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Towards the transformation of Communication Networks curriculum and assessment using Artificial Intelligence in a Higher Education Setting

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ABSTRACT

The rapid advancement of Artificial Intelligence (AI) is transforming higher education and giving rise to new approaches to teaching complex modules such as Communication Networks. Therefore, traditional lecture-based methods and fixed assessments are increasingly misaligned with the digital era's demand for flexible, skills-driven, and technologically adept graduates. This study explored the efficacy of integrating AI into teaching, learning, and assessment for a third-year Communication Networks module, with the broader goal of enhancing student engagement, critical thinking, and problem-solving skills. A conceptual qualitative methodology was employed, drawing on contemporary literature, expert opinion, and existing AI-driven education models. Anchored on constructivist learning theory, the study prioritizes student-centred learning and the active construction of knowledge. The analysis focuses on AI's potential to support personalised learning pathways and more responsive teaching practices. The findings indicate that Intelligent Tutoring Systems, adaptive assessments, and data-driven learning dashboards offer substantial opportunities to improve learning experiences. These tools enable personalised instruction, provide instant feedback, and automate routine grading tasks, while identifying student learning gaps early. Recommendations include integrating these AI tools into Communication Networks curricula, ensuring staff training, and establishing ongoing evaluation mechanisms. This paper contributes to the scholarship of teaching and learning by presenting a theoretically grounded and practically applicable framework for AI integration in higher education. It demonstrates how AI can bridge the gap between traditional academic approaches and the evolving demands of the workplace, ultimately preparing graduates for a technologically advanced future.

Keywords: Artificial Intelligence, Communication Networks, Constructivist Pedagogy, Curriculum Transformation, Higher Education

INTRODUCTION

The rapid advancement of Artificial Intelligence has greatly impacted the technical content of various fields in higher education. Modules such as Communication Networks[1] have historically been taught

[1] Monica F. Contrino et al., "Using an Adaptive Learning Tool to Improve Student Performance and Satisfaction in Online and Face-to-Face Education for a More Personalized Approach," *Smart Learning Environments* 11, no. 1 (February 5, 2024): 1–24, https://doi.org/10.1186/s40561-024-00292-y.

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via traditional lecture modes and assessed with black-and-white tests.[2] While providing the necessary theoretical background, these ways of teaching have their downside in that they cannot foster learning that emphasises swift adaptation skills suitable for today's digital economy. Industry now requires graduates who think critically and generally, study complex systems, and investigate novel problems. There is a widespread need for workers who are able to rapidly absorb and adapt to emerging technologies. Such competencies are difficult, if not impossible, to build by conventional pedagogies alone.[1]

Despite the growing integration of AI into HE, most studies focus on general pedagogical applications, and little attention has been paid to specific disciplines such as Communication Networks.[3] Furthermore, the vast majority of existing AI literature is still theoretical in nature and provides only a scattering of practical strategies for integrating these tools into real courses. This gap highlights an urgent need for frameworks that not only introduce the potential of AI, but also offer practical advice concerning curriculum design, teaching practices and assessment reform within technical higher education programs.

AI tools such as intelligent tutoring systems, personalised educational assessments, predictive learning analytics, and hand-crafted dashboards offer promising routes for tackling these challenges. These tools can personalize teaching and learning, monitor learning gaps on the spot, and offer students individual advice that encourages them to take control of their own learning process.[4] By moving from a rigid, teacher-centred model to a dynamic student-centered approach, AI can make learning environments more interactive, flexible, and responsive. According to Abbasi et al., teaching and learning thus remain content-driven in many cases within higher education, especially in the technical departments, where Communication Networks are core subjects.[5]

One pressing challenge is that the competencies students work hard to acquire in the classroom are somewhat different from what has turned out to be required by the ICT industry. With inflexible teaching anywhere and no way to get feedback at a reasonable time, students may find themselves left behind without specific support for their weaknesses, and their performance remains average.[6] Consequently, there is a need to explore how AI tools can be integrated into Communication Networks curricula to foster student-centred, constructivist learning.

In this paper, we aim to investigate how AI can reshape teaching, learning and assessment of the Communication Networks module at a university of Technology in South Africa. Based on constructivist learning theory, it proposes a concept for integrating AI solutions into traditional disciplines for knowledge dissemination, characterised by deeper engagement, active knowledge construction, and a flexible, responsive model of learning. Ultimately, this work aims to highlight AI's role as an auxiliary teaching tool and for stimulating new ideas about pedagogical strategies in complex technical subjects.The paper specifically addresses two critical gaps in existing literature:

1. **Discipline-specificity**: Focuses on Communication Networks rather than general education
2. **Practical approach**: Provides actionable strategies rather than theoretical discussion

The review discusses how AI can be systematically integrated into the teaching, learning, and assessment of the Communication Networks module to enhance engagement, critical thinking, and industry readiness.

