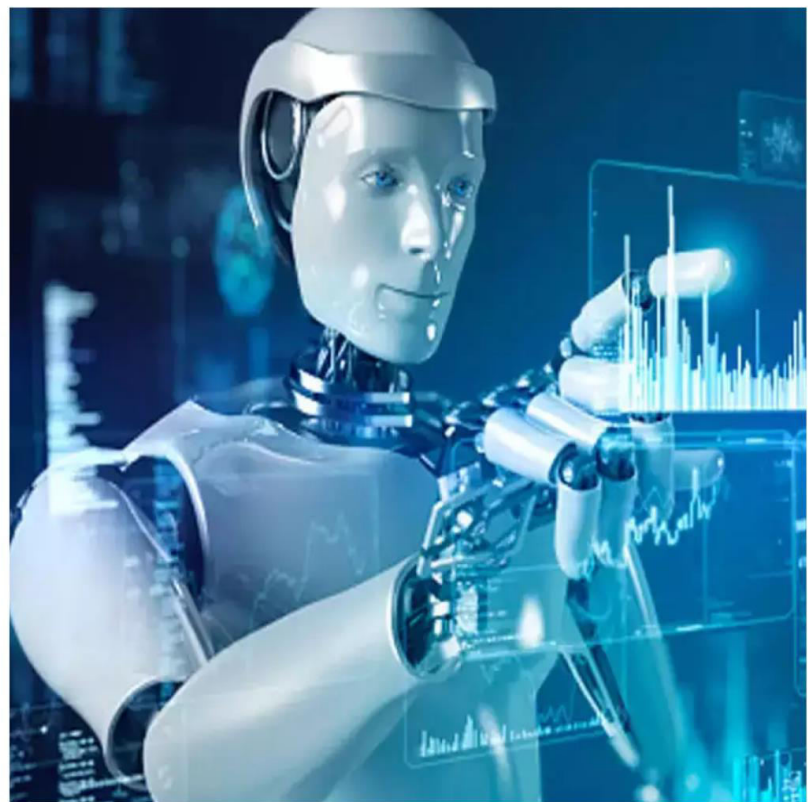




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Cultivating Independent Learners: Designing an Innovative Interactive Model to Enhance Self-Directed Learning and Autonomy in Elementary Education

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ABSTRACT: Education is crucial in human development which spans from childhood up to whole life. It aids persons in being autonomous, adapting to their surroundings, and enhancing their quality of life. This study presents an innovative interactive educational model designed to foster self-learning and independence among primary school children (SLIEE) model and prototype, with a specific focus on Elementary Education. Grounded in educational theories such as constructivism, active learning, and self-directed learning, the model incorporates user-friendly interfaces and dynamic content delivery. The development process utilized iterative design strategies, progressing through Low-Fidelity and High-Fidelity Prototypes (LFP and HFP), with a focus on critical components including comprehension, language, multimedia learning, motivation, interactivity, usability, and feedback mechanisms. Subjective satisfaction conducted as Usability testing to evaluate students and their parents with the prototype. The result indicates a significant statistical variation among participants' responses to the SUS on prototypes stages. The significance level was < 0.05 . It was noted the subjective satisfaction in stage 1 was (69.38) and around (72.50) for stage 2. The standard deviation was (8.19) in stage 1 and about (10.20) for stage 2. The correlation value in each stage was (.784), and the significance value (less than 0.001) indicates a higher correlation between them on subjective satisfaction. This research contributes to educational technology by offering a scalable and adaptable prototype that supports diverse learning environments while promoting autonomy and critical thinking among young learners.

Keywords:

KEYWORDS: Self-learning, independence, usability testing, interactive learning, primary education, educational technology.

I. INTRODUCTION

Up to the date, a human's success is necessarily dependent on the ability to promote human resources and skills that are capable of solving complex and continuously various problems. This growth need's shifting educational and learning approaches toward elaborating self-directed learners. Out of age educational programmes, however, may struggle to align with this desire due to their teacher-centered approach and teacher talking time way of teaching approach, and the culturally inheritance approaches that out of the most acts as a micromanagement. Active, self-directed approach of learning becomes significantly difficult to implement among large classrooms with multi-diverse curricula. Therefore, it is critical to think or implement or try to design and test innovative educational models that align with contemporary educational gaps.

Education is essential to human's kind and overall development, since birth and continuing throughout living. It encourages individuals to maintain independence and adapt to their environments and overall well-being. These downfalls the importance of the effectiveness of learning strategies and methodologies from an early stage of age's (Jones, 2020; Smith & Taylor, 2019). In elementary education, this promotion to self-directed and autonomous learning has gained humongous recognition and certification as a fundamental goal (Brown, 2018). Basic cultural and inheritance Approach of classroom models, which are often teacher-centered and reliant on textbooks, are becoming less effective in

engaging young students and nurturing a love of learning (Johnson & White, 2017). These approaches may hinder children and elderly from developing a robust foundation for lifelong learning (Embarak et al., 2022; Embarak, Ismail, et al., 2023).

To encounter these challenges, there is a growing emphasis on creating innovative learning environments that engage students actively and promote independence (Clark & Wilson, 2021). This shift from passive to student-centered learning involves nurturing curiosity, creativity, and critical thinking (Anderson & Parker, 2016). By integrating diverse educational strategies such as experiential learning, cooperative learning, storytelling, and play-based learning, educators can create dynamic classrooms that foster self-directed learning (Nelson, 2020). These approaches collaborated to enhance children to take ownership of their educational gain, helping them set goals, manage their progress, and reflect on their learning experiences—skills essential for thriving in a rapidly changing world (Winardi, Andreas, 2024).

