Digital Human Innovation in Education Industry

Yaoyu Liu

{yliu0430@uni.sydney.edu.au}

The Faculty of Engineering, The University of Sydney, Sydney, 2008, Australia

Abstract. The applications of digital humans are getting wider and wider, while helping human development and progress in different industry sectors. This paper discusses the innovative factors of digital humans and their current applications in the education industry and explores future directions. By analyzing the case studies of UneeQ and BabyX, this paper concludes that Digital human has a significant role to play in the education industry, and in the future more products will be put in place to help people learn as well as train. This paper describes the development, applications, and markets for digital humans and the innovation factors of digital humans also analyzes the development of digital humans in education through 2 case studies.

Keywords: digital human, AI, innovation, education, UneeQ, BabyX

1 Introduction

What is a digital human

A digital human can be expressed as a computer-generated realistic entity, typically powered by artificial intelligence (AI) that enables it to engage in conversing. As shown in figure 1, exhibiting an emotional connection and performing various tasks like a human being by using AI algorithms, deep learning, natural language processing (NLP), and realistic graphics [1][2]. A digital human resembles a human in form, behavior, expression, and sometimes even the intelligence of a real human. It can act as a lifelike avatar on screens and a digital assistant to interact with users through the expression of tone of voice and body language, it can even sense users' reactions to respond appropriately [3].

Figure 1. Digital Human Technologies

Digital humans reshape various industries by enhancing experiences, increasing efficiency, and innovating across sectors. NEON integrates into the finance and banking industry for personalized financial advice [4]. Lil Miquela, a virtual influencer, collaborates with fashion

EIMT 2024, March 29-31, Wuhan, People's Republic of China

DOI 10.4108/eai.29-3-2024.2347652

brands to promote products in the entertainment industry [5]. Jill Watson, an education industry teaching assistant, effectively handles students' intricate queries and enriches online learning [6]. Molly acts as a virtual nurse and aims the healthcare industry in managing patients' health conditions [7]. And Sophie aids the travel industry by providing tourism information and airline support [8].

Market potential

The Emergenresearch [9] provided that the global digital human market was valued at USD 29.51 billion in 2022 and is expected to grow at 34.2% CAGR(Compound annual growth rate) during the forecast period. Digital humans will be poised to dominate the majority of the market share within the entertainment industry, and growing student demand drives the market's expansion in education. Additionally, digital humans are encouraged in the healthcare and service industry by handling real-time information and decentralized problem-solving efficiently to mitigate unexpected risks.

Current state of development

Now the technology for digital humans has matured considerably. As shown in figure 2, this is a realistic image of a digital face effect generated using 3D modelling and rendering techniques. It has been widely used in media and entertainment, but the process of creating digital humans requires a huge amount of work to produce manually, it requires hundreds of domain experts, such as artists and programmers [10]. Today major AI players such as NVIDIA are working on tools and developing methods to accelerate and simplify the creation of digital humans.

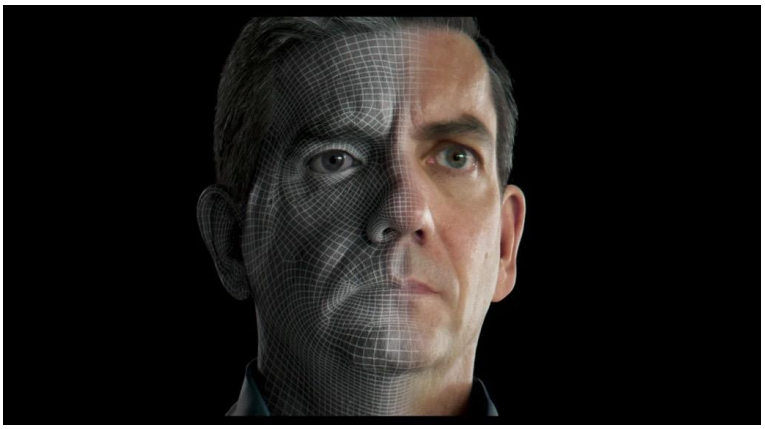

Figure 2. Digital Human [11]

2 Innovation concepts

Dominant design

Dominant design refers to the specific technology that constitutes the product, which wins loyalty after occupying a market. After the dominant design is formed, subsequent creation will be based on existing design.

