

# Authentic learning and job readiness: Are mixed-reality simulations effective tools for preparing business students for the real world?

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Advances in technology have significantly enhanced the quality of mixed-reality simulations, incorporating both real and virtual aspects. Mixed-reality simulations have been used to develop individual knowledge, skills and abilities in higher education; however, the use of such simulations to introduce authentic learning activities into higher education courses remains under-researched. In the current paper, we detail the design, implementation, continuous improvements and student perceptions of a mixed-reality simulation used in a final-year undergraduate business unit. An iterative approach proved important to improving the simulation across deliveries. Clear instructions, student preparation, familiarisation with the technology used and support for the development of communication skills also influenced student perceptions of the activity. Our findings from over 200 students indicate that the use of mixed-reality simulations is an authentic and effective teaching approach for the development and demonstration of employability skills. This study is useful to educators seeking to understand the value of mixed-reality simulations in higher education and their ability to provide authentic learning experiences which increase overall student satisfaction.

## *Implications for practice or policy:*

- Student satisfaction and employability skills can be improved through participation in authentic mixed-reality simulations.
- Students may require support developing communication skills required to interact with the simulation.
- Educators can enhance the student experience by demonstrating how the simulation works, familiarising them with the avatars and how they interact with participants.
- Educators should focus on continuous improvement to get the simulation right.
- Universities should consider implications for workloads, technical support and budgets when introducing mixed-reality simulations.

*Keywords:* authentic learning, mixed reality, simulations, higher education, business education

## Introduction

Higher education institutions are increasingly seeking to deliver authentic learning (Pitchford et al., 2020), integrating real-world problems into the curriculum (Wald & Harland, 2017) to deliver job ready graduates to industry (Jopp, 2019). Skills required by employers include complex skills, such as a positive attitude, problem-solving, teamwork and ethical decision-making (Preston & Rosairo, 2021). Although industry-based learning in the workplace is highly authentic (Kaider et al., 2017), it is not always appropriate or possible when activities are dangerous or difficult due to the low frequency of occurrence (Cannon-Bowers & Bowers, 2009), high cost (Dahlin et al., 2015) or a lack of access to real-world participants.

Simulations, with or without technology, are used in higher education to link academic learning to the real world (Preston & Rosairo, 2021; see Rooney & Nyström, 2018), enabling students to learn and apply skills in a realistic environment without real-world consequences (Evans & Kerridge, 2021). Emerging technologies have enabled the development of online simulations, evolving from using text-based interactions to incorporating graphical agents (McGarr, 2020). However, the computer-controlled responses with forced choice menus potentially affect their authenticity. More recently, the development of mixed-reality technologies addresses these issues by enabling simulations in a realistic digital environment with the human operation of multiple avatars with verbal and non-verbal capabilities (Bondie et al., 2021), blending both real and virtual objects in real time (Rasimah et al., 2011). Mixed-reality simulations have been researched extensively in pre-service teacher training (Bondie et al., 2021; Dittrich et al., 2022; Howell & Mikeska, 2021; Nickl et al., 2022); however, their application in business education remains under-researched.

We began to address this gap through a descriptive longitudinal study (Williams, 2009) exploring the design, implementation, continuous improvement and student perceptions of a mixed-reality simulation used in a final-year undergraduate business unit. We examined the effectiveness of the simulation over 2 semesters, asking students ( $N = 201$ ) about their satisfaction with the simulation as a learning activity and their perceptions of its authenticity and effectiveness in enabling students to develop and demonstrate real-world skills.

This paper provides a unique example of the emerging use of mixed-reality simulations as a learning tool for business education and, more importantly, presents opportunities for learning and improvement for those who want to incorporate mixed-reality simulations in their own courses. Our findings suggest that these simulations may have benefits in developing communication skills across a range of higher education contexts beyond the previously reported use in pre-service teacher training.

### **Authentic learning**

Authentic learning has become a common refrain in higher education research, with scholars aiming to better understand the connection between academic learning and the requirements of the real world (e.g., Bennet et al., 2002; Pitchford et al., 2020). Higher education institutions are increasingly looking to authentic learning to deliver job-ready graduates to industry (Jopp, 2019; Pallant et al., 2022) by providing students with valuable employability skills (Sotiriadou et al., 2020). The concept of authentic learning remains contested, but the key component shared by the varying operationalisations is the integration of real-world problems into the curriculum (Wald & Harland, 2017). The unifying theme is linking what students are taught and how they are assessed, to what they will be required to do in the workplace post university (Jopp, 2019; Simpson, 2016).