This essay explores the essential paradigm of designing innovative learning platforms that simulate and test various learners in elementary school and education. These components have been marginalized through diverse educational theories and practices, such as Active Learning (John Dewey, 1994) and other learning frameworks, such as Humanism, Cognitivism, and Constructivism. Moreover, the foundational components for demonstrating the Low-Fidelity Prototype (LFP) were identified by extracting scratch elements from previous studies. These components were divided and elaborated based on their similarities, coming to a head in the identification of conceptual components. These components include Comprehension, Language, Story-Based Learning, Multimedia Learning, Motivation and Rewards, Interactivity, Usability, Self-Directed Learning, Feedback, and Interaction. Educating and Active learning theories works for as foundational frameworks for the alter design process which enhance the use of both low-fidelity and high-fidelity prototypes. By understanding how children learn and understand and processing information, both educational models can be created based on alignment with their behavioural and psychological enhancing stages. Moreover, educational and learning strategies act as a vital component in fostering children's engagement, communication, learning, sharing and motivating them to learn through active participation and interaction. However, the subjective satisfaction of participants was calculated using a ten-item SUS questionnaire formulated with a total score of 100. After 20 children with their parents as participants' responses to the post-study questionnaire were analysed, the statistically significant tests were used. The normality test was conducted to check the distribution of data. The result illustrates the distribution of scores was reasonably 'normal'. Then, A Pair sample t-test was utilized. The test indicates that the subjective satisfaction of participants using prototype was statistically significant

II. LITERATURE SURVEY

Over the past period, researchers and developers have embarked on a journey to resolve innovative educational and learning Approaches that foster intellectual independence and engines natural curiosity for learning; Back in the 1980s, Lev Vygotsky introduced the influential concept of the Zone of Proximal Development (ZPD), significantly highlighting the circulation role of social intervention and its interaction and language in learning. Vygotsky's work demonstrated how children reach higher levels of understanding when guided by peers and mentors, inspiring classrooms that prioritize collaboration and dialogue. Building on this foundation, Ormrod (2008) revealed how children construct knowledge by integrating new information with prior experiences, encouraging educators to design curricula tailored to individual learners' needs and fostering deeper, more connected learning.

In 2009, storytelling emerged as a powerful educational tool. Wrenn and Wrenn demonstrated how narratives resonate deeply with children, translating abstract ideas into relatable, memorable experiences. This approach was expanded by Sidhu Koskela (2013), who launched digital storytelling through animations and videos, captivating young learners and stimulating their creativity. Further enhancing engagement, Dian Andarini et al. (2016) explored multimedia, showing how combining visuals, text, and sound creates immersive, multi-sensory learning experiences that make education both enjoyable and effective. incentive also proved critical, with Tashnim et al. (2017) emphasizing the role of praise and rewards in inspiring children to embrace learning with enthusiasm.

Meanwhile, Monteiro et al. (2022) and Hashim et al. (2024) highlighted the potential of intuitive digital tools, demonstrating that user-friendly designs and interactive features capture attention and make learning seamless and enjoyable. In 2024, Ahmed et al. explored the use of artificial intelligence in adaptive learning systems, showing how these systems can personalize educational experiences to meet individual learners' needs. Similarly, Lee and Johnson (2024) examined gamified learning platforms, revealing their effectiveness in engaging children and encouraging active

participation through game-like elements. Another factor influencing children’s learning is supportive environments, emphasized by Morris (2019), who underscored their importance in empowering children to take charge of their educational paths. This autonomy instilled a sense of responsibility and confidence, laying the groundwork for lifelong learning. Finally, Tan Jiaji and Shi Shun (2023) underscored the critical role of continuous feedback, showing how proactive responses to student efforts enhance their confidence and encourage sustained engagement.

These pioneering studies have shaped a holistic educational framework that seamlessly integrates storytelling, multimedia, motivational strategies, digital interactivity, and constructive feedback, all while formatting foundational theories of language, cognitive growth, and autonomy. This model not only addresses the needs of modern learners but also gunning them to fruitfully get in an increasingly interconnected world, embracing lifelong learning with curiosity, resilience, and confidence.

III. METHODOLOGY

This study adopts the Design Science Research Methodology (DSRM) as outlined by Peffers et al. (2007). DSRM is a systematic approach that integrates practical applications with academic theories to develop and evaluate innovative solutions addressing real-world challenges. This methodology is particularly suitable for educational projects, such as designing a model aimed at enhancing self-learning and autonomy among children in primary education. As it was used in (Adbelrjal et al., 2020; Embarak, Othman, et al., 2023). The journey began with a deep dive into modern educational theories and practices to uncover ways to support self-directed learning among children. The team explored active learning techniques, focusing on strategies that encourage children to actively participate and interact with the educational process. This shift from passive reception to interactive involvement aimed to empower young learners, fostering curiosity and motivation through dynamic learning experiences.

With these insights, the project transitioned to the creative phase, where interactive educational content was brought to life. The team designed materials covering all primary education subjects, incorporating engaging tools like educational games and integrated activities. A low-fidelity prototype was developed to outline the core features of the interactive content, which was then refined into a high-fidelity prototype—a polished, fully functional educational platform that promised to make learning both enjoyable and stimulating for children.