Product Categories

- Basic Chatbots: Simple text-based bots with predefined responses [12].
- AI Chatbot: The Chatbot based on AI for NLP [12].
- Virtual Agents: summarized the technologies in one interface [12].
- AI Avatars & Digital Humans: Lifelike characters for healthcare, education, and more [3].
- Holistic AI Companions (Future): Advanced companions providing support and assistance in daily life, integrating various AI technologies.

The technology is evolving to offer customized solutions in various industries to enhance unique personal experiences, from tailored e-commerce guidance to empathetic personalized education and training [13]. Moreover, many companies are engaging the experimentation with different product designs, for example, ColorDigital introduced a digital human to facilitate an end-to-end digital workflow for fashion brands [9]. Samsung created digital humans for business support in any language and at any time [2]. As new inventions and directions are constantly emerging, it is covering existing technologies. Therefore, Digital human technology is potentially in the "Era of Ferment" stage.

Diffusion of innovation

Digital Human is categorized in product and technological innovation. It creates a whole new class of virtual entities with human characteristics and capabilities through technologies from a number of fields, including AI, computer graphics (CG), and NLP [2]. This innovation goes beyond traditional computer programs or human-machine interfaces.

Digital humans are in the “Early Adopters” of Technology Adoption Lifecycle. Its early adopters were companies that develop digital human products. Such as EY, that company “creates digital human doubles of its partners for video editing” [14].

Adoption Rate:

Relative advantage - Digital humans have relative advantages in terms of cost, customizability, and scalability [14]. They can provide smarter interactions, personalized user experiences, 24/7 usability, and emotion recognition.

Compatibility - Digital humans are compatible with existing devices, applications, and operating systems, and can be used in a variety of areas to meet the specific needs of the user.

Simplicity - Through NLP, image recognition and AI technologies, Digital Human can implement user-friendly interfaces and communication methods that allow users to use them without a complex learning curve.

Trialability - Users can experience the functionality and effectiveness of digital humans in a relatively small-scale and secure environment (free trial).

Observe-ability - Digital human products like “Neon”, "Lil Miquela" and "Jill Watson" demonstrate the potential and value of this technology in industries such as financial, entertainment and education, etc.

Disruptive innovation concepts

The concept of destructive innovation creates new technologies that replace old ones. Digital humans are currently at the intersection of the low-end and new market phases. Digital humans are becoming accessible in the low-end market due to tech advancements and competition. They're integrated into customer service, virtual assistants, and basic entertainment. In a new market area, digital humans bring transformation by offering immersive experiences and defying traditional norms. They foster personalized engagement, emotional connections, and innovative branding chances. Those markets that could change industries like entertainment, customer service, healthcare, and education [2].

Digital humans change how we connect with computers, blurring real and virtual boundaries. This has influenced how modern industries work [2]. by collecting biometric data as the start of the value chain and based on AI and CG to create the digital human model and publish. Digital humans can through the NLP, gestures and emotions to interact with humans in the later stage of the value chain. For example, Epic Game Inc. [16], a leading developer of game engines, launched the MetaHuman Creator, as shown in figure3, which enables authors to create “High-fidelity digital humans” with preset motion capture and rendering by their own computer.

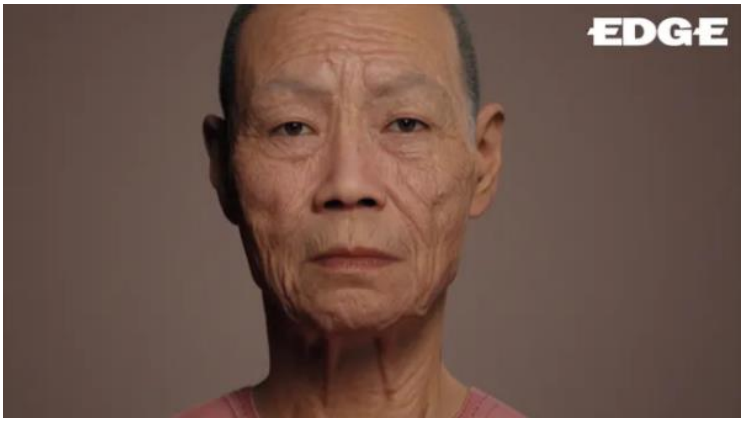

Figure 3. MetaHuman Creator [15]

3 Digital human in education

Nowadays, a number of AI innovations such as digital humans have been applied to the education industry. Due to the spread of COVID-19, many higher education institutions are forced to use digital humans or e-learning for real-time education [16]. A digital human is a computer-generated and artificial intelligence-powered lifelike entity that enables it to engage in a dialogue with people, and it can sense the user's reaction and give it back to the user in the form of shape, behavior, expression, or language [3]. This paper will present two examples of digital human applications and innovations in the education industry.

