Available Online at www.e-iph.co.uk
Indexed in Clarivate Analytics WoS, and ScienceOPEN

E-B Environment - Behaviour Proceedings Journal

IC-ACT2024Kuching

https://icactech.wixsite.com/first

e-IPH e-International Publishing House Ltd., United Kingdom

International Conference of Art And Creative Technology Malaysia
Borneo Cultures Museum Sarawak, Kuching, Sarawak, Malaysia, 23 - 24 October 2024
Organiser: Faculty of Art, Sustainability and Creative Industry, Sultan Idris Education University (UPSI), Malaysia

A Conceptual Framework of a Mediation Model for Anthropomorphic 3D Avatar Prototypes with Anonymity to Assess TVET Students' Engagement

Siti Nur Shuhada Abu Samah[1,3*], Erni Marlina Saari[2*], Ahmad Zamzuri Mohamad Ali[1]
** Corresponding Author*

[1] Department of Creative Multimedia, Faculty of Art, Sustainability and Creative Industry, Universiti Pendidikan Sultan Idris, Tanjong Malim, Perak, Malaysia
[2] Department of Computer Science and Digital Technology, Faculty of Computing and Meta-Technology, Universiti Pendidikan Sultan Idris, Tanjong Malim, Perak, Malaysia
[3] Program of 3D Animation, Teluk Intan Community College, Department of Polytechnic Education and Community Colleges, Ministry of Higher Education, Teluk Intan, Perak, Malaysia

iamshuhada64@gmail.com, marlina@meta.upsi.edu.my, zamzuri@fskik.upsi.edu.my
Tel: +60135204144

Abstract
This study develops a conceptual framework of a Mediation Model for anthropomorphic 3D avatar prototypes with manipulation on nominal anonymity to assess undergraduate TVET students' engagement. This framework addresses six conditions of anthropomorphic avatars with two nominal anonymity manipulations. Seven propositions are developed for the mediation model: one examines the impact of the relationship between anthropomorphic 3D avatars and nominal anonymity on student engagement, while the other six examine the mediating effect of social presence, enjoyment and cognitive burden on the relationship. This study offers insight into mitigating the negative impact on student engagement by observing other variables.

Keywords: Mediation Model, Anthropomorphic 3D avatar, Nominal Anonymity, Undergraduate TVET Students' Engagement

DOI: https://doi.org/10.21834/e-bpj.v10iSI36.7561

1.0 Introduction

Engagement keeps students connected with the learning activities. Student engagement is considered one of the predictors of academic achievement and soft skills development (Kim et al., 2023). Avatar-based technologies as a pedagogical agent provide an alternative solution for remote learning with the potential to foster positive communication and enhance the engagement of students in an online learning environment.

Innovative method for addressing varied learning requirements of undergraduate Technical and Vocational Education and Training (TVET) students is the development of a conceptual framework for anthropomorphic 3D avatar prototypes with manipulation on the strategic benefit of deindividuation (nominal anonymity) through the utilization of a Mediation Model. Examining the efficacy of prototypes in gauging the agentic engagement of undergraduate TVET students and how three variables of social presence, enjoyment, and cognitive burden mediate the relationship is the purpose of this study. The framework investigates how the visual of an anthropomorphic 3D avatar with different conditions of anthropomorphism and truthfulness, visual fidelity with deindividuation manipulations of nominal

eISSN: 2398-4287 © 2025. The Authors. Published for AMER by e-International Publishing House, Ltd., UK. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/). Peer–review under responsibility of AMER (Association of Malaysian Environment-Behaviour Researchers).
DOI: https://doi.org/10.21834/e-bpj.v10iSI36.7561

anonymity, affects undergraduate TVET student's engagement and uncovers the mediating role of social presence, enjoyment, and cognitive burden in the relationship. This study primarily contributes a conceptual framework and principles for character design in the context of avatar-based technology as a pedagogical agent in remote learning.

2.0 Literature Review

A study by bt Nasroddin et al. (2023) in local Malaysian TVET institutions on online platform technologies used for learning has found that when the online class could not promote positive interaction between students and the lecturer, some of the students exhibited behaviour of passively listening to lectures instead of taking an active role in discussions. Student's lack of intention to give responses and feedback on topics discussed during online classes indicates that the learning session is not interesting, not fun and boring to the students, thereby hindering critical thinking and the development of a growth mindset.

