

THE APPLICATION OF THE KANO MODEL IN ENHANCING DIGITAL LEARNING SATISFACTION: A TOTAL QUALITY MANAGEMENT PERSPECTIVE

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Abstract

The transformation of digital learning demands a quality approach that is contextual and student-centered. This article explores the integration of the Kano Model and Total Quality Management (TQM) as a strategic framework for improving the quality of digital learning based on student satisfaction. The Kano Model is employed to classify learning attributes into must-be, one-dimensional, and attractive categories, based on students' perceptions of various digital learning features. Meanwhile, TQM provides a systemic structure for continuous improvement and stakeholder involvement in quality enhancement processes. This study uses a descriptive qualitative approach, with data collected through Kano-based questionnaires, interviews, and documentation involving university students. The results indicate that the Kano Model, when applied in digital learning, enables educators and administrators to classify learning service attributes based on their influence on learner satisfaction ranging from must-be (platform accessibility and material clarity), one-dimensional (teacher interaction and feedback), to attractive qualities (gamification and content personalization). At the same time, TQM offers a comprehensive management foundation that emphasizes continuous improvement, data-driven decision-making, customer focus, innovation, and stakeholder engagement. The combination of both models contributes to building an adaptive, responsive, and learner-centered digital education environment. This integration not only enhances student satisfaction but also strengthens institutional competitiveness and ensures sustainable quality assurance in the era of digital transformation. Thus, the study provides a conceptual contribution to developing a holistic quality framework for digital learning that is technologically efficient, pedagogically meaningful, and socially equitable.

Keywords: Kano Model; Total Quality Management; Digital Learning; Student Satisfaction; Education Quality

A. Introduction

The development of information and communication technology (ICT) has become a major catalyst in the transformation of global education. Over the past two decades, rapid advances in cloud computing, artificial intelligence, big data, and internet connectivity have reshaped the educational paradigm toward a more flexible, inclusive, and data-driven model (J. Chen et al., n.d.; Darmawan & Grenier, 2021). Education is no longer confined to physical classrooms but has evolved into a digital learning ecosystem accessible anytime and anywhere. This digital transformation is not merely a matter of technological adoption but represents epistemological, pedagogical, and managerial shifts in how education is designed and implemented.

The COVID-19 pandemic served as a pivotal moment that accelerated global digital transformation while also exposing disparities in access, infrastructure readiness, and teachers' pedagogical capacity (UNESCO, 2020; Karimah et al., 2023; Lan et al., 2024a). This shift has brought significant implications for how learning is conducted: from face-to-face interaction to online engagement, and from uniform instructional approaches to more personalized and adaptive learning. In this context, learners have transitioned from being passive recipients of information to active participants who control their learning pace and sources through various digital platforms such as Learning Management Systems (LMS), interactive videos, online simulations, and virtual forums (Karimah et al., 2023).

This transformation also necessitates a redefinition of the teacher's role. Teachers are no longer mere transmitters of knowledge but facilitators, designers of learning experiences, and reflective mentors. This new role requires enhanced competencies in designing meaningful digital learning, managing virtual interactions, and evaluating learning processes adaptively (Darmawan & Grenier, 2021). Moreover, educational institutions must develop support systems that enable digital learning to be effective and sustainable in terms of infrastructure, policy, and organizational culture.

Nevertheless, the digital learning transformation cannot be separated from the issue of quality. Pedagogically, digital learning demands flexible and contextual instructional designs that integrate theories such as constructivism, connectivism, and project-based learning to create active and meaningful learning experiences (Theresiawati et al., 2023). From a managerial perspective, educational quality should not be measured solely through academic achievement or accreditation but must also consider learner satisfaction, engagement, and the effectiveness of digital interaction (Aslamiah et al., 2021). Evaluating quality based on learner satisfaction is essential, as it reflects the extent to which learning experiences meet learners' expectations and needs (Handayani & Wiyata, 2020; Ningsih, 2020). In the context of digital learning, learner satisfaction is multidimensional, encompassing technical aspects (platform accessibility and connection stability), pedagogical aspects (quality of teacher interaction and clarity of instruction), and affective aspects (emotional and social support). To understand this complexity, the Kano Model offers an analytical framework that categorizes learning attributes into must-

be, one-dimensional, and attractive dimensions based on learner perceptions (Harrington, 2020; Theresiawati et al., 2023). The must-be attributes include basic elements such as content clarity and platform stability; one-dimensional attributes involve teacher interaction and feedback speed; while attractive attributes refer to innovative elements such as gamification and content personalization (C. K. Chen et al., 2022; Ghogare et al., 2015).