Authentic learning involves educational activities that replicate workplace tasks and scenarios (Simpson, 2016). Authentic learning activities occur along a continuum. For example, Bosco and Ferns (2014) and Kaider et al. (2017) presented a typology of authentic learning activities based on the metrics of proximity and authenticity. Proximity relates to the physical closeness to industry, with industry-based learning opportunities such as professional placements and internships reflecting the highest level of proximity as they occur in the workplace with practitioners (Kaider et al., 2017). These types of learning experiences also have the highest degree of authenticity, as the tasks performed directly reflect professional practice. Active case studies and simulations also rate highly in terms of authenticity, but lower in proximity, as the learning activity occurs at university and/or at home and not in the workplace.

### **The role of technology in authentic learning**

Technology-enhanced learning in the higher education sector has risen significantly in recent years (Kennedy & Dunn, 2018), with educators looking for more engaging and innovative ways to utilise new technologies in providing authentic learning opportunities. Digital technology is most often used in learning activities to either improve efficiencies or enhance authenticity (Nieminen et al., 2022). Some technology-enhanced activities can provide efficiencies in terms of time-saving capabilities and a

reduction in the manual facilitation of assessment and marking (e.g., online tests), while others require substantial investment of staff time to learn new processes or competencies. Time-poor academics may be more likely to choose what they see as quick and easy solutions (Bennett et al., 2017).

This presents a potential disconnect between technology and pedagogy, with inadequate technical support identified as a major factor hampering efforts to integrate technology into learning activities. Evidence suggests that technology-enhanced initiatives are often adapted or abandoned in the next iteration of a unit, indicating that better strategies are needed during the initial design and implementation stages (Bennett et al., 2017). Poor sustainability of these initiatives highlights the importance of reflecting on the effectiveness of the design process to improve future iterations of the innovation.

### **Simulations in higher education**

Simulations are used to develop complex skills across many higher education settings including engineering, management, medical, science, technology, engineering and mathematics, teacher education (Chernikova et al., 2020) and political science (Perry & Robichaud, 2020). Simulations are defined as “any artificial environments that are created to manage an individual’s experience of reality” (Bell et al., 2008, p. 1417). Simulations link academic learning to the real world (Preston & Rosario, 2021), enabling students to learn and apply skills in a realistic environment without the risks of real-world failure (Evans & Kerridge, 2021). This is important for dangerous activities or when engaging with the real world is difficult due to the low frequency of occurrence (Cannon-Bowers & Bowers, 2009), high costs (Dahlin et al., 2015) or lack of access to real-world participants.

Simulations can be performed either in the classroom without technology through role-plays and board games or with increasingly sophisticated technology through online games and activities (Bell et al., 2008). Simulations are often created to simplify the real world, to control and reduce complexity and to focus student learning on identified issues (Howell & Mikeska, 2021). Simulations are a form of learning that focuses on interaction between the student and the issue that they are dealing with through experience, experimentation and feedback (Stermann, 2014). Individuals apprehend their experience through conceptual interpretation and analysis, process it through their emotional reactions to the experience and transform their knowledge through internal reflection (Prado et al., 2020).

Simulations, with or without technology, facilitate the development of complex skills, such as problem-solving, communication and collaboration and teamwork skills, across higher education domains (Chernikova et al., 2020). In business education, simulations are perceived by students to be more effective than case studies and lectures in developing interpersonal skills and improving self-awareness and equal to case studies but above lectures for developing problem-solving skills (Farashahi & Tajeddin, 2018).

Skills required by employers include a positive attitude, problem-solving, teamwork and ethical decision-making (Preston & Rosairo, 2021), which can be developed and practised through simulations. Simulations provide students an opportunity to create narratives that demonstrate to potential employers how they have applied their skills to a realistic situation and what they have learned (Evans & Kerridge, 2021). This may be particularly helpful in job interviews for candidates with little practical experience.

### **Mixed-reality simulations**

Emerging technologies have enabled the development of different forms of simulations with implications for simulation design, delivery and the authenticity of the experience (Bondie et al., 2021). The emergence of the Internet enabled the development of online simulations, originally with text-based interactions (McGarr, 2020). Over time, graphical agents were incorporated into the simulations to interact with learners; however, these text-based and computer-controlled responses were limited by forced-choice menus with limited responses available to participants, affecting authenticity (McGarr, 2020). Recently,

developed mixed-reality technologies involve the human operation of multiple realistic avatars, with verbal and non-verbal capabilities, in a realistic digital environment (Bondie et al., 2021).