UneeQ

In the current education sector, traditional education has many drawbacks. Heavy educational load and time pressure are the biggest difficulties faced by the teaching force [17]. For

students, each student learns at a different pace and the curriculum and teaching methods inherent in schools cannot accommodate every student, but UneeQ can solve these problems successfully. It provides personalized learning support for students and helping teachers to correct assignments. UneeQ is a great help to the education industry, both from the point of the students and the education team, so UneeQ is a great example for digital human in education industry.

UneeQ uses natural language processing, emotion recognition technology and machine learning to enable interaction with the user. As shown in figure 4, 3D modelling, animation rendering, facial expression synthesis and voice synthesis technologies bring the appearance, movements and voice of UneeQ virtual assistants closer to that of real humans[18].

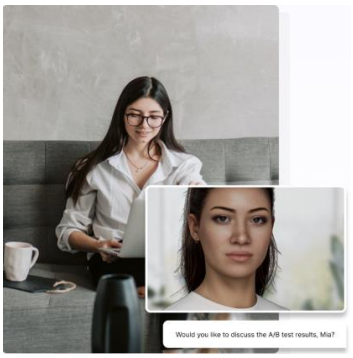

Figure 4. UneeQ [18]

UneeQ creates new business opportunities through international presence and unique marketing. It supports multilingual and cross-cultural communication, which makes it widely available in the international marketplace[18]. UneeQ uses digital humans to act as its own brand advocates, helping to promote the company and personalize the brand at the same time.

UneeQ is a New Zealand-based company specializing in the development and deployment of digital human technologies [18]. The UneeQ Virtual Assistant can act as a virtual tutor or teaching assistant. As a tutor, it can answer students' questions and provide reasonable explanations; as a teaching assistant, it can guide students through assignments and assist them with virtual experiments. The UneeQ Virtual Assistant can provide personalized learning support to students. For example, by analyzing students' performance to adjust the study plan and provide appropriate study suggestions. In addition, for the teaching team, teachers do not have to spend a lot of time solving problems for each student, which reduces a lot of time and allows teachers to spend more time improving the quality of teaching. UneeQ virtual assistants have brought great benefits to the education industry, both from the students and the education team, which has helped it expand its market bringing new business opportunities.

UneeQ uses open innovation strategy. It works with external partners, developers and innovation communities to drive innovation together, for example UneeQ has deep collaboration with existing NLP, ChatGPT projects or chatbot collaborations [18]. UneeQ gives developers the freedom to create, customize and integrate digital humans by providing flexible development tools and open APIs [19]. This open innovation approach provides

companies with more autonomy and facilitates a personalized user experience, accelerating innovation while attracting more customers.

UneeQ also use user innovation strategy. It collects and analyses feedback from users and partners of its products and services through data analytics, social media monitoring and other channels [18]. Through this feedback, UneeQ actively improves its technology to provide a better user experience and meet user needs [20]. Furthermore, UneeQ not only provides open APIs, but also allows users to customize their avatars and also open up their own applications [19]. These opportunities for user innovation allow users to participate in the creation of a digital human being and improve it to meet their needs, and this promotes the widespread use of digital human technology.

BabyX

BabyX technology is an important research and innovation in the field of digital humans and is one of the best-known digital agents [14]. It has important implications for the early childhood education and care. Therefore, using BabyX as an example can help to understand the potential and innovation of digital humans in the education sector.

BabyX development utilizes theories from different fields such as neuroscience, cognitive science and psychology [21]. As shown in figure 5, it is driven by a form of artificial intelligence and uses backward learning combined with natural language understanding to complete the interaction with the user [14].

BabyX is a milestone for digital humanity [21]. BabyX research brings new business opportunities in the preschool sector, firstly to help young children learn the basics, and secondly to help parents or educators better understand the cognitive and emotional aspects of young children [22]. BabyX technology can be used for research, education and virtual reality applications. Many companies are attracted to create virtual babies for various applications.

BabyX has been researched and developed by Soul Machines to simulate the appearance, behaviors and emotions of a human baby to mimic human cognition and to study pre-school education [21]. BabyX is based on the simulation of a real child around the age of 18 months [23]. BabyX is emotionally intelligent and can simulate a wide range of emotions, expressed through facial expressions and simple sounds [21]. It can interact in real time through voice dialogue, facial expression recognition, and gesture control [22]. BabyX technology is suitable for pre-schools, simulating learning interactions to help educators better understand the learning needs and emotional experiences of young children. BabyX can also be used as an adjunct to early childhood education to provide early learning experiences.

