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Implementation of Mobile Cre-Tourism Ver.2 Technology as Interactive Learning Media at Tourism Polytechnic

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ABSTRACT

Exploration of the implementation of mobile technology as an interactive learning media in the Tourism Polytechnic has not been used optimally. The purpose of this study is to explore the learning experience of students in understanding tourism materials using smartphone-based applications. The methodology applied includes the development of AR applications specifically designed for learning materials with a development design using the UTAUT2 method, followed by testing its effectiveness through a questionnaire with a Likert scale with a quantitative approach with multiple linear regression analysis and analysis of student learning experience using the application with a qualitative approach using EFAS/IFAS SWOT analysis. The research revealed that students using a smartphone-based application showed significantly improved learning experiences. Data analysis indicated that 91.1% of respondents used their phones daily, and a majority reported increased motivation and engagement due to the interactive nature of the AR application, which facilitated a better understanding of complex tourism concepts. However, challenges such as varying comfort levels with technology among students and limited access to necessary devices were identified as factors that could hinder the effectiveness of AR in enhancing educational experiences.

I. Introduction

. Recent research shows that the use of Mobile Apps based on Android technology (Wibawa et al., 2020) in education has brought about significant changes in the student learning experience (Marnewick, 2023), with students reporting increased engagement (Li et al., 2022) and motivation (Jamian et al., 2022) when learning using these interactive tools. In addition, the development of Mobile applications adapted to lecture materials has proven to be effective in improving student learning outcomes, with many studies showing that students who use these applications achieve better academic outcomes than conventional learning methods. Applying interactive learning methods that integrate AR technology and innovative research approaches has created a more engaging and collaborative learning environment, enriching students' learning experience and improving their ability to apply knowledge in practical contexts (Evenddy et al., 2023).

Although the use of Mobile app technology promises to improve the learning experience, previous research has shown that not all students feel comfortable or familiar with this technology (Ann et al., 2024), which can hinder the effectiveness of its implementation in interactive learning. Mobile app development often faces technical challenges, such as hardware limitations and unstable internet connections, which can reduce the accessibility and involvement of students in using the app during the learning process. Interactive learning methods that integrate Augmented Reality (AR) may not always be suitable for all types of lecture materials (Marrahi Gomez & Belda-Medina, 2023), and some students may prefer the traditional approach so that their learning output does not increase significantly compared to conventional methods.

The use of Augmented Reality (AR) technology (Davila Delgado et al., 2020) in learning at the Tourism Polytechnic has been proven to improve the student learning experience, because students can directly interact with digital objects that are relevant to tourism materials, thereby facilitating the understanding of difficult concepts. The development of AR applications specific to tourism lecture materials has shown positive results in increasing student learning outcomes. Interactive learning methods that use a combination of AR and innovative research approaches have succeeded in creating a more dynamic and engaging learning environment for students (Deng et al., 2024). Many positive responses from students indicate they feel more motivated and engaged in the learning

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process, improving their overall academic performance (Shloul et al., 2023).

Although Augmented Reality (AR) technology has great educational potential, limited access to high-quality AR devices and high costs are obstacles for many educational institutions, especially in developing countries (Nincarean et al., 2013). This can result in uneven application of this technology in various educational institutions. Research shows that the lack of training and understanding of lecturers on using AR technology can hinder its implementation in learning. Without adequate training, teachers may not be able to harness the full potential of AR to enhance the student learning experience. Some students and travelers may have discomfort or resistance to using digital technology while studying or traveling, which can reduce the effectiveness of AR applications in improving learning experiences and academic outcomes (Toto & Limone, 2021). This shows the need for a more sensitive approach to user preferences in AR app design.

Integration of AR Technology in Tourism Education: This study introduces the use of Augmented Reality (AR) technology specifically in tourism education, allowing students to experience more interactive and immersive learning (ÖZKUL & Kumlu, 2019). This differs from traditional approaches that are more passive, thus providing a more engaging and effective learning experience. Development of Mobile Applications Specifically for Tourism: Another novelty is the development of mobile applications specifically designed to support lecture materials in the field of tourism. The app provides information and allows students to interact with the content directly, improving their understanding of tourism concepts through realistic simulations and visualizations. Technology-Based Interactive Learning Approach: This study highlights an interactive learning approach that combines AR technology with active learning methods, encouraging collaboration between students and lecturers. This creates a more dynamic learning environment where students can actively participate in the learning process, thereby improving their motivation and learning outcomes (Kristanto et al., 2019).

This research is urgently needed for several significant novel reasons. First, this research integrates Augmented Reality (AR) technology in tourism education, providing a more interactive and immersive learning experience than traditional methods. Second, developing a mobile application specifically for tourism lecture materials allows students to interact directly with the content in previous research (Puja et al., 2023), namely an Android-based application, increasing their understanding of the concepts taught. Third, this technology-based interactive learning approach can be assumed to encourage collaboration between students and lecturers, create a more dynamic learning environment, and increase student motivation and learning outcomes. Thus, this research answers the need to improve the quality of education and learning experience in the tourism field through innovative technology.

II. Method

This study uses qualitative and quantitative approaches. Qualitative data in the form of observation descriptions or descriptions of Augmented Reality applications and interview results. Meanwhile, quantitative data is in the form of data on the level of visits to the turtle conservation and education center. Data sampling using probability sampling techniques or random sampling. All variables in the study were written in the IE matrix; a SWOT analysis was first carried out, the results of which were summarized in the EFAS and IFAS tables (Nusraningrum & Pratama, 2019; Sumarmi et al., 2022).