The use of this technology has expanded over recent years, particularly in pre-service teacher training to simulate classroom experience during COVID-19, when students were unable to enter real-world classrooms (Bondie et al., 2021; Dittrich et al., 2022; Howell & Mikeska, 2021; Nickl et al., 2022). In the teacher training context, trainee teachers enter the computer-based simulation through an Internet connection and interact with multiple animated avatars, all controlled remotely by a single human operator (Bondie et al., 2021). Mixed-reality simulations have been used for trainee teachers to develop skills, including managing a classroom of five schoolchildren avatars, facilitating parent-teacher interviews with avatar parents and interacting with avatar teaching peers (Bondie et al., 2021). This type of mixed-reality simulation offers a low-risk way for trainee teachers to practise teaching and question-and-answer skills and for their readiness to teach to be assessed (Berg et al., 2023).

There is limited understanding about how students perceive the authenticity and effectiveness of mixed-reality simulations in relation to skill development (Howell & Mikeska, 2021). Initially, research centred on teacher education, where students' perceptions of authenticity during a simulation were negatively affected if they believed that they were interacting with automated rather than human responses, or if the avatar's actions were not considered reflective of real-world behaviour (Howell & Mikeska, 2021). Students have been found to prefer mixed-reality simulations to in-person role-plays as they enable students to focus on the professional task rather than acting (Dittrich et al., 2022). This mixed-reality technology represents an opportunity to design and deliver simulations in business education to help students develop and apply complex skills demanded by employers. Simulation company Mursion (n.d.b) claims that this technology is highly effective for workplace training in areas such as leadership, diversity, sales and customer service. The rise of online business meetings, through technologies such as Zoom, may increase the authenticity of such a simulation; yet the use, perceived authenticity and effectiveness of simulations are under-researched in this context.

The current paper examines the advantages and limitations of technology-based simulations by providing a longitudinal study on the creation and progression of a mixed-reality simulation used in a final-year unit at an Australian business school. We present this in a descriptive longitudinal study, similar to the methodology employed by Williams (2009) and share the challenges and learnings from the educators' perspectives. We also analyse the students' perceptions, specifically whether mixed-reality simulation-based training effectively enhanced student satisfaction and skills development.

## **Research context**

The mixed-reality simulation took place in a final-year capstone unit of the Bachelor of Business, which is typically taken in the penultimate semester of a student's degree. The unit, Advanced Innovative Business Practice, brings students together from all business majors (e.g., marketing, management, accounting, human resources, supply chain, finance and entrepreneurship). The unit is positioned to develop cross-disciplinary research, analysis and communication skills to prepare students for real-world industry projects included in their final semester of study. The simulation was introduced with two objectives: to increase students' ethical decision-making skills and to increase student engagement with the unit. The unit had received low student satisfaction survey results, at only 89% of the university unit average over the previous 3 semesters. The simulation and associated assessments represent 45% of the final grade for the unit and is a major focus during Weeks 2 to 5 (12-week semester), with the reflection assessment due in Week 7. The remaining classes and assessments relate to a major group assignment that involves building a business case to bring an international product into Australia and is unrelated to the content of the mixed-reality simulation.

The mixed-reality simulation was administered by the university's online delivery entity using the Mursion (n.d.a) mixed-reality platform. The simulation case was designed and developed by ethics, sustainability and teaching scholars with experience teaching the Advanced Innovative Business Practice unit. The

learning objective of the simulation was to develop students' ethical decision-making skills by exposing them to an ethical dilemma in a safe environment. The scholars designed a case that centred on the formation of a business partnership between an Australian business and a company operating within a fictitious overseas country.

In the case, an allegation of potential child labour had surfaced in the supply chain of the overseas company and the Australian business had appointed a three-person taskforce to investigate these accusations prior to signing partnership documents. Students participated as members of the three-person taskforce preparing for and attending an approximately 15-minute online meeting (completed in a single sitting) in the simulation with executives of the fictitious company: the chief executive officer, the chief financial officer and the chief sustainability officer. These three executive roles were played by avatars within the simulation and were operated by a single human actor (i.e., simulation specialists – SS). The students' objectives for the simulation meeting were to gather information to enable them to provide a recommendation to the Australian business as to whether to proceed with the partnership or not. At the end of the meeting with the executives, the student team members remained in the simulation for 10 to 15 minutes to discuss meeting dynamics and potential recommendations amongst themselves.

### **Initial design and development of the simulation**

Trials of the case took place with the SS, until the design team believed they had the foundation required for students to simulate the conflict of opinions and to prompt questions and discussion between teammates as they embarked on their fact-finding task. Likewise, the team invested in the design of assessments for an authentic simulation experience. To assist with preparing students for the simulation, prescribed readings covering ethical decision-making, child labour issues and cultural awareness provided students with a useful context for understanding ethical dilemmas. Additionally, we administered a short multiple-choice test (worth 20% of the unit grade) in the week before simulations started to motivate students to develop knowledge of ethical decision-making theories and frameworks and child labour issues and to inform planning for, and participation in, the simulation.

