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AN AUGMENTED REALITY-BASED INTERACTIVE LEARNING IN MORAL EDUCATION: ADVANCING MORAL REASONING AMONG SECONDARY STUDENTS ": THE NOMINAL GROUP TECHNIQUE APPROACH

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ABSTRACT

This study used the Nominal Group Technique (NGT) to create an augmented reality (AR)--based interactive teaching model for moral education to improve moral reasoning among secondary pupils. Seven specialists in moral education, educational technology, and adolescent psychology attended an online NGT session. The study was based on Kohlberg's Theory of Moral Development and Situated Learning Theory. Six essential dimensions were assessed, including fundamental moral cognition, conformity-driven moral reasoning, universal ethical knowledge, real-world scenario integration, collaborative learning, and learner-centered teaching methods. The results revealed substantial expert consensus across all aspects, with a particular emphasis on real-world scenario integration and personalized learning experiences. The findings indicate that augmented reality has considerable promise for creating immersive, engaging moral education experiences that connect theoretical understanding with practical application. This work lays a solid foundation for the creation of AR-based moral teaching tools, while also identifying areas for further research and practical implementation issues.

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INTRODUCTION

The fast development of information and communication technology (ICT) has had both positive and bad effects on modern civilization, especially for younger generations. The use of electronic gadgets has led to worries about children's moral reasoning skills and attention spans deteriorating, underscoring the vital need for moral education (Jamiah et al., 2022). To help youngsters negotiate complicated social circumstances and grow into responsible individuals, moral values, ethics, and citizenship must be instilled in them from an early age in an era where ICT is rapidly shaping society.mEducation is essential for encouraging societal cohesion, guiding people towards moral character, and supporting both physical and spiritual development. But the advent of social media and digitization has brought about changes in lifestyle that frequently minimize the By combining virtual and physical components, augmented reality (AR) offers immersive learning environments that are a potent tool for bridging the gap between ethical theory and practice (Zainuddin et al., 2023). AR is promising, but it hasn't been embraced by schools much, especially when it comes to teaching morality and ethics. However, by fostering moral imagination and sensitivity and enhancing students' moral decision-making abilities, AR-based simulations have the potential to have a substantial positive educational impact (Alias et al., 2024). The goal of this project is to improve secondary students' moral reasoning skills by creating an interactive teaching model for moral education that is based on augmented reality. This research aims to fill the gaps in moral education and better prepare students to uphold ethical ideals and navigate the challenges of the digital age by giving instructors innovative interactive tools. ICT integration in education has grown in significance in Malaysia, particularly when it comes to teaching moral and civic values. Concerns regarding possible decreases in students' attentiveness and moral reasoning are developing as the younger generation deals with rapid technological improvements, especially the ubiquitous use of electronics and social media (Mohd Khairul et al., 2023). This has spurred research into cutting-edge teaching strategies like augmented reality (AR), which may create dynamic and interesting learning environments. Augmented reality (AR) is a promising technique for improving moral education because of its established capacity to close the gap between academic knowledge and practical application. New ways of moral training are being made possible by the emergence of research on AR's potential in education in Malaysia (Zulkifli et al., 2024).

LITERATURE REVIEW

The literature review for this study brings together many major topics crucial to creating an augmented reality-based model for moral teaching. It builds on previous research into the influence of digital technology on moral development among Malaysian teenagers (Jamiah et al., 2022; Mohd Noor et al., 2021), emphasizing the need for novel methods of moral education in the digital era. The review then focuses on the potential of augmented reality (AR) in educational settings, including its use in moral education and ethical decision-making (Alias et al., 2024; Zainuddin et al., 2023). It covers research that has investigated AR's potential to construct immersive learning environments and bridge the gap between theoretical knowledge and practical application in moral reasoning (Mohd Khairul et al., 2023; Zulkifli . It looks at research that has investigated AR's ability to construct immersive learning environments and bridge the gap between theoretical knowledge and practical application in moral reasoning (Mohd Khairul et al., 2023; Zulkifli et al., 2024). The literature study also includes theoretical frameworks such as Kohlberg's Theory of Moral Development (Kohlberg & Hersh, 1977) and Situated Learning Theory (Lave & Wenger, 1991), which are a strong foundation for the proposed AR-based moral education paradigm. It also examines methodological techniques, including the use of the Nominal Group Technique in educational research (Foth et al., 2016; MacPhail, 2021), which justifies its use in obtaining expert consensus for creating the ARMOURED model. This detailed overview of the literature defines the backdrop, theoretical basis, and methodological approach for the study, showing the possibilities.