The transformation of digital learning demands a quality approach that is contextual and student-centered. This article explores the integration of the Kano Model and Total Quality Management (TQM) as a strategic framework for improving the quality of digital learning based on student satisfaction. The Kano Model is employed to classify learning attributes into must-be, one-dimensional, and attractive categories, based on students' perceptions of various digital learning features. Meanwhile, TQM provides a systemic structure for continuous improvement and stakeholder involvement in quality enhancement processes.

This study uses a descriptive qualitative approach, with data collected through Kano-based questionnaires, interviews, and documentation involving university students. The results indicate that the Kano Model, when applied in digital learning, enables educators and administrators to classify learning service attributes based on their influence on learner satisfaction, ranging from must-be (platform accessibility and material clarity), one-dimensional (teacher interaction and feedback), to attractive qualities (gamification and content personalization).

At the same time, TQM offers a comprehensive management foundation that emphasizes continuous improvement, data-driven decision-making, customer focus, innovation, and stakeholder engagement. The combination of both models contributes to building an adaptive, responsive, and learner-centered digital education environment.

This integration not only enhances student satisfaction but also strengthens institutional competitiveness and ensures sustainable quality assurance in the era of digital transformation. Thus, the study provides a conceptual contribution to developing a holistic quality framework for digital learning that is technologically efficient, pedagogically meaningful, and socially equitable.

Meanwhile, the Total Quality Management (TQM) approach provides a systemic framework for the continuous improvement of educational quality. TQM emphasizes the involvement of all organizational components, continuous improvement, and a focus on customer satisfaction which, in the educational context, refers to learners (Sallis, 2014; Diana & Faslah, 2025; Wulogening & Timan, 2020). Implementing TQM in digital education requires a cultural shift within institutions toward a reflective and participatory system. The core principles of TQM continuous improvement, total involvement, and customer focus are essential to ensuring the quality of digital learning that remains adaptive to technological changes and learner needs (Indadihayati & Hariyanto, 2023).

This aligns with the ideals of humanistic and democratic education, where learners are positioned as partners in the learning process rather than mere objects of evaluation (Smith & Johnson, 2023). The integration of the Kano Model and TQM offers a comprehensive strategy for managing digital learning quality based on learner satisfaction. The Kano Model serves as a diagnostic tool to identify learner needs and expectations, while TQM provides the framework for systematically implementing and managing quality improvement (L. S. Chen & Hsu, 2019; Arafat, 2024). The synergy between these two models enables educational institutions to balance technological and humanistic dimensions of digital education ensuring that technological innovation aligns with the emotional, social, and academic needs of learners.

The current introduction implicitly presents a research gap; however, it should explicitly articulate what has not been adequately explored in previous studies, particularly the *operational integration* of the Kano Model and Total Quality Management (TQM) within digital learning contexts. Previous research has mainly focused on the application of the Kano Model for assessing learner satisfaction or on the implementation of TQM for institutional quality assurance in general education (e.g., Wang et al., 2023; Kusuma & Handayani, 2022). Yet, empirical studies rarely explore how these two frameworks can be *synthesized* to create a continuous quality improvement cycle in digital education systems.

This study therefore contributes by developing a conceptual and empirical framework for integrating the Kano Model and TQM principles to evaluate and enhance the quality of digital learning environments. Specifically, it seeks to operationalize the integration of these models as a strategic mechanism for improving learner-centered quality management in digital contexts. Such integration allows for a systematic identification of “must-be,” “one-dimensional,” and “attractive” attributes of digital learning, which can then inform institutional decision-making and continuous quality enhancement.

Furthermore, the transformation of digital learning requires not only technological readiness but also a comprehensive vision of quality management that places learners at the center of educational innovation. As highlighted by recent studies, digital quality management must address not just system efficiency and usability, but also pedagogical meaningfulness, accessibility, and social equity in the learning experience (Zhou et al., 2024; Alqahtani & O'Connor, 2023). Through this approach, educational institutions are expected to design learning ecosystems that are technologically efficient, pedagogically sound, and socially inclusive, aligning with global movements toward learner-driven quality assurance in higher education.