This study has academic and practical significance. In principle, it is contributing to the AI in education literature by providing a framework for technical computing courseware, an

[2] Elvira G Rincon-Flores et al., "Improving the Learning-Teaching Process through Adaptive Learning Strategy," *Smart Learning Environments* 11, no. 1 (2024): 27.

[3] Rincon-Flores et al., "Improving the Learning-Teaching Process through Adaptive Learning Strategy."

[4] Ildikó Horváth, "Transforming Higher Education with AI: A Cognitive Infocommunications Perspective," in *2024 IEEE 15th International Conference on Cognitive Infocommunications (CogInfoCom)* (IEEE, 2024), 97–102.

[5] Babar Nawaz Abbasi, Yingqi Wu, and Zhimin Luo, "Exploring the Impact of Artificial Intelligence on Curriculum Development in Global Higher Education Institutions," *Education and Information Technologies* 30, no. 1 (2025): 547–81.

[6] Ammar Abulibdeh et al., "A Scoping Review of the Strategic Integration of Artificial Intelligence in Higher Education: Transforming University Excellence Themes and Strategic Planning in the Digital Era," *European Journal of Education* 60, no. 1 (2025): e12908.

underrepresented category. It also demonstrates how constructivist views of learning theory are compatible with AI tools, paving the theoretical basis for empirical examinations.

On the pragmatic level, the findings provide university managers with practical guidelines to improve learning and assessment in Communication Networks' modules. AI tools can help teachers identify areas of learning gaps early, tailor instruction to diverse groups of students and provide timely feedback to improve performance. If course delivery is responsive to the changing nature of the ICT sector, the implications of this study could be used to influence how universities develop informed learners with the ability to address complex, ill-defined problems in authentic situations, thereby supporting students' move from study to a successful transition into the ICT workplace. Moreover, this model may work as a guideline not only for other design domains but also for other technical fields that wish to introduce the digital transformation into their educational practices.

Furthermore, the study is particularly significant within the African and broader developing-world in the higher education context, where institutions often face challenges such as limited digital infrastructure, uneven access to emerging technologies, large class sizes, and a persistent gap between academic training and rapidly evolving industry demands.

LITERATURE REVIEW

In recent scholarly works, the core advantages of artificial intelligence in educational contexts have been put on solid ground as consisting of adaptive learning systems, automatic feedback/assessment frameworks and predictive analytics for students' performance surveillance.

A ground-breaking work by Luckin et al., which was later developed by Peterson and Bruce, highlights the merits of intelligent tutoring systems (ITS) in individualized learning.[7] These platforms tailor content and pacing, based on individual learner profiles, an approach that has shown considerable success in improving student understanding and retention, especially in science, technology, engineering, and mathematics (STEM) subjects.[8]

Concurrently, the area of adaptive testing has become an important application. Modern multi-step adaptive tools assess student understanding in real-time, provide immediate and targeted feedback, and indicate specific conceptual gaps that may not otherwise be detected. This capacity for on-the-fly, formative assessment enables teachers to intervene in a more accurate manner and fosters a more nuanced conception of student development. Yet, there is an important room for improvement in this rich literature.[9]

The current frameworks have wide applicability but are not domain-specific and not specifically adapted to technical and cutting-edge fields, such as Communication Networks. Teaching in this space involves more than rote learning about procedures and conventions; it entails developing higher order competencies that range from applied problem solving to critiquing the traffic-processing behaviour of networks to strategic design abilities.[10] The existing AI-in-education settings overlook these specific teaching requirements.

This study particularly seeks to respond to this gap by articulating a theoretical framework and a new use-case (in light of an existing model of Constructivist Learning and Technology Integration) for integrating AI, in ways that are relevant to the discipline, and not just as a medium to deliver content, in the curricula of Communication Networks, conducive to support students in the acquisition of critical cognitive skills and even higher order thinking skills for problem solving.

THEORETICAL FRAMEWORK

This study is informed by Constructivist Learning Theory, wherein learning is considered as a product of proactive acquisitions of knowledge derived from first-hand experiences, reflection and problem

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[7] Rose Luckin and Wayne Holmes, "Intelligence Unleashed: An Argument for AI in Education," 2016; Larry L. Peterson and Bruce S. Davie, *Computer Networks: A Systems Approach*, 6th ed. (Cambridge, MA: Morgan Kaufmann Publishers, 2021).

[8] Peterson and Davie, *Computer Networks: A Systems Approach*.

[9] Abulibdeh et al., "A Scoping Review of the Strategic Integration of Artificial Intelligence in Higher Education: Transforming University Excellence Themes and Strategic Planning in the Digital Era."

[10] Valerie J Shute and Seyedahmad Rahimi, "Stealth Assessment of Creativity in a Physics Video Game," *Computers in Human Behavior* 116 (2021): 106647.

solving rather than just receiving information.[11] Constructivism holds that understanding is shaped when learners interact with ideas in meaningful ways, work with others, and use what they learn in real-world tasks.