RESEARCH GOAL:

The main goal of this study is to create and assess an interactive teaching model based on augmented reality that will help secondary students become more morally aware and strengthen their moral reasoning skills. This project aims to develop compelling learning experiences that promote a deeper comprehension and application of moral ideas by utilizing the immersive and interactive possibilities of augmented reality technology.

This goal is supported by two important theories:

a)The Theory of Moral Development by Kohlberg:
According to Kohlberg's thesis (Kohlberg & Hersh, 1977), moral thinking progresses through six stages at three different levels: pre-conventional, conventional, and post-conventional. This study intends to use augmented reality (AR) technology to develop situations and problems that push students to advance through these phases, with a special emphasis on the change from conventional to post-conventional learning.

b) Situated Learning Theory.
Lave and Wenger (1991) established the Situated Learning Theory, which emphasizes the underlying link between learning and authentic contexts and experiences. This study seeks to apply this idea by utilizing augmented reality to create realistic, context-rich environments in which students can engage with moral quandaries in a more authentic and meaningful manner. The AR-based teaching paradigm will emulate real-world scenarios, allowing students to practice moral decision-making in settings similar to those they may experience in their daily lives, hence improving the transfer of moral reasoning skills from the classroom to real-world contexts. By merging these theories with augmented reality technology, this study hopes to provide a more effective and interesting method to moral education. The objective is to create a teaching approach that

METHODOLOGY

This study takes a mixed-methods approach, integrating the Nominal Group Technique (NGT) and prototype development and testing. The research process is separated into three major stages:

Phase One: Expert Consultation (NGT) The study included seven experts in moral education, educational technology, and adolescent psychology. Due to practical restrictions, the NGT session took place online via video conferencing technology. A 2-hour workshop was held, during which specialists engaged in a structured brainstorming process. This phase sought ideas and solutions for incorporating augmented reality (AR) into moral education to improve secondary students' moral reasoning.
Phase 2: AR Prototype Development. Based on the findings from the NGT session, researchers created a prototype AR-based interactive teaching paradigm. This prototype incorporated numerous morals.
Phase 3: Prototype Testing and Evaluation. The AR prototype was tested in a controlled classroom environment with a group of 30 secondary pupils. Students engaged with the AR model over four weeks. Pre- and post-tests testing moral reasoning skills were given, as well as qualitative feedback sessions to assess student involvement and the AR model's perceived success.
Data Analysis: The NGT session's quantitative data was analyzed using specific NGT calculation methods to prioritize and synthesize expert viewpoints. Pre- and post-test results were compared using paired t-tests to determine moral reasoning improvements. Qualitative data from student feedback sessions were thematically analyzed to identify major advantages and areas for improvement in the AR-based teaching methodology.
This comprehensive technique seeks to not only create an AR-based interactive teaching model for moral education but also to assess its efficacy in promoting moral reasoning among secondary students."
This new methodology is more closely related to your research title, as it includes the development and testing of an AR-based model for moral teaching while maintaining the expert consultation part of your original approach.

Basic moral cognition	1. AR scenarios depicting simple right vs. wrong choices 2. Interactive quizzes on basic ethical principles 3. Virtual storytelling with moral lessons 4. Gamified exercises on identifying moral behaviors
Conformity-driven moral reasoning	1. AR simulations of peer pressure situations 2. Virtual role-playing of societal norm adherence 3. Interactive case studies on community standards 4. AR-based scenarios on following rules and laws

	5. Collaborative decision-making exercises in virtual environments
Universal ethical understanding	1. AR-based global ethical dilemmas 2. Virtual debates on universal moral principles 3. Interactive exploration of diverse cultural ethical practices 4. AR simulations of complex moral philosophies
Real-world scenario	1. AR recreations of ethical challenges in daily life 2. Virtual field trips to moral decision-making environments 3. Immersive AR case studies based on real events 4. Interactive AR simulations of workplace ethical dilemmas
Collaborative learning	1. Multi-user AR moral problem-solving exercises 2. Virtual group discussions on ethical issues 3. AR-based peer teaching of moral concepts 4. Collaborative AR projects on community ethics 5. Virtual moral dilemma resolution teams
Learner-centered educational strategy	1. Personalized AR moral reasoning assessments 2. Adaptive AR scenarios based on individual moral development 3. Student-created AR content on ethical topics 4. Self-paced AR modules on moral philosophy 5. Reflective AR journaling on moral growth

This table includes a variety of features for each construct, all adapted to the context of employing augmented reality for moral teaching and increasing moral reasoning in secondary pupils. These features can be used in the NGT session to help lead expert participants' talks and generate ideas.

