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A User Experience-Centered Design Framework for Optimizing English Learning on All-in-One Multimedia PC

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***Abstract*— This research aims to develop a user experience (UX)-centered design framework for educational content delivered through All-in-One Multimedia Personal Computers (AOMPCs), focusing specifically on optimizing English learning and enhancing teaching effectiveness. By analyzing existing AOMPC-based English learning applications, the research explores how content presentation influences students' motivation, classroom engagement, and academic performance. The findings reveal that user experience optimization relies on multiple interrelated dimensions, including interface design, interactivity, visual aesthetics, and multimedia integration. These elements collectively shape a more engaging and immersive learning environment. Furthermore, the study integrates theoretical perspectives with empirical data to identify core drivers of an effective AOMPC learning experience, such as real-time feedback, adaptive content, and interactive task design. These factors significantly elevate learner motivation and cognitive engagement. The study not only offers practical insights for designing multimedia teaching tools but also contributes a theoretical foundation for future research and innovation in educational technology.*
Keywords*— User Experience (UX), All-in-One Multimedia PC (AOMPC), Classroom Learning Engagement, Multimedia-Assisted Learning, Cognitive Load Theory, Educational Technology Innovation

I. INTRODUCTION

The digital transformation of education, driven by rapid advancements in information and communication technologies, is fundamentally reshaping pedagogical models, instructional delivery, and learner engagement. Multimedia-assisted instruction—through the integration of text, visuals, audio, and video—has demonstrated considerable potential in enhancing teaching quality, stimulating student interest, and fostering deeper cognitive processing (Abdulrahaman et al., 2020; Austin, 2009). As educational institutions increasingly adopt digital platforms and smart devices, the demand for seamless, intuitive, and effective learning environments has intensified.

Within this evolving landscape, the All-in-One Multimedia Personal Computer (AOMPC) has emerged as a powerful educational tool, offering a compact and integrated solution that combines computing power, display functionality, audio systems, video capture, and touch-based interactivity. Compared to conventional, single-functional teaching equipment, AOMPCs streamline instructional delivery by eliminating the need for multiple devices and facilitating a centralized control of multimedia resources (AlShaikh et al., 2024). Their increasing deployment across primary and secondary schools, higher education institutions, and training centers signifies a broader shift toward digital, intelligent, and multimodal learning environments.

However, while AOMPCs provide the technological infrastructure for interactive and immersive learning, the true impact of such systems on educational outcomes hinges critically on the design of the user experience (UX) and the structuring of digital learning content. Research has shown that UX design in educational settings must not only accommodate learners' cognitive and emotional needs but also stimulate their motivation, foster interaction, and scaffold complex conceptual understanding (Bai et al., 2019; Barraza, 2021). Furthermore, studies have emphasized the multidimensional nature of classroom engagement—comprising emotional, behavioral, and cognitive components—each of which is directly influenced by the structure and presentation of digital content (González-Peño et al., 2021; Xu et al., 2023).

Interactive multimedia teaching, particularly when facilitated by devices such as AOMPCs, offers a viable pathway for enhancing all three dimensions of student engagement. Rich media elements can evoke emotional resonance, promote active behavioral participation through real-time feedback and collaboration tools, and foster deeper cognitive involvement via scenario-based learning and personalized recommendations (Alsadoon, 2023; Li et al., 2024). These affordances align with cognitive load theory and multimedia learning principles, which emphasize that well-orchestrated multi modal content can enhance knowledge acquisition, reduce extraneous load, and improve transfer ability of skills (He & Wu, 2023; Kalyuga, 2007).

Nevertheless, there exists a significant research gap at the intersection of UX design, multimedia learning, and integrated educational hardware such as AOMPCs. While prior studies have explored UX in web applications, mobile learning platforms, and traditional PC-based educational systems, few have systematically investigated the unique design considerations and pedagogical affordances of AOMPCs (Nakamura et al., 2018). These all-in-one systems demand a novel approach to instructional design—one that harmonizes hardware capabilities with learner-centered UX principles and empirically validated multimedia learning strategies.

This study seeks to address this gap by developing a UX centered design framework tailored to AOMPC-based English learning environments. Drawing from theories in UX, multimedia learning, and classroom engagement, the research aims to identify the critical design factors that influence learner motivation, interaction, and academic performance. Through a combination of design science methodology, empirical experimentation, and mixed-methods evaluation, the study constructs a comprehensive model for optimizing digital content in AOMPC supported classrooms.

The objectives of this research are threefold. First, to analyze key UX design dimensions—such as interface intuitiveness, interactivity, visual clarity, and multimedia coherence and their impact on learner engagement. Second, to propose design strategies that enhance cognitive efficiency, emotional resonance, and participatory behavior. Third, to offer an actionable framework for educators and developers, enabling the creation of adaptive, engaging, and pedagogically sound learning environments through AOMPC platforms.

Ultimately, this research contributes to both theory and practice. Theoretically, it expands the scope of UX research in educational technology by integrating design principles with pedagogical outcomes. Practically, it provides educators with concrete guidelines for leveraging AOMPCs in a way that transcends mere technology adoption, advancing toward truly transformative learning experiences. By bridging the gap between interface design and instructional effectiveness, this study lays the foundation for a new generation of intelligent, interactive, and learner-centered educational environments.