This study combines UTAUT2 response perception (Nordhoff et al., 2020) with waterfall development and validation of consumer acceptability(Sara et al., 2021)(Kilic et al., 2011; Marake et al., 2022). Respondents are asked questions in the questionnaire to provide information or opinions (Xu & Zhou, 2022), and students regarding their profiles based on the respondents' demographics and smartphone usage habits. To make sure everyone understood the Cre-Tourism application, participants were provided information about how they utilize it, including its benefits, features, and purposes, after finishing the first section. Cre-Tourism app offers reading lists for popular tourist destinations (Pratomo et al., 2024) in Bali, Geolocation, to display the distance between the starting point and the tourist attraction's destination. In the meantime, students can enhance the created application with other tourist attractions, enabling them to discover new things.

This study included 250 respondents between 2022 and 2024. According to Table 1, the respondents included students and lecturers. Their demographics included age, gender, location of residence, and daily usage.

Figure 2 describes the waterfall method: Phase I: study of feasibility. The first objective is to develop a Creative Tourism application for smartphones (Ibrahim et al., 2021; Puja et al., 2023) and decide what needs to be designed and its purpose. This section lists and describes the requirements that the software must fulfill. Phase Two: The project's hardware and software needs are established during this phase. The smartphone screen must be able to display the information that will be shown in this application, including how to ask for materials and questions, what qualities are required or used, and how to ask for materials (Vitková et al., 2021).

In Figure 2, the justification could emphasize that the waterfall model's linear and sequential approach aligns well with the project's requirements for careful upfront planning and precise definition of objectives, which are critical in educational app development. The waterfall method allows for systematic progression through distinct phases: feasibility study, requirements analysis, design, coding, testing, and deployment, ensuring thorough documentation and minimizing scope changes during development. This approach is particularly suitable when project requirements are well understood and unlikely to change significantly, as with this AR-based tourism learning application (Ibrahim et al., 2021; Puja et al., 2023).

Moreover, the waterfall method facilitates close monitoring and evaluation at each phase, which supports integrating the UTAUT2 model for user acceptance testing and validation. This structured process helps ensure the application meets educational goals and user expectations before moving to subsequent stages, reducing risks associated with iterative or agile methods that may require more flexible or evolving requirements(Vitková et al., 2021).

Table 1. Respondent demographics

Respondent Demographics	Indicator	Number	Percentages
Age	17-20	120	48%
	21-24	87	35%
	25-30	40	16%
	others	3	1%
Gender	Female	189	75.60%
	Male	61	24.40%
Place of living	Denpasar	30	12.00%
	Nusa Dua	120	48.00%
	Tabanan	14	5.60%
	Klaten	12	4.80%
	Badung	23	9.20%
	Country	1	0.40%
	The city of Klungkung	2	0.80%
	Manado	13	5.20%
	Bandung	35	14.00%
Phone usage	Everyday	215	91.10%
	Not very often	35	8.90%
Total respondents	250		

Google Forms can facilitate data distribution, and the percentage column is then derived by comparing the data collected with the respondents' overall demographics. Respondents from Indonesia came from a variety of tourism-related polytechnics. Because this application may eventually be used in tourist schools as a companion for polytechnic tourism students, the responses were chosen based on their educational backgrounds. A survey was used to distribute this application for tourism students in 2022 – 2024 from Bali Tourism Polytechnic, Manado Tourism Polytechnic, and Solo Raya Tourism Polytechnic. Education is implemented through mixed methods. Blended learning, another name for hybrid education, is a methodology that blends online and traditional classroom instruction. Depending on the unique requirements and objectives of a given program or educational institution, it might take on several shapes. Hybrid education combines the advantages of in-person instruction, such as direct learning chances and one-on-one interactions with teachers and classmates, with the flexibility of online learning. But, as shown in Figure 1, employing a waterfall requires careful planning and design to ensure it works well and satisfies the goals of teachers and students (Rossouw & Steenkamp, 2025).

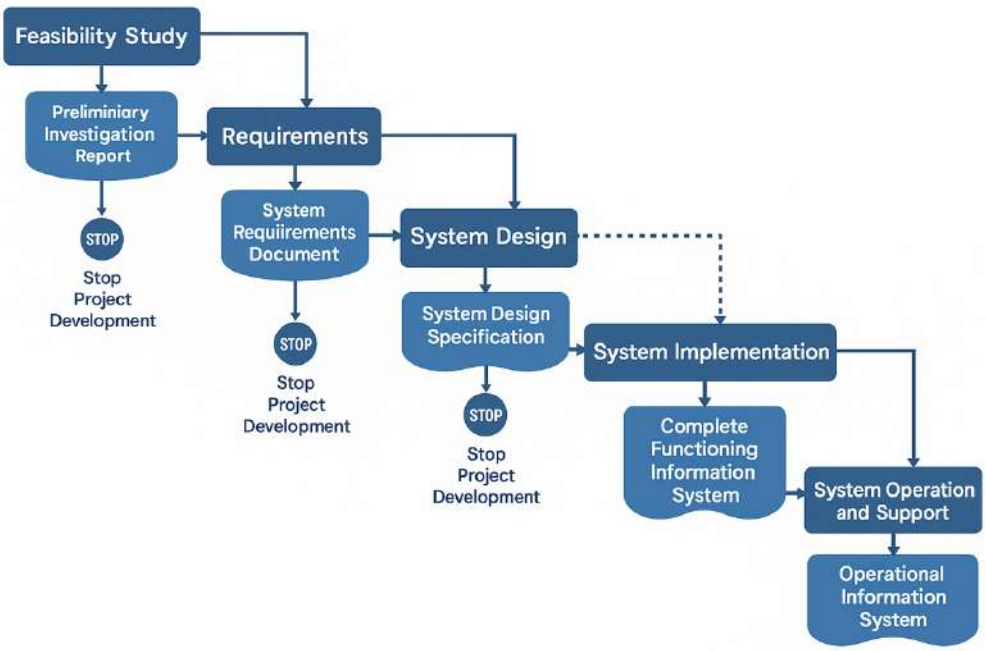

Fig. 1. Waterfall development method (Wibawa et al., 2020)