Gu et al. (2024) validate the importance of agentically engaged behaviour among students in which students constructively and actively contribute to the flow of the instructions received from the lecturer during online class interactions, such as expressing their preferences, asking questions, and letting the lecturer know what they like, need, and want should be given serious emphasis and measured. Using avatars as pedagogical agents has effectively assisted in student learning and promoted engagement (Lively & Hutson, 2025).

However, there is a lack of studies and empirical evidence that can measure undergraduate TVET student's engagement using anthropomorphic 3D avatars as pedagogical agents since most existing studies on student engagement in TVET institutes in Malaysia investigated and focused on pedagogical methods other than avatar-based technologies such as Gamification (Ismail et al., 2025) and e-learning using WhatsApp and Online Video (Mohsin & Halili, 2025). These studies fail to validate the credibility of their empirical evidence on student's agentic engagement since the pedagogical methods used most in these studies didn't involve two-way interaction between student and lecturer with no projection of social cues (i.e. verbal and non-verbal cues).

Anthropomorphism visual fidelity on an avatar is the degree of visual resemblance to a human in general in the design of an avatar. On the other hand, truthfulness visual fidelity is the degree of visual resemblance between the avatar and the human user who embodies the avatar. Both fidelity on anthropomorphic avatars can influence affinity, which results in different psychological experiences for audiences. However, most existing studies on the avatar's role in facilitating learning experience or pedagogical agent often focus on the visual fidelity of realism instead of inspecting the visual fidelity of anthropomorphism and truthfulness (Wenzel et al., 2025). Realism alone is a bad predictor of eeriness for the uncanny valley effect (Zell et al., 2015), Thus, addressing visual fidelity of anthropomorphism and truthfulness can identify a safe level of affinity that could avoid eeriness and increase affinity towards meaningful communication.

Seymour et al. (2017) stated that the traditional Uncanny Valley theory primarily used in existing studies to identify and explain the outcome of affinity cannot validate the empirical findings of an interaction between human and avatar, because the original theory only theorize and evaluate in the dimension of observation on visual fidelity of still and moving (animated) avatar without taking into account the dimension of interactivity of interaction with avatar. Evaluating the effect of behavioural fidelity on social interaction without considering both the visual fidelity of the avatar and interaction aspects can lead to misleading results, as the effects interact. Studies also revealed the inconsistency in the outcomes of using pseudonyms and orthonyms on avatars. This suggests that further studies on the differential impact of using nominal anonymity of pseudonyms and orthonyms on avatars are needed to understand more about the conditions needed to achieve the positive effect on engagement (Yang et al., 2024).

The human-like qualities of anthropomorphic avatars can significantly enhance the benefits of positive interaction. However, different designs of visual anthropomorphism on avatars are also expected to generate different kinds of uncanniness in users and affect communication diversely. The diverse impact caused by various levels or conditions of anthropomorphic avatars on student engagement suggested that this relationship of anthropomorphic 3D avatars in a communication environment could be mediated by other variables such as social presence (Tsai et al., 2021; Dubosc et al., 2025), enjoyment (Lim & Lee, 2024), and cognitive load (Choi et al., 2024; Schöbel et al., 2019). Nonetheless, there are limited studies investigating the impact of anthropomorphic 3D avatars with manipulation on the strategic benefit of deindividuation (nominal anonymity) on student's agentic engagement and educator's social presence, enjoyment, and cognitive load simultaneously. These research gaps create three research questions in general as follows:

RQ1: What are the effects of interactions between the condition of visual anthropomorphism on the 3D avatars and manipulation of nominal anonymity?

RQ2: What are the mediating factors in the relationship between the condition of visual anthropomorphism on a 3D avatar, manipulation of nominal anonymity and student engagement?

RQ3: How can RQ1-2 and the developed Research Conceptual Framework be tested and evaluated?

3.0 Methodology

The conceptual framework in this study is built upon a mediation model based on a mediation analysis methodology and theoretical study. To answer RQ1-3, the theoretical framework of a mediation model describes the mechanism that underpins an observed relationship of direct effect and indirect (mediating) effect between anthropomorphic 3D avatar prototypes and student engagement via the inclusion of third explanatory variables known as mediator variables, which are social presence, enjoyment and cognitive burden.