II. LITERATURE REVIEW

The evolution of digital learning environments has ushered in an era where user experience (UX) is no longer a peripheral concern, but rather a foundational element in the design and effectiveness of educational platforms. Particularly within the context of language acquisition in secondary education, a growing body of interdisciplinary research—spanning educational technology, human-computer interaction, and cognitive psychology has emphasized the centrality of UX in shaping learner engagement, cognitive processing, and academic performance. This section synthesizes existing theoretical and empirical work related to UX design, multimedia learning theory, and classroom engagement, with a specific focus on the application of All-in-One Multimedia Personal Computers (AOMPCs) in junior secondary English classrooms.

2.1 User Experience (UX) Theory in Educational Contexts

UX theory encompasses the holistic perceptions, emotions, and responses users experience when interacting with a digital system or interface. In educational settings, particularly those involving emerging technologies such as AOMPCs, UX design determines not only the usability of the platform but also its ability to sustain attention, foster motivation, and facilitate deep learning. Effective UX design within this domain is predicated on the alignment between cognitive ergonomics and pedagogical goals. This entails creating interfaces that are intuitive, non-intrusive, and emotionally engaging, allowing learners to focus on the instructional content rather than the mechanics of system navigation (Bai, 2019; Barraza, 2021). Recent studies have shown that middle school students, whose cognitive development and attention regulation are still in formative stages, are particularly sensitive to UX design (Li et al., 2023; Shao et al., 2025). Elements such as visual appeal, response immediacy, and interactive feedback loops significantly influence emotional and behavioral engagement. For instance, reward systems (badges, progress bars), gamified elements, and peer interaction features have been empirically linked to improved motivation and sustained classroom participation (Alsadoon, 2023; Capatina et al., 2024).

2.2 Multimedia Learning Theory and Cognitive Load Management

Multimedia learning theory, notably articulated by Mayer and supported by dual-coding theory (He & Wu, 2023), posits that individuals learn more effectively when instructional materials engage both visual and auditory channels. In practice, this means that multimedia instruction—when designed correctly—can facilitate deeper cognitive encoding and stronger knowledge retention. However, there exists a critical caveat: cognitive load theory warns that when multimedia elements are poorly integrated or excessively complex, they may overload working memory and hinder rather than enhance learning outcomes (Kalyuga, 2007; Skulmowski & Xu, 2022). In the context of AOMPC-based instruction, managing this balance becomes essential. Research indicates that multimedia interfaces should adhere to minimalist design principles, presenting only essential information to avoid overloading cognitive capacity (Sozio et al., 2024; AlShaikh et al., 2018). Content should be sequenced progressively, with increasing complexity scaffolded by system-generated prompts and feedback. This approach not only aids knowledge construction but also supports learners' metacognitive regulation, allowing them to monitor and adjust their learning strategies.

2.3 Dimensions of Classroom Learning Engagement

Learning engagement has emerged as one of the most reliable predictors of academic success. Contemporary engagement models conceptualize it as a tripartite construct—emotional, behavioral, and cognitive (Wong & Liem, 2022). Each of these dimensions plays a distinct role in shaping the learning process and can be strategically influenced through UX design. Emotional engagement, involving interest, enthusiasm, and a sense of belonging, is closely linked to the design of affective affordances within the AOMPC interface. Interactive storytelling, digital avatars, and real-time performance feedback (e.g., points, animations) have been found to enhance emotional resonance and classroom morale (Pietarinen et al., 2014;

Shao et al., 2025). Behavioral engagement, referring to students' active participation in tasks, is fostered through interactive modules that promote agency and task ownership. Features such as live polls, embedded quizzes, and collaborative simulations—when seamlessly integrated—encourage learners to participate more frequently and meaningfully in classroom activities (Nguyen et al., 2016; González-Peño et al., 2021). Cognitive engagement involves the learner's psychological investment in understanding and mastering the material. Deep learning is facilitated by well-structured content that challenges students intellectually, supports exploration, and allows for knowledge application in realistic scenarios. Tools such as scenario-based tasks, AI-driven personalized feedback, and adaptive learning paths align with this dimension by fostering critical thinking and sustained attention (Richardson, 2006; Lv et al., 2022).

2.4 Core Design Principles for AOMPC-Based Learning Content

An emerging consensus in the literature suggests that the pedagogical effectiveness of integrated teaching platforms like AOMPCs is contingent on four interlocking design dimensions: usability, interactivity, visual design, and content presentation (Keenan et al., 2022; Tong et al., 2022). Usability ensures that the system is easy to learn, navigate, and operate under real-time instructional conditions. For instructors, this translates into interfaces with streamlined access to teaching tools and minimal procedural complexity. For students, it means reduced friction in accessing and completing learning tasks, thereby maximizing instructional time and minimizing distraction (Ferreira et al., 2020; Lewis & Sauro, 2021). Interactivity is pivotal in translating passive learning into active construction. Real-time student response systems, voice and handwriting recognition, and role-play simulations are shown to significantly boost classroom dynamics and engagement metrics (Srivastava et al., 2024; Tai & Wei, 2023). Moreover, when interactivity is linked to feedback mechanisms—such as instant performance analytics—students are more likely to maintain motivation and self-regulate their learning. Visual design contributes not just to aesthetic appeal but to functional clarity. Research underscores the need for consistent color schemes, semantic iconography, and hierarchical text structures (Austin, 2009; Masina et al., 2020). Customizable modes (e.g., light/dark themes) and minimal visual noise also reduce visual fatigue and enhance attention span. Content presentation, the most pedagogically critical dimension, must follow evidence-based learning theories. Multimodal presentation—combining text, video, animation, and interactivity—has proven effective in language acquisition tasks such as vocabulary building, pronunciation, and grammar comprehension (Abdulrahaman et al., 2020; Zhang, 2022). The integration of AI recommendation engines further refines this process by adapting content delivery based on student performance and preferences, thereby supporting personalized learning trajectories.