Finally, the prototype's impact on children's self-learning skills and independence was rigorously evaluated. The team collected data and feedback from both children and educators to analyse how effectively the platform supported learning outcomes. Observing the children’s interactions with the content provided invaluable insights, enabling the team to assess the success of their efforts in achieving the project’s educational goals.

IV. EMPOWERING CHILDREN THROUGH ENGAGEMENT AND INDEPENDENT LEARNING

The basic components that format the SLIEE model are shown in Table 1. These components were carefully identified by gathering and analysing data from previous and similar studies (Ormrod, 2008, Vygotsky, 1980, Sidhu Koskela, 2013, Dian Andarini et al., 2016, Tashnim et al., 2017, Monteiro et al., 2022, and Morris, 2019), which were grouped and simplified into the main components as conducted in (Alsayed, Ismail, Hasan, & Embarak, 2023; Alsayed, Ismail, Hasan, Syed, et al., 2023).

Component	Description
<i>Comprehension</i>	Strategies to help students process and understand information.
<i>Language</i>	Emphasizes the role of language as a tool for knowledge transfer.
<i>Story-Based Learning</i>	Uses storytelling to create engaging and memorable experiences.
<i>Multimedia Learning</i>	Combines visuals, text, and videos to enrich learning.
<i>Motivation and Rewards</i>	Encourages participation through positive reinforcement.

<i>Interactivity</i>	Enhances dynamic engagement between learners and content.
<i>Usability</i>	Ensures user-friendly, accessible interfaces.
<i>Self-Directed Learning</i>	Promotes autonomy in managing learning activities.

The SLIEE model is a structured-based extension of the active learning strategies. One of the ideas of homeschooling is to create a need for thinking and independence to create self-learning! The next step in the transition was the SLIEE model which included Active Learning principles which means that the learners will have active participation in interactive tasks like experimentation, discussions and exploration. These strategies support John Dewey's active learning, which highlights that children were not considered passive recipients of information, but instead active participants in gaining knowledge (Dewey, 1994).

V. KEY STRATEGIES AND THEORIES SUPPORTING CHILDREN'S LEARNING ACCORDING TO ACTIVE LEARNING PRINCIPLES

There are different strategies to promote self-learning and independent learning in children based on Active Learning Principles integrated into the High-fidelity prototype. This emphasis is based on well-established educational theories that prioritize critical interest, involvement, and independent learning. Here are some ways to enhance children's learning:

1. Role Modelling

This strategy is lay on **Social Learning Theory**. It means showing children good examples to follow. Parents, teachers, or peers can be role models. Children watch and mimic these behaviours. This Approach helps them learn skills by observing real-life situations and copying them.

2. Experiential Learning

Drawing on **Constructivist Theory**, experiential learning emphasizes hands-on experiences and practical applications. Children engage in interactive activities that allow them to apply acquired knowledge in real-world situations, fostering deeper understanding and retention.

3. Play-Based Learning

Play-based learning incorporates games and recreational activities as tools for skill development. This approach, influenced by **Active Learning** principles, promotes engagement, creativity, and skill acquisition while making the learning process enjoyable and accessible for young learners.

4. Dialogic Learning

This strategy focuses on fostering critical thinking through dialogue and open discussions. Grounded in **Social Constructivism**, dialogic learning enables children to articulate their thoughts, ask questions, and explore ideas through verbal interactions with teachers and peers.

5. Storytelling

Storytelling, an effective tool inspired by **Social Learning Theory**, simplifies complex concepts by presenting them through engaging narratives. Stories enhance comprehension, memory retention, and creative thinking, making learning both enjoyable and meaningful for children.

6. Scaffolding Learning

Based on **Scaffolding Theory**, this strategy provides gradual and structured support to learners as they acquire new skills. The support is reduced progressively as children gain confidence and proficiency, enabling them to perform tasks independently.

7. Interactive Learning

It emphasizes collaboration and group-based activities, aligning with **Social Constructivist Theory**. It encourages teamwork, communication, and problem-solving through shared projects, interactive tasks, and peer-to-peer learning.

8. Use of Technology

Informed by **Digital Learning Theories**, this strategy integrates technology to enhance the learning experience. Tools such as computers, tablets, and multimedia resources provide dynamic, interactive, and visually rich content, engaging children in a modern and stimulating learning environment.

9. Self-Directed Learning

Aligned with **Self-Directed Learning Theory**, this approach promotes learner autonomy by encouraging children to take responsibility for their own education. Children are empowered to set personal goals, manage their progress, and develop self-regulation skills, fostering independence and lifelong learning habits.

VI. INTEGRATION OF THEORIES AND COMPONENTS

The design integrates educational approaches into a unified model promoting self-learning and independence. The proposed model integrates educational approaches into a cohesive framework, aligning them with relevant learning theories. The table 2 below outlines this relationship:

Table. 2. shows how the mentioned Approaches can be integrated with the previous components

Learning Theory	Approach	Component
<i>Social Learning Theory</i>	Storytelling	Story-based learning, language comprehension
<i>Digital Learning Theories</i>	Integration of Technology	Multimedia learning, interaction, and motivation
<i>Self-Directed Learning Theory, Social Learning Theory, and Social Constructivism</i>	Self-Directed Learning	Self-guided learning, ease of use, and interaction through experience and environmental interaction

VII. THE INTEGRATION OF LEARNING COMPONENTS, EDUCATIONAL STRATEGIES, AND UNDERLYING THEORIES

Each component has been classified based on the most suitable strategy for delivering content to learners. These strategies have been further linked to relevant educational theories to clarify the theoretical foundations of each teaching Approaches. The purpose of this classification is to demonstrate how different educational theories can be effectively applied to enhance understanding, interaction, and, ultimately, promote self-learning and independence among children.