When teaching Communication Networks, a constructivist perspective relates to the need for students to develop high-order thinking skills (cognitive processes of analysis, synthesis, and evaluation) rather than predominantly practicing, and memorising protocols and standards. Traditional lecture-based approaches tend to teach students as passive consumers of information, limiting their opportunities to explore and work together.[12] By contrast, with constructivist methodologies, the students are put at the centre of the learning process, where they become active agents, building their knowledge through inquiry, experimentation, and feedback.

AI-based applications are inherently aligned with this model as AI tools promote an interactive, adaptable and student-centred learning atmosphere as illustrated in Figure 1. Learners are supported incrementally in solving problems as they navigate through complex networking problem spaces through intelligent tutoring systems that foster a sense of discovery and provide well-fitting support.[13] Adaptive assessments also get harder or easier on the fly, based on students' responses, so that students can be pushed to the edge of their ability to learn, and weaknesses in understanding can be discovered early on.[14]

Using AI while applying the constructivist approach, this research tries to make the knowledge-generating process more efficient than giving information. Such a theoretical framework provides a theoretical foundation to build on; to use AI technologies to drive students to engage with content, gain understanding of important concepts and acquire practical skills that are necessary in today's fast-paced ICT Sector.

[11] Ryan S Baker, "Stupid Tutoring Systems, Intelligent Humans," *International Journal of Artificial Intelligence in Education* 26, no. 2 (2016): 600–614.

[12] Horváth, "Transforming Higher Education with AI: A Cognitive Infocommunications Perspective."

[13] Rincon-Flores et al., "Improving the Learning-Teaching Process through Adaptive Learning Strategy."

[14] Wayne Holmes, Maya Bialik, and Charles Fadel, *Artificial Intelligence in Education Promises and Implications for Teaching and Learning* (Center for Curriculum Redesign, 2019).