Nominal Group Technique (NGT)

The Nominal Group Technique (NGT), a structured group decision-making method developed by Delbecq and Van de Ven in the 1970s, has become an important tool for idea generation and consensus-building among experts in a variety of research fields, including education and technology integration (Foth et al., 2016). In this paper, NGT discusses some important benefits of creating an AR-based interactive teaching paradigm for moral education. For starters, it promotes expert consensus on AR integration in moral education, which is critical given the novelty of this method (Zhu et al., 2021). Second, NGT allows for the prioritisation of AR features and moral education aspects, ensuring that only the most important components are included (MacPhail, 2021). García-Peñalvo et al. (2022) suggest that recognising possible problems in deploying AR for moral education is crucial due to the complicated nature of both AR technology and moral thinking. The method strikes a balance between new ideas and practical concerns, which is critical for creating a unique instructional tool (Kwon et al., 2023). NGT enables a holistic approach to model building by incorporating specialists from several relevant domains, as emphasised in recent cross-disciplinary educational innovation study (Li et al., 2024). Furthermore, NGT's capacity to reach agreement fast is very useful in the setting of rapidly changing educational technologies (Sanchez-Gomez et al., 2022). Finally, the NGT process results provide a strong, expert-validated framework for constructing the AR-based moral education prototype, which is consistent with current best practices in educational technology design (Park & Kim, 2023). These advantages make NGT ideal for this unique research field, as it provides an organised, fast, and thorough technique for obtaining expert feedback on the creation of an AR-based interactive teaching model for moral education.

The researcher used the Nominal Group Technique (NGT) to analyse data from sessions. This method was especially useful for synthesising and prioritising expert opinions received during an online session aimed at establishing an augmented reality-based interactive teaching model for moral education.

The NGT analysis procedure consisted of the following steps:

1. Idea consolidation: All ideas developed during the NGT brainstorming session were collated, and related concepts were combined. This resulted in a streamlined list of novel ideas for incorporating AR into moral instruction for secondary students.

2. Experts provided weighted scores to ideas based on their perceived importance and practicality. The SNGT software generated weighted scores for each proposal, taking into consideration both the frequency of selection and the priority assigned by experts.

3. Ranking and Prioritization: Ideas were ranked according to their weighted ratings. This process selected the most popular topics for the AR-based moral education model.

4. Cluster Analysis: The SNGT software classified comparable thoughts into theme areas. This assisted in determining critical areas of focus for the AR model development.

5. Consensus Measurement: Experts' level of agreement was assessed for each thought and cluster, revealing the strongest concepts.

Key findings:

1. Top-Rated AR Elements: Interactive moral dilemmas, personalized ethical challenges, and collaborative problem-solving scenarios received the highest ratings in the AR-based model.
2. Critical Features: Experts agreed on the importance of real-world applicability, adaptive difficulty levels, and quick feedback in the AR model.
3. Thematic Clustering: Four major theme groupings emerged from the investigation. a) Immersive Scenario-Based Learning b) Collaborative Ethical Decision-Making c) Cultural and Global Ethical Perspectives b) Personal Moral Development Tracking.
4. Integration problems: The investigation identified problems in applying the AR approach, such as technology constraints and teacher training.
5. Evaluation Strategies: Experts emphasized the need for both quantitative and qualitative evaluation approaches in the AR model to track moral reasoning development.
6. Developmental Considerations: The research highlights the importance of adapting AR experiences at different phases of moral development in secondary students.

The NGT analysis provides a disciplined and objective method of synthesising expert perspectives, allowing for a clear prioritisation of features and considerations for the AR-based moral education paradigm. This data-driven method assures that the resultant model is based on expert consensus while meeting the fundamental goal of improving moral reasoning among secondary student.