Figure 5. BabyX [21]

BabyX used a strategy of closed innovation upfront. Between versions 1.0 and 4.0, BabyX was developed entirely in-house by Soul Machines and did not drive innovation through openness or external collaboration, and BabyX was only used by its developers and subjects involved in child development experiments [23]. An open innovation strategy was adopted after BabyX version 5.0, which began to collaborate with major companies to innovate [24]. BabyX 5.0 can display a piano keyboard from sites such as Virtual Piano or a drawing board from Sketch.IO [24].

After BabyX 5.0, Soul Machines hired a multi-scientific team to create an entire team of highly intelligent digital humans as well as to continue the development of BabyX [25]. At the same time Soul Machines began to adopt a user innovation model. It actively collects user feedback through user testing and evaluation. This allows Soul Machines to get users' views on virtual humans (including BabyX), including their appearance as well as their performance. The company also uses this has feedback to identify potential points of improvement and continuously updates the digital human assistant. Soul Machines has collaborated with partners and customers to meet the specific needs of different customers [24].

4 Comparative analysis

The goal of UneeQ and BabyX is the same that is promote the education industry. Except that UneeQ favors higher education while BabyX favors pre-school education. UneeQ has always used open innovation while BabyX used closed innovation in the early stages. While closed innovation may help protect research results and data, it may also limit the potential for external perspectives and innovation. This led BabyX to adopt an open innovation strategy in the second phase. The target groups of the two products are of course different, as detailed in the table 1 below.

Table 1. The comparison in UneeQ and Baby X

	UneeQ	Baby X
Purpose in education	Helping students to plan their systems and answer questions reduces the workload of teachers.	Assistance and development of pre-school education.
Open/Close innovation	Open	Closed innovation in the first half, open innovation in the second half.
Use user innovation strategy	Yes	Yes
Target customer	Schools, students and teachers	Pre-school institutions, parents of newborns

5 Conclusion

The research and release of BabyX is of historic significance to Digital Humans [14], as it shows everyone the possibilities of what Digital Humans can do to help in the education. It is because of BabyX that more digital human products like UneeQ will be applied to the

education industry. In the future digital humans will be widely used in all schools and in all infant counselling and training.

References

[1] Silva, ES & Bonetti, F 2021, 'Digital humans in fashion: Will consumers interact?', Journal of Retailing and Consumer Services, vol. 60, p. 102430, viewed 30 August, 2023, DOI https://doi.org/10.1016/j.jretconser.2020.102430

[2] Jiang, K 2023, From Science Fiction To Reality: How Digital Humans Are Forging New Realitie, Forbes, 8 June, viewed 11 October, 2023, https://www.forbes.com/sites/forbestechcouncil/2023/06/08/from-science-fiction-to-reality-how-digital-humans-are-forging-new-realities/?sh=52f4690044fd

[3] Collier, M, Manion, S & Boyett, DR 2019, Artificial Intelligence in Action: Digital Humans, ai-forum, viewed 11 October 2023, https://aiforum.org.nz/wp-content/uploads/2019/10/FaceMe-Case-Study.pdf

[4] Marr, B 2020, Artificial Human Beings: The Amazing Examples of Robotic Humanoids and Digital Humans, Forbes, viewed 24 August, 2023, https://www.forbes.com/sites/bernardmarr/2020/02/17/artificial-human-beings-the-amazing-examples-of-robotic-humanoids-and-digital-humans/?sh=5be777965165

[5] Kemp, A 2023, Will AI make virtual influencers influential again?, The Drum, viewed 24 August, 2023, https://www.thedrum.com/news/2023/03/29/will-ai-make-virtual-influencers-influential-again

[6] Meister, J 2018, AI Plus Human Intelligence Is The Future Of Work, Forbes, viewed 24 August, 2023, https://www.forbes.com/sites/jeannemeister/2018/01/11/ai-plus-human-intelligence-is-the-fut ure-of-work/?sh=4993381d2bba

[7] Prior, E & McKeown, E 2019, The computer will see you now: Six examples of AI in healthcare, pwc Australia, viewed 24 August, 2023, https://www.pwc.com.au/digitalpulse/ai-healthcare-adoption-examples.html

