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Transforming Pedagogy with Nano-Learning in Higher Education: A Critical Analysis

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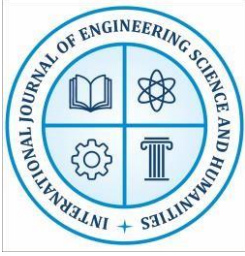
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Abstract:

Higher education was both hurt and given new opportunities by the COVID-19 pandemic. In order to improve professional and career development, online teaching and learning may continue to be one of the major trends in higher education in the upcoming year. In the upcoming years, "Nano-learning" is probably going to be the big thing. Every young professional wants to develop their professional abilities and flexible learning in these days, therefore there must be more effective, efficient, and time-friendly ways for them to do so. With 1,000 universities and 40,000 higher education institutions, India boasts the largest higher education system in the world. The New Education Policy (NEP) 2020 will be crucial in defining higher education in India as the country's higher education systems prepare for a significant upheaval. Analyzing the impact of COVID-19 on the Indian higher education system and projecting future advancements in this area are the goals of this study. This study made use of previously published studies on Nano learning patterns, COVID-19, and NEP-2020 (Ansari, Hasan & Khan, 2023).

In addition to upending higher education around the world, the COVID-19 pandemic sparked revolutionary changes in professional development, teaching, and learning. The adoption of online and remote learning tools, which are now essential components of academic delivery and continue to have an impact even after the acute phase of the epidemic, was expedited by the forced closure of universities and colleges. According to research, the move to online learning offered accessible and adaptable substitutes for traditional in-person instruction. This led to advancements in digital pedagogy and increased use of technology-mediated learning platforms in higher education across the globe, including in India. Simultaneously, as learners look for quick and efficient ways to improve their professional competencies in an increasingly digital world, new learning modalities like Nano-learning bite-sized educational content created for efficient and focused competency development are becoming more and more popular. Research on Nano-learning shows that it may swiftly impart focused, concise knowledge, which fits with the changing tastes of online learners and marks a significant shift in post-pandemic educational design (Chalil, Hoque & Kumar, 2023).



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Keywords: Transforming Pedagogy, Nano-Learning, Higher Education, Critical Analysis

Introduction:

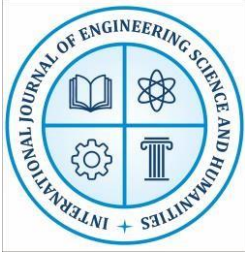
Many facets of Indian official, non-formal, and informal educational settings have been severely damaged by the COVID-19 virus's propagation, which is a major determinant of a country's economic future. The lockdown that has been imposed due to the outbreak has created both possibilities and challenges for India's higher education sector. Numerous scholars have found that the Covid-19 pandemic had an impact on the higher education sector overall, but it also highlights a number of novel trends and teaching strategies that might persist in the future (*Borah & Chitrakar, 2022*).

The COVID-19 pandemic has presented new chances for innovation in higher education, despite these obstacles. Previously ancillary to mainstream academic delivery, digital technology and pedagogical tools have become more widely used as a result of the mandated transition to online teaching and learning platforms. This has required many institutions to reconsider their teaching methods, include e-learning platforms, and increase access to online classrooms, laying the foundation for future educational models that are more adaptable and blended. Research shows that although concerns like internet access and digital preparedness are still important, the pandemic served as a spur for educational stakeholders to investigate different teaching strategies and provide students with a range of digital skills (*Gochhayat & Das, 2023*).

The epidemic has had two effects on Indian higher education: it has made already difficult issues worse while also encouraging creativity and adaptability in teaching and learning methods. Institutions with little experience with digital platforms were forced to implement online systems, which raised questions about quality and equity as well as prospects for increased access. Scholars stress the significance of comprehending how these swift changes, from instructional design to institutional policy responses, will influence higher education's future beyond the current crisis as the industry continues to manage these changes. In order to develop measures that improve resilience and educational continuity in the face of future disruptions, it is imperative that these implications be examined comprehensively (*Chalil, Hoque & Kumar, 2023*).