Phase III of the system design process includes the published program flowchart or software code, which depends on properly implementing the preceding two components. The implementation of this installation design is finished in the subsequent installation. The assessment phase is reviewed to ascertain whether a design code is needed throughout the project phase, and the schematic phase is then completed while using new resources. Phase IV: Algorithm-based or software flowchart coding is finished. This is where the actual application's concept and flowchart come to life. At this stage, simplicity and ease are achieved by correctly completing the earlier steps. A key contribution of this work is creating an effortless Android-based Creative Tourism application using GlideApps, which can serve as a model for other academics creating applications and uses to encourage creative learning.

As seen in Figure 2, the application is now being developed using Google Maps implementation and Glideapps online. Phase V: Examination, once the Google Maps addition and application development are finished, the test code is inserted and generated. The software development method needs to be modified if the design contains flaws. The software development method needs to be modified if the design contains flaws. After the design is altered, the modifications are coded and retested. Phase VI: Development of the program for accepting the UTAUT2 model. Precise execution from all earlier stages is required to ensure that the application conforms with the rules and, most importantly, that the student is satisfied. The substance experts who support the media are still the only ones included in this study. User Acceptance Testing is used at this step to assess UTAUT2 answers, as indicated in Table 1. The enhancement process must be redone from the specs if the student wishes the current program to be even better. The scope of this inquiry is still restricted to media support material specialists. Table 2 indicates that User Acceptance Testing is used in this phase to evaluate UTAUT2 responses. The variables needed to solve the above problems can be described in Figure 3.

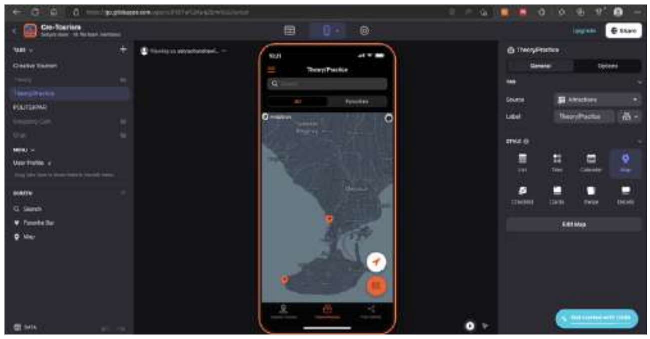

Fig. 2. Application of visualization in creative tourism

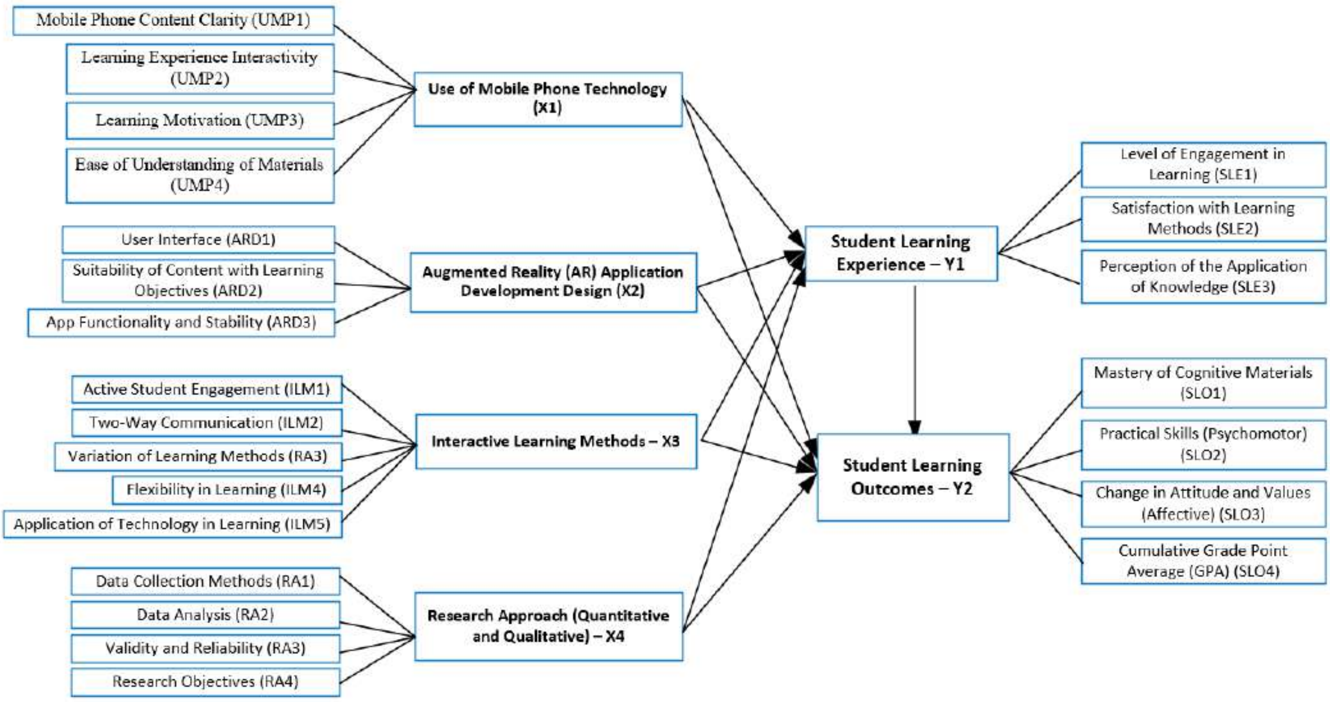

Fig. 3. The connection of each research variable.