- **Storytelling**

This strategy presents educational content through stories and narratives, helping children learn by imitating observed models and behaviours. Rooted in Social Learning Theory, storytelling is particularly effective for teaching skills or values in an engaging manner. Interactive or historical stories, for instance, embed meanings and values within contextualized narratives.

- **Use of Technology (Multimedia Learning)**

Technology, such as videos, educational games, and interactive media, has been employed to facilitate learning and enhance interaction with educational content. Grounded in Digital Learning Theories, this strategy provides engaging and visually stimulating tools that support flexible and interactive learning experiences.

- **Interactive Learning**

This approach encourages children to collaborate and interact within groups, enabling them to build knowledge collectively through shared activities. Emphasizing Social Constructivist Theory, the focus is on discussions, interactive tasks, and problem-solving activities that promote dynamic learning and teamwork.

- **Play-Based Learning**

Play-based learning incorporates simple educational games as an effective means of teaching children while developing their abilities through recreational activities. This strategy aligns with Active Learning Principles, which highlight the value of engagement and experiential activities in skill development.

- **Dialogic Learning**

Dialogic learning fosters open discussions and dialogue among children or between children and teachers. Interactive games and multimedia tools often require structured conversations, which help children develop critical thinking skills and articulate their ideas clearly. This strategy is rooted in Social Constructivist Theory, emphasizing verbal interaction as a pathway to deeper understanding.

VIII. MODEL MAPPING AND DESIGN

1. CLASSIFICATION OF CORE COMPONENTS BASED ON STRATEGIES AND EDUCATIONAL THEORIES

The classification of core components was conducted based on the suitability of each instructional strategy to the targeted learning approach, while aligning each strategy with its supporting educational theory. The final classification of components is presented in Table 3 and visually illustrated in Figure 1.

- **Suitability of Strategies to Targeted Learning**

The instructional strategies were selected according to their appropriateness for delivering knowledge, whether through storytelling, social interaction, self-directed learning, or the use of technology.

- **Theoretical Foundations Supporting Each Strategy**

Linking each strategy to its underlying educational theory enhances understanding of its effectiveness. For example, Social Learning Theory aligns with storytelling, as learning occurs through observation and modelling.

2. CLASSIFICATION OF COMPONENTS, STRATEGIES, AND THEORETICAL FRAMEWORKS

Table 3 provides a detailed mapping of each component to its corresponding instructional strategy and supporting educational theory. Figure 1 illustrates the final design of the refined model, demonstrating the integration of components, strategies, and theories.

- **Storytelling and Social Learning Theory**

Storytelling presents behaviours or models for learners to emulate, aligning with Social Learning Theory, which posits that individuals learn through observation and imitation of others.

- **Use of Technology and Digital Learning Theories**

Technology provides diverse tools, such as interactive videos and educational games, to stimulate engagement and enrich learning experiences. Digital Learning Theories support this approach by emphasizing the role of electronic media in enhancing the learning process.

- **Interactive Learning and Social Constructivism**

Interactive learning emphasizes collaborative activities and group-based tasks, aligning with Social Constructivist Theory, which highlights that learning occurs through social interactions and collective knowledge-building.

- **Self-Directed Learning and Self-Directed Learning Theory**

This approach encourages learners to take responsibility for their own learning, consistent with Self-Directed Learning Theory, which focuses on learner autonomy and the development of self-regulated learning skills.

3. MAPPING COMPONENTS, STRATEGIES, AND EDUCATIONAL THEORIES

The integration of core components, instructional strategies, and educational theories is presented in Table 3 which provides a clear and structured overview of these relationships, while Figure 1 visually illustrates the refined prototype, showcasing the integration of strategies, components, and theories in a cohesive framework. The idea of mapping was adapted from (Abdulhamid Omar Eltheeb, 2018; Embarak et al., 2022; Embarak, Ismail, et al., 2023; Jugunta et al., 2023). However, the integration of core components, instructional strategies, and educational theories is summarized as:

- **Storytelling and Social Learning Theory**

Storytelling is used to present behaviours and models that learners can imitate. This aligns with Social Learning Theory, which emphasizes learning through observation and replication of positive role models.

- **Use of Technology and Digital Learning Theories**

Technological tools, such as interactive videos and educational games, provide flexible and engaging learning experiences. This approach aligns with Digital Learning Theories, which emphasize the importance of multimedia tools in modern education.

- **Interactive Learning and Social Constructivism**

Interactive learning promotes collaboration through group activities and discussions, aligning with Social Constructivist Theory, which highlights the role of social interaction in collective knowledge-building.

- **Self-Directed Learning and Self-Directed Learning Theory**

This strategy encourages learners to take control of their own learning journey, consistent with Self-Directed Learning Theory, which focuses on learner independence, goal-setting, and self-regulation.