[8] Pullar-strecker, T 2018, Air NZ's 'Sophie', Vodafone's 'Kiri' - ever noticed that most virtual helpers are female?, Stuff, viewed 24 August, 2023, https://www.stuff.co.nz/business/industries/108035228/no-coincidence-vodafones-digital-hum an-kiri-is-female

[9] Emergenresearch 2023, Digital Human Avatar Market, By Product Type (Interactive Digital Human Avatar and Non-Interactive Digital Human Avatar), By Industry Verticals (Gaming, Retail, IT & Telecommunications, Education, and Others), and By Region Forecast to 2032, Emergenresearch, viewed 24 August, 2023, https://www.emergenresearch.com/industry-report/digital-human-avatar-market

[10] Omniverse, N 2021 An era of digital humans, Medium, viewed: August 31, 2023, https://medium.com/@nvidiaomniverse/an-era-of-digital-humans-bfa10d41e289

[11] "Voice cloning software for content creators," Respeecher.com. Available: https://www.respeecher.com/.

[12] IBM 2023, What is a chatbot?,IBM, viewed 1 September, 2023, https://www.ibm.com/topics/chatbots

[13] Netscribes 2023, The rise of digital humans: Exploring the future of virtual reality, Netscribes, viewed September 1, 2023, https://www.netscribes.com/the-rise-of-digital-humans-exploring-the-future-of-virtual-reality/

#:~:text=Digital%20humans%2C%20which%20was%20once,and%20used%20across%20different%20domains
[14] Seymour, M, Lovallo, D, Riemer, K, Dennis, AR & Yuan, L 2023, 'AI with a Human Face', Harvard Business Review, vol. 101, no. 2, pp. 49–54, viewed 29 August, 2023, https://hbr.org/2023/03/ai-with-a-human-face
[15] Epic Games, Inc 2023, MetaHuman Creator, Unreal Engine Epic Games Inc., viewed 29 August, 2023, https://www.unrealengine.com/en-US/metahuman
[16] Aldulaimi, SH, Abdeldayem, MM, Alazzawi, A, & Abdulrazaq, ML 2021, 'Digital Education Industry and Academic Perception to Improve Business Intelligence', in 2021 International Conference on Data Analytics for Business and Industry (ICDABI), pp. 218–225, IEEE, viewed 11 October 2023, DOI 10.1109/ICDABI53623.2021.9655982.
[17] Blegur, J, Lumba, A & Ngongo, M 2023, 'Tracing physical education teachers' teaching difficulties in online era using teaching skill indicators,' Pegem Journal of Education and Instruction, vol. 13, pp. 125–134, viewed 11 October 2023, DOI 10.47750/pegegog.13.01.15.
[18] UneeQ 2023 Digitalhumans.com, viewed 11 October 2023, https://www.digitalhumans.com/product
[19] Flitter, J 2020, UneeQ drives new human to machine interface with unveiling of first-of-its-kind digital human creator platform, NewZealand.AI, viewed 11 October 2023, https://newzealand.ai/insights/uneeq-launches-first-of-its-kind-digital-human-creator-platform
[20] Stratten, J 2020, How UneeQ is making the human touch digital, Insider Trends. https://www.insider-trends.com/how-uneeq-is-making-the-human-touch-digital/
[21] Baby X 2020, Soul Machines, viewed 11 October 2023, https://www.soulmachines.com/resources/research/baby-x/
[22] Knott, A, Sagar, M & Takac, M 2022, 'The ethics of interaction with neurorobotic agents: a case study with BabyX'. AI Ethics, vol. 2, 115–128, viewed 11 October, 2023, DOI https://doi.org/10.1007/s43681-021-00076-x
[23] Lant, K 2017, An artificially intelligent baby could unlock the secrets of human nature, Futurism, viewed 12 October, 2023,https://futurism.com/an-artificially-intelligent-baby-could-unlock-the-secrets-of-human-nature
[24] Mark Sagar Made a Baby in His Lab. Now It Plays the Piano 2017, Bloomberg.com, viewed 12 October, 2023,https://www.bloomberg.com/news/features/2017-09-07/this-startup-is-making-virtual-people-who-look-and-act-impossibly-real
[25] Frazier, A 2017, This virtual baby has real, human emotions, & it's seriously freaky, Romper, viewed 11 October,https://www.romper.com/p/this-virtual-baby-can-interact-with-people-just-like-a-real-one-its-kinda-freaky-3906874