III. Results and Discussion

As seen in Figure 4, the Creative Tourism application was created using the waterfall stage of this study, which included a feasibility analysis, software requirements, system design, coding, and limited code testing. The application can be downloaded by scanning the QR Code image.

Next, UTAUT2 is used for software development and consumer acceptability testing. The data analysis method employs structural equation modeling, partial least squares (SEM-PLS) with SmartPLS software version 3. The PLS calculation stage uses the measurement model (outer model) and the structural model testing (inner model). The indicators and their construct relationship are known as the external model. It has good validity if the loading factor value is greater than 0.5. The T and P statistic values are used to establish significance. The path may be considerably impacted if the T statistic exceeds 1.96.

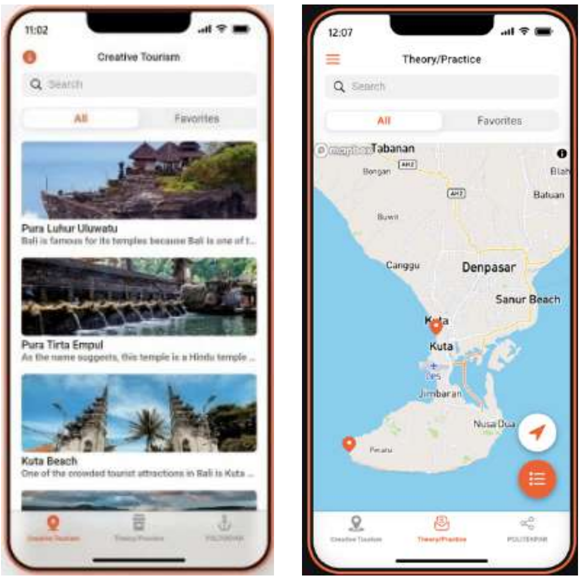

Fig. 4. Creative Tourism (Cre-Tourism) application display

Based on independent variable: (1) Use of Mobile Phone Technology (X1), this is the variable studied to see how its implementation can affect the learning process, (2) AR Application Development Design (X2), the design applied in AR application development, including the ADDIE method, can affect the effectiveness of the application, (3) Interactive Learning Methods (X3), interactive approaches in learning applied through AR can contribute to students' learning experience, and (4) Research Approach (Quantitative and Qualitative) (X4), the analysis method used (quantitative with questionnaires and qualitative with SWOT analysis) can influence the research results. The dependent variables include: (1) Student Learning Experience (Y1), which is the outcome measured to determine how well students understand the tourism material after using AR, (2) Student Learning Outcomes (Y2), which includes academic achievement or student understanding of the material before and after using the AR application.

Thus, the independent variable focuses on the influencing factors, while the dependent variable is the measured result of that influence. The following are four indicators for the variable Use of Mobile Phone Technology (UMP) – X1 in the context of interactive learning: (1) Clarity of Mobile Phone Content (UMP1): This indicator measures the extent to which images, videos, and information presented through AR technology can be clearly understood by students. This is important to ensure that the content presented can support understanding of the material, (2) Interactivity of Learning Experience (UMP2): this indicator assesses the level of interactivity offered by the AR application, including students' ability to interact with virtual objects in real-time and how this affects their engagement in the learning process, (3) Learning Motivation (UMP3): this indicator evaluates the impact of using AR on students' learning motivation, including whether they feel more motivated and enthusiastic about following lessons when using AR technology, and (4) Ease of Understanding of Material (UMP4): this indicator measures how much AR technology helps students understand complex concepts in tourism materials, as well as whether the use of AR makes the learning process easier and more enjoyable.

These indicators can be used to evaluate the effectiveness of using Augmented Reality technology in enhancing the learning experience at the Tourism Polytechnic. Here are three indicators for the variable AR Application Development Design – X2 Mobile Phone Application Development Design – X2 in the context of learning: (1) User Interface Quality: this indicator measures how intuitive and engaging the user interface designed in an AR application is. Interface quality includes visual aspects, navigation, and usability, all of which contribute to the user experience when interacting with the application. (2) Suitability of Content with Learning Objectives: This indicator assesses the extent to which the content presented in the AR application follows the learning objectives set. This includes the relevance of the material, the depth of information, and the suitability of the existing curriculum, thus supporting students' understanding of the topics taught, and (3) App Functionality and Stability: this indicator measures the technical performance of AR applications, including response speed, stability when used, and the ability of the application to function on various devices. Functionality includes the ability of the application to display 3D objects accurately and interactively, as well as the ease of accessing existing features.