Two weeks following the simulation, students individually reflected on their simulation experience and considered what they had learnt about themselves, ethical decision-making and the cultural implications of global business and developed a 5-to-7-minute individual reflective assessment video worth 25% of their total mark. The process of reflecting on their experience allowed students to recognise their strengths and limitations in the ethical decision-making process and identify what they would do differently, in a similar real-world situation. Reflection promotes authenticity where students think about and learn from their experiences.

### **Implementation and improvements between the two iterations**

Participation rates increased in the second iteration to a 94% participation rate compared to 60% in the first iteration (this is not to be confused with the survey response rate, which was lower). The first implementation of the simulation yielded considerable challenges, including an unexpected introduction of a university firewall, which led to reduced participation. Further challenges emerged with the administrator's booking system with students registering for simulation sessions as individuals contributing to reduced attendance and decreased participation in the first iteration.

Apart from these technical issues, a review of sample simulation session recordings, feedback from administrators and SS and a review of student survey responses related to Iteration 1 identified multiple opportunities to improve the simulation. There was some confusion amongst students on the simulation objectives and instructions, many groups and individual participants did not adequately prepare for their simulation and some students appeared to be lacking some of the communication skills required to manage the meeting and engage with the executive avatars.

Incremental improvements to the preparation, administration and delivery of the simulation were introduced for the second iteration, resulting in more students attending the simulation and being

proactive in driving discussions. A revised simulation brief provided a clearer task for students and more comprehensive instructions and information for SS. Efforts to further embed the simulation within the unit to heighten authenticity were introduced for the second iteration, including extra resource videos to assist students develop the communication and meeting skills necessary to engage with the simulation. These videos covered preparation for the simulation, management of the simulation meeting and reflection. In class, the simulation structure and process were discussed, reinforcing the links between the suite of assessments and the registration process for the simulation managed in class, reducing any technical challenges. Students formed groups of three for the simulation rather than as random individuals on a sign-up sheet (as was the case in Iteration 1), enabling students to plan together for the simulation, instilling students with confidence to explore their role to its fullest, in a safe and secure learning environment.

## Materials and methods

### Methods and sources of data

Multiple methods and sources of data were used to examine the design, implementation and continuous improvements of the mixed-reality simulation. These include general unit student feedback surveys (SFS), a survey specific to the simulation, teacher observations and informal discussions with the administrators of the simulation including the Mursion SS or actor(s) who voiced the avatars within the simulation (Mursion, n.d.a). Mursion offers a platform for simulations, delivered by the SS who voice and control different avatars that interact online with participants (students).

A five-question survey was administered to students to collect data about their simulation experiences, more specifically, the contributions to student satisfaction, perceptions of authenticity and perceived contributions to job readiness. Student demographic data was also collected followed by an open-ended question seeking any student observations or comments. This research was approved by the Swinburne University of Technology Human Research Ethics Committee. After reading the plain language statement and providing consent, students were asked to confirm that they participated in the mixed-reality simulation session before completing the student survey.

The mixed-reality simulation student experience survey consisted of four items adapted from Schultz et al. (2022) and designed to capture:

- Satisfaction with the learning experience (“How satisfied were you with your simulation experience?”)
- Job readiness: desirable skills to an employer (“To what extent do you think you were able to demonstrate knowledge, understanding and skills that would be typical of the kinds of attributes a future or current employer might demand?”)
- Authentic learning: how realistic (“To what extent was the information and situation experienced in the simulation realistic? That is, could you see the simulation as a proxy for the real world?”)
- Authentic learning: practical skill development (“To what extent do you think the simulation helped you to develop skills that you could use in other contexts - ones that are required and valued in the real world?”).

All items were rated on bi-polar scales ranging from 1 to 7, where, for example, 1 = *very dissatisfied* and 7 = *very satisfied*.

The survey then included a fifth qualitative question enabling students to enter textual comments on their perception of the simulation, its impact on their learning about ethical decision-making and/or how it may impact their future thinking and behaviours.

## Participants

Participants consisted of two student cohorts, one in each of 2 semesters. Simulation delivery were investigated to explore the process of improving the simulation and implications of enhancements on student perceptions. In the first iteration (Semester 1), 340 students were enrolled in the unit and 204 completed the Mursion simulation, representing 60% of the cohort (the relatively low completion rate in Iteration 1 is discussed in the Research context section). The second iteration (Semester 2) consisted of 160 student enrolments, with 150 completing the simulation (94% of the cohort). Participation in the associated student survey was voluntary, and responses were collected anonymously. A total of 201 responses were collected over the 2 semesters; see Table 1 for participant demographics.