Background of the Study:

In recent years, technology improvements, changing learner expectations, and global upheavals like the COVID-19 epidemic have all contributed to the rapid transformation of the higher education sector. It has become more difficult for traditional pedagogical models which mostly relied on lengthy lectures in class and instructor-centered approaches to engage students who want individualized, flexible, and time-efficient learning opportunities. Educators and educational institutions around the world have taken a keen interest in Nano-learning, a new pedagogical technique that offers brief, targeted learning units that target particular knowledge or skill areas. Modern learners' cognitive preferences are met by Nano-learning, which provides high-impact instruction in brief, readily assimilated formats and is frequently facilitated by digital



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platforms and mobile technology. This method is especially applicable in higher education settings where students must juggle their academic, personal, and professional obligations because it not only promotes quick skill acquisition but also self-directed learning and ongoing professional development.

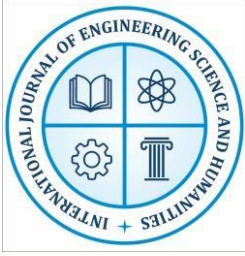
Statement of the Research Problem:

Technological developments, changing learner expectations, and worldwide disruptions like the COVID-19 pandemic are all driving significant change in higher education today. Modern learners want flexible, individualized, and time-efficient learning experiences, and traditional pedagogical approaches which mostly rely on lengthy lectures and instructor-centered teaching frequently fail to interest them. Nano-learning the transmission of brief, targeted learning modules intended for quick skill acquisition has become a viable pedagogical innovation in response to these issues. Although Nano-learning is becoming more and more popular, there are still serious concerns about its efficacy, scalability, and compatibility with current curriculum frameworks.

There is still little empirical data on how Nano-learning affects academic performance, knowledge retention, and competency development in higher education settings, despite research showing its potential advantages, such as enhanced learner engagement, flexibility, and self-directed learning. Furthermore, the swift transition to digital and hybrid learning settings has brought to light inequalities in teacher preparedness, institutional support, and technical access, all of which could have an impact on how well Nano-learning projects are implemented. Additionally, there aren't many thorough studies looking at the instructional design techniques, pedagogical frameworks, and evaluation procedures needed to successfully incorporate Nano-learning into higher education curriculum.

Review of related Literature:

1. Vivekananth P. (2022), "Nanolearning: A New Paradigm Shift in Teaching and Learning", the study characterizes Nano-learning as extremely focused, brief learning materials, usually lasting less than five minutes, that are tailored to accommodate the shorter attention spans of contemporary students. It emphasizes how Nano-learning may be used in both blended learning and traditional classroom settings, with the potential to enhance learning outcomes and engagement. The article highlights both methodological uses and potential improvements for the integration of Nano-learning modules into remote learning. Additionally, the study places Nano-learning in the context of current digital education trends, contending that bite-sized learning is more successful than traditional long-form instruction at supporting Gen Z learners. This study presents Nanolearning as a progressive pedagogical approach that is in line with contemporary educational requirements.
2. Saeed Jameel Aburizaizah & Tahany Abdulaziz Albaiz (2021), "Review of the Use and Impact of Nano-Learning in Education", the review of the literature shows how Nano-



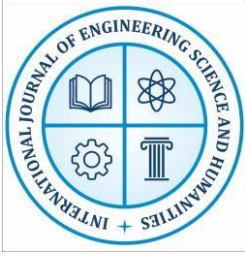
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learning developed from more general e-learning paradigms, particularly as a result of connectivist theory and the growth of social media. It introduces Nano-learning as a subset of microlearning, in which microcontent is further divided into minuscule pieces that are tailored to particular learning goals. The authors contend that by utilizing social media platforms and networked technology, Nano-learning can revolutionize instructional design and provide flexible, learner-controlled, and individualized learning. Discussions like instructional design, content depth, and how Nano-learning undermines conventional pedagogical presumptions are also highlighted in the paper.