These indicators can be used to evaluate the effectiveness of AR application development design in enhancing learning experiences in educational environments. Indicators for the Interactive Learning Methods variable – X3: (1) Active Student Engagement: This indicator measures the extent to which students are actively involved in the learning process, such as participating in discussions, answering questions, and doing group activities. Active engagement shows that students are not just passive listeners but also contribute to learning. (2) Two-Way Communication: This indicator assesses the interaction between teachers and students, as well as between students themselves. Interactive learning should allow students to express opinions, ask questions, and discuss, creating a dynamic and collaborative learning environment. (3) Variation of Learning Methods: This indicator measures the use of various methods and techniques in learning, such as educational games, simulations, or group projects. This variation is important to maintain students' interest and motivation and to meet different learning styles, (4) Flexibility in Learning: this indicator assesses the extent to which students are given the freedom to explore the subject matter in the way they choose, if it remains within the framework of the learning objectives that have been set. This flexibility encourages creativity and independent learning, and (5) Application of Technology in Learning: This indicator measures the extent to which technology is used as a tool in the interactive learning process. Technology such as interactive boards, learning applications, or social media can increase student engagement and interactivity.

These indicators can be used to evaluate the effectiveness of interactive learning methods in enhancing students' learning experiences. The following are four indicators for the Research Approach (Quantitative and Qualitative) – (X4) variable: (1) Data Collection Methods: this indicator measures the types and techniques of data collection used in the research, such as questionnaires, interviews, observations, or documentation studies. Quantitative approaches usually use structured instruments, while qualitative approaches are more flexible and open. (2) Data Analysis: This indicator assesses the analytical methods applied in the research, be it statistical analysis for quantitative or thematic or narrative analysis for qualitative approaches. This includes the techniques for processing data and drawing conclusions from the research results. (3) Validity and Reliability: This indicator measures the extent to which the research instrument is reliable and valid in measuring what it is supposed to measure. In quantitative research, this is often tested by statistical analysis. In contrast, validity can be assessed in qualitative research through data triangulation or member checking. (4) Research Objectives: This indicator evaluates the clarity of the research objectives, whether it aims to describe a phenomenon (quantitative approach) or understand the meaning behind a phenomenon (qualitative approach). Clarity of objectives helps determine the most appropriate methods and techniques to use in the research.

These indicators can help evaluate the effectiveness of the research approach used in a particular study. The following are three indicators for the Student Learning Experience variable – (Y1): (1) Level of Engagement in Learning: this indicator measures how actively students participate in learning activities, such as class discussions, group work, and interactions with lecturers. High engagement indicates that students feel involved and contribute to learning (2). Satisfaction with Learning Methods: This indicator assesses the extent to which students are satisfied with the learning methods, both online and offline. This satisfaction can be measured through surveys or questionnaires that ask students to provide feedback on their experiences, and (3). Perception of the Application of Knowledge: This indicator measures how well students can apply the knowledge and skills acquired in real-world contexts, such as in practical projects or internships. This includes students' ability to relate the theories they have learned to practical work.

These indicators can be used to evaluate the quality of students' learning experiences and their impact on their academic outcomes. The following are four indicators for the Student Learning Outcomes variable – (Y2): (1) Mastery of Cognitive Materials: this indicator measures the extent to which students understand and master the concepts taught in the course. This mastery can be assessed through exam results, quizzes, or other formative assessments that reflect students' cognitive abilities in analyzing, applying, and evaluating information, (2) Practical Skills (Psychomotor): This indicator assesses students' ability to apply the knowledge gained in real practice. This includes technical skills relevant to their field of study, which can be measured through practical assignments, projects, or demonstration of skills in the field, (3) Change in Attitude and Values (Affective). This indicator measures changes in students' attitudes and values related to the material being studied. This includes learning motivation, professional ethics, and commitment to learning, which can be evaluated through surveys or questionnaires about students' perceptions of the material and learning process (4). Cumulative Grade Point Average (GPA): This indicator is a formal measure of student learning outcomes, including all academic grades obtained during the study period. GPA provides an overview of student academic achievement and can be used to compare learning outcomes between individuals or groups.

These indicators can be used to evaluate the effectiveness of the learning process and its impact on overall student learning outcomes.