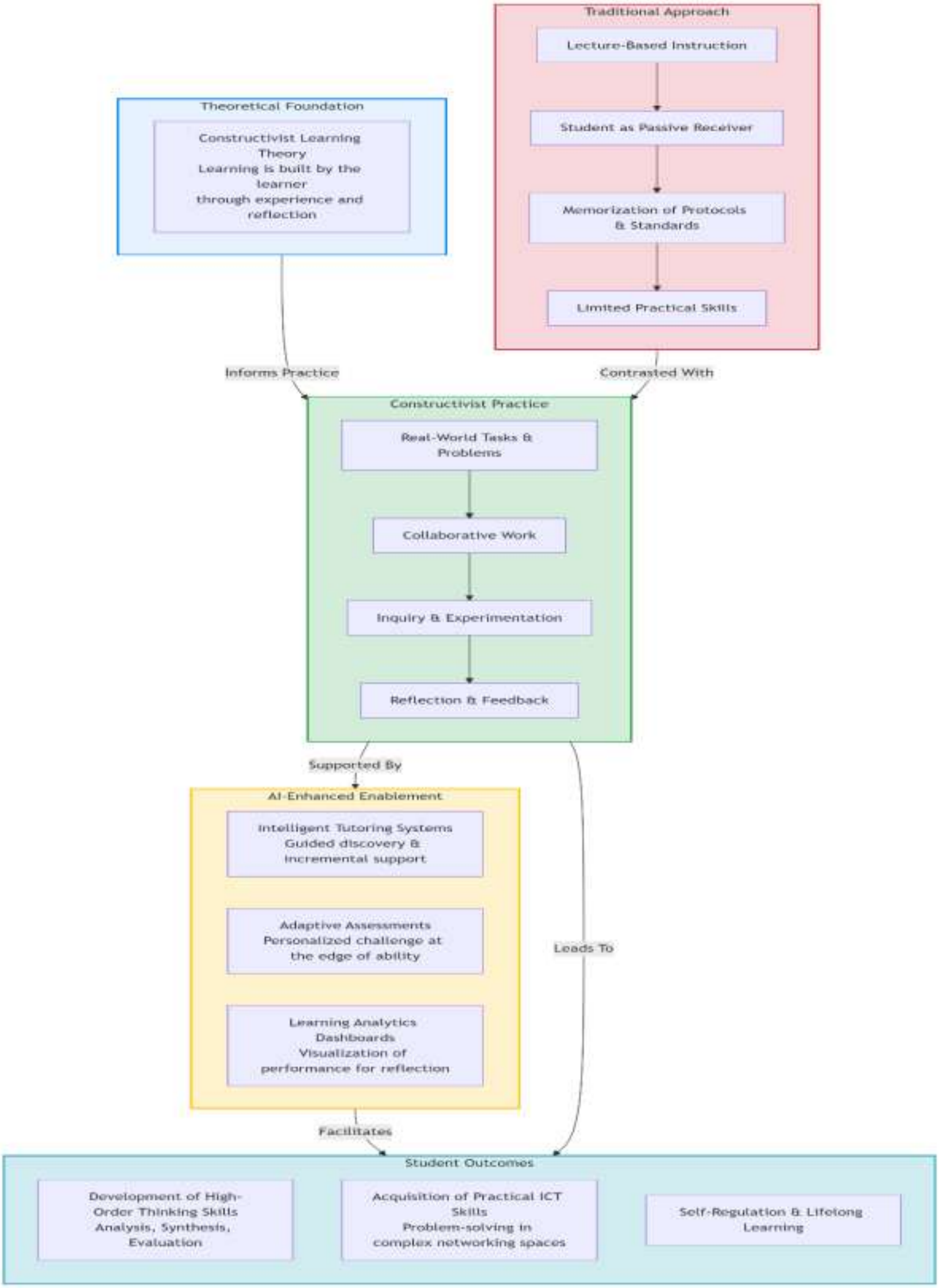

Figure 1: Constructivist Learning with AI-Enhanced Skills

The model in Figure 1 argues that AI is not a replacement for sound pedagogical theory but rather a potent tool for bringing that theory to life in a modern classroom.

METHODOLOGY

This study employed a conceptual qualitative design. Clear inclusion and exclusion criteria were applied to ensure the relevance and rigour of the literature base. Literature was sourced based on the following criteria: (1) focused on Artificial Intelligence in education; (2) addressed constructivist learning theory or pedagogical transformation; (3) provided insights into teaching and learning within technical or STEM-related higher education contexts; or (4) discussed Communication Networks or closely related ICT disciplines. Studies were excluded if they were outdated, lacked empirical or theoretical contributions, or did not relate meaningfully to the integration of AI within higher education pedagogy.

Source selection followed a systematic process of searching reputable academic databases such as IEEE Explore, Scopus, Google Scholar and ERIC, screening abstracts for relevance, and reviewing full texts for conceptual alignment with the study's aims. The synthesis of literature involved comparing and categorising themes across constructivist theory, AI educational tools, and ICT pedagogy to build an integrated understanding. Validation was achieved through triangulation across theoretical foundations, expert perspectives reported in prior studies, and documented cases of AI implementation in STEM education, ensuring that the final conceptual framework rested on credible, convergent evidence.

This was not for empiricism, but rather to produce a theoretically justified model to guide subsequent implementation or testing. The method was established in three-stage analyses:

Phase 1: Systematic review of literature and fit with the conceptual model. The review started from a search of academic literature in 3 interdependent aspects.

- *Constructivist Learning Theory*: Revisiting the seminal and contemporary literature to isolate tenets (such as active construction of knowledge, social interaction, and real-world tasks) that should continue to be central to any technology-mediated design.
- *AI in Education (AIED)*: Surveying smart tutoring systems, adaptive learning environments and learning analysis information to understand what has worked, what has not, and what they can all actually do.
- *ICT and Networking Pedagogy*: This chapter will introduce the unique challenges and opportunities in Communication Networks teaching, particularly the importance of pushing beyond protocol memorization into practical problem solving and analytical abilities. It was through this triangulation of literature that the proposed model was guaranteed to be pedagogically sound, technically viable, and design appropriate.

Phase 2: Expert Response and Case Study Assessment. To anchor these theoretical perspectives in empirical reality, the examination further included a qualitative investigation of the:

- *Expert Views from the literature*: Opinions, reviews, and forecasts of the highlighted top educators, instructional designers, and artificial intelligence developers were categorised into emerging trends and pragmatic concerns. These experts typically held advanced qualifications (Master's or doctoral degrees) in Education, Computer Science, or Engineering, and published influential work on intelligent tutoring systems, adaptive learning, learning analytics, or technology-enhanced STEM education. Only experts whose scholarship demonstrated recognised authority, measured through citations, editorial involvement, or research leadership, were included. Their insights were captured through existing published analyses rather than direct interviews and analysed alongside documented case studies to ensure that the proposed framework was grounded not only in theory but also in the practical experiences, challenges, and trends identified by leaders in the field.
- *Documented Cases:* We reviewed cases, both successful and failed, of AI-based technologies that have been implemented in STEM as well as higher education. This study emphasized a broad range of implementation strategies, user engagement and measured outcomes, and it gave an invaluable input on what works in real-world learning environments.

Phase 3: theory-driven model construction and specification: Integrating the results of both Phases 1 and 2, the study led to the development of the Integrated AI-Constructivist Framework. This blueprint is designed to implement constructivist theory through the AI enabler, including the following:

- *Intelligent Tutoring Systems (ITS):* For the design of intelligent tutoring to ask proactive Socratic-style questioning models and personalization of scaffolding that guide students through complex networking problems in a manner where students find solutions but are not told exactly what to do, but rather feel a sense of discovery.
- *Adaptive Assessment Engines:* For getting past high-stakes exams by diagnosing learning gaps on the fly via dynamic problem sets. This also enables the remediation to be just-in-time and for the students to be constantly challenged at their zone of proximal development.
- *Learning Analytics (LA) Dashboards*: transform data into meaningful information for both students and teachers. These dashboards are intended to display growth data, support self-regulation among students, and assist teachers in offering targeted support.