3. Khlaif, Z. N. & Salha, S. (2021), "Using TikTok in Education: A Form of Micro-learning or Nano-learning?", the paper connects Nano-learning theory with the pedagogical consequences of employing short-form social media videos (like those on TikTok) as teaching aids. In line with mobile and social media consumption patterns, Nano-learning is positioned as providing single-objective learning units that should ideally last less than a minute. The study emphasizes the advantages for accessibility, motivation, and learner engagement, indicating that Nano-learning may be particularly helpful when creative content is employed in both formal and casual settings. Additionally, design considerations for successful Nano-learning content on digital platforms are covered.
4. Edi Sukmojati (2024), "Nano Learning in Education: Concept and Best Practice", according to conceptual analysis, Nano-learning is a technique that divides instructional material into brief, highly targeted chunks that improve retention and lessen cognitive overload. It makes the case that Nano-learning is in line with how contemporary learners most efficiently process information by using recent empirical research and cognitive load theory. In order to make content more interesting, the chapter describes recommended practices, such as utilizing interactive tools and multimedia forms. Additionally, it talks about how the short duration of Nanolearning facilitates just-in-time learning, allowing students to fit their education into hectic schedules.
5. Kanwal, Z. & Farooq, M. S. (2025), "Development and Validation of a Nano Learning Practices Scale (NLPS)", a measurement tool for evaluating Nano-learning practices in higher education is developed and validated through quantitative research. Through the identification of crucial elements including chunked content, multimedia utilization, well-defined goals, and prompt feedback, the study offers a trustworthy metric to assess the effectiveness of Nano-learning in educational settings. The study's conclusions highlight how methodical Nano-learning module design improves student engagement and increases the efficacy of educational procedures. For instructors looking to rigorously adopt Nano-learning, this work offers useful tools.
6. Ria Maisalinia et al. (2024), "Leveraging Nano-Learning into the Fashion Design Classroom Using TikTok, Educate", an empirical study uses TikTok video modules to give



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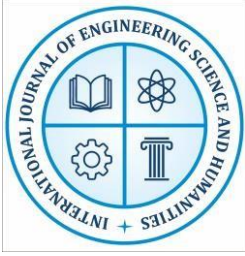
brief courses while applying Nano-learning concepts in a fashion design school setting. According to student responses, short-form video Nanolearning improved accessibility, engagement, and understanding of difficult design concepts. The study emphasizes how Nano-learning can foster creativity and learner autonomy, but it also points up drawbacks including information filtering and the possibility of cognitive overload if poorly designed. This study demonstrates the cross-disciplinary applicability of Nanolearning.

7. Appolenon Lee Gordon (2024), "An Examination of Nano-Learning Trends in Educational Leadership for Social Transformation", the study investigates Nano-learning as a tool that goes beyond skill acquisition, looking at its function in social change and educational leadership. It emphasizes the adaptability and accessibility of Nano-learning and highlights how, when carefully included into more comprehensive educational systems, it may promote equity and inclusion. Additionally, the study warns that if the content is too short, it could lead to superficial learning unless it is pedagogically scaffolded. Through the article's placement of Nano-learning inside leadership frameworks, its macro-level implications for educational change are better understood.
8. International Journal of Engineering Technology and Management Sciences (2023), New Trends in Higher Education with "Nano-Learning", contextualizes Nano-learning within broader shifts in higher education post-COVID-19, describing the ways in which flexible learning strategies and digital developments are changing pedagogy. It makes the case that as educators look for quick, easy, and efficient ways to assist professional competency development, Nano-learning will probably gain popularity. The essay outlines India's extensive higher education system and proposes that legislative frameworks like NEP 2020 could hasten the implementation of Nanolearning.

Research Gap:

Even while Nano-learning has become more popular as a cutting-edge teaching strategy, the literature now in publication highlights a number of holes that need to be filled, especially in the context of higher education. The majority of research focuses on defining Nano-learning, investigating its theoretical underpinnings, or recording immediate advantages such improved accessibility, flexibility, and learner engagement (*Grading et al., 2019; Illeris, 2021*). The long-term effects of Nano-learning on learning outcomes, information retention, and skill development, particularly in different higher education contexts, have not, however, been thoroughly studied empirically. Few studies have investigated Nano-learning's systematic integration into formal curricula and its alignment with learning objectives and evaluation methodologies, despite the fact that several have looked at its use in particular disciplines or through social media platforms.

Furthermore, issues with faculty readiness, instructional quality, and pedagogical design are brought up by the use of Nano-learning in higher education. Since many schools lack defined



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frameworks or procedures for creating successful Nano-learning modules, teachers are left to experiment without enough evidence to back them up. Additionally, the infrastructure constraints and digital gap in nations like India present major obstacles to equitable implementation—a problem that is frequently disregarded in the literature. The learner viewpoint is also the focus of the majority of studies, with comparatively little focus on institutional preparedness, governmental support, or curricular reform required to successfully expand Nano-learning across universities.