2.5 Synthesis and Theoretical Implications

In sum, the literature affirms that optimizing AOMPC-based instructional environments requires a holistic design philosophy—one that integrates UX principles, cognitive science, and pedagogical theory into a cohesive framework. The convergence of usability, interactivity, visual clarity, and multimodal content forms the backbone of an engaging and effective learning system. However, most existing studies remain fragmented, with few offering a unified model that addresses the specific affordances and constraints of AOMPCs in secondary language education. This study aims to bridge that gap. By synthesizing insights from user-centered design, multimedia learning, and engagement theory, we propose a novel UX-centered framework tailored for AOMPC-based English instruction. This framework not only addresses the technical and cognitive dimensions of digital learning but also aligns with the motivational and emotional needs of adolescent learners. As the educational landscape continues to digitize, such integrative models will be critical in shaping the next generation of intelligent, inclusive, and effective classroom technologies

III. METHODOLOGY

To systematically investigate and validate the proposed user experience (UX)-centered design framework for English learning content on the All-in-One Multimedia Personal Computer (AOMPC) platform, this study employs a Design Science Research (DSR) methodology. DSR is particularly suited for addressing real-world educational challenges that demand iterative solution development, empirical testing, and refinement. By integrating both quantitative and qualitative approaches, this methodological framework ensures that the resulting design model is not only theoretically grounded but also pedagogically effective and practically deployable.

This study unfolds across three interrelated dimensions: (1) the structured development of the UX design framework via DSR, (2) a mixed-methods evaluation combining experimental and observational data, and (3) the theoretical underpinnings rooted in multimedia learning theory and interface design principles. The goal is to develop a robust, adaptive, and empirically tested interface and content model that enhances classroom engagement, facilitates cognitive processing, and improves academic performance in middle school English classrooms.

3.1 Design Science Research Framework

Design Science Research provides a structured, iterative process for creating and evaluating technological artifacts aimed at solving complex problems. The DSR process adopted in this study encompasses the following key stages:

Problem Definition: An initial needs assessment was conducted to identify specific pain points in existing AOMPC-based educational content. Issues such as cognitive overload, low emotional engagement, and poor interface intuitiveness were identified as primary barriers to effective learning.

Goal Setting: Based on the problem analysis, a set of design objectives was articulated. These included enhancing user engagement through intuitive interface design, reducing cognitive load through structured multimedia content, and improving academic outcomes through adaptive learning pathways.

Development of UX Design Guidelines: A comprehensive set of UX design principles was established, focusing on interaction mechanisms, visual aesthetics, feedback systems, and multimedia coherence. These guidelines served as the foundational blueprint for system development.

Framework Construction: Using the design principles as scaffolding, a modular AOMPC-based English learning content framework was constructed. The framework integrates features such as voice-activated interactions, multimodal instructional assets, real-time feedback systems, and personalized learning modules.

Evaluation and Iterative Refinement: The framework was subjected to empirical evaluation through controlled experimentation, user surveys, and classroom observations. Based on the results, iterative refinements were implemented, aligning the design with actual classroom needs and learner preferences.

Validation: The effectiveness of the optimized design was assessed through post-intervention tests and a one-month follow-up, ensuring not only short-term performance gains but also sustainability of learning outcomes.

The iterative nature of the DSR approach allows for continuous feedback loops between theory, design, and practice—ensuring that the framework remains adaptable to diverse educational contexts and technological advancements.

3.2 Mixed-Methods Research Design

To comprehensively assess the impact of the UX-optimized AOMPC platform on student learning, this study adopts a mixed-methods research design. Quantitative methods allow for statistical generalizability, while qualitative insights provide depth and contextual understanding.

3.2.1 Quantitative Methods

Experimental Design: A between-subjects experimental design was implemented, involving two matched groups of 30 students each. The experimental group used the UX-optimized AOMPC interface, while the control group followed traditional instructional methods without digital enhancement. Both groups received equivalent instructional content over a four-week period.

Metrics: Data were collected on academic performance (via standardized English tests), task completion time, and classroom engagement frequency. These metrics provided objective indicators of learning efficiency and behavioral engagement.

Survey Instruments: Validated tools such as the System Usability Scale (SUS) and the User Experience Questionnaire (UEQ) were administered to assess students' perceptions of usability, learnability, and overall satisfaction.

3.2.2 Qualitative Methods

Semi-Structured Interviews: Post-intervention interviews were conducted with both students and instructors to gain nuanced insights into interface preferences, interaction quality, emotional responses, and perceived learning effectiveness.