To test and evaluate the propositions and hypotheses, six anthropomorphic 3D avatar prototypes are being developed using the 3D authoring tool and administered for testing in a live video conferencing platform as embodied avatars for the TVET lecturer.

3.1 Theoretical Framework

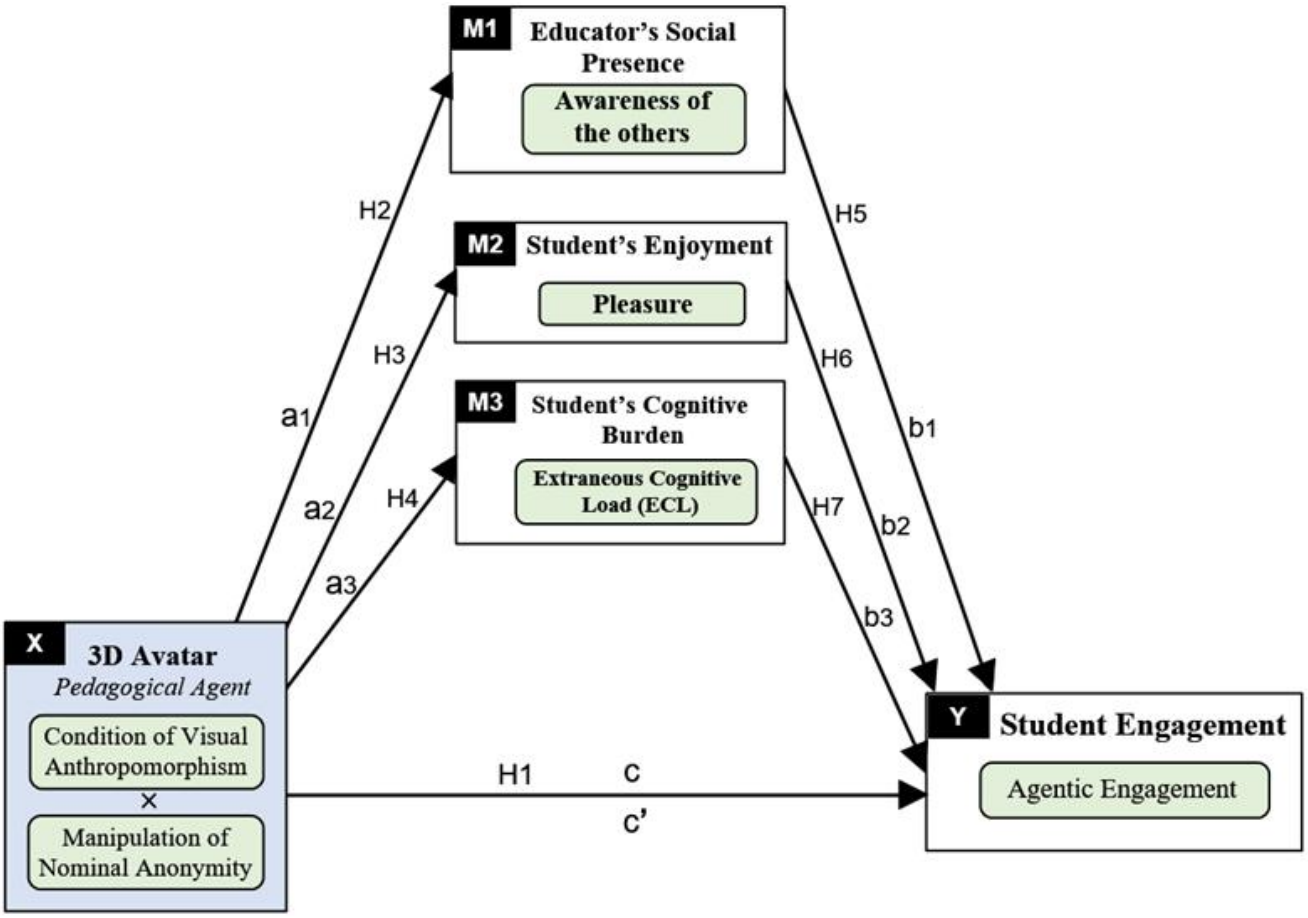

Fig. 1: Proposed Mediation Model of Anthropomorphic 3D Avatar and Student Engagement Relationship
(Source: Author)