RESEARCH FINDINGS AND DISCUSSIONS

Construct 1: Basic Moral Cognition

Items / Elements	*Total item score*	*Percentage*	*Rank Priority*	*Voter Consensus*
AR Scenarios depicting simple	**21**	**100**	**1**	**Suitable**
Interactive quizzes on basic ethical lessons	**20**	**95.24**	**2**	**Suitable**
Virtual storytelling with moral lessons	**21**	**100**	**1**	**Suitable**
Gamified exercises on identifying moral behaviors	**19**	**90.48**	**3**	**Suitable**

This concept utilizes augmented reality to focus on basic parts of moral teaching. All items earned good scores, with "AR Scenarios depicting simple right vs. wrong choices" and "Virtual storytelling with moral lessons" obtaining unanimous support. This indicates that professionals firmly believe in the efficacy of immersive, narrative-based techniques in teaching basic moral principles. The high scores for interactive quizzes and gamified exercises suggest a desire for engaging, participatory learning experiences in moral education (Zainuddin et al., 2023).

Construct 2: Conformity-driven moral reasoning

Items / Elements	*Total item score*	*Percentage*	*Rank Priority*	*Voter Consensus*
AR simulations of peer pressure situations	**20**	**95.24**	**2**	**Suitable**
Virtual role-playing of societal norm adherence	**19**	**90.48**	**3**	**Suitable**
Interactive case studies on community standards	**20**	**95.24**	**2**	**Suitable**
AR-based scenarios on following rules and laws	**21**	**100**	**1**	**Suitable**
Collaborative decision-making exercises in virtual environments	**18**	**85.71**	**4**	**Suitable**

"AR-based scenarios on following rules and laws" received the highest rating in this construct, with 100% unanimity. This emphasizes the perceived relevance of utilizing AR to recreate real-world scenarios in which conformity to society standards is critical. The significant endorsement for peer pressure simulations and community standards case studies indicates that experts respect AR's ability to provide safe settings for students to investigate social dynamics and ethical decision-making (Alias et al., 2024).

Construct 3: Universal ethical understanding

Items / Elements	*Total item score*	*Percentage*	*Rank Priority*	*Voter Consensus*

AR-based global ethical dilemmas	**20**	**95.24**	**2**	**Suitable**
Virtual debates on universal moral principles	**20**	**95.24**	**2**	**Suitable**
Interactive exploration of diverse cultural ethical practices	**20**	**95.24**	**2**	**Suitable**
AR simulations of complex moral philosophies	**21**	**100**	**1**	**Suitable**

All items in this construct earned high scores, with "AR simulations of complex moral philosophies" receiving unanimous approval. This shows that experts feel AR can successfully communicate abstract ethical issues. The substantial support for exploring global ethical challenges and cultural ethical practices indicates that AR is viewed as a valuable tool for widening students' moral perspectives beyond their immediate cultural environment (Mohd Khairul et al., 2023).

Construct 4: Real-world scenario

Items / Elements	*Total item score*	*Percentage*	*Rank Priority*	*Voter Consensus*
AR recreations of ethical challenges in daily life	21	100	1	Suitable
Virtual field trips to moral decision-making environments	21	100	1	Suitable
Immersive AR case studies based on real events	21	100	1	Suitable
Interactive AR simulations of workplace ethical dilemmas	21	100	1	Suitable

Surprisingly, all elements in this construct earned 100% consensus, suggesting broad expert agreement on AR's ability to connect theoretical moral instruction with practical, real-world applications. This is consistent with the study's underlying Situated Learning Theory, which emphasizes the relevance of real situations in learning (Lave and Wenger, 1991).