Classroom Observations: Researchers conducted structured observations during AOMPC-integrated lessons, focusing on interaction dynamics, attention patterns, and task engagement. The observational data helped triangulate findings from surveys and interviews.

3.3 Theoretical Foundation

This study draws on two interrelated theoretical frameworks—Multimedia Learning Theory and Interface Design Theory—to inform the development and evaluation of the learning platform.

Multimedia Learning Theory posits that students learn more effectively when information is delivered through multiple sensory channels, such as text, audio, and visuals, provided cognitive overload is managed. In this study, instructional content was designed using dual-coding and segmenting principles, allowing learners to absorb complex information progressively and contextually.

Interface Design Theory emphasizes ergonomic alignment and cognitive accessibility. AOMPC interfaces were designed to match user expectations and cognitive processing patterns, using clear visual hierarchies, consistent iconography, and responsive input systems to streamline interaction.

Together, these theories provided a principled basis for system design that harmonizes technological affordances with pedagogical objectives.

3.4 UX-Centered Content and Interface Design

In alignment with UX and cognitive load principles, the AOMPC content was constructed to incorporate multimodal assets (e.g., images, videos, interactive simulations), organized to minimize extraneous processing and enhance retention. For instance, vocabulary instruction was paired with dynamic audio-visual examples, while grammar tutorials included drag-and-drop sentence builders and voice feedback mechanisms. Interfaces featured real-time progress indicators, personalized task recommendations, and interactive storytelling components designed to foster sustained attention and emotional engagement.

3.5 Experimental Protocol

The empirical evaluation proceeded across three phases:

Intervention Phase (Weeks 2–5): The experimental group received instruction via the AOMPC system, engaging with interactive tasks such as speech recognition, virtual simulations, and touch-based activities. The control group received parallel content through traditional teaching methods.

Post-Test Phase (Weeks 6–7): Both groups completed a battery of assessments, including standardized English proficiency tests, engagement self-reports, and learning motivation questionnaires. Differences were analyzed using ANOVA and regression modeling to determine the statistical significance of the intervention effects.

Follow-Up Phase (One Month Later): A delayed post-test was conducted to assess knowledge retention, sustained engagement, and attitudinal changes. These data provided evidence of long-term efficacy and UX durability.

3.6 Experimental Design Validity and Ethical Considerations

To ensure scientific rigor, several procedural safeguards were employed:

Randomized Group Assignment: Participants were randomly distributed into experimental and control groups, matched by baseline academic performance.

Incentive Structures: Gamified reward systems (points, badges) were integrated into the AOMPC platform to maintain motivation and reinforce task completion behaviors.

Participant Anonymity: All data were anonymized to protect student privacy, and all observations were conducted in accordance with institutional ethical standards.

Informed Consent: Prior to participation, informed consent was obtained from students, parents, and teachers. The study protocol was reviewed and approved by an Institutional Review Board (IRB), ensuring compliance with ethical research practices.

3.7 Summary

Through a rigorous, multi-phase methodology grounded in established design and learning theories, this study provides a robust empirical foundation for the UX-centered optimization of AOMPC-based educational platforms. The integration of design science with mixed-methods research enables both theoretical validation and practical applicability. Results from this study are expected to inform the future design of multimedia educational interfaces and offer evidence-based guidance for developers, educators, and policymakers seeking to enhance learning experiences through user-centered design. The methodological framework established herein serves not only as a blueprint for UX evaluation in educational technology but also as a catalyst for broader innovations in digital learning environments

IV. RESULTS

The evaluation of the UX-centered AOMPC learning environment yielded a series of significant empirical findings across multiple dimensions of user experience and educational effectiveness. The results are presented under four core domains: user experience factors, classroom engagement, learning efficiency, and user satisfaction, followed by a data-driven comparison of academic outcomes between experimental and control groups. Each domain is supported by both quantitative and qualitative evidence, enabling a multidimensional analysis of how UX-optimized design influences middle school students' English learning performance.

4.1 User Experience Dimensions and Their Pedagogical Impact

To assess the educational affordances of UX-driven AOMPC design, four critical UX domains were analyzed: usability, interactivity, visual design, and learning efficiency.

4.1.1 Usability

Participants in the experimental group reported significantly higher ease of use when interacting with the AOMPC interface. The learning environment, characterized by intuitive layout, responsive navigation, and consistent feedback, facilitated rapid student acclimatization. Survey data showed that 80% of students rated the interface as either "very user-friendly" or "relatively user-friendly." Observational records confirmed that students were able to navigate between modules (e.g., vocabulary, grammar, and listening tasks) with minimal instructional scaffolding. These results underscore the importance of cognitive ergonomics in digital learning design, particularly in reducing operational friction for adolescent users (Kalyuga, 2007; Lewis & Sauro, 2021).

4.1.2 Interactivity

Interactivity emerged as a central mechanism linking user engagement with improved academic performance. Compared to the control group, students in the experimental group exhibited a 35% increase in classroom interaction frequency. This was attributed to multimodal input methods such as voice recognition, drag-and-drop mechanics, and real-time response tasks. For instance, in listening comprehension exercises, students engaged with dynamic touch-based quizzes and speech recognition modules, which prompted immediate feedback and peer discussion—substantially elevating participation levels (Alsadoon, 2023; Capatina et al., 2024).