3.2 Proposition Development of Direct Effect of 3D Avatar on Student Engagement

Several studies argue that anthropomorphic 3D avatars with anonymity positively affect student engagement. For example, Chen & Kent (2020) found that via avatar anonymity, regardless of anthropomorphic level, learning activities execution and engagement can be maximized, thus fostering more authentic communication, increasing confidence and motivation, as well as empowering learners. It is also revealed that anthropomorphic avatars with pseudonyms and orthonyms as usernames that pass the self-profiling authenticity are crucial determinants of engagement during information sharing (Yang et al., 2024). Based on these findings, the proposition for the impact of anthropomorphic 3D avatars with nominal anonymity manipulation on student engagement is as follows:

H1: The study demonstrates a significant interaction effect between the visual anthropomorphism condition of 3D avatars and the manipulation of nominal anonymity on student engagement (agentic engagement).

3.3 Proposition Development of Mediating Effect in 3D Avatar – Student Engagement Relationship

Humanoid-robot avatars with facial anthropomorphism and usernames that can make eye contact in communication and have the ability to exchange social cues induce a higher sense of social presence compared to humanoid-robot avatars with facial anthropomorphism that cannot display eye contact in communication and have a lesser ability to exchange verbal cues and non-verbal cues (Dubosc et al., 2025). The visual fidelity of anthropomorphism on an avatar helps to induce a higher sense of social presence regardless of the limited use of non-verbal cues. Real-time interaction using an anthropomorphic avatar with an authentic username improves the perceived educator's social presence the most but reduces learning outcome, whereas the timeline-anchored interaction, on the other hand, improves social presence at no cost of learning performance (Yuan & Gao, 2024). The following is the proposition for the impact of anthropomorphic 3D avatars with nominal anonymity manipulation on educator's social presence:

H2: The study demonstrates a significant interaction effect between the visual anthropomorphism condition of 3D avatars and the manipulation of nominal anonymity on educator's social presence (awareness of the others).

Several studies argue that an anthropomorphic 3D avatar with anonymity has the ability to influence student's enjoyment. For example, avatar-based interaction that anonymously hides real names effectively alleviates student's negative emotions and activates positive emotions of enjoyment during video conferencing-based online learning (Lim & Lee, 2024). In other study, the affective design of smiling faces on anthropomorphic pedagogical agents, games and higher self-similarity with one's avatar are the factors that activate the positive emotion of enjoyment among students in avatar-mediated learning (Pröbster et al., 2023). The following is the proposition for the impact of anthropomorphic 3D avatars with nominal anonymity manipulation on student's enjoyment:

H3: The study demonstrates a significant interaction effect between the visual anthropomorphism condition of 3D avatars and the manipulation of nominal anonymity on student's enjoyment (pleasure).

Studies have shown that the collaborative learning mode of a virtual environment using a virtual humanoid avatar with a real name reduces cognitive burden and increases learning effectiveness and motivation of the students in the virtual group compared to students in the real face-to-face group (Cho et al., 2022). Cognitive load was negatively related to task performance, where the participant using the virtual assistant (avatar) performed better at the task and had a lower cognitive load (Brachten et al., 2020). This indicates that imbuing an avatar with a visual body and task-related gestures that can express information through speech, gaze and a pointing gesture can significantly reduce cognitive load and improve co-presence in human-avatar collaborative decision-making. Therefore, the following is the proposition for the impact of anthropomorphic 3D avatars with nominal anonymity manipulation on student's cognitive burden:

H4: The study demonstrates a significant interaction effect between the visual anthropomorphism condition of 3D avatars and the manipulation of nominal anonymity on student's cognitive burden (extraneous cognitive load).
An interactive online learning communication tool (i.e., Chatbot Tutor) fosters strong student-instructor interactions. It enhances the instructor's social presence, student engagement and satisfaction in online classes (Tan et al., 2025). Tsai et al. (2021) claimed that anthropomorphic brand avatars with a high social presence can significantly enhance consumer engagement compared to non-anthropomorphic brand avatars with a low social presence. This indicates that anthropomorphic profile design can dramatically enhance the brand avatar's social presence. The outcome of Tan et al. (2025) and Tsai et al. (2021) studies identified that an anthropomorphic avatar's social presence has the ability and potential to influence student engagement. Therefore, mediating effect of the educator's social presence on the relationship between the anthropomorphic 3D avatar and the manipulation of nominal anonymity and the student engagement relationship can be proposed as follows:

H5: The educator's social presence (awareness of others) significantly mediates the relationship between the condition of visual anthropomorphism on the 3D avatar with manipulation of nominal anonymity and student engagement (agentic engagement).
A study has demonstrated a preference for a human-like avatar over a cartoon-like avatar in the metaverse (Park et al., 2025). This suggests that visual fidelity design on avatars can be a factor that generates positive emotions. Visually appealing human-like avatars that can show delicate and natural movements convey feelings and personalities, activate a positive emotional experience, and promote engagement more (Zhang & Wu, 2024). This suggests that emotive design on avatars helps to trigger positive emotions in students and encourages engagement. Therefore, the mediating effect of Student enjoyment on the relationship between anthropomorphic 3D avatars with manipulation of nominal anonymity and the student engagement relationship can be proposed as follows:

H6: The student's enjoyment (pleasure) significantly mediates the relationship between the condition of visual anthropomorphism on a 3D avatar with manipulation of nominal anonymity and student engagement (agentic engagement).
Choi et al. (2024) study on cognitive processes has found that a pedagogical agent (tutor) with a positive emotion design was more effective in reducing cognitive load and increasing the motivation of learners to stay engaged in learning activities than a pedagogical agent with a negative emotion design. However, Schöbel et al. (2019) stated that the effect of cognitive burden on student engagement may differ for each student depending on their prior experience and extraneous cognitive load. Therefore, the mediating effect of student's cognitive burden on the relationship between anthropomorphic 3D avatars with manipulation of nominal anonymity and the student engagement relationship can be proposed as follows:

H7: The student's cognitive burden (extraneous cognitive load) significantly mediates the relationship between the condition of visual anthropomorphism on the 3D avatar with manipulation of nominal anonymity and student engagement (agentic engagement).

4.0 Conceptual Framework and Proposed Hypotheses

Concepts are generated, and seven propositions or hypotheses are developed. One proposition investigates the relationship impact of anthropomorphic 3D avatar prototypes with nominal anonymity manipulation on student engagement, while the other six propositions look into the mediating effect of educator's social presence, student's enjoyment, and student's cognitive burden on the relationship. The study used data from theories and concepts to shape the conceptual framework.

