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Does behavior simulation based on augmented reality improve moral imagination?

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Abstract

Innovative learning techniques are needed, to match the expectations of the current audience to improve business ethics education for the twenty-first century. One of the innovative technologies which is believed to have a big effect on a bachelor's degree is augmented reality (AR). Incorporating AR into the modern education system is expected to produce optimal augmentation in the learning and teaching environment. This will have a large impact on increasing students' moral imagination. This study examines the use of AR-based behavior simulation, as an innovative technique for learning ethics, to improve moral imagination. This study employs a 3 × 2 experiment method, three training modes (AR-based behavioral simulation, paper-based-behavioral simulation, and no training) and two times (time one and time two) between- and within-subject factorial design. The subjects are 147 students on a business ethics course. The result of this study reveals that the use of AR-based behavior simulation can improve moral imagination.

Keywords Moral imagination · Simulation based · Augmented reality · Innovative technology

1 Introduction

Corporate and financial scandals increase every year (OECD 2015; Sullivan 2006), giving rise to a crisis in the credibility of members of the accountancy profession, and of managers and businessmen. This raises questions about the effectiveness of the teaching of ethics (Conroy and Emerson 2004; Mayhew and Murphy 2009). The business schools' pursuit of infusing ethical values into students is replete with challenges; among which is the problem that students may not readily grasp the

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relationship between ethics theories and real-world applications (Raman et al. 2019). To overcome this, innovative techniques, such as visual simulation tools, are needed (Fleig-Palmer et al. 2012).

Simulation-based learning is an innovative approach to learning, which provides more concrete experiences or learning practices by representing problems that occur in real business life, thereby increasing the students' immersion in learning (Jagger et al. 2016). Innovative delivery is in line with the expectations of the current audience, who are a millennial generation with an educational instrumentalist view (Raman et al. 2019) and look for investment returns from whatever they learn (Clayson and Haley 2005). One of the innovative technologies that has a big effect on a bachelor's degree is augmented reality (AR) (Garzón and Acevedo 2019). However, the use of AR in education at the undergraduate level is still very limited (Garzón et al. 2019). This study examines the effectiveness of AR-based behavior simulations for learning business ethics.

An effective ethics education is one that encourages students to have skills in ethical decision making (Simola et al. 2010). In the context of the teaching of ethics, behavioral simulation aims to improve the skills, confidence and practice of ethical decision making (Thorne LeClair and Ferrell 2000). In behavioral simulations, individuals will choose certain roles, understand the complexity and act on problems or opportunities created by the simulation's designers (Dunbar et al. 1992).

Behavior-simulation design using AR technology presents interesting interactions for users. Augmented reality is a technology that provides a crucial tool to enhance the experience of interacting with the real world (Garzón et al. 2019). The interaction with virtual content strengthens the imagination and creativity (Karamanoli and