4.1.3 Visual Design

The AOMPC interface employed high-contrast color schemes, consistent visual hierarchies, and icon-based navigation to minimize cognitive load and visual clutter. 85% of students rated the visual design as "very appealing" or "relatively appealing." Eye-tracking and classroom observation indicated that students were more likely to remain visually focused on AOMPC tasks, as compared to chalkboard or textbook-based activities. Visual coherence appeared to support attention regulation and knowledge retention, particularly during grammar visualization tasks and contextual vocabulary acquisition (Barraza, 2021; Esplendori et al., 2022).

4.1.4 Learning Efficiency

A key finding of the study was a 25% reduction in task completion time within the experimental group, highlighting the impact of UX optimization on cognitive efficiency. Learning modules were designed to sequence content progressively and adapt to user performance. As a result, students exhibited quicker task navigation, lower error rates, and more targeted corrective behavior. Notably, the real-time assessment features of AOMPC allowed learners to identify and rectify misconceptions immediately, accelerating their path toward mastery (Skulmowski & Xu, 2022; Sozio et al., 2024).

4.2 Classroom Engagement and Academic Outcomes

The empirical comparison between the control and experimental groups revealed statistically and educationally significant differences across several learning dimensions.

4.2.1 Enhanced Learning Outcomes via Interactive UX

Post-test results revealed a 12-point average improvement in English test scores among the experimental group (from 72 to 84), compared to only a 1-point gain in the control group. Notable gains were recorded in listening comprehension and oral expression, directly attributable to the voice-enabled and multimedia components of the AOMPC platform. Students noted that real-time pronunciation feedback and simulated conversational tasks provided immersive, practical language use opportunities that were absent in conventional instruction (Aljehani, 2022; Austin, 2009).

4.2.2 Elevated Classroom Participation

Behavioral and emotional engagement showed the largest inter-group divergence. Students using AOMPC demonstrated a 30% increase in classroom participation relative to the control group. Emotional engagement, measured via self-reports and behavioral proxies, rose sharply due to gamified incentives and multimedia stimuli. Behavioral engagement—such as voluntary answering, group discussion frequency, and task persistence—was significantly enhanced by interactive task structures and reward systems (e.g., badges and progress bars) (Nguyen et al., 2016; Ogunyemi et al., 2022).

4.2.3 Longitudinal Retention and Motivation

Follow-up assessments conducted one month after the intervention confirmed the sustainability of learning gains. The experimental group maintained elevated scores in vocabulary retention, speaking fluency, and classroom participation. Moreover, survey responses indicated a continued sense of self-efficacy and interest in English learning, suggesting that the motivational effects of AOMPC's UX design extend beyond short-term novelty effects (Capatina et al., 2024; Shao et al., 2025).

4.3 Stratified Effects Across Learner Profiles

A stratified analysis revealed differentiated impacts based on learner characteristics:

Visual and Kinesthetic Learners: Demonstrated particularly strong responses to AOMPC's touch- and image-based modules. Vocabulary retention and reading comprehension were markedly improved in these subgroups (Ferreira et al., 2020; Masina et al., 2020).

Auditory Learners: Benefited most from voice recognition, listening feedback, and oral response features, with measurable gains in listening comprehension and speaking proficiency (He & Wu, 2023; Maslov et al., 2021).

These findings suggest that the AOMPC platform aligns well with multiple learning modalities, fulfilling a core objective of differentiated instruction through personalized, multimedia-rich pathways.

4.4 Quantitative Evidence: Comparative Tables

Table 4.1 Changes in Student English Scores

group	Average Score (Pre-Experiment)	Average Score (Post-Experiment)	Score Change
experimental	72	84	12
control	73	74	1

Interpretation: The experimental group exhibited a substantial improvement in test performance, supporting the hypothesis that UX-optimized multimedia interfaces foster deeper learning and application in second language acquisition.

Table 4.2 Classroom Engagement Scores Comparison

Engagement Dimension	Experimental Group (Average Score)	Control Group (Average Score)	Improvement
Emotional Engagement	8.2	6.5	1.7
Cognitive Engagement	7.9	6.8	1.1
Behavioral Engagement	8.5	6.4	2.1

Interpretation: All engagement dimensions showed statistically and pedagogically meaningful gains. Behavioral engagement showed the greatest change, reflecting the strong influence of interactive task mechanics.

Table 4.3. Task Completion Time

Learning Efficiency Improvement Comparison			
Group	Average Task Completion Time (Pre-Experiment)	Average Task Completion Time (Post-Experiment)	Time Difference
Experimental	45 minutes	34 minutes	-25%
Control	46 minutes	45 minutes	-2%

Interpretation: UX-centric design substantially reduced cognitive friction and redundant task navigation, leading to more efficient content mastery .

Table 4.4 User Satisfaction Survey Results

Satisfaction Level	Percentage of Experimental Group Students
Very Satisfied	45%
Satisfied	40%
Neutral	12%
Dissatisfied	3%

Interpretation: An overwhelming majority (85%) of participants expressed strong satisfaction with the AOMPC interface, citing intuitive navigation, responsive feedback, and engaging media as key strengths. Negative feedback (3%) was primarily associated with initial device unfamiliarity, suggesting potential for improvement through onboarding strategies.