4.1 Conceptual Framework

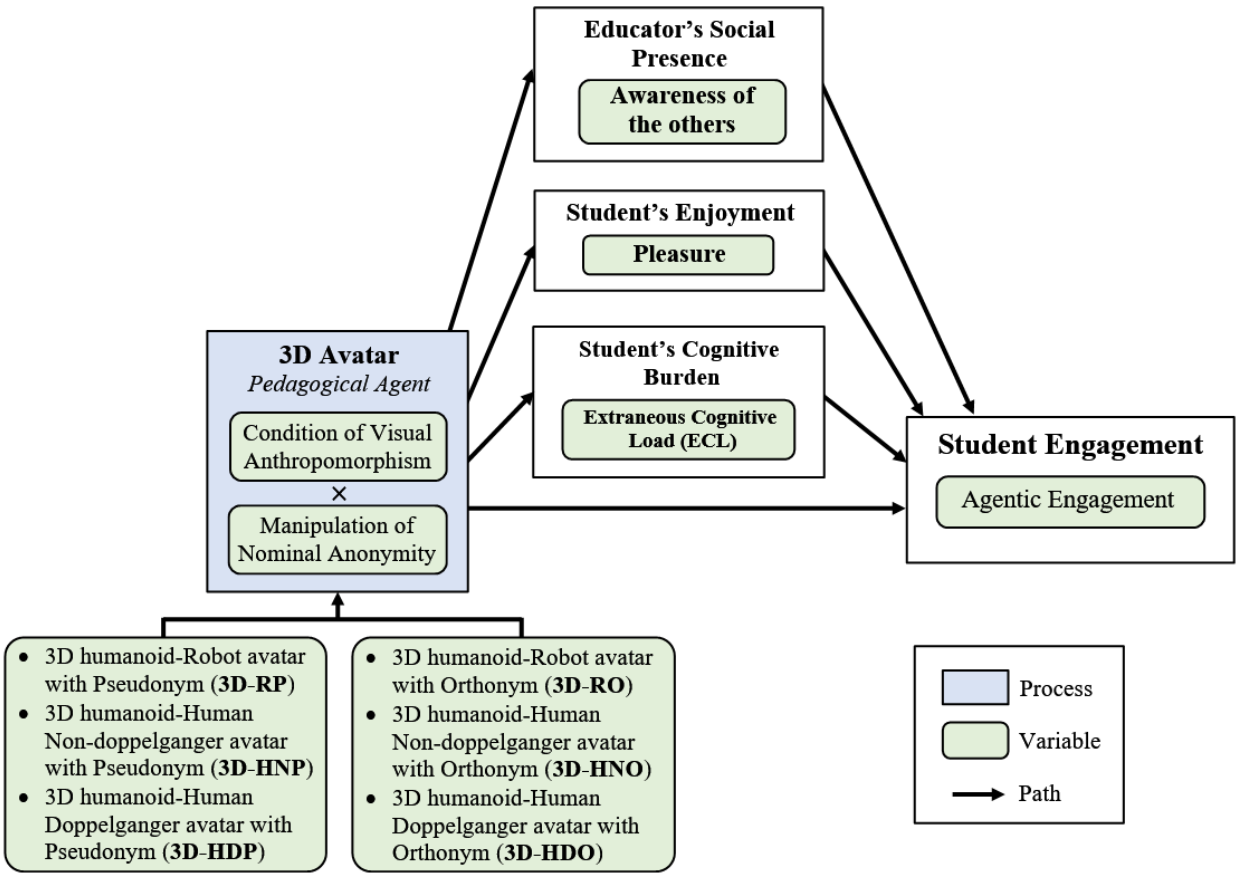

Fig. 2: Proposed Conceptual Framework of a Mediation Model for Anthropomorphic 3D Avatar Prototypes
(Source: Author)

To investigate the propositions developed in this conceptual framework and test the hypotheses, six anthropomorphic 3D avatar prototypes (humanoid) that consist of two visual fidelity of anthropomorphism (human, robot) and truthfulness (doppelganger) are used as pedagogical agents and will be embodied by the lecturer in three TVET institutes. The interaction sessions between students and avatars are conducted on a live video conferencing platform. The study instruments will be employed to assess the quality of the findings. 3D-RP, 3D-HNP, 3D-HDP, 3D-RO, 3D-HNO and 3D-HDO, which are the components of the Uncanny Valley of Interactivity, will be examined using the User Experience Questionnaire (UEQ) to evaluate the acceptance of 3D avatar prototypes.

The student engagement in this study examines the agentic engagement, where the student's active role in class discussions and contributions towards engagement are measured and validated. Recent studies in TVET institutions have critically validated the Four Dimensions of Student Engagement Model that stresses the importance of a genetically engaged behaviour of students that is crucial in shaping the educational achievement of students (bt Nasroddin et al., 2023).

In this study, the educator's social presence through an embodied avatar is examined. Based on the Embodied Social Presence Theory, a significant level of awareness of others in promoting proximity with others is crucial for enhancing educator's social presence and promoting online interactions for learning (De Medeiros & Gomes, 2022). Therefore, the educator needs to have a strong social presence and should consider effective pedagogical methods, such as avatar-mediated communication, that can keep students engaged and motivated throughout the online classes to enhance student engagement.

Studies have shown that the affective states (emotional) facial design of an avatar, the avatar's ability to project social cues and higher self-similarity with one's avatar are factors that activate the positive emotion of enjoyment among students, which consequently affects engagement in avatar-mediated learning (Pröbster et al., 2023). Thus, to examine the mediation effect of students' enjoyment for this study, the Self-Assessment Manikin (SAM) is employed.