Table 1  
*Participant demographics*

Responses and demographics	Iteration 1	Iteration 2	Total
Total students completing simulation	204	150	354
Responses (N)	160	41	201
Response rate	78.4%	27.3%	56.8%
<b>Gender</b>			
Male	51.2%	39%	48.7%
Female	46.9%	61%	49.8%
Non-binary	1.9%	0%	1.5%
<b>Age</b>			
Mean age (years)	22.1	22.4	22.2

## Data analysis

The textual survey data was analysed using open and axial coding (Miles et al., 2019) to name and categorise phenomena and identify relationships around and between these (Strauss & Corbin, 1990). Written survey comments were extracted and compiled in a separate document. These comments were coded against the related survey item. This document formed a logbook of codes that we shared amongst us for review and refinement, where “incidents [are] ... compared against other incidents for similarities and differences” (Strauss & Corbin, 1990, p. 9). A thematic analysis was conducted to identify key themes from across the data (Patton, 2014). Quantitative items were analysed at the descriptive level. Means and standard deviations can be found in Table 2.

## Results

Table 2 compares the means and percentage of responses (on a scale from 1 to 7) for each of the four student evaluation questions across the two deliveries. Examination of the mean scores shows that student ratings were relatively high (at around the 5 out of 7) for each question in Iteration 1 (i1), with these results improving across all categories in Iteration 2 (i2).

Table 2  
*Comparison of Iteration 1 and Iteration 2: Quantitative responses*

	Satisfaction with the learning experience		Job readiness: desirable skills to an employer		Authentic learning: how realistic		Authentic learning: practical skill development	
	i1	i2	i1	i2	i1	i2	i1	i2
M	5.1	5.4	5.0	5.5	5.2	5.4	4.9	5.5
SD	1.5	1.6	1.6	1.6	1.42	1.7	1.6	1.5
Responses (%)								
High (5–7)	71.3%	75.6%	68.7%	80.4%	73.7%	70.7%	65.6%	80.5%
Mid (4)	15.6%	14.6%	13.1%	9.8%	15.0%	19.5%	13.8%	12.2%
Low (1–3)	13.1%	9.8%	18.2%	9.8%	11.3%	9.8%	20.6%	7.3%

The following section examines responses to each of the four questions and provides supporting qualitative comments from students sourced from the simulation surveys (iteration number, student [s] respondent number) and general unit student feedback surveys (iteration number or SFS comment number).

### Satisfaction with the learning experience

I think it was a really cool experience. It was better than doing a role play with other students, which I feel would be a comparable task. (i1, s40)

Most students were highly satisfied with the simulation in both Iteration 1 and Iteration 2, with satisfaction increasing across iterations, as shown in Table 2. The mean satisfaction rating of 5.1 (out of 7) in Iteration 1 rose to 5.4 (Iteration 2), with 71.25% (Iteration 1) of students rating the simulation high (5 to 7) increasing to 75.6% (Iteration 2). However, not all students were satisfied with the simulation, with 13.1% of students giving the simulation a low rating (1 to 3) in Iteration 1, falling to 9.8% (Iteration 2). Student satisfaction with the unit (as measured in the student satisfaction survey) improved after the simulation was implemented, with the satisfaction reported in Iteration 2 19% above the unit average of the 3 previous semesters and increasing from 89% to 105% of the university average.

A common sentiment expressed about the simulation was its novelty or uniqueness as a learning activity, as indicated in the quote above (i1, s40) and expressed by the following students: “It was a unique learning experience and I enjoyed it” (i1, s2); “For me, the virtual simulation is creative and novel. I learned to be well-prepared before entering the simulation, and I desire to have more activities like this” (i2, s14). This uniqueness was seen as a challenge for some students who did not feel that they were adequately prepared regarding the purpose of the exercise or how it would operate, for example:

I really liked the simulation experience ... However, I would have liked more information about what to expect from the simulation prior to going in. It would have been good to see a video example to show how the avatars interact with the participants because I didn't realise that the avatars would be able to respond to our questions so easily. (i2, s15)

For some students, satisfaction was influenced by their view as to whether ethical decision-making is an appropriate topic to study and its fit within this unit. Two positive views were “I found learning about ethics and ethical dilemmas to be quite interesting” (i1, SFSs11) and “Philosophy (ethics). Emmanuel Kant is my religion now. But in all seriousness, I've taken a greater interest in philosophy now” (i1, SFSs12). A negative view was expressed by i1, SFSs13: “Everything in first 6 weeks was doing assignments about ethics, which is religion. In Year 12, I didn't sign up for religious education.”

The composition of the teams for the simulation was an issue identified by eight students in Iteration 1. Issues ranged from working with unprepared students to expressing concerns about social loafing, with one student explaining, “The people I was in it with didn't ask any questions, so I had to ask them all” (i1, s8). Changes made to how teams were established in Iteration 2 reduced this issue and introduced positive aspects of teamwork: “The feeling that we were part of the representative team was exciting” (i2, s31).