Objectives of the Study:

1. To study the emerging trends and futuristic developments of Nano-learning within the context of higher education in India.
2. To examine analyze the potential of Nano-learning as a transformative pedagogical approach in higher education institutions.
3. To assess whether Nano-learning can function as a complementary or alternative instructional model within the Indian higher education system.

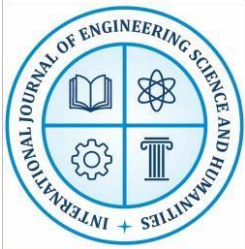
Research Methodology:

Primary Sources

In order to gather primary data, surveys, interviews, and focus groups involving higher education stakeholders such as instructors, instructional designers, and students will be conducted. Perceptions of Nano-learning's efficacy, accessibility, and engagement as well as the difficulties encountered during implementation will be gauged via the survey instrument. Faculty and instructional designer interviews will yield detailed information about curriculum integration, pedagogical approaches, and instructional design factors for Nano-learning modules. Student focus groups will be used to record their experiences, preferences, and opinions about the advantages of bite-sized learning materials. A thorough grasp of the trends, obstacles, and possibilities in the adoption of Nano-learning will be possible thanks to the statistical methods for quantitative responses and thematic analysis for qualitative responses used to examine the main data.

Secondary Sources

A thorough examination of the body of research papers, books, policy documents, and reliable internet sources pertaining to Nano-learning, digital pedagogy, and reforms in higher education will be used to collect secondary data. Studies on technology-enhanced learning, microlearning and Nanolearning frameworks, and evaluations of the use of digital pedagogy in higher education both internationally and in India will be among the key literature. In order to comprehend institutional support for new pedagogical techniques, policy papers such as India's New Education Policy (NEP 2020) will also be analyzed. In order to highlight best practices, trends, and gaps in the use of Nano-learning, the secondary data will supply the theoretical framework and contextual background.



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Discussion:

Changes in Indian Higher Education Following COVID-19:

COVID-19 has shifted from the well-known offline teaching approach known as "chalk and talk" to a new approach known as "technology-mediated learning." Institutions of higher learning are experimenting with various online solutions to facilitate communication between students and instructors. Google Classrooms, Zoom, and Microsoft Teams are all popular platforms for classroom instruction. Due to COVID-19, schools were compelled to administer exams online. Tests were administered using Google Forms, and homework was submitted by email. Edtech platforms have the power to alter the conventional wisdom surrounding college and university education and post-secondary life. According to IBEF data, there were 1.57 million paying customers and the online education market was valued at US\$247 million in 2016. It is anticipated to reach US\$ 1.96 billion in 2021 at a compound annual growth rate (CAGR) of 52%. Edtech platforms will continue to expand in the post-COVID era as more students utilize them to access high-quality content (*Jena, 2020*).

NEP-2020 for prospects in Education:

In July 2020, the Union Cabinet approved the National Education Policy (NEP). With this strategy, the country's educational system will be drastically changed in an effort to make "India a global knowledge superpower". According to the government, the foundation of National Education Policy 2020 is flexibility; there is no strict division between academic pursuits, schoolwork, and hobbies; learning may also take place outside of school; and the focus is on multidisciplinary courses to comprehend emerging educational trends (*Government of India, 2020*).

Table 1: Using Nano Learning to Transform Pedagogy in Higher Education

Dimension	Description/Focus	Key Pedagogical Impacts
Conceptual Change	Traditional long-form content is broken down into extremely brief, targeted learning units (often less than five minutes) by Nano learning. This is a reflection of learners' shifting choices for technology and attention spans.	supports cognitive engagement by accommodating the shorter attention spans of contemporary learners and enabling self-paced, bite-sized mastering.
Student Involvement	One goal or idea per module is taught in each lesson, which increases interaction frequency and lessens screen-time weariness.	Increases student concentration, lessens cognitive overload, and encourages ongoing drive to finish several units.
Design of Instruction	Demands that the curriculum be redesigned into modular learning	