Table 3 The integration of core components, instructional strategies, and educational theories

Strategy	Component	Implementation
<i>Storytelling</i>	Narrative Learning	Present content through stories to clarify concepts, teach moral values, and convey ethical lessons (e.g., religious stories like prophets' stories or historical events).
	Comprehension	Assess learners' understanding of story content through short quizzes, interactive tools like multiple-choice questions, and surveys.
	Language	Use appropriate, engaging language in stories to enhance vocabulary and language skills.
<i>Use of Technology</i>	Multimedia Learning	Incorporate text, images, and videos into learning materials to provide a rich, interactive educational experience.
	Interactivity	Add interactive elements such as clickable diagrams and animated visuals to engage learners actively.
<i>Interactive Learning</i>	Motivation and Rewards	Create a reward system where learners earn points or receive virtual rewards (e.g., badges) for completing tasks.
	Interactivity	Facilitate interaction through group discussions, collaborative problem-solving tasks, and multiple-choice activities.
	Feedback and Interaction	Provide instant feedback after each activity or quiz to guide and support learners.
<i>Self-Directed Learning</i>	Guided Learning	Offer access to diverse educational resources to enable independent exploration and self-paced learning.
	Ease of Use and Interaction	Design a simple, intuitive interface to ensure ease of navigation and engagement with educational materials.

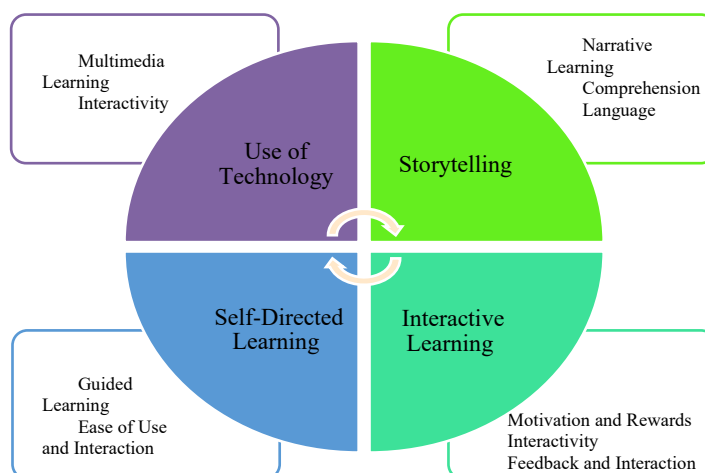


Figure .1. utilized the elements and main components of proposed model main

4. HIGH-FIDELITY PROTOTYPES

4.2 Transitioning from Low-Fidelity Prototype (LFP) to High-Fidelity Prototype (HFP)

The progression from low-fidelity to high-fidelity prototypes includes a pivotal phase in advancing a refined and proficient educational system. This section elucidates the process employed to facilitate this transformation, emphasizing the role of interactive interfaces that showcase the system's finalized design features.

Module Representation and Interface Design

In the first lesson interface of the high-fidelity prototype (HFP), Surah Al-Fatihah is taught to first-grade students using innovative technology that integrates the educational model components interactively. The objective is to teach the Surah in a simplified and engaging way that aligns with the age group of children. The focus is on correct listening to the verses and learning their proper order through an interactive game embedded within the interface. Below is an explanation of the educational model components used:

- **Comprehension Module**

The Surah is divided into individual verses, enabling children to click on each verse to listen to it. This method facilitates comprehension by helping children easily understand and organize Quranic texts, thereby enhancing their educational experience. This module was developed based on Table 3, which outlines each component and its corresponding element used to promote comprehension. Figure 2 (g) illustrates how this system allows children to interact directly with the text, promoting self-directed learning.

- **Feedback and Interaction Module**

Immediate feedback is provided to children through messages displayed after each attempt to arrange the verses, whether correct or incorrect. This feedback helps children correct errors and motivates them to improve their performance. This module, designed based on Table 3, promotes immediate feedback, as shown in Figure 2 (h) and (i), which illustrate responses for correct and incorrect answers, respectively.

- **Ease of Use and Interaction Module**

The user interface is intuitively designed, allowing children to click on verses to listen and view clear text. Navigation between lesson sections is simple and efficient. The module emphasizes creating a straightforward interface, as detailed in Table 4.4, and illustrated in Figure 2 (d).

- **Story-Based Learning Module**

The Hadith is taught narratively to make it memorable and comprehensible, instilling religious values in children. Developed based on Table 3, this method uses religious stories to foster engagement and understanding while providing an enjoyable educational experience, as shown in Figure 2 (f).

- **Multimedia Learning Module**

Effective multimedia elements, such as videos, text, and images combined with interactive features, are used to enhance children's comprehension. This module creates an engaging and rich learning environment, as depicted in Figure 2 (f).

- **Interactivity Module**

Multiple-choice questions following the video allow learners to select the correct answers. This interactive approach engages children beyond merely watching the video, encouraging active participation, as shown in Figure 2.

- **Self-Directed Learning Module**

The interface enables children to independently learn the Hadith by watching the video and answering questions at their own pace. This fosters autonomy and builds confidence while encouraging continuous learning. This module, developed based on Table 3, supports self-directed learning, as demonstrated in Figures 2 (e).