Factors raised by some students as potentially reducing satisfaction with the simulation included the look and sound of the avatars and perceived failure of the avatars to answer questions and limited contextual information provided to students before the simulation. The following quote is an example: “It was sold to us as an opportunity to talk to a company about real-life problems but instead spoke with three cartoons with humorously high-pitched voices who didn't answer any of the questions properly” (i2, s6). As discussed in later sections, other students were much more positive on the technical aspects and saw challenges in extracting information as an important learning outcome.



### **Job readiness: Desirable skills to an employer**

I liked how the simulation provided us with a clear idea of how it would feel if we were actually communicating with a client in the real industry. (i2, s4)

Most students rated the simulation high on the demonstration of skills and knowledge (Table 2). The average response for the question around job readiness was 5.0 in Iteration 1 and increased to 5.5 in Iteration 2. In total, 68.7% of students in Iteration 1 and 80.4% in Iteration 2 rated the simulation highly in this regard, while 18.2% rated it low in Iteration 1 compared to 9.8% in Iteration 2.

In class discussions, some students believed that the simulation enabled them to demonstrate knowledge, understanding and skills that would be typical of the kinds of attributes a current or future employer would demand, such as communicating with a client, dealing with information uncertainty and preparing for business meetings. However, there were few survey comments relating to the specific demonstration of skills, with most students reflecting on the development of relevant skills.

### **Authentic learning: How realistic**

I really like the realism of the Mursion (simulation), and I think it prepared me well for the real world and gave me insight on what I could do prior to prepare in a real-life situation. (i1, s34)

Consistent with the above quote, most students (Iteration 1: 73.7%; Iteration 2: 70.7%) rated the simulation highly as a realistic proxy for the real world with the average rating of 5.2 (Iteration 1) and 5.4 (Iteration 2) for this survey item (see Table 2). A minority (Iteration 1: 11.3%; Iteration 2: 9.8%) struggled to suspend disbelief while performing the simulation, rating realism low.

The simulation was shown to replicate a professional work context or experience in new situations, with one student commenting: "The Mursion simulation was an enjoyable experience, got to experience what it would be like to be within a corporate meeting solving problems and suggesting advice in order to become a solution" (i1, s13). Another described the simulation as "some of the only practical work in the whole degree" (i1, s49).

Despite some challenges with the perceived realism of the avatars, overall, students were positive about their experience, with one (i1, s28) suggesting it provided a "solid interview simulation experience". Another student (i1, s14) extended this rationale by indicating that "this is a useful tool for training students for situations that (they) have not had exposure to". The practical nature of the simulation was also complimented for its realism and ability to provide a positive learning environment: "The virtual simulation is very good for practice. I can learn many things from the simulation" (i1, s52). Learners indicated that the simulation helped them to clearly link theory to real-world practice (i2, s1); and the authentic nature of the simulation was perceived to replicate communications and/or meetings with real world clients enabling skill development and the acquisition of knowledge (i2, S4; i2, S9).

Some students indicated that the perceived realism of the simulation was impacted by the cartoonish nature of the avatars and a realisation that the avatars did not always behave as expected. However, the ratings and students' comments indicate that most students found the simulation valuable, despite the limitations, for example, "Maybe could be a little more realistic with voices that aren't so robotic and better animation. But was overall a very interesting and unique experience that was very helpful and unlike anything I've done before" (i2, s12).

As indicated in the satisfaction results explored earlier, some students in Iteration 1 believed that the way students registered for the simulation as individuals and completed the simulation as a group with people that they did not know, was not reflective of how groups would realistically prepare and handle meetings together in practice. This was well articulated by i1, s55:

Honestly the experience was so rushed I barely had time to think of what I could ask next, didn't know who I was going into the meeting with until I was in the meeting. In the real world, you would know your team pretty well and have a plan of attack to make sure your questions were logical and you would be able to better work as a team.

Learning how the simulation operated presented issues for how some students evaluated the authenticity of the simulation; however, they still expressed that the simulation was a valuable learning exercise. For example, realising that the avatars were actually operated by one SS who was voicing each of the characters diminished the realism of the experience for one student:

In theory, the Mursion simulations are a great idea, the way it is presented definitely creates the right atmosphere for an interview situation. However, the whole experience was slightly unsettling and intimidating. The 'fake' or animated hosts established a sense of 'uncanny valley' and was slightly disturbing at times. The animation were a little janky and once I realised that it was one actor playing three people, it broke the immersion for me. I definitely came out of the experience with some valuable lessons and feedback, but a lot of that came with my preparation for the interview. Overall, a solid interview simulation experience and with some polish can become a very useful tool. (i1, s28)