4.5 Summary of Results

The cumulative evidence across quantitative and qualitative dimensions confirms the efficacy of the AOMPC platform when optimized through UX principles. Students demonstrated marked improvements in academic performance, emotional and behavioral engagement, and learning efficiency. The multi-sensory, multimodal interface design contributed to sustained learner motivation, particularly among students with diverse cognitive profiles. Importantly, the UX-optimized system not only produced short-term gains but also exhibited positive retention effects over time, underscoring its pedagogical robustness and long-term applicability.

These findings establish a strong empirical foundation for the claim that UX design is not merely an interface consideration, but a pedagogical catalyst that can meaningfully shape learning behavior and academic trajectories in digitally enhanced classrooms (Capatina et al., 2024; Kalyuga, 2007).

V. DISCUSSION

The study's results affirm the hypothesis that UX-centered design significantly enhances learning outcomes, especially in language learning contexts where engagement and motivation are pivotal. Compared to prior research, this study introduces a more structured and empirically validated design framework tailored specifically for AOMPC environments. The integration of interactivity, visual clarity, and multimedia elements contributes not only to improved performance but also to deeper emotional and cognitive engagement.

The design guidelines proposed in this study are refined based on the findings. Visual and interface design should prioritize simplicity, consistency, and legibility, employing high-contrast colors and clear fonts to minimize cognitive load. Interaction design must ensure smooth, responsive operations, with features that promote peer collaboration and teacher-student engagement. Content presentation should be adapted to the nature of language learning, leveraging multimedia tools such as animations, videos, and audio clips to create immersive, context-rich learning scenarios.

From an educational perspective, the study provides practical implications for secondary school English instruction. Teachers are encouraged to integrate AOMPCs not merely as tools for content delivery, but as platforms for active learning and digital collaboration. This approach fosters a more interactive and student-centered classroom environment, promoting digital literacy, independent thinking, and teamwork.

6. Conclusion

This study aims to explore the impact of user experience (UX) design based on an integrated multimedia personal computer (AOMPC) on classroom learning outcomes. Through experimental design and data analysis, the study systematically evaluates the effectiveness of AOMPC in enhancing students' English proficiency, classroom participation, and learning motivation. The findings indicate that AOMPC's interactivity, usability, visual design, and optimization of learning efficiency significantly improved student learning outcomes, with particularly notable results in promoting classroom participation and learning motivation. By comparing the experimental and control groups, the study reveals the advantages of interactive design and multimedia elements in language learning, further validating the important role of UX design in educational technology. Combining both quantitative and qualitative research, this study provides valuable insights into the optimization direction of AOMPC platform design and offers a practical reference framework for the development of future educational tools.

6.1 Research Contributions and Practical Implications

6.1.1 Research Contributions

The main contributions of this study include: filling the gap in user experience (UX) research within educational technology by providing empirical evidence that demonstrates the impact of UX design in AOMPC-based learning environments on classroom learning outcomes; validating the positive effects of multidimensional UX design (such as interactivity, usability, visual presentation, and learning efficiency) on learning motivation, classroom participation, and academic performance; and, based on the experimental results, proposing a set of UX design guidelines to guide the optimization and development of AOMPC and similar educational technology platforms to enhance teaching effectiveness.

6.1.2 Practical Implications

The practical significance of this study is reflected in several key areas: First, it provides educators with theoretical support on the use of multimedia teaching tools, helping them understand how to leverage innovative teaching tools (such as AOMPC) to enhance student performance, particularly in improving classroom participation and learning motivation. Second, it offers specific user experience (UX) improvement recommendations for educational technology developers, especially in the areas of interactivity design and content presentation. The findings provide valuable insights for the interface design and functional optimization of AOMPC and similar platforms, contributing to enhanced usability and teaching effectiveness. Finally, the study offers insights for policymakers and education administrators, emphasizing that integrating AOMPC and similar technological tools into the classroom can help improve educational quality, particularly in terms of student participation and motivation, thus driving education reform and modernization efforts.

REFERENCES

[1] Abdulrahaman, M. D., Faruk, N., Oloyede, A. A., Surajudeen-Bakinde, N. T., Olawoyin, L. A., Mejabi, O. V., Imam-Fulani, Y. O., Fahm, A. O., & Azeez, A. L. (2020). Multimedia tools in the teaching and learning processes: A systematic review. *Heliyon, 6*(11), e05312. https://doi.org/10.1016/j.heliyon.2020.e05312

[2] Aljehani, L. M. (2022). The effectiveness of using color-coding in teaching grammar for female Saudi EFL learners in KSA. *International Journal of English Language Education, 10*(1), 21. https://doi.org/10.5296/ijele.v10i1.19956

[3] Alsadoon, H. (2023). The impact of gamification on student motivation and engagement: An empirical study. *Dirasat: Educational Sciences, 50*, 386–396. https://doi.org/10.35516/edu.v50i2.255