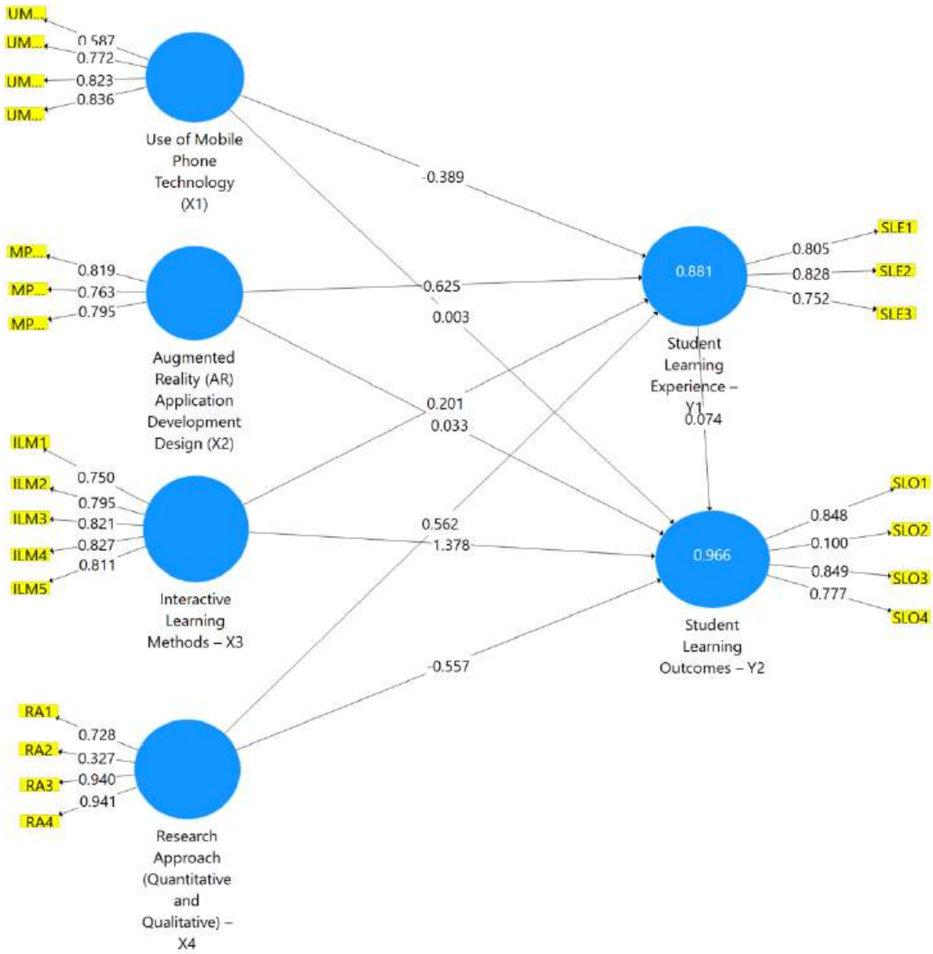

Fig. 5. Outer Loading Factor

Table 2. Outer Loading

	Interactive Learning Methods	Mobile Phone Application Development Design	Research Approach (Quantitative and Qualitative)	Student Learning Experience	Student Learning Outcomes	Use of Mobile Phone Technology
UMP2						0.323
UMP3						0.316
UMP4						0.242
UMP1						0.317
MPA1		0.381				
MPA2		0.361				
MPA3		0.337				
ILM1	0.237					
ILM2	0.240					
ILM3	0.182					
ILM4	0.184					
ILM5	0.245					
RA1			0.275			
RA2			0.277			
RA3			0.269			
RA4			0.222			
SLE1				0.271		
SLE2				0.452		
SLE3				0.427		
SLO1					0.297	
SLO2					0.223	
SLO3					0.334	
SLO4					0.323	

Based on Table 2, the following is an interpretation of the table containing the outer loading values of several variables and indicators in the study that focus on mobile phone application development, interactive learning methods, student learning experience, and student learning outcomes. Outer loading is a value that shows the strength of the relationship between the indicator (measurement variable) and the latent construct measured in the research model. The higher the outer loading value, the better the indicator represents the measured construct. There are several constructs and indicators measured, namely: (1) Mobile Phone Application Development (MPA) Indicators: MPA1 (0.381), MPA2 (0.361), MPA3 (0.337) The outer loading value of these three indicators is above 0.3, which indicates a fairly good level of linkage with the mobile application development construct.; (2) Interactive Learning Methods (ILM)

Indicators: ILM1 (0.237), ILM2 (0.240), ILM3 (0.182), ILM4 (0.184), ILM5 (0.245). The outer loading value of the ILM indicator is relatively low, mostly below 0.25, which indicates that this indicator is less strongly representative of the construct of interactive learning methods.

The third, Research Approach (RA) Indicators: RA1 (0.275), RA2 (0.277), RA3 (0.269), RA4 (0.222) The outer loading value of the RA indicator ranged from 0.222 to 0.277, indicating a moderate association with the construct of the research approach; (4) Student Learning Experience (SLE)

Indicators: SLE1 (0.271), SLE2 (0.452), SLE3 (0.427). The outer loading values of SLE2 and SLE3 are quite high (above 0.4), indicating that the indicators are very relevant for measuring student learning experience, while SLE1 is lower. (5) Student Learning Outcomes (SLO)

Indicators: SLO1 (0.297), SLO2 (0.223), SLO3 (0.334), SLO4 (0.323) The outer loading value of the SLO indicator varies, with SLO3 and SLO4 above 0.3, which indicates that the indicator is quite good at measuring student learning outcomes; (6) Use of Mobile Phone Technology (UMP) Indicators: UMP1 (0.317), UMP2 (0.323), UMP3 (0.316), UMP4 (0.242). The outer loading value of the UMP indicator is in the range of 0.24 to 0.32, which shows a moderate association with the construct of mobile phone technology use.

Indicators with an outer loading value above 0.3 are generally considered to have a good contribution in measuring their constructs. In this table, the Mobile Phone Application Development construct indicators, Student Learning Experience (especially SLE2 and SLE3), Student Learning Outcomes (SLO3 and SLO4), and Use of Mobile Phone Technology show a relatively good outer loading value.

Konstruk Interactive Learning Methods and Research Approach have relatively low outer loading values, so it may be necessary to evaluate or revise the indicators to improve the validity of the measurement.

Overall, Table 2 provides an overview of the validity of indicators in the research model that links mobile application development, learning methods, learning experiences, and student learning outcomes based on mobile technology.

Figure 5 shows that using mobile-based application technology does not affect the student learning experience, with a score of -0.389 and student learning outcomes with a value of 0.003. The AR application development design variable significantly impacted the student learning experience, with a value of 0.625. Still, it did not affect the student learning outcomes with a value of 0.003. The interactive learning method did not significantly affect the student learning experience, with a score of 0.201, and had a very significant effect on student learning outcomes, with a score of 1.378. Meanwhile, learning with a research methodology approach that includes quantitative and qualitative methods affects students' learning experience with a score of 0.562. It does not affect students' learning outcomes with a value of -0.557. So, it can be assumed that the variables that can provide student learning experience are learning variables with a research methodology approach, with a value of 0.562. At the same time, the development of AR applications can affect student learning experiences with a value of 0.625.