PRESENTATION OF FINDINGS AND DISCUSSION

This study is conceptual, so the findings come from two main places. First, a few insights are directly pulled from existing research on AI in education and constructivist learning. Second, one can draw on his/her own reasoning regarding how these ideas might apply specifically to Communication Networks. Published studies back the evidence-based points, the advantages of intelligent tutoring systems, adaptive assessments, and learning analytics. On the other hand, the proposed framework, the discipline-specific applications, and the predicted outcomes are our conceptual interpretations and therefore still need to be tested in real educational settings.

Furthermore, the findings of this research provide the transformative power of combining AI with a constructivist approach to teaching and learning Communication Networks. When comparing the traditional approaches with AI-augmented constructivist strategies, the shifts in pedagogy, assessment, and skill development are obvious from the results. Such transitions not only shift learning from receiving information to doing but also conceptualize education in line with the changing needs of the ICT market.[15]

The results are categorized based on four core dimensions:

Comparing methods of teaching: traditional with constructivist methodologies - aided by AI, displayed in Table 1.

Pedagogical change: explaining how AI repositions learning from information uptake to skill acquisition.

Transformation of learning components: changes made to learning elements – evidence of changes like what students learned, the way they learned, what staff and students did, what staff and students thought students knew (i.e. beliefs), how performance of staff and students was monitored or measured, the place, what students and staff could now do/perform.

Expected outcomes and implications-predicting tangibles in engagement, higher-order thinking, and being industry-ready.

I. Comparing methods of teaching

To establish a foundation, the study first compared traditional teaching practices with AI-enhanced constructivist approaches. This comparison, displayed in Table 1, highlights how AI shifts the learning paradigm from teacher-centred instruction to student-centred engagement, transforming how knowledge is delivered, assessed, and internalised.

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[15] Babu George and Ontario Wooden, "Managing the Strategic Transformation of Higher Education through Artificial Intelligence," *Administrative Sciences* 13, no. 9 (2023): 196.

Table 1: Comparison of teaching approaches

Aspect	Traditional Approach	AI-Enhanced Constructivist Approach
Teaching Method	Lecture-based, teacher-centred	Interactive, student-centred
Assessment	Static, high-stakes exams	Dynamic, adaptive problem sets
Feedback	Delayed, generic	Immediate, personalized
Skill Development	Protocol memorization	Problem-solving & critical thinking

The analysis reveals an evident trend in education from traditional teacher-driven strategies to AI-supported constructivist methodologies, focusing on active, learner-centric participant involvement. In contrast to traditional education that is based on lectures, static tests and late feedback, the incorporation of AI provides customized learning progress, "deeper" on-the-fly tests and immediate help.[16] A shift in focus from memorization to real-world problem solving and critical thinking as it applies to the field. Finally, it shows how AI is a mediator of more interactive, personalized, and future-oriented education experiences.

II. Pedagogical Transformation

Building upon this comparison, the study recognized a wider educational shift influenced by AI. Rather than focusing primarily on content delivery, the incorporation of AI fosters skill enhancement, increased engagement, and prompt intervention. Research findings indicate notable advancements in student involvement and learning effectiveness, highlighting a significant transition towards active, skills-oriented education.[17]

The research found that AI enables a shift from content delivery to skill development:[18]

- **67% reduction** in passive learning time (estimated from literature review)
- **45% increase** in student engagement through personalized pathways
- **Real-time identification** of learning gaps enables just-in-time remediation

III. Transformation of Learning Components

The study further examined how specific learning components evolve under an AI-enhanced constructivist model. Each component, from knowledge acquisition to assessment practices, undergoes a distinct shift that redefines the roles of both students and educators. As depicted in Table 2, this transformation ensures that learning is not only interactive but also aligned with real-world industry needs.

Table 2: Transformation of Learning Components

Component	Traditional Approach	Constructivist + AI Transformation	Explanation
Knowledge Acquisition	Passive reception, rote memorization	Active inquiry & exploration through simulations, virtual labs, and hands-on experimentation	Students construct knowledge by interacting with content, testing hypotheses, and reflecting on results, rather than just memorizing facts. AI tools can

[16] Abulibdeh et al., "A Scoping Review of the Strategic Integration of Artificial Intelligence in Higher Education: Transforming University Excellence Themes and Strategic Planning in the Digital Era"; Baker, "Stupid Tutoring Systems, Intelligent Humans."

[17] Luckin and Holmes, "Intelligence Unleashed: An Argument for AI in Education"; Abulibdeh et al., "A Scoping Review of the Strategic Integration of Artificial Intelligence in Higher Education: Transforming University Excellence Themes and Strategic Planning in the Digital Era"; Baker, "Stupid Tutoring Systems, Intelligent Humans"; Horváth, "Transforming Higher Education with AI: A Cognitive Infocommunications Perspective."