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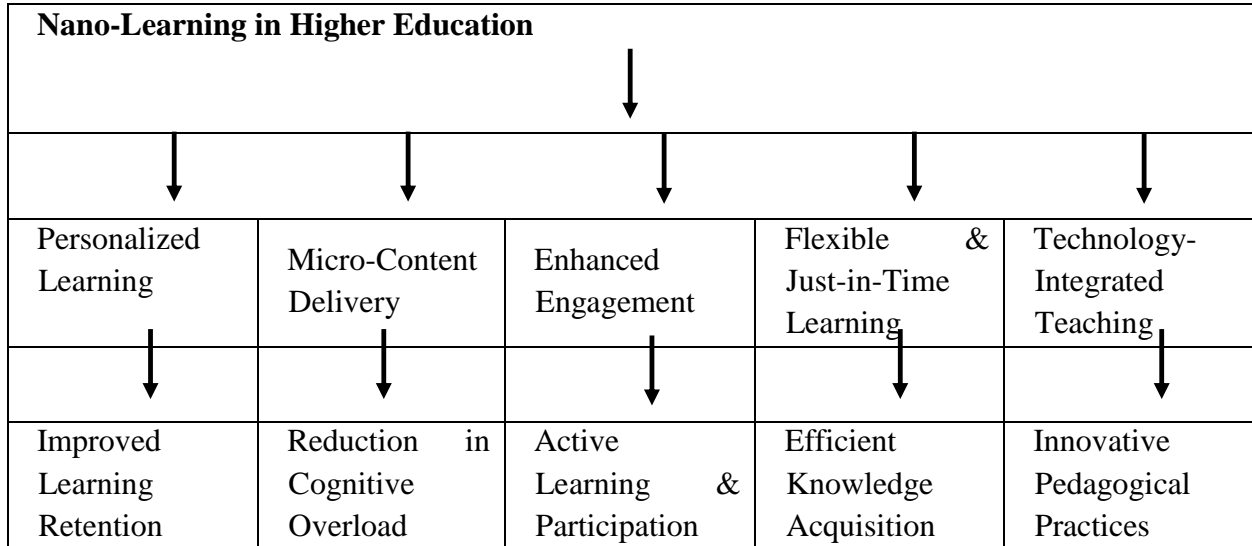
	modules with high levels of engagement and explicit, quantifiable results.	Encourages adaptable, customized learning pathways; for improved accessibility, it is compatible with digital platforms and multimedia formats.
Integration of Technology	Makes effective use of digital tools, short video platforms, and mobile devices to offer succinct content.	Increases reach and adaptability by promoting the wider use of social learning platforms, mobile apps, and LMS in pedagogy.
Evaluation and Comments	Assessment procedures adapt to short, frequent understanding tests as opposed to long, drawn-out exams.	Promotes adaptive support and prompt feedback loops; boosts student confidence; and continuously monitors progress.
Obstacles and Restrictions	Maintaining content quality, avoiding information fragmentation, and striking a balance between depth and brevity.	Maintains consistency between courses by rigorous instructional design, which requires professional development for teachers to execute.

Initiatives of the Government of India:

Since COVID-19 will have an impact on the educational system, the Indian government also launched initiatives like Vidya Daan, PM eVidya, SWAYAM, Karmyogi, and others to educate and learn online. In 2020, Vidya-Daan was created to provide excellent e-services, such as e-learning materials and tutorials, as well as to use tools of the Digital Infrastructure for Knowledge Sharing (DIKSHA) kind. On May 17, 2020, PM eVidya went live, combining all of the online, digital, and live teaching methods. The government has also provided educational assistance during COVID-19 through the use of SWAYAM-PRABHA Channels, online textbook resources, and the National Repository of Open Educational Materials, or NROER.

Combining online and classroom instruction marked the start of the blended learning era. Teachers will continue to use digital tools in the classroom based on personalized education and learning concepts, as COVID-19 forced them to do. This raises the bar for educational resources with modern tools like artificial intelligence (AI) and cloud computing, among others, making it possible to create customized lessons and instructional approaches for all educational and learning activities. All of these characteristics are present in "Nano-Learning," which promotes the consistent flow of information, improving pedagogy and making learning easier for students. This is because "Nano-Learning" encourages students to actively participate in class activities and use all of their senses, including audio and vision sensors, which will increase their capacity for learning (*Indian Government, 2021*).