Drawing on Cognitive Load Theory, Choi and Lee (2022) have validates that extraneous cognitive load is a negative load that should be avoided at all costs. It is considered a great hindrance to cognitive processing because it creates a split attention effect, which can result in a decline in learning. For the learning session to be effective, extraneous cognitive load should be kept as low as possible during the learning session. However, the effect on cognitive processing due to extraneous cognitive load may differ since it also depends on the learner's prior experience (Schöbel et al., 2019).

5.0 Conclusion

Avatar-based technologies as pedagogical agents for remote learning are an alternative solution to foster positive communication and enhance student's engagement in online learning environments. This study introduces a conceptual framework to investigate how 3D avatars affect student engagement, educator's social presence, student's enjoyment and student's cognitive load. It focuses on 2 visual fidelity forms: (1) anthropomorphic, examining the visual appearance of 3D avatars ranging from robot-like to human-like, and (2) truthfulness, examining the visual appearance of 3D avatars ranging from human-like not resembling the user (non-doppelganger) to human-like resembling the user (doppelganger). This study also focused on the deindividuation manipulation of identity, specifically the name, ranging from pseudonym (fictitious name) to orthonym (real name). This study only addresses the aspect of agentic for engagement, the aspect of awareness of the others for educators' social presence, the aspect of pleasure for students' enjoyment, and the aspect of extraneous cognitive load for students' cognitive burden. This study is limited to students from a single course, which may affect the generalizability of the findings. However, this may enhance the internal validity of the study for similar contexts. This study provides input and potential solutions for mitigating the negative effect on student engagement by observing the impact of other variables in the relationship. A straightforward extension of this study would be to expand to other variables of study and the scope of participants to include a more diverse range of students across different courses and institutions. This will enhance the study analysis and provide a more comprehensive understanding of the impact of avatar representations on student learning experiences.

Acknowledgements

This research was not funded by any grant.

Paper Contribution to Related Field of Study

This study generates insight and new findings on mitigating the negative effect on student's engagement in avatar-mediated communication learning by observing other variables. Through mediation analysis, this study provides a framework for developing and accessing avatar-mediated communication technology and the strategic benefit of the deindividuation effect. The framework enables educators and researchers to determine the design parameters and conditions needed for an anthropomorphic 3D avatar to optimize pedagogical effectiveness in promoting agentic engagement, which is crucial in shaping students' educational achievement.

References

Brachten, F., Brünker, F., Frick, N. R., Ross, B., & Stieglitz, S. (2020). On the ability of virtual agents to decrease cognitive load: an experimental study. *Information Systems and e-Business Management*, *18*(2), 187-207.

bt Nasroddin, S. N., bin Norhan, M. N., & bin Abdullah, M. A. (2023). Kesediaan Pelajar Politeknik Mersing Mengikuti Pembelajaran dan Pengajaran Secara Dalam Talian Bagi Kursus Engineering Science. *Engineering and Technology International Journal*, *5*(01), 12-19.

Chen, J. C., & Kent, S. (2020). Task engagement, learner motivation and avatar identities of struggling English language learners in the 3D virtual world. *System*, *88*, 102168.

Cho, I. H., Yeo, J. H., Hwang, G. H., & Yang, H. H. (2022). Impact of a virtual environment on the learning effectiveness, motivation, cognitive load, and group self-efficacy of elementary school students in collaborative learning. *Educational technology research and development*, *70*(6), 2145-2169.

Choi, S., Kang, S., Lee, K., Ju, H., & Song, J. (2024). The Effect of an Agent Tutor's Integration of Cognitive and Emotional Gestures on Cognitive Load, Motivation, and Achievement. *Contemporary Educational Technology*, *16*(1).

Choi, Y., & Lee, H. (2022). Psychometric properties for multidimensional cognitive load scale in an e-learning environment. *International Journal of Environmental Research and Public Health, 19*(10), 5822.

De Medeiros, F. P. A., & Gomes, A. S. (2022). An approach based on social network analysis to enhance social presence in a collaborative learning environment. *IEEE Transactions on Education, 65*(4), 608-616.

Dubosc, C., Gorisse, G., Lefrou, T., Richir, S., & Christmann, O. (2025). Effect of avatar stylization and facial expression intensity in virtual interactions. *Virtual Reality, 29*(4), 163.