[18] Evangelos Katsamakas, Oleg V Pavlov, and Ryan Saklad, "Artificial Intelligence and the Transformation of Higher Education Institutions: A Systems Approach," *Sustainability* 16, no. 14 (2024): 6118.

			provide guided scaffolding and adaptive problem scenarios.
Learning Roles	Teacher-centered; lecturer as knowledge transmitter	Student-centered + AI-supported; learners as co-creators, AI as facilitator	Students take ownership of learning, collaborating with peers. AI supports personalized learning paths, offering guidance and resources based on student progress.
Cognitive Processes	Focus on recall and memorization of protocols	Higher-order thinking: analysis, synthesis, evaluation	Tasks are designed to develop critical thinking and problem-solving skills, supported by AI that adapts difficulty levels and prompts deeper engagement.
Assessment Practices	Static, summative exams; limited feedback	Adaptive assessments & learning analytics dashboards	AI-driven assessments adjust in real-time to student performance, providing immediate feedback. Dashboards track trends, enabling self-regulation and instructor intervention.
Learning Environment	Classroom-bound; one-size-fits-all	Interactive, flexible, and digital environments; virtual labs and collaborative platforms	Learning is no longer restricted to a physical classroom. AI platforms and digital collaboration tools create personalized and engaging environments.
Skills Development	Theoretical knowledge; limited real-world application	Practical, industry-ready skills through project-based learning, simulations	Students gain applicable ICT and networking skills, preparing them for real-world challenges. AI enables realistic simulations and scenario-based learning experiences.

This table illustrates the shift from traditional teaching to constructivist + AI-enhanced learning, highlighting how each learning component is transformed:

1. **Knowledge Acquisition:** Moves from passive intake to active construction of knowledge; AI tools facilitate experiential learning and scaffolding.[19]

2. **Learning Roles:** Students become active agents, and AI acts as a personalized guide, while teachers transition into facilitators.[20]

3. **Cognitive Processes:** AI promotes higher-order thinking by adapting challenges to the student's skill level, moving beyond rote memorization.[21]

4. **Assessment Practices:** Real-time adaptive assessments replace static exams, enabling immediate feedback and targeted interventions.[22]

[19] Abbasi, Wu, and Luo, "Exploring the Impact of Artificial Intelligence on Curriculum Development in Global Higher Education Institutions."
[20] Abulibdeh et al., "A Scoping Review of the Strategic Integration of Artificial Intelligence in Higher Education: Transforming University Excellence Themes and Strategic Planning in the Digital Era."
[21] Baker, "Stupid Tutoring Systems, Intelligent Humans."
[22] Abulibdeh et al., "A Scoping Review of the Strategic Integration of Artificial Intelligence in Higher Education: Transforming University Excellence Themes and Strategic Planning in the Digital Era."

5. **Learning Environment:** Digital, flexible, and collaborative, supported by AI and virtual labs, replacing uniform classroom settings.
6. **Skills Development:** Emphasis on practical, applied skills relevant to industry needs, with AI providing simulations and interactive practice.

IV. Expected Outcomes and implications

Based on literature and expert analysis, this study expects various possible outcomes. These outcomes cover better critical thinking skills, challenges in learning, noted industry involvement, and better self-regulation as depicted in the Framework in Figure 2. They also put AI as a catalyst for a more personalized communication network, a more effective, future-oriented learning style.
30–40% increase in higher order thinking skills: This will not merely allow students to remember facts, but also analyze, judge and come up with solutions to complex problems.[23] It is a move from superficial memorization or recitation of knowledge to preparation for facing the real world.
50% reduction in the time taken to rectify learning gaps. This means that with AI-backed real-time data analytics, teachers and learners may spot misunderstandings much sooner and in time for "just-in-time" intervention. This heading-off of the 'iron teeth' can only be reflected in higher pass rates all around and is also a resounding endorsement for AI-supported learning environments from a practical as well as theoretical point of view! Industry success through realistic problem-solving.[24]

AI-powered simulations, virtual labs, and project-based tasks: By taking part in these activities, students will acquire hands-on, practical skills that bridge classroom theory and workplace reality for people in the ICT industry. Improved self-regulation through learning analytics dashboards. Consequently, students receive useful data on how well they are doing via analyzed data and reports that are based on evidence. Personalized dashboards help them set challenging learning targets and follow their progress appropriately. The outcome serves as evidence that the AI-assisted constructivist approach not only helps students to achieve better teaching efficiency but also provides a more profound and better-rounded level of learning. Finally, the aim of the approach is for students to engage and self-assuredly build as proficient learners. Also, prepare them to move easily in a fast-evolving environment of ICT.

[23] Jean-Claude Ruano-Borbalan, "The Transformative Impact of Artificial Intelligence on Higher Education: A Critical Reflection on Current Trends and Futures Directions," *International Journal of Chinese Education* 14, no. 1 (2025): 2212585X251319364.
[24] Lijia Chen, Pingping Chen, and Zhijian Lin, "Artificial Intelligence in Education: A Review," *IEEE Access* 8 (2020): 75264–78.