Schematic Representation of Layout Flow

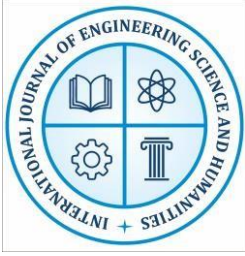


The potential of micro and Nano learning in education is being progressively realized via virtual online platforms, which offer brief, targeted, and easily assimilated learning modules. These brief sessions fit easily into hectic schedules, enhance recall of information, and sustain student interest. Through interactive content, infographics, movies, and quizzes, students can access specific knowledge at any time and from any location. This adaptable and customized method promotes lifelong learning, improves skill development, and increases educational accessibility in the digital age.



Virtually Unlock the Educational Potential of Micro and Nano Learning

Source: <https://www.asiancollegeofteachers.com/blogs/1588-Harness-the-Potential-Of-Micro-and-Nano-Learning-in-Education-Complete-Guide-blog.php>



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Results:

Pedagogical Implications for Classrooms in Higher Education

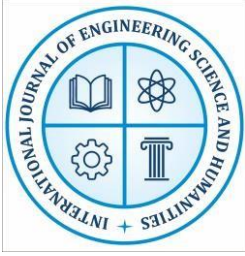
The results show that Nano-learning has the potential to significantly alter the pedagogy of higher education. Nano-learning opens up new possibilities for adaptable, learner-centered instructional design in the quickly changing EdTech ecosystem. The results of the analysis are as follows:

- ❖ **Increased Pedagogical Flexibility:** Faculty members can include micro-content into lectures, blended learning, and flipped classroom models thanks to Nano-learning's support for a variety of teaching approaches.
- ❖ **Increased Knowledge Accessibility:** Students can interact with learning materials at any time and from any location thanks to digital platforms.
- ❖ **Closing Knowledge Gaps:** Conceptual gaps that frequently go unfilled in conventional lecture-based classrooms are addressed by Nano-learning modules.
- ❖ **Improved Cognitive recall:** Condensed, targeted learning units help reinforce important ideas and enhance memory recall.
- ❖ **Quick Skill Acquisition:** Nano-learning's succinct format promotes faster understanding of certain subjects and improves learning efficiency.
- ❖ **Complementary Role to Traditional Pedagogy:** Nano-learning improves and supplements current teaching strategies rather than taking the place of them.
- ❖ **More Learning Opportunities:** Students have access to a variety of learning pathways, more autonomy, and customized pacing.
- ❖ **Instant Access to Learning Modules:** Just-in-time learning is supported and engagement is raised by simple and rapid access to modular information.

Essential Elements and Educational Goals of Nano-Learning

According to the study, Nano-learning has a number of distinguishing features that make it pedagogically applicable in higher education.

- ❖ **Short Duration:** To ensure concentrated cognitive engagement, learning modules usually last between one and fifteen minutes.
- ❖ **Goal-Oriented Design:** Every module is made to accomplish a single, distinct learning objective.
- ❖ **Self-Paced Learning:** Encouraging autonomy and self-regulated learning, students can advance on their own.
- ❖ **Concise Concept Delivery:** To prevent cognitive overload, information is delivered in succinct, organized manner.
- ❖ **Multi-Device Compatibility:** This feature increases versatility by making content available on desktops, tablets, and smartphones.
- ❖ **Multimodal Learning Formats:** To support a range of learning preferences, Nano-learning incorporates text, audio, video, images, and interactive components.



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- ❖ **Goal-Oriented and Immediate Application:** The structure places a strong emphasis on applying information in real-world situations right away.

Higher Education Implementation Considerations

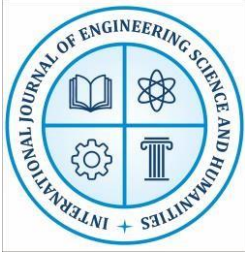
Although nano-learning has great pedagogical promise, meticulous planning is necessary for its successful deployment.

- ❖ **Infrastructure for Digital Access:** Organizations need to guarantee dependable internet access and digital device availability.
- ❖ **Ideal Module Length:** To maintain the fundamental idea of Nano-learning, the content should be brief.
- ❖ **Well-Defined Learning Outcomes:** Every Nano-module needs to concentrate on a specific, quantifiable goal.
- ❖ **Assessment of Learner Suitability:** Teachers should determine whether or not pupils are prepared for multimedia-based learning settings.
- ❖ **Collaborative Learning Integration:** To improve critical thinking, teachers should promote group conversations and collaborative involvement even while Nano-learning allows for individual pace.