B. Method

Research Design

This study employed a descriptive qualitative approach aimed at providing an in-depth depiction of students' and teachers' perceptions of digital learning attributes that influence learner satisfaction. This approach was chosen because it allows the researcher to explore phenomena contextually and reflectively, capturing the complexity of learning experiences that cannot be fully explained through quantitative data alone. Although primarily qualitative, the study also integrates quantitative elements through the use of the Kano Model questionnaire, enabling the categorization of digital learning attributes based on students' perceptions. Accordingly, the research adopted a light mixed-method design, where quantitative data served to complement and reinforce qualitative findings (Creswell & Plano Clark, 2018).

Sample Size and Composition

The study involved 112 student participants and 12 teachers from a digitally oriented junior high school Indonesia. The students were drawn from grades VIII and IX, comprising 54 males and 58 females, aged between 13 and 15 years. They had participated in online or blended learning for at least one semester. Meanwhile, the teacher participants included both male and female educators from various subject areas such as mathematics, science, language, and social studies, all actively engaged in digital learning design and implementation. Participant selection used purposive sampling to ensure diversity in experience, subject representation, and digital competence (Miles, Huberman, & Saldaña, 2014).

Instrument Development and Validation

The study used a Kano Model questionnaire that was adapted from Harrington's (2020) guidelines and contextualized for digital learning environments. The adaptation involved modifying item statements to reflect educational attributes such as *access to learning materials*, *clarity of instructions*, *teacher interaction*, *feedback mechanisms*, *gamification features*, *content personalization*, and *platform stability*. The instrument was subjected to expert validation by three specialists in educational technology and instructional design to ensure content relevance and construct clarity.

In addition, semi-structured interview protocols for teachers and administrators were developed to explore perceptions of digital learning quality, instructional design strategies, and the application of Total Quality Management (TQM) principles. The interview guides were reviewed by two qualitative research experts for clarity and thematic coverage before implementation.

Data Collection Procedures

Data were collected using three complementary techniques: questionnaires, interviews, and documentation.

1. Kano Model Questionnaire: Distributed online via Google Forms to students, assessing their satisfaction toward various digital learning attributes. Each item contained two core questions to evaluate how students felt when a specific attribute was *present* and when it was *absent*. Responses were categorized into five

Kano types: *must-be*, *one-dimensional*, *attractive*, *indifferent*, and *reverse* (Harrington, 2020).

2. Semi-Structured Interviews: Conducted with 12 teachers and 3 school administrators. The interviews focused on (a) perceived quality of digital learning, (b) instructional design strategies, (c) implementation of TQM principles, and (d) perceived impact on student engagement and satisfaction. Each interview lasted approximately 45–60 minutes and was recorded with participant consent (Merriam & Tisdell, 2016).
3. Document Analysis: Examined digital learning modules, evaluation rubrics, institutional quality reports, and policy documents related to technology-based education. This step provided contextual data on how digital quality management and instructional design were operationalized (Bowen, 2009).

Integration of Quantitative and Qualitative Data

Integration occurred at the data interpretation stage. Quantitative findings from the Kano questionnaire were used to prioritize learning attributes that significantly influenced satisfaction. These results then informed the thematic coding of qualitative data, allowing for cross-validation between categories and themes. For instance, attributes identified as “must-be” in the Kano analysis (e.g., platform stability, clarity of instructions) were examined in teacher interviews to understand how such expectations were addressed in digital teaching design. This sequential integration ensured that quantitative trends guided deeper qualitative interpretation (Fetters, Curry, & Creswell, 2013).

Data Triangulation and Validation

To enhance validity and trustworthiness, method triangulation and source triangulation were employed (Denzin, 2017). Method triangulation was achieved through the convergence of questionnaire results, interviews, and document analysis, while source triangulation compared perspectives across students, teachers, and administrators. Investigator triangulation was also used by involving two independent coders who cross-checked qualitative themes to reduce researcher bias. Data credibility was further reinforced through member checking and peer debriefing, ensuring that interpretations accurately reflected participant perspectives (Lincoln & Guba, 1985).