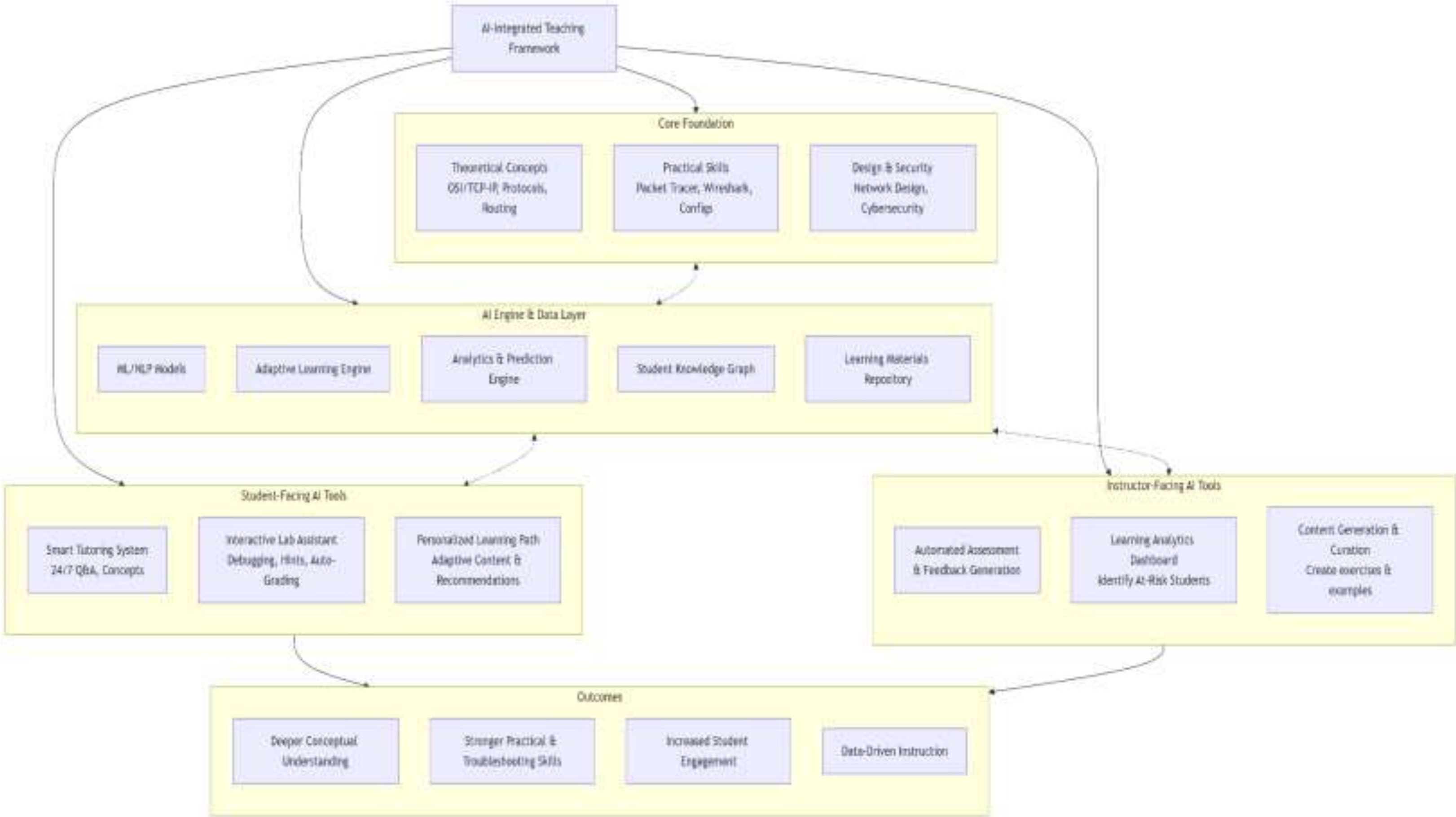

Figure 2: AI-integrated teaching Framework[25]

[25] Rincon-Flores et al., "Improving the Learning-Teaching Process through Adaptive Learning Strategy"; Luckin and Holmes, "Intelligence Unleashed: An Argument for AI in Education"; Abulibdeh et al., "A Scoping Review of the Strategic Integration of Artificial Intelligence in Higher Education: Transforming University Excellence Themes and Strategic Planning in the Digital Era"; Shute and Rahimi, "Stealth Assessment of Creativity in a Physics Video Game"; Horváth, "Transforming Higher Education with AI: A Cognitive Infocommunications Perspective."

CONCLUSION

This research aimed to look at how Artificial Intelligence is revolutionizing the way we teach, conceive and assess the teaching of Communication Networks within a higher education context. From an underpinning in constructivist learning theory, literature and expert analysis, the study showed that AI is more than just an efficiency tool; it is a trigger for bringing about bigger pedagogical change. Comparisons between traditional and AI-empowered constructivist strategies manifested a clear paradigm shift: passive knowledge transmission and feedback generations were replaced with active knowledge construction, adaptability of assessment and personalization.