- **Motivation and Rewards**

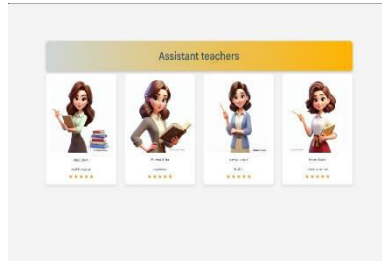
Children earn points for correct answers, encouraging continued interaction and fostering a positive learning experience. This module, based on Table 3.

4.3 High-Fidelity Prototype Interfaces

The HFP simulates the final system design with a high level of detail and interactivity, closely resembling the actual product. This prototype is used to test user experience (UX) before full development, ensuring the design meets objectives and requirements. Key features include a near-final interface, realistic interaction, comprehensive details, and usability for testing such as figure2 (a),(b) and (c).



(a)

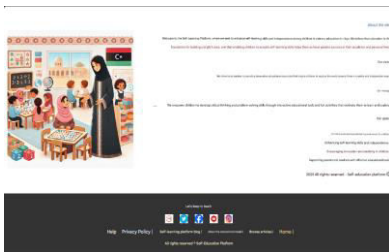


(b)



(c)

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(d)



(e)



(f)



(g)



(h)



(i)

IX. EXPERIMENTAL RESULTS

In this phase, an experimental study was conducted to verify and evaluate the usability of the proposed SLIEE model and guarantee that the recommended model can be used by the users effectively. The System Usability Scale (SUS) by Brooke (1996) was used to quantify enhancing self-learning and autonomy among children in primary education. The original SUS instrument has ten questions, while the System Usability Scale's final scores could be from 0 to 100, where higher scores denote reasonable satisfaction. This user satisfaction was conducted with 20 participants as indication in (Embarak, Othman, et al., 2023; Ismail et al., 2022). Most participants were experienced in using electronic devices (such as tablet, iPad and computers or the Internet). It was also found that most of them with their family had familiarity with the basic functionalities of existing social media.

1. EXPERIMENTAL PROCEDURE

After the elderly and one of their parents agreed to participate, the test occurred in a laboratory or at their sites. For the assessment, participants arrived at a predetermined time. They were required to complete a recruiting form that evaluated their knowledge of computers and associated systems, as well as their familiarity with online social media and discussion forums, age, and gender.

Participants received a brief explanation of the experimental procedures prior to the assessment starting. 15 minutes were allotted for unrestricted prototype investigation for every participant. Every participant was urged to share what they

were seeing and thinking throughout this time. They might inquire about the prototype user interface in any pertinent details. The goal was to get them used to the interface.

After the free exploration of the prototype, they were given three tasks and asked to work independently. The participants were instructed to cease working on any assignment after 15 minutes (investigation stage) and move on to the next stage (testing stage). If they were unable to accomplish a task and desired to go on, it was permitted. Participants complete a questionnaire on their subjective satisfaction after finishing all the tasks (SUS). The results of these processes are reported in following details.

X. SUBJECTIVE SATISFACTION

This SLIEE prototype not only addresses the needs of modern learners but also gunning them to fruitfully get in an increasingly interconnected world, embracing lifelong learning with curiosity, resilience, and confidence. However, The SUS questionnaire was utilized in this measurement to evaluate participants' subjective satisfaction. A set of two SUS-modified statements were conducted in this experiment; An individual score of five children for two investigation stage (stag1) and testing stage (stage 2) of prototype is illustrated in Table 4

Table 4 The participants' score of SUS for the prototypes

Participant	Stage 1	Stage 2	Participant	Stage 1	Stage 2
1	75.00	77.50	11	75.00	80.00
2	77.50	80.00	12	55.00	60.00
3	62.50	65.00	13	80.00	70.00
4	67.50	70.00	14	62.50	67.50
5	62.50	67.50	15	70.00	72.50
6	82.50	100.00	16	65.00	67.50
7	75.00	77.50	17	72.50	60.00
8	67.50	70.00	18	65.00	77.50
9	60.00	62.50	19	85.00	90.00
10	60.00	60.00	20	75.00	67.50

The participants' SUS score in different stages 1 and 2, is charted in Figure 2 (a) The lowest SUS score was rated for stages 1, which was set around fifty-five a score rating. Only a participant got the complete score rating assigned for stages 2, while the highest rating for stages 1 was 85.

The average SUS score for both stages is shown in Figure 2 (b). The average scores of those participants with stages 1 and 2 were 69.38 and 72.50, respectively.

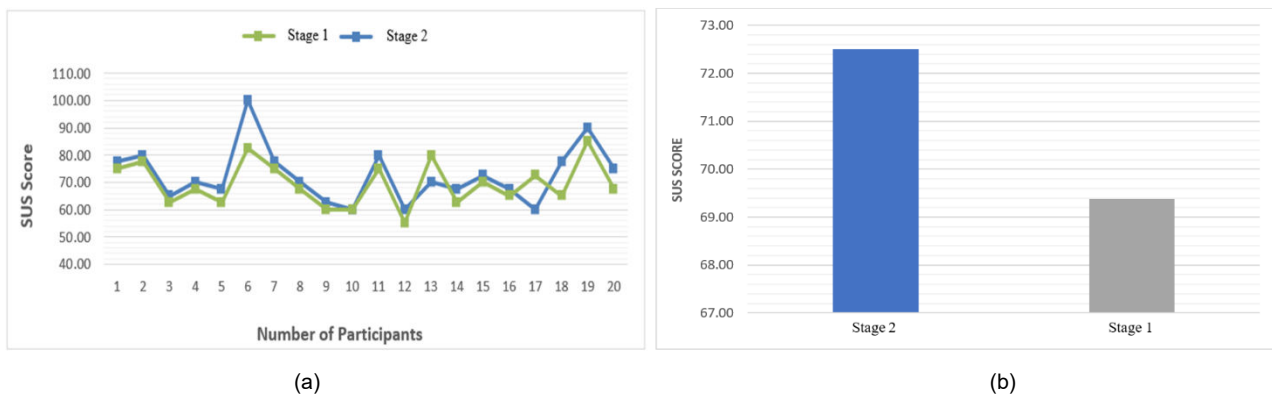


Figure 2 shows the results of experimental. (a) A line chart for each stage of individual SUS scores. (b) The total average SUS score for each stage.