[4] AlShaikh, R., Al-Malki, N., & Almasre, M. (2024). The implementation of the cognitive theory of multimedia learning in the design and evaluation of an AI educational video assistant utilizing large language models. Heliyon, 10(3), e25361. https://doi.org/10.1016/j.heliyon.2024.e25361

[5] Austin, K. (2009). Multimedia learning: Cognitive individual differences and display design techniques predict transfer learning with multimedia learning modules. *Computers & Education, 53*(5), 1339–1354. https://doi.org/10.1016/j.compedu.2009.06.017

[6] Bai, Y., Liu, Y., Liang, Y., & Tang, M. (2019). Exploiting user experience from online customer reviews for product design. *International Journal of Information Management, 46*, 173–186. https://doi.org/10.1016/j.ijinfomgt.2018.12.006

[7] Barraza, G. (2021). *The role of aesthetics in classroom design: Implications for engagement and equity* (Master's thesis, University of San Francisco). https://repository.usfca.edu/thes/1385

[8] Capatina, A., Juarez-Varon, D., Micu, A., & Micu, A. E. (2024). Leveling up in corporate training: Unveiling the power of gamification to enhance knowledge retention, knowledge sharing, and job performance. *Journal of Innovation & Knowledge, 9*(3), 100530. https://doi.org/10.1016/j.jik.2024.100530

[9] Capili, B., & Anastasi, J. K. (2024). Ethical guidelines and the institutional review board – An introduction. *American Journal of Nursing, 124*(3), 50–54. https://doi.org/10.1097/01.NAJ.0001008420.28033.e8

[10] Esplendori, G. F., Kobayashi, R. M., & Püschel, V. A. A. (2022). Multisensory integration approach, cognitive domains, meaningful learning: Reflections for undergraduate nursing education. *Revista da Escola de Enfermagem da USP, 56*, e20210381. https://doi.org/10.1590/1980-220X-REEUSP-2021-0381

[11] Ferreira, J. M., Acuña, S. T., Dieste, O., Vegas, S., Santos, A., Rodríguez, F., & Juristo, N. (2020). Impact of usability mechanisms: An experiment on efficiency, effectiveness and user satisfaction. Information and Software Technology, 117, 106195. https://doi.org/10.1016/j.infsof.2019.106195

[12] González-Peño, A., Franco, E., & Coterón, J. (2021). Do observed teaching behaviors relate to students' engagement in physical education? *International Journal of Environmental Research and Public Health, 18*(5), 2234. https://doi.org/10.3390/ijerph18052234

[13] He, X., & Wu, D. (2023). Does additional audio really work? A study on users' cognitive behavior with audio-visual dual-channel in panoramic digital museum. *Information & Management, 60*(4), 103791. https://doi.org/10.1016/j.im.2023.103791

[14] Kalyuga, S. (2007). Enhancing instructional efficiency of interactive e-learning environments: A cognitive load perspective. *Educational Psychology Review, 19*(4), 387–399. https://doi.org/10.1007/s10648-007-9051-6

[15] Kang, E., & Hwang, H.-J. (2023). The importance of anonymity and confidentiality for conducting survey research. *Journal of Research in Practical Education, 4*, 1–7. https://doi.org/10.15722/jrpe.4.1.202303.1

[16] Keenan, H. L., Duke, S. L., Wharrad, H. J., Doody, G. A., & Patel, R. S. (2022). Usability: An introduction to and literature review of usability testing for educational resources in radiation oncology. *Technology in Innovation and Patient Support in Radiation Oncology, 24*, 67–72. https://doi.org/10.1016/j.tipsro.2022.09.001

[17] Lewis, J., & Sauro, J. (2021). Usability and user experience: Design and evaluation. In *The Wiley Handbook of Human Computer Interaction* (Chapter 38). https://doi.org/10.1002/9781119636113.ch38

[18] Li, J., Xue, E., Li, C., & He, Y. (2023). Investigating latent interactions between students' affective cognition and learning performance: Meta-analysis of affective and cognitive factors. *Behavioral Sciences (Basel), 13*(7), 555. https://doi.org/10.3390/bs13070555

[19] Li, Y., Chen, D., & Deng, X. (2024). The impact of digital educational games on students' motivation for learning: The mediating effect of learning engagement and the moderating effect of the digital environment. *PLOS ONE, 19*(1), e0294350. https://doi.org/10.1371/journal.pone.0294350

[20] Low, R., & Sweller, J. (2014). The modality principle in multimedia learning. In *The Cambridge Handbook of Multimedia Learning* (2nd ed.). https://doi.org/10.1017/CBO9781139547369.012

[21] Lv, S., Chen, C., Zheng, W., & Zhu, Y. (2022). The relationship between study engagement and critical thinking among higher vocational college students in China: A longitudinal study. Psychology Research and Behavior Management, 15, 2989–3002. https://doi.org/10.2147/PRBM.S386780

[22] Masina, F., Orso, V., Pluchino, P., Dainese, G., Volpato, S., Nelini, C., Mapelli, D., Spagnolli, A., & Gamberini, L. (2020). Investigating the accessibility of voice assistants with impaired users: Mixed methods study. *Journal of Medical Internet Research, 22*(9), e18431. https://doi.org/10.2196/18431

[23] Maslov, I., Nikou, S., & Hansen, P. (2021). Exploring user experience of learning management systems. *International*