Major Findings of the study:

The major findings of the study are-

1. **The concept of "Nano-learning" is relatively new:** According to the report, the idea of Nano-learning is still relatively new in the Indian educational setting, having only recently gained traction. According to the respondents, Nano-learning is a cutting-edge, technologically advanced method of knowledge acquisition, whereas traditional learning techniques are well-established. Because of its freshness, educators' and students' knowledge and comprehension of Nano-learning are still expanding. Its launch is viewed as a component of the larger movement toward digital and microlearning approaches. Therefore, the key to its successful incorporation into schools is early adoption and experimentation.
2. **The majority of respondents concur that Nano-learning would be the way that concepts are learned in India in the future:** The future of education in India will be greatly influenced by Nano-learning, according to a sizable portion of participants. They think it fits in with students' changing preferences for learning modules that are brief, to the point, and simple to access. Many responders underlined that this approach's efficiency and adaptability will help the workforce of the future. It was emphasized that technology will inevitably be incorporated into education, and Nano-learning offers a creative remedy. All things considered, there is general agreement that Nano-learning will soon become a revolutionary teaching tool.



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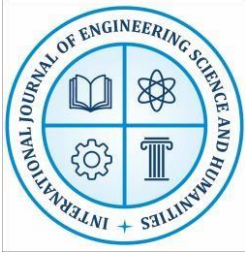
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3. **Nano-learning enhances the standard teaching approach:** According to the study, participants view Nano-learning as an adjunct to existing teaching techniques rather than as a substitute for them. Instructors said they would be open to using Nano-learning strategies in their class plans if given the right training. Through increased engagement and interaction, this hybrid approach can improve traditional classroom experiences. Additionally, participants noted that Nano-learning can support the reinforcement of ideas that have already been taught using conventional techniques. It is therefore seen as a helpful tool that enhances the educational process as a whole.
4. **Nano-learning would enhance learning quality:** Every responder concurred that using Nano-learning can enhance learning outcomes. They pointed out that this method promotes targeted and concentrated learning, which aids pupils in understanding ideas more quickly. Bite-sized content helps students process and remember information more effectively. Teachers emphasized that Nano-learning's flexibility and personalization lead to better learning outcomes as well. In the end, everyone agrees that this approach might greatly raise educational standards.
5. **Nano-learning will improve students' memory and the quality of instruction:** Participants stressed that Nano-learning improves students' information retention since it makes it simpler to retain important details through brief, targeted modules. They added that the ability of teachers to convey accurate and organized content using technology enhances the quality of instruction. This dual advantage helps teachers and students alike, fostering a more productive learning environment. Additionally, Nano-learning modules' conciseness and clarity lessen cognitive stress. The respondents concurred that these enhancements are necessary to promote greater comprehension and improved academic achievement.
6. **Nano-learning is good for young brains and not bad:** According to the study, all participants agreed that Nano-learning is good for pupils and safe. Participants emphasized that brief, focused lessons pique students' interest without overloading them. It is believed that Nano-learning encourages positive interaction with instructional materials, in contrast to excessive screen time or conventional rote learning. Additionally, educators noted that it promotes self-paced learning and active engagement. All things considered, Nano-learning is seen as a progressive instrument that promotes cognitive growth while keeping students' minds secure.

Conclusion:

It's true that the Internet has made a lot of things easier, but with practically all education now taking place online, there is a serious worry that kids' attention is waning to traditional learning concepts while parents are upset about their children spending more time in front of screens. Fortunately, Nano-learning has surfaced as a remedy in this regard (*Vivekananth, 2022*). Shorter



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interactive learning modules offered by Nano-learning have helped to reduce screen fatigue and provide a solution for one issue. The focus is on delivering knowledge or information in smaller, more frequent doses over a shorter period of time. The "Futuristic Approach to Learning" has garnered broad support from educational stakeholders and others due to these factors, as well as the fact that it increases efficiency, grabs learners' attention, and helps them learn in an era where all current practices are overloaded with data (*Senandheera, Muthukumarana, Ediriweera & Rupasinghe 2024*).

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