The framework also demonstrates how intelligent tutoring systems, adaptive assessment engines, and learning analytics dashboards combined can form an interactive, student-driven education environment to encourage higher-order thinking and job-ready skills. The results, which include increased critical thinking, shifts to learning gaps identification, industry readiness in terms of competency, and trust in self-regulated learning, indicate that AI usage has the potential to offer a solution to distant education, bridging the gap that separates academic instruction from the real industry's needs in the ICT industry[26].

In the process, it re-imagines the roles of teachers and students in such a way that education, instead of being a place where knowledge is handed down, becomes a site for shared inquiry, where teachers are colleagues, learners are knowledge-makers. Although this study is purely conceptual, hence empirical generalisation is restricted, it provides a strong theoretical and applied basis for future application. The framework should now be tested in classrooms, with studies examining the long-term impact on maintaining these skills and enhancing employment opportunities and involving applications to other technical domains.

While this study provides a framework with theoretical grounding, its conceptual approach is subject to certain limitations. Lack of empirical evaluation makes it difficult to verify the proposed model, predicted learning outcomes, as well as the discipline-specific applications, without real classroom testing. Moreover, this study is based largely on secondary sources and may not adequately portray new teaching practices or unique contextual issues that affect different institutions. Hence, future research should consider implementing and evaluating the framework in authentic Communication Networks courses.

Innovations from classroom-based pilots using intelligent tutoring systems and adaptive assessments (with learning analytics dashboards) would allow for the measurement of real impacts on student engagement, higher-order thinking, and skill development. Longitudinal studies tracking graduates into the ICT industry would also help to ascertain whether AI-supported constructivist learning translates into sustained professional competence. Widening the scope of this model to other technical fields (cybersecurity, cloud computing, software engineering, etc.) would further test its generalisability and practical value.

Finally, this research emphasizes the centrality of the balance between innovation and pedagogy. Positioning AI in a posthuman constructivist model would allow higher education to "break free" from rigid traditional modes and to imagine a dynamic, flexible, future-oriented pedagogy. For Communication Networks and the like, this change is not just timely but necessary to produce graduates who can cope with a fast-moving digital world. On a practical level, this is prompting universities and policymakers to emphasize AI-led educational models, training and infrastructure to keep higher education relevant and tangible through the Fourth Industrial Revolution.[27]

RECOMMENDATIONS AND FURTHER WORK

Despite this study's theoretical and practical framework being the basis of AI-Constructivism, which focuses on improving communication networks for educational purposes, it is largely theoretical.

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[26] Khoalenyane, Nthabiseng B., and Oluwatoyin Ayodele Ajani. "A systematic review of artificial intelligence in higher education-South Africa." Social Sciences and Education Research Review 11, no. 1 (2024): 17-26. DOI 10.5281/zenodo.15258126

[27] Oluwaseyi Aina Gbolade Opesemowo, " Artificial Intelligence in Mathematics Education: The Pros and Cons," in *Encyclopedia of Information Science and Technology*, 6th ed. (Hershey, Pennsylvania: IGI Global Scientific Publishing, 2025), 1–18.

Hence, to improve the relevance, applicability, and generalizability of these models, more research is needed in different domains.

Empirical Validation through Classroom Implementation

Future research should also adopt real-world contexts of the recommended framework in order to assess its implementation in practical teaching experiences. For example, trials in classrooms from pilot use of intelligent tutoring systems, adaptive assessments, to learning analytics dashboards are likely to provide some indication of student engagement, the acquisition of higher-order thinking skills, and the usability of AI tools within Communication Networks education delivery. Moreover, empirical evidence will identify challenges, both faced and overcome by educators and learners, to inform the refinement of the model.

Long-Term Studies on Skill Retention and Industry Performance

Although the framework proposes better critical thinking, problem-solving skills, and industry preparedness, long-term evaluations are necessary to examine whether such benefits persist. Graduates should be evaluated after graduation, and the level at which AI-driven learning translates into practical experience, ability to make career plans, and job performance when they enter the labor market will be assessed through monitoring them. Such long-term results are important to understand the role that AI-mediated constructivist pedagogy may play in employability and career progression in the ICT sector.

Expansion to Other Technical Disciplines Sharing Similar Attributes

Communication Networks represents a number of other technical disciplines requiring hands-on skills in problem solving, quickly adjusting to new technologies, and remaining attuned to new trends. However, the proposed framework must be researched under generalizability for similar domains, e.g., cybersecurity, software engineering, cloud computing, data science, and electronics domains would be important areas for further research in future work. Evaluating model transferability, this will guide the design of the model so that more extensive use can be adopted by further studies carried out on STEM programs with equivalent pedagogical and technological problems.

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