Journal of Information and Learning Technology, ahead-of-print. https://doi.org/10.1108/IJILT-03-2021-0046

[24] Morgan, P., & Patrick, J. (2010). Designing interfaces that encourage a more effortful cognitive strategy. Proceedings of the Human Factors and Ergonomics Society Annual Meeting, 54, 408–412. https://doi.org/10.1177/154193121005400429

[25] Mucedola, M. S. (2018). Intrinsic motivation paired with community outreach strategies to improve student success. *The Clearing House, 91*(6), 229–235. https://www.jstor.org/stable/48537806

[26] Nakamura, W., Teixeira de Oliveira, E., & Conte, T. (2018). Applying design science research to develop a technique to evaluate the usability and user experience of learning management systems. *Proceedings of the Brazilian Symposium on Computers in Education (SBIE), 953*. https://doi.org/10.5753/cbie.sbie.2018.953

[27] Nguyen, T., Cannata, M., & Miller, J. (2016). Understanding student behavioral engagement: Importance of student interaction with peers and teachers. The Journal of Educational Research, 111(1), 1–12. https://doi.org/10.1080/00220671.2016.1220359

[28] Ogunyemi, A. A., Quaicoe, J. S., & Bauters, M. (2022). Indicators for enhancing learners' engagement in massive open online courses: A systematic review. *Computers and Education Open, 3*, 100088. https://doi.org/10.1016/j.caeo.2022.100088

[29] Pietarinen, J., Soini, T., & Pyhältö, K. (2014). Students' emotional and cognitive engagement as the determinants of well-being and achievement in school. *International Journal of Educational Research, 67*, 40–51. https://doi.org/10.1016/j.ijer.2014.05.001

[30] Richardson, J. (2006). The role of students' cognitive engagement in online learning. *The American Journal of Distance Education, 20*(1), 23–37. https://doi.org/10.1207/s15389286ajde2001_3

[31] Rogti, M. (2024). The effect of mobile-based interactive multimedia on thinking engagement and cooperation. *International Journal of Instruction, 17*(1), 673–696. https://doi.org/10.29333/iji.2024.17135a

[32] Santoso, H. B., Schrepp, M., Isal, R. Y. K., Utomo, A. Y., & Priyogi, B. (2016). Measuring user experience of the student-centered e-learning environment. *The Journal of Educators Online, 13*(1), 58.

[33] Shao, Y., Feng, Y., Zhao, X., et al. (2025). Teacher support and secondary school students' learning engagement: A moderated mediation model. *Scientific Reports, 15*, 2974. https://doi.org/10.1038/s41598-025-87366-0

[34] Skulmowski, A., & Xu, K. M. (2022). Understanding cognitive load in digital and online learning: A new perspective on extraneous cognitive load. *Educational Psychology Review, 34*, 171–196. https://doi.org/10.1007/s10648-021-09624-7

[35] Sozio, G., Agostinho, S., Tindall-Ford, S., & Paas, F. (2024). Enhancing teaching strategies through cognitive load theory: Process vs. product worked examples. *Education Sciences, 14*(8), 813. https://doi.org/10.3390/educsci14080813

[36] Srivastava, K., Siddiqui, M. H., Kaurav, R. P. S., Narula, S., & Baber, R. (2024). The high of higher education: Interactivity, its influence, and effectiveness on virtual communities. *Benchmarking: An International Journal, 31*(10), 3807–3832. https://doi.org/10.1108/BIJ-09-2022-0603

[37] Tai, K. W. H., & Wei, L. (2023). Engaging students in learning and creating different translanguaging sub-spaces in Hong Kong English Medium Instruction history classrooms. *Language and Education, 39*(1), 190–231. https://doi.org/10.1080/09500782.2023.2248958

[38] Tong, D. H., Uyen, B. P., & Ngan, L. K. (2022). The effectiveness of blended learning on students' academic achievement, self-study skills and learning attitudes: A quasi-experiment study in teaching the conventions for coordinates in the plane. *Heliyon, 8*(12), e12657. https://doi.org/10.1016/j.heliyon.2022.e12657

[39] Wang, A. I., & Tahir, R. (2020). The effect of using Kahoot! for learning – A literature review. *Computers & Education, 149*, 103818. https://doi.org/10.1016/j.compedu.2020.103818

[40] White, H. (2013). An introduction to the use of randomised control trials to evaluate development interventions. *Journal of Development Effectiveness, 5*(1), 30–49. https://doi.org/10.1080/19439342.2013.764652

[41] Wong, Z. Y., & Liem, G. A. D. (2022). Student engagement: Current state of the construct, conceptual refinement, and future research directions. *Educational Psychology Review, 34*, 107–138. https://doi.org/10.1007/s10648-021-09628-3

[42] Xu, X., Shi, Z., Bos, N. A., & Wu, H. (2023). Student engagement and learning outcomes: An empirical study applying a four-dimensional framework. *Medical Education Online, 28*(1), 2268347. https://doi.org/10.1080/10872981.2023.2268347

[43] Zhang, Y. (2022). Development and application of artificial intelligence multimedia technology based on big data. *Mobile Information Systems*, 2022, 2073091. https://doi.org/10.1155/2022/2073091