Data Analysis

Data analysis proceeded in three stages:

1. Quantitative Stage: Kano responses were tabulated and analyzed to determine the distribution of learning attributes across satisfaction categories.
2. Qualitative Stage: Interview transcripts and documents were analyzed using thematic analysis (Braun & Clarke, 2019), focusing on themes such as *perceived quality*, *instructional design strategies*, *challenges in implementing TQM*, and *expectations toward digital learning systems*.
3. Integrative Interpretation: Results from both analyses were synthesized to provide a holistic view of how digital learning attributes contribute to learner satisfaction and how TQM principles can be operationalized in digital education.

Through this rigorous methodological framework, the study seeks to provide a comprehensive and reflective understanding of how digital learning attributes influence student satisfaction and how TQM principles can guide the sustainable development of technology-enhanced education systems.

C. Finding and Discussio

1. Finding

a. Empirical Density and Overview

The analysis of the Kano Model questionnaire distributed to students (n = 112) revealed that perceptions of digital learning attributes can be classified into three primary categories: *must-be*, *one-dimensional*, and *attractive* attributes. This categorization provides a clear depiction of the elements perceived as essential, directly influential, or value-adding to students' learning satisfaction (Handayani & Wiyata, 2020; Industri et al., 2018; Ningsih, 2020).

Table 1. Analysis Of The Kano Model Questionnaire Distributed

Kano Category	Learning Attribute	Frequency (n)	Percentage (%)	Interpretation
Must-be	Platform accessibility	101	90.2	Basic requirement; absence causes dissatisfaction
Must-be	Clarity of learning materials	96	85.7	Core expectation for understanding
One-dime	Teacher interaction	88	78.6	Linear satisfaction driver
One-dime	Quality of feedback	82	73.2	Strong motivator and reinforcement
Attractive	Gamification features	67	59.8	Value-added, engagement enhancer
Attractive	Content personalization	61	54.5	Enrichment factor and differentiation

These results demonstrate that while technological accessibility and content clarity are viewed as non-negotiable prerequisites, teacher responsiveness, feedback quality, and creative engagement through gamification and personalization significantly enhance overall learning satisfaction.

b. Mapping of Learning Attributes

The analysis of the Kano Model questionnaire distributed to students revealed that perceptions of digital learning attributes can be classified into three main categories: *must-be*, *one-dimensional*, and *attractive* attributes. This classification provides a clear depiction of the elements that are perceived as essential, directly influential, or value-adding to

students' learning satisfaction (Handayani & Wiyata, 2020; Industri et al., 2018; Ningsih, 2020).

a. **Must-be Attributes: Platform Accessibility and Clarity of Learning Materials**

Must-be attributes represent the fundamental elements that must exist within digital learning environments. The absence of these attributes leads to significant dissatisfaction; however, their presence does not necessarily enhance satisfaction explicitly, as they are perceived as basic requirements.

- 1) Access to learning platforms: The majority of students stated that easy access to digital learning platforms such as *Google Classroom*, *Moodle*, or other learning applications is an absolute necessity in digital education. When platforms are difficult to access, slow, or unstable, students experience frustration and a decline in learning motivation. This indicates that technological accessibility is no longer an additional feature but a basic requirement that must be fulfilled by educational institutions.
- 2) Clarity of learning materials: Learning materials that are unstructured, ambiguous, or overly dense cause confusion and reduce learning effectiveness. Students expect concise, clear materials accompanied by visual explanations or concrete examples. Clarity in task instructions is also part of this attribute, as unclear directions often lead to mistakes and dissatisfaction with the learning process. These findings indicate that *must-be* attributes must be ensured before institutions move toward instructional innovation. Without these foundational elements, quality improvement efforts will lack a stable basis.

b. **One-Dimensional Attributes: Teacher Interaction and Feedback**

One-dimensional attributes are elements that have a linear relationship with students' satisfaction the better the quality of these attributes, the higher the satisfaction level (L. S. Chen & Hsu, 2019; Harrington, 2020).