XI. DISCUSSION

During the evaluation, the participants faced various difficulties while performing tasks, such as task sequencing, finding a place, spatial orientation, and navigation, since these tasks require high-level cognitive functioning, which is what the participants struggle with the most. An observer observed the participants' activity during the evaluation. Most participants commented that they found it challenging to complete some tasks. One of the children, Participant P3, mentioned that she could not finish the assignments. Participant P1, in her outlook, could support this.

"singing up on the prototype is more tiring; working inside the prototype is more comfortable compared to outside".

The subjective satisfaction of participants was calculated using a ten-item SUS questionnaire formulated with a total score of 100. After 20 children with their parents as participants' responses to the post-study questionnaire were analysed, the statistically significant tests were used. The normality test was conducted to check the distribution of data. The result illustrates the distribution of scores was reasonably 'normal'. Then, A Pair sample t-test was utilized. The test indicates that the subjective satisfaction of participants using prototype was statistically significant.

The result indicates a significant statistical variation among participants' responses to the SUS questionnaire on prototypes stages. The significance level was < 0.05 . it was noted the subjective satisfaction in stage 2 was (72.50 seconds) and around (69.38 seconds) for stage1. The standard deviation was (8.19) in stage 1 and about (10.20) for stage 2. The correlation value in each stage was (.784), and the significance value (less than 0.001) indicates a higher correlation between them on subjective satisfaction.

XII. CONCLUSION

As previously stated, the subjects' satisfaction ratings were gathered utilising the System Usability Scale (SUS) with an overall score of 100. This satisfaction measurement in this experimental study demonstrated how much more satisfying the SLIEE prototype designs for usage. The respondents were satisfied since they could easily communicate with the interface and its advanced features while performing the tasks. the prototype was delivered in two stages testing a subjective satisfaction rate among participants of more than 68%, which succeeded in passing the average of acceptable. Finally, the Outcomes from this analysis indicated that the children's satisfaction in stage 2 was higher than stage 1 and reached the user's satisfaction point (Bangor et al., 2009).

REFERENCES

- [1]. Abdulhamid Omar Eltheeb, M. H. B. S. (2018). Virtual Keyboard Optimization with Vision Controlled Human Interaction for Disabled Users. UTM Press, Universiti Teknologi Malaysia.
- [2]. Adbelrijal, F., Ismail, N. A., Othman, S., Embarak, F., Ismail, N. A., & Othman, S. (2020). The Impact of Online Social Community Platforms on The Elderly Daily Activities: A Systematic Literature Review. *International Journal of Future Generation Communication and Networking*, 13(1), 877–902.
- [3]. Alsayed, A. O., Ismail, N. A., Hasan, L., & Embarak, F. (2023). A Comprehensive Review of Modern Methods to Improve Diabetes Self-Care Management Systems. *International Journal of Advanced Computer Science and Applications*, 14(9)
- [4]. Alsayed, A. O., Ismail, N. A., Hasan, L., Syed, A. H., Embarak, F., & Da'u, A. (2023). A systematic literature review for understanding the effectiveness of advanced techniques in diabetes self-care management. *Alexandria Engineering Journal*,
- [5]. Andarini, D., Putri, S., & Pratama, H. (2016). The impact of multimedia-based learning on student engagement and comprehension. *Journal of Educational Multimedia*, 14(2), 123–140.
- [6]. Bangor, A., Kortum, P. T., & Miller, J. T. (2009). Determining what individual SUS scores mean: Adding an adjective rating scale. *Journal of Usability Studies*, 4(3), 114–123.
- [7]. Brown-Martin, G. (2018). Education and the Fourth Industrial Revolution (Learning to thrive in a transforming world). In 11th Annual International Conference of Education, Research and Innovation (p. 7270). Seville, Spain.
- [8]. Clark, D. D., & Wilson, W. H. (2021). An analysis of Clark-Wilson model in a database environment. *International Journal of Computer Applications*, 34(4), 1–5. <https://doi.org/10.5120/ijca2021921150>
- [9]. Dewey, J. (1994). *The moral writings of John Dewey* (J. Gouinlock, Ed.). Prometheus Books.
- [10]. Embarak, F., Azman Ismail, N., Shahin, O. R. R., & Alabdali, R. N. N. (2022). Design of autonomous online social community architecture for older adults. *Computers and Electrical Engineering*, 100, 107900.
- [11]. Embarak, F., Ismail, N. A., Ghazali, M., Mahmud, M., Zuraifah, N., Othman, S., Hasan, L., Said, C. S., Yong, Y., & Alsayed, A. O. (2023). ONLINE SOCIAL INTERACTION COMMUNITY MODEL FOR UNMET NEEDS OF OLDER PEOPLE. *Journal of Theoretical and Applied Information Technology*, 101, 22. www.jatit.org