Some students had issues with the level of information provided by the SS within the simulation. Although recognising that the level of detail provided by the SS was perhaps reasonable for an activity, it was not perceived by a minority to be adequate for a real-world situation and therefore limited some students' capacity to engage with the task at a high level: "There was a limit to the depth of questions I could ask to get a response for. This is not a criticism as I think the level was quite reasonable for a university activity, I just had more scope for discussion than was required" (i2, s17). Students differed on their views as to whether the inability to obtain all of the information that they thought they required from the avatars was realistic or not, with some seeing it as a limitation of the simulation (i2, s6) and others perceiving it as a key learning from the simulation: that executives may not have or be willing to share all of the facts (i2, s9 below; i2, s18).

### **Authentic learning: Practical skill development**

In the virtual simulation experience, I did not get the information that I wanted but in a real world, this could be real, as there is not possible to get every answer wanted in a meeting. (i2, s9)

Across both iterations students reported that the simulation helped them to develop skills required and valued in the real world, with the mean ratings improving from 4.9 (Iteration 1) to 5.5 in Iteration 2; with 66% (Iteration 1) and 80.5% (Iteration 2) of students rating the simulation highly (Table 2). Conversely, the percentage of students rating the simulation as low fell substantially from Iteration 1 (20.6%) to Iteration 2 (7.3%).

Students expressed value in participating in simulations, as captured by i1, s14: "I can see this as a helpful tool for training staff for situations they have not had exposure to. Also a chance to understand how they react and developed strategies in future situations". Students felt they had developed invaluable skills including learning to participate in corporate meetings and solve problems (i1, s13), skills for interviewing (see i1, s28 below), "diplomatic reasoning and sensitivity to cultural issues" (i1, s24), ethical decision-making skills (i1, SFs2), as well as skills for operating in new situations (see i1, s18 above) and operating under uncertainty (i2, s18).

As seen in previous survey items, other students identified with the authentic nature of the simulation enabling them "to understand the bridge between the real-world and theory" (i2, s21). They valued the authentic nature of the simulation in its ability to replicate business meetings with real-world clients, enabling students to develop valued communications and negotiation skills: "The Mursion simulation was a good educational experience on talking to another organisation about an issue. Even though I didn't

rate myself that highly in my/our performance, it was a great educational opportunity” (i2, s5). (See i2, s4; i2, s9 above.)

The organisational experience also translated to team-work skills, with students valuing the simulation’s capacity to provide an experience that helped them to work with diversity: “This unit teaches us how to collaborate well in a team with people from diverse backgrounds and majors while at the same time exposing to different scenarios such as the interview simulation” (i2, SFS s6). Others discussed the simulation’s ability to aid them in learning how to prepare for meetings but also providing a dynamic situation where they had to rethink and adapt to the context and deal with incomplete information:

I learned how to design my question in an effective and efficient way before doing this and also I found out the answers might not go as I expected. This is because I designed the questions expecting them will give the answer I want, which when they did not, I had to rethink how could I ask on the spot, it was quite panicking but fun at the same time. (i2, s18)

Overall, both iterations of the simulation were positively received by students. However, significant improvements to the second iteration led to better results across all metrics, indicating the importance of an iterative implementation approach based on continuous improvement. The following sections discuss the lessons learnt and the implications for educators.

## **Discussion**

This study sought to trial and evaluate the use of mixed-reality technology in a business unit. The study focused on the student experience, including student satisfaction with the mixed-reality simulation, student perceptions of the authenticity of the simulation in replicating a real-world work environment, as well as how the simulation enabled students to both demonstrate their existing skills and develop further practical skills relevant to the workplace. The findings were mostly positive across each of these dimensions, suggesting that mixed-reality simulations can be used effectively in business education. Student responses to this learning activity support the use of a mixed-reality simulation, further supporting prior studies on simulations in general, which suggest such activities enable students to develop workplace relevant knowledge and skills (Chernikova et al., 2020) and demonstrate such skills to potential employers (Evans & Kerridge, 2021).

Although average student satisfaction ratings were high and most students rated the simulation experience positively, a minority of students were less satisfied. Qualitative responses suggest that satisfaction was impacted by student perceptions of the authenticity of the simulation and of practical skills development. In addition, the findings indicate that the novelty of this type of learning experience can be seen as positive by some students and negative for others, suggesting that familiarising students with the technology before the simulations may reduce dissatisfaction for some. This finding is consistent with research on the use of mixed-reality simulations in pre-service teacher training (Dittrich et al., 2022). The group nature of the simulation impacted some students’ satisfaction negatively, where they perceived that other students taking part in the same simulation did not prepare appropriately or participate sufficiently in the exercise.