- 1) Interaction between teachers and students: Active, responsive, and meaningful interaction is a critical factor in digital learning. Students appreciate teachers who create space for discussion, respond promptly to questions, and foster supportive communication throughout the learning process. Such interactions are not only academic but also emotional, as teachers act as facilitators and learning companions.
- 2) Feedback on assignments and learning activities: Prompt, clear, and constructive feedback is highly valued by students. They feel more motivated and understand improvement directions when teachers provide specific and thoughtful comments. Feedback also serves as an indicator that their learning process is recognized and appreciated. These attributes highlight that the quality of pedagogical relationships in digital learning remains a key determinant of student satisfaction. Technology cannot replace the essential role of teachers as the primary agents in constructing meaningful learning experiences.

c. **Attractive Attributes: Gamification and Content Personalization**

Attractive attributes are elements not explicitly expected by students but, when present, significantly enhance satisfaction and engagement in learning (L. S. Chen & Hsu, 2019; Harrington, 2020).

- 1) **Gamification in learning:** The incorporation of game-like elements such as points, levels, challenges, and leaderboards in digital learning has been proven to increase motivation and participation. Students feel more engaged and challenged when learning is presented interactively and enjoyably. Although not all teachers implement gamification, its presence has a significant positive effect on learning satisfaction.
- 2) **Personalization of learning content:** Content tailored to students' interests, learning styles, or ability levels fosters a sense of being valued and recognized. Personalization may involve topic choices, flexible learning schedules, or recommendations for supplementary materials. Students feel more comfortable and motivated when learning is not uniform but allows room for individual preferences.

2. Discussion

a. Implications for Learning Satisfaction

The mapping of digital learning attributes using the Kano Model provides significant insight into how students perceive the quality of learning in the digital era. Learning satisfaction is not solely determined by the presence of technology but is profoundly shaped by the quality of interaction, content relevance, and the consciously designed learning experiences facilitated by teachers. The implications of these findings highlight two key dimensions: the relationship between learning attributes and perceived quality, and the teacher's role as a designer of learning experiences (Lan et al., 2024b).

1) The Relationship Between Learning Attributes and Perceived Quality

Students' satisfaction with digital learning is strongly influenced by the type and quality of attributes they experience throughout the learning process. Must-be attributes such as platform accessibility and clarity of materials serve as the foundation of quality. When these attributes are not met, students tend to perceive the learning process as inadequate or unprofessional, regardless of the presence of other innovative features. In other words, must-be attributes establish the minimum quality threshold that educational institutions must fulfill (Handayani & Wiyata, 2020).

One-dimensional attributes, such as teacher interaction and feedback, exhibit a linear relationship with perceived quality. The better the interaction quality and the faster and more relevant the feedback, the higher the students' satisfaction levels. These attributes directly reflect pedagogical effectiveness and the teacher's commitment to the learning process (Harrington, 2020). Meanwhile, attractive attributes such as gamification and content personalization function as quality enhancers. The presence of these features not only improves satisfaction but also fosters the perception that digital learning is an engaging, relevant, and personally rewarding experience. These attributes contribute to

building a positive image of both the school and the teacher, while simultaneously increasing intrinsic motivation to learn (J. Chen et al., n.d.). Hence, the relationship between learning attributes and perceived quality is hierarchical and complementary. Must-be attributes ensure adequacy, one-dimensional attributes determine effectiveness, and attractive attributes create excellence. Educational institutions capable of balancing these three types of attributes are more likely to build high-quality and sustainable digital learning systems (Harrington, 2020).

2) The Teacher's Role as a Designer of Learning Experiences

The findings also emphasize that teachers hold a central role as designers of learning experiences, rather than mere transmitters of content. In digital learning contexts, teachers are required to design interactions, select media, structure content, and manage virtual classroom dynamics strategically and reflectively.

As designers, teachers must understand students' expectations, identify impactful learning attributes, and craft instructional strategies that meet those needs. This role includes:

- a) Designing clear and flexible learning structures to enable students to follow learning paths comfortably and independently.
- b) Building meaningful interactions both synchronous and asynchronous to foster connection and emotional support.
- c) Providing timely and constructive feedback as recognition of student effort and as a tool for learning reflection.
- d) Integrating innovative elements such as gamification and personalization to enhance engagement and learning relevance.

The teacher's role as a designer also demands competence in interpreting student satisfaction data, reflecting on teaching practices, and collaborating with peers in continuous quality improvement. Within the framework of Total Quality Management (TQM), teachers act as primary agents in the cycle of ongoing improvement, where each instructional interaction and decision contributes to the overall quality of the learning system (Theresiawati et al., 2023).