- [12]. Embarak, F., Othman, N. Z., Hasan, L., & El-Aziz, R. (2023). Usability Study of the Online Social Community Model Through Heuristic Evaluation (p. 205).
- [13]. Hashim, A., Latiff, N., & Noor, F. (2024). Designing user-friendly digital tools for children's education: Lessons from interactive app development. *International Journal of Educational Technology*, 29(1), 45–60.
- [14]. Ismail, A., Atiqah, N., Fua'ad, M., Zulkifli, M. S., Embarak, F., Zuhairah, N., Husni, A., Mohamed, S. E., Syaza, P., Megat, K., & Zainon, M. (2022). Design and Usability Study of Hypertension Management Guideline Mobile Application with Hypertension and Non-hypertension Patients. *International Journal of Advanced Computer Science and Applications*, 13(4)
- [15]. Johnson, D. W., & Johnson, R. T. (2009). An educational psychology success story: Social interdependence theory and cooperative learning. *Educational Researcher*, 38(5), 365–379. <https://doi.org/10.3102/0013189X09339057>
- [16]. Jones, W., Gallagher, K., & Midraj, J. (2020). Does size really matter in university preparatory English language classrooms? *Issues in Educational Research*, 30, 988-1004.
- [17]. Jugunta, S. B., Rengarajan, M., Gadde, S., El-Ebiary, Y. A. B., Vuyyuru, V. A., Verma, N., & Embarak, F. (2023). Exploring the Insights of Bat Algorithm-Driven XGB-RNN (BARXG) for Optimal Fetal Health Classification in Pregnancy Monitoring. *International Journal of Advanced Computer Science and Applications*, 14(11), 731–741.
- [18]. Koskela, S. (2013). The potential of digital storytelling in primary education: Engaging young learners through creative narratives. *Digital Learning Studies*, 8(1), 22–36.
- [19]. Lee, S., & Johnson, K. (2024). Gamified learning platforms: Enhancing engagement through game-based strategies in primary education. *Contemporary Educational Research*, 34(2), 56–70.
- [20]. Monteiro, R., Carvalho, J., & Silva, T. (2022). Interactive digital tools for early childhood education: Bridging engagement and cognitive development. *Educational Computing Research*, 41(4), 75–92.
- [21]. Morris, T. (2019). Self-directed learning environments: Empowering students for lifelong learning. *Journal of Progressive Education*, 23(3), 145–160.
- [22]. Morris, T. (2019). Self-directed learning environments: Empowering students for lifelong learning. *Journal of Progressive Education*, 23(3), 145–160.
- [23]. Nelson, C. (2022). The power of playful learning in the early childhood setting. *Young Children*, 77(2), 8–15. <https://www.naeyc.org/resources/pubs/yc/summer2022/power-playful-learning>
- [24]. Ormrod, J. E. (2008). *Human learning* (5th ed.). Upper Saddle River, NJ: Pearson Education.
- [25]. Ormrod, J. E. (2008). *Human learning* (5th ed.). Upper Saddle River, NJ: Pearson Education.
- [26]. Peffers, K., Tuunanen, T., Rothenberger, M. A., & Chatterjee, S. (2007). A design science research methodology for information systems research. *Journal of Management Information Systems*, 24(3), 45–77.
- [27]. Roberts, B. W., & Davis, J. P. (2016). Young Adulthood Is the Crucible of Personality Development. *Emerging Adulthood*, 4(5), 318-326. <https://doi.org/10.1177/2167696816653052>
- [28]. Roberts, C. D. (2020). Developing critical thinking through cooperative learning. *Journal of Educational Psychology*, 59(4), 205-218. <https://doi.org/10.1037/edu0000422>
- [29]. Tan, J., & Shi, S. (2023). The importance of feedback in self-directed learning: A study on continuous engagement and confidence building. *Asian Journal of Educational Psychology*, 19(2), 98–112.
- [30]. Tan, J., & Shi, S. (2023). The importance of feedback in self-directed learning: A study on continuous engagement and confidence building. *Asian Journal of Educational Psychology*, 19(2), 98–112.
- [31]. Tashnim, M., Ali, H., & Rashid, F. (2017). Motivating young learners through praise and rewards: Implications for classroom strategies. *Educational Psychology International*, 12(1), 48–63.
- [32]. Tashnim, M., Ali, H., & Rashid, F. (2017). Motivating young learners through praise and rewards: Implications for classroom strategies. *Educational Psychology International*, 12(1), 48–63.
- [33]. Taylor-Smith, E., & Smith, C. F. (2019). Investigating the online and offline contexts of day-to-day democracy as participation spaces. *Information, Communication & Society*, 22(13), 1853-1870.
- [34]. Vygotsky, L. S. (1980). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.
- [35]. Vygotsky, L. S. (1980). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.
- [36]. Winardi, Andreas. (2024). Enhancing Student Self-Regulated Learning: The Evolving Role of Educators. [10.5772/intechopen.1006329](https://doi.org/10.5772/intechopen.1006329).
- [37]. Wrenn, A., & Wrenn, B. (2009). The power of storytelling in education: Connecting children to concepts through narrative strategies. *Journal of Educational Innovation*, 6(3), 112–126.



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