Overall, most students reported the authenticity of the simulation to the real-world as high, yet this did not ring true for some students. Real-world replication is crucial for effective simulations (Perry & Robichaud, 2020) and we utilised a simplified approximation of practice (Grossman et al., 2009). However, some students found this too simplistic and requested more information and guidance for interacting with the avatars. Findings also suggest that student perceptions of the simulation’s authenticity can be impacted by gaps in students’ current knowledge of the real world that the exercise is replicating. For example, some students could not believe that real-world executives would not have all the relevant information or may not be able or willing to answer every question asked, which contributed to some students perceiving that the avatar executives did not act authentically. These comments suggest that

students may benefit from exposure to further learning that covers decision-making under uncertainty prior to the simulation.

The technology itself impacted the perceived authenticity of the simulation, with some students not finding the look and sound of the avatars believable. Indeed, several participants who discovered the control of avatars by one human actor felt that this knowledge impacted their ability to suspend disbelief during the session. Perceived authenticity can be negatively impacted where students believe that they are interacting with an automation rather than a human (Howell & Mikeska, 2021). This highlights the need for further understanding of the implications of what students know is going on behind the scenes of the simulation.

Likewise, alternative technology approaches also have attributes that impact on potential authenticity. For example, a low or no technology role-play simulation whereby teachers and/or students play the roles of interviewed executives requires students to suspend disbelief and accept the roles played by each party during class. However, many teachers and students may not have the acting skills and abilities that the professional actors operating the avatars in the mixed-reality exercise have. The simulation enables students to focus on the professional task rather than on acting (Dittrich et al., 2022). Furthermore, the authenticity of computer-programmed simulations can be negatively impacted using forced-choice menus (McGarr, 2020) that do not have the same flexibility as human responses allowed in a mixed-reality simulation. As such, in circumstances where proximity is not possible, such as having hundreds of students interact in small teams with a senior management team, mixed-reality simulations present an authentic and practical alternative.

The authenticity in these mixed-reality simulations is not just required in the interaction between students and avatars, but also between participating students. This was identified as an issue for some groups in our first iteration of the simulation, whereby students may not have met prior to the simulation to prepare and discuss their approach. We addressed this by introducing a more authentic professional approach in the second iteration, with students forming teams and preparing together prior to the simulation experience.

An early finding in this project is that to successfully navigate the simulation, students needed some complex skills that were not the initial focus of the simulation. These included interview skills and how to plan and participate in a business meeting. Training materials to support the development of these skills were created for the second iteration of the simulation, further demonstrating the value of an iterative process. Indeed, the need to reinforce collaborative teamwork and communication skills required to participate in simulations has been identified (Preston & Rosario, 2021).

### **Limitations and future research**

In addition to the technical and administrative issues previously outlined, another limitation of this study is the relatively small sample size for the quantitative component, which did not allow for a meaningful statistical comparison between iterations. However, the use of a descriptive longitudinal study approach (Williams, 2009), with the addition of student comments and reflections of the educators, allows a comprehensive review, rich with insights.

Further research is needed on the implications of this type of simulation and the achievement of learning outcomes, in different business disciplines and with larger student numbers, to enable more comprehensive statistical analyses. The broad range of perceptions on the simulation reported by students across all survey questions suggests future benefits in exploring the characteristics of students that navigate the simulation well and those that struggle, as has been performed in the pre-service teacher training field (Nickl et al., 2022).

## Recommendations to educators (practical contributions)

Our findings indicate that the use of mixed-reality simulations can be perceived by students as an effective teaching approach in business education. Introducing such an exercise requires additional work from teaching staff to learn the capabilities of the technology, develop the simulation scenario and coordinate with external suppliers or actors to operate the avatars in simulation sessions. Universities therefore need to provide the required teaching workload and budget to do so. As with the introduction of any new teaching technologies, appropriate technical support is required for teaching staff and students (Bennet et al., 2017). Introducing this type of simulation into the curriculum may take a few iterations to get right. Our experience shows that evidence from multiple sources, including student surveys, discussions with avatar operators and observation of a sample of simulation session recordings, can all be valuable in identifying areas for improvement.

Clear communication regarding how the simulation will run, and enabling students to see the avatars and how they interact with participants prior to the simulation, may potentially prevent some students being unable to accept the animated nature of the avatars. Depending on the simulation and the experience of students, they may need support developing communication, meetings and teamwork skills, to better enable them to successfully interact with both the avatars and their peers to achieve the objectives of the simulation.

## Author contributions

**Mark Pickering, Ryan Jopp, Melissa Wheeler, Cheree Toppie:** Conceptualisation, Literature review, Data collection and analysis, Writing – original draft, Writing – review and editing.

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