Therefore, students' learning satisfaction depends not merely on the technology utilized but on the quality of the learning experience design crafted by teachers. When teachers strategically and reflectively manage learning attributes, digital learning evolves beyond a tool for information delivery into a space for growth, engagement, and transformation (Handayani & Wiyata, 2020).

b. Integration in Total Quality Management (TQM) Practice

The findings of this study indicate that integrating the mapping of digital learning attributes with the principles of Total Quality Management (TQM) can serve as an effective strategy in developing a quality, adaptive, and learner-centered educational system. Two primary TQM principles that are particularly relevant in this context are continuous improvement through satisfaction evaluation and learner involvement in

instructional design. These principles not only enhance learning effectiveness but also foster a participatory and reflective quality culture within the school environment (Diana & Faslah, 2025).

1) Continuous Improvement through Satisfaction Evaluation

One of the key findings of this study is that learner satisfaction can function as a central indicator in the quality improvement cycle of digital learning. By employing the Kano Model, schools can map the learning attributes that have the greatest impact on satisfaction and use these insights as a foundation for evaluation and decision-making (Matzler et al., 2019). Learner satisfaction evaluation should not be merely summative; it must be conducted periodically and take a formative approach. Simple surveys, open reflections, and participation data analysis can be utilized to identify areas requiring improvement. For instance, if learner express dissatisfaction regarding unclear instructions or delayed feedback, teachers and curriculum developers can immediately adjust the instructional design accordingly (Setiawan & Sayuti, 2022).

Within the TQM framework, this process is known as continuous improvement, wherein each learning cycle serves as a space for reflection, evaluation, and innovation. Improvements are made not only to content or technology but also to pedagogical approaches, communication strategies, and support systems. By positioning learner satisfaction as the starting point, schools can ensure that digital learning does not merely function but evolves continuously (Chen et al., 2022). Furthermore, satisfaction evaluation serves as a tool for building accountability and transparency within the educational system. When learners feel that their voices are heard and used as a basis for improvement, their trust in the institution increases, leading to greater motivation to learn (Nurhayati & Ramadhan, 2021).

2) Learner Involvement in Instructional Design

The principle of total involvement in TQM emphasizes that all members of an organization should participate in the quality improvement process. In the educational context, learners are not merely recipients of instruction but active partners in designing the learning experience. This study shows that learners possess insightful perceptions of the learning attributes they encounter and can provide constructive feedback for instructional design (Diana & Faslah, 2025; Nawawi & La'alang, 2020; Susanto et al., 2024). Learner involvement can be actualized through various means, including:

- a) Open reflections and learning journals, in which learners express their experiences, challenges, and expectations regarding digital learning.
- b) Discussion forums or focus groups, enabling learners to engage directly with teachers and curriculum teams to share ideas and evaluations.
- c) Kano Model-based satisfaction surveys, serving as formal instruments to map learners' expectations and perceptions of learning attributes.

By involving learners in instructional design, educators can craft more relevant, contextual, and impactful strategies. Content personalization, flexible scheduling, and

media selection can be adapted to learners' preferences, thereby increasing engagement and satisfaction. This involvement also has long-term implications for character formation. Learners develop reflective thinking, participate in decision-making, and understand that educational quality is a shared responsibility. Within the TQM framework, this concept is referred to as ownership of quality, wherein every individual feels responsible for maintaining and improving the quality of the system (Diana & Faslah, 2025; Sallis, 2014).

In conclusion, the integration of satisfaction evaluation and learner involvement in instructional design represents a concrete application of TQM in digital education. When schools succeed in building a system that listens, responds, and actively engages learners, the quality of learning improves not only technically but also culturally and emotionally.

E. Conclusion

The application of the Kano Model within the framework of Total Quality Management (TQM) in digital learning has proven to be a strategic approach to improving student satisfaction and learning quality. By categorizing learning attributes based on learner needs such as must-be, one-dimensional, and attractive factors the Kano Model enables educators and institutions to identify key areas that most influence digital learning experiences. Integrating TQM principles such as continuous improvement, stakeholder involvement, and process optimization ensures that the implementation is systematic and sustainable. Overall, the synergy between the Kano Model and TQM creates a holistic management system that not only measures but also enhances the quality of digital learning services. This integration supports educational institutions in achieving excellence and fostering adaptive, learner-centered digital education environments.

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