessment of the effectiveness of Intelligent Tutoring Systems should be conducted to identify strengths, challenges, and areas for improvement. Feedback from students and educators should inform continuous refinement of the systems.

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