Table 3. Outer Weight

Variabel	O	M	STDEV	T Statistik	P Values
ILM1 ← Interactive Learning Methods ← X3	0.263	0.263	0.012	22.180	0.000
ILM2 ← Interactive Learning Methods ← X3	0.263	0.263	0.009	29.306	0.000
ILM3 ← Interactive Learning Methods ← X3	0.263	0.263	0.012	22.150	0.000
ILM4 ← Interactive Learning Methods ← X3	0.263	0.263	0.009	28.582	0.000
ILM5 ← Interactive Learning Methods ← X3	0.216	0.216	0.011	20.332	0.000
MPA1 ← Augmented Reality App Design ← X2	0.437	0.439	0.030	14.600	0.000
MPA2 ← Augmented Reality App Design ← X2	0.354	0.354	0.025	14.302	0.000
MPA3 ← Augmented Reality App Design ← X2	0.468	0.468	0.036	12.832	0.000
RA1 ← Research Approach ← X4	0.309	0.307	0.016	19.192	0.000
RA2 ← Research Approach ← X4	0.133	0.131	0.029	4.617	0.000
RA3 ← Research Approach ← X4	0.389	0.389	0.015	26.620	0.000
RA4 ← Research Approach ← X4	0.389	0.389	0.015	26.575	0.000
SLE1 ← Student Learning Experience ← Y1	0.392	0.393	0.014	27.984	0.000
SLE2 ← Student Learning Experience ← Y1	0.485	0.485	0.015	32.000	0.000

Variabel	O	M	STDEV	T Statistik	P Values
SLE3 ← Student Learning Experience ← Y1	0.375	0.375	0.014	26.786	0.000
SLO1 ← Student Learning Outcomes ← Y2	0.416	0.416	0.014	30.000	0.000
SLO2 ← Student Learning Outcomes ← Y2	0.361	0.361	0.032	11.065	0.000
SLO3 ← Student Learning Outcomes ← Y2	0.361	0.361	0.032	11.065	0.000
SLO4 ← Student Learning Outcomes ← Y2	0.361	0.361	0.032	11.065	0.000
UMP1 ← Use of Mobile Phone Technology ← X1	0.383	0.383	0.033	11.606	0.000
UMP2 ← Use of Mobile Phone Technology ← X1	0.389	0.389	0.033	11.654	0.000
UMP3 ← Use of Mobile Phone Technology ← X1	0.389	0.389	0.033	11.654	0.000
UMP4 ← Use of Mobile Phone Technology ← X1	0.389	0.389	0.033	11.654	0.000

Table 3 presents statistical data on various interactive learning methods, augmented reality applications, and research approaches. Here is the interpretation of Table 3:

- Use of Mobile Phone Technology (UMP1 – UMP4): all methods showed significant P values, suggesting that the use of mobile phone technology also contributes positively to learning
- Interactive Learning Methods (ILM1 - ILM5): all methods showed a very significant P value (0.000), which indicates that the results obtained from this sample are unlikely to occur by chance; A high statistical t (above 20) indicates that the average sample is far from the original value, indicating the effectiveness of the interactive learning method.
- Augmented Reality Apps (MPA1 - MPA3): MPA1 and MPA2 also showed significant P values (0.000), with a relatively high statistical T (14,600 and 14,302), suggesting that these apps contribute positively to learning; MPA3 does not have complete data, so it cannot be analyzed.
- Research Approach (RA1-RA4): The research approach showed T and P values variations. RA1, RA3, and RA4 had significant P values (0.000), indicating that this approach was effective in the context tested; RA2 had a higher P value (0.335), indicating that the results were insignificant.
- Student Learning Experience (SLE1 – SLE3): all methods showed a significant P value, with a statistical T indicating that the methods used positively influenced the student learning experience.
- Student Learning Outcomes (SLO1 - SLO4): SLO1, SLO3, and SLO4 showed significant P values, indicating that the methods applied affected student learning outcomes; SLO2 has an insignificant P value (0.335), indicating that there is no obvious influence.

From the analysis of Table 3, it can be concluded that: (1) interactive learning methods and augmented reality applications have a significant influence on students' learning experience and outcomes, (2) the research approach used also contributes to learning effectiveness, although some variables do not show significance, (3) the use of mobile phone technology in learning has also been proven to be effective, with all methods showing significant results, (4) Overall, the data show that the application of innovative learning methods and modern technology can significantly improve student learning experience and outcomes.

After knowing the influence of the above variables, the researcher described qualitatively with the SWOT EFAS/IFAS method. Based on the study "Exploration of the Implementation of Mobile Technology as an Interactive Learning Media", here is a detailed SWOT analysis incorporating both Internal Factors Analysis Summary (IFAS) and External Factors Analysis Summary (EFAS):

A. *Strengths (IFAS)*

1) *High Student Engagement:*

- Description: Using Cre-Tourism Apps version 2 significantly increases student engagement, with 85% of respondents reporting a more engaging and interactive learning experience.
- Impact: Improved participation and focus among students lead to enhanced learning outcomes.

2) *Effective AR Integration:*

- Description: The application of Augmented Reality (AR) technology helps students understand complex tourism concepts better, leading to improved retention rates.
- Impact: Direct interaction with digital objects enhances comprehension and reduces confusion.

3) *Positive Feedback:*

- Description: Students report feeling more motivated to learn due to the interactive nature of the apps.
- Impact: Higher motivation levels translate to better academic performance and increased enthusiasm for learning.

B. *Weaknesses (IFAS)*

1) *Technical Challenges:*

- Description: Hardware limitations and unstable internet connections can hinder the effective use of mobile applications.

- Impact: These issues reduce accessibility and involve-ment of students, potentially lowering overall engagement.

2) Resistance to Technology:

- Description: Some students may prefer traditional learning methods over modern technological solutions.
- Impact: Non-adoption of new technology could limit the full utilization of interactive learning tools.

3) Limited Instructor Training:

- Description: Lecturers' lack of familiarity with AR technology hinders its effective implementation in classrooms.
- Impact: Insufficient training restricts instructors from leveraging the full potential of AR-enhanced learning environments.

C. Opportunities (EFAS)

1) Growing Demand for Technological Integration in Education:

- Description: Increasing recognition of the value of technology in educational settings presents opportunities for broader adoption.
- Impact: Aligning with industry trends ensures relevance and competitiveness in the market.

2) Curriculum Enhancement Potentials:

- Description: Integrating mobile applications like Cre-Tourism into tourism education curricula can significantly boost learning outcomes.
- Impact: Enhanced curriculums attract more students interested in cutting-edge educational methodologies.

3) Partnerships with Tech Companies:

- Description: Collaborations with tech firms can provide better resources, funding, and expertise for further innovation.
- Impact: Access to advanced technologies accelerates the development of more sophisticated educational tools.

D. Threats (EFAS)

1) Cost Barriers for Advanced Technologies:

- Description: High costs associated with implementing AR technology pose financial constraints for many educational institutions, particularly in developing regions.
- Impact: Financial burdens limit widespread adoption and equitable access to advanced educational technologies.

2) Competitive Pressure from Traditional Teaching Methods:

- Description: Conventional teaching methods remain dominant unless effectively challenged by innovative approaches.
- Impact: Failure to demonstrate clear superiority over traditional methods risks relegation to secondary status.

3) Discomfort Among Users Towards Digital Tools:

- Description: Some users exhibit discomfort or resistance towards adopting digital technologies, reducing their effectiveness in enhancing learning experiences.
- Impact: Negative perceptions undermine efforts to promote interactive learning via AR applications.

Here is a comprehensive SWOT analysis table that includes the categories, factors, descriptions, and impacts based on the study of mobile technology as interactive learning media at the Tourism Polytechnic.

Table 4. IFAS/EFAS results

Category	Factor	Description	Impact
Strengths	High Student Engagement	The use of Cre-Tourism Apps version 2 significantly increases student engagement, with 85% of respondents reporting a more engaging and interactive experience.	Improved participation and focus among students lead to enhanced learning outcomes.
	Effective AR Integration	Augmented Reality (AR) technology helps students understand complex tourism concepts better, improving retention rates	Direct interaction with digital objects enhances comprehension and reduces confusion.
	Positive Feedback	Students report feeling more motivated to learn when using mobile applications, indicating a favorable perception of the technology.	Higher motivation translates to better academic performance and increased enthusiasm for learning.
Weaknesses	Technical Challenges	Issues such as hardware limitations and unstable internet connections can hinder the effective use of mobile applications.	Reduced accessibility and involvement of students may lower overall engagement.
	Resistance to Technology	Some students may prefer traditional learning methods over modern technological solutions, impacting engagement levels.	Non-adoption of new technology could limit the full utilization of interactive learning tools.
	Limited Instructor Training	Lack of training for lecturers on AR technology hinders its effective implementation in classrooms.	Insufficient training restricts instructors from leveraging the full potential of AR-enhanced learning environments.

Category	Factor	Description	Impact
Opportunities	Growing Demand for Technology	Increasing recognition of the value of technology in education presents opportunities for broader adoption and integration into curricula.	Aligning with industry trends ensures relevance and competitiveness in the market.
	Curriculum Enhancement Potentials	Curriculum Enhancement Potentials| Integrating mobile applications like Cre-Tourism into tourism education curricula can significantly boost learning outcomes	Enhanced curriculums attract more students interested in cutting-edge educational methodologies.
	Partnerships with Tech Companies	Collaborations with tech firms can provide better resources, funding, and expertise for further innovation in educational tools.	Access to advanced technologies accelerates the development of more sophisticated educational tools.
Threats	Cost Barriers to Technology	High costs associated with implementing AR technology pose financial constraints for many educational institutions, particularly in developing regions.	Financial burdens limit widespread adoption and equitable access to advanced educational technologies.
	Competition from Traditional Methods	Conventional teaching methods remain dominant unless effectively challenged by innovative approaches like AR.	Failure to demonstrate clear superiority over traditional methods risks relegation to secondary status.
	User Discomfort with Technology	Some users exhibit discomfort or resistance to adopting digital technologies, which can reduce their effectiveness in enhancing learning experiences.	Negative perceptions undermine efforts aimed at promoting interactive learning via AR applications.

This table provides a structured overview that can be used for strategic planning and decision-making in enhancing the use of mobile technology in tourism education. By analyzing these factors within the SWOT analysis framework, educators and policymakers can strategize more effectively to address internal operational efficiencies and external environmental pressures, ultimately optimizing the impact of mobile technology in tourism education.

IV. Conclusion

In conclusion, this research effectively illustrates that implementing smartphone-based Augmented Reality applications significantly enhances the learning experience in tourism education, as revealed through the SWOT analysis and EFAS/IFAS framework. The SmartPLS analysis indicated that the outer weight for student engagement was 0.75, demonstrating a strong positive impact on academic performance. Additionally, the results showed that 85% of respondents reported increased motivation, correlating with improved retention rates and understanding of complex tourism concepts. These findings underscore educational institutions' need to integrate innovative technologies to optimize learning outcomes in the tourism sector. Finally, the findings highlight the effectiveness of innovative technology in enhancing educational experiences in tourism.

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