Gu, J., Zhan, Y., Zhao, L., & He, W. (2024). Teachers' motivating styles and students' agentic engagement in online learning. *Distance Education*, *45*(4), 535-551.

Ismail, R. A., Darus, N. A., & Ahmad, S. (2025). Gamification In Food Technology Education: Enhancing Learning Outcomes for Student with Learning Disabilities (Special Certificate in Food Processing) at College Community Arau, Perlis Malaysia. In *Prosiding Seminar Nasional Teknologi Komputer dan Sains* (Vol. 3, No. 1, pp. 295-303).

Kim, M., Albers, N. D., & Knotts, T. L. (2023). Academic Success through Engagement and Trust Fostered by Professor Leadership Style. *Education Sciences*, *13*(6), 537.

Lim, J., & Lee, M. (2024). The buffering effects of using avatars in synchronous video conference-based online learning on students' concerns about interaction and negative emotions. *Education and Information Technologies*, 1-24.

Lively, J., & Hutson, J. (2025). Enhancing Digital Pedagogy and Creativity: Generative AI, Video Avatars, and Personalized Learning in Online Education. In *Human-Computer Creativity: Generative AI in Education, Art, and Healthcare* (pp. 99-113). Cham: Springer Nature Switzerland.

Mohsin, N., & Halili, S. H. (2025). Implementing Design-Based Research in Developing Mobile Flipped Learning Module at TVET Institution. In *Multidisciplinary Educational Perspectives on Design-Based Research* (pp. 429-470). IGI Global Scientific Publishing.

Park, S., Chu, Y., & Chung, J. H. (2025). Designing AI Agents for New Product Endorsement: Do Human-Like or Cartoon-Like AI-Generated Endorsers Evoke More Positive Ad Engagement from Consumers?. *Journal of Advertising Research*, 1-19.

Pröbster, M., Tomaske-Graff, R. D., Herget, D., Lucht, M., & Marsden, N. (2023). Am I like me? Avatar self-similarity and satisfaction in a professional training environment. In *International Conference on Human-Computer Interaction* (pp. 384-400). Cham: Springer Nature Switzerland.

Schöbel, S., Janson, A., & Mishra, A. (2019). A configurational view on avatar design–the role of emotional attachment, satisfaction, and cognitive load in digital learning. *Fortieth International Conference on Information Systems*, Munich.

Seymour, M., Riemer, K., & Kay, J. (2017). Interactive realistic digital avatars-revisiting the uncanny valley.

Tan, C. T., Atmosukarto, I., Tandianus, B., Shen, S., & Wong, S. (2025). Exploring the Impact of Avatar Representations in AI Chatbot Tutors on Learning Experiences. In *Proceedings of the 2025 CHI Conference on Human Factors in Computing Systems* (pp. 1-12).

Tsai, W. H. S., Liu, Y., & Chuan, C. H. (2021). How chatbots' social presence communication enhances consumer engagement: The mediating role of parasocial interaction and dialogue. *Journal of Research in Interactive Marketing, 15*(3), 460-482.

Wenzel, A., Geiger, J. M., & Liening, A. (2025). Beyond the screen: Investigating the added value of realism enabled by the metaverse in digital game-based entrepreneurial learning. *Computers in Human Behavior Reports, 19*.

Yang, Y., Zhang, J., & Gao, T. (2024). How do username and avatar affect people's engagement with native advertising on social media: From the self-disclosure perspective. *Psychology & Marketing, 41*(6), 1289-1317.

Yuan, Q., & Gao, Q. (2024). Being there, and being together: Avatar appearance and peer interaction in VR classrooms for video-based learning. *International Journal of Human–Computer Interaction, 40*(13), 3313-3333.

Zell, E., Aliaga, C., Jarabo, A., Zibrek, K., Gutierrez, D., McDonnell, R., & Botsch, M. (2015). To stylize or not to stylize? The effect of shape and material stylization on the perception of computer-generated faces. *ACM Transactions on Graphics (TOG), 34*(6), 1-12.

Zhang, R., & Wu, Q. (2024). Impact of using virtual avatars in educational videos on user experience. *Scientific Reports*, *14*(1), 6592.