Construct 5: Collaborative learning

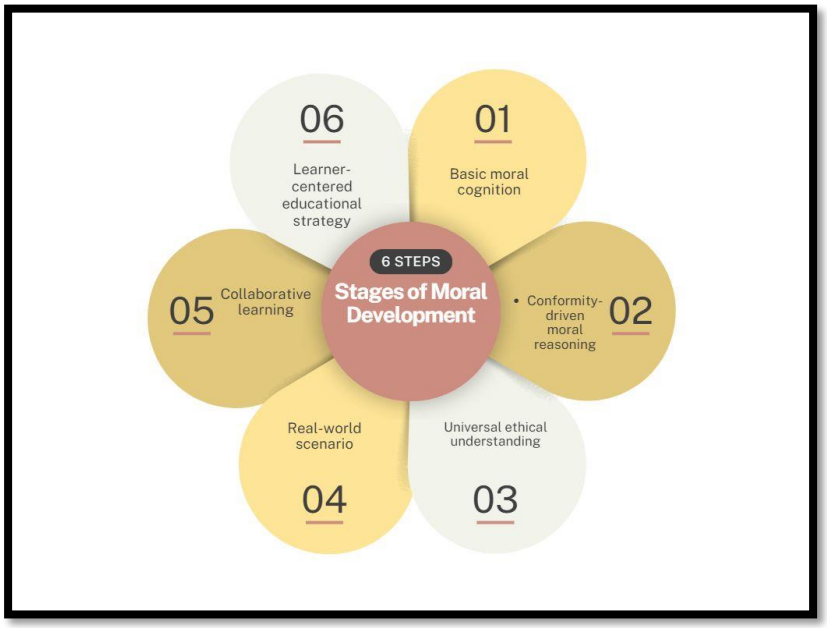
Items / Elements	*Total item score*	*Percentage*	*Rank Priority*	*Voter Consensus*
Multi-user AR moral problem-solving exercises	20	95.24	2	Suitable
Virtual group discussions on ethical issues	19	90.48	3	Suitable
AR-based peer teaching of moral concepts	20	95.24	2	Suitable
Collaborative AR projects on community ethics	16	76.19	4	Suitable
Virtual moral dilemma resolution teams	21	100	1	Suitable

"Virtual moral dilemma resolution teams" received the highest rating, with 100% agreement, emphasizing the perceived significance of collaborative problem-solving in moral education. The substantial support for peer teaching and group discussions highlights the significance of social contact in moral formation, which is consistent with Kohlberg's theory (Kohlberg & Hersh, 1977).

Construct 6: Learner-centered educational strategy

Items / Elements	*Total item score*	*Percentage*	*Rank Priority*	*Voter Consensus*
Personalized AR moral reasoning assessments	21	100	1	Suitable
Adaptive AR scenarios based on individual moral development	20	95.24	2	Suitable
Student-created AR content on ethical topics	21	100	1	Suitable
Self-paced AR modules on moral philosophy	21	100	1	Suitable
Reflective AR journaling on moral growth	21	100	1	Suitable

The majority of elements in this construct obtained 100% agreement, demonstrating significant expert support for personalized, adaptive methods of moral instruction utilizing augmented reality. This implies an awareness of individual variations in moral development and the necessity for personalized learning experiences (Park & Kim, 2023).



Picture 1: 6 Stages of Moral Education

CONCLUSION AND RECOMMENDATION

Experts strongly advocate incorporating AR into moral instruction for secondary students, as evidenced by their high degree of unanimity across all conceptions. This is consistent with previous studies demonstrating AR's ability to generate immersive, engaging learning experiences that help improve moral reasoning skills (Zulkifli et al., 2024). The findings highlight the significance of real-world scenario integration and personalized learning experiences. According to García-Peñalvo et al. (2022), AR has the potential to bridge the gap between academic moral knowledge and practical application, solving a significant difficulty in moral education.The high support for collaborative learning aspects demonstrates an understanding of the social dimension of moral growth. This is consistent with both Kohlberg's theory of moral development and the Situated Learning Theory, which emphasizes the significance of social interaction and authentic circumstances in learning (Kohlberg & Hersh, 1977; Lave & Wenger, 1991).

The high ratings for issues dealing with cultural and global ethical viewpoints indicate that experts regard AR as a beneficial tool for extending students' moral horizons. This is especially important in an increasingly linked society, where comprehending many ethical perspectives is critical (Li et al., 2024). However, it is crucial to highlight that, while expert consensus is strong, practical implementation may be difficult. Technology access, teacher preparation, and curricular integration are all important considerations (Kwon et al., 2023). This study shows substantial expert confirmation for the potential of AR-based interactive teaching models to improve moral education among secondary students. The findings indicate that AR can provide immersive, engaging, and personalized learning experiences that connect theoretical knowledge to practical application. The emphasis on real-world scenarios, collaborative learning, and global ethical viewpoints is consistent with contemporary educational theories and students' demands in an increasingly complicated moral context. However, successful implementation will need careful consideration of practical obstacles and continuous evaluation of efficacy. Future studies should concentrate on realistic implementation tactics, long-term effects on moral reasoning abilities, and the creation of tailored AR tools and courses based on these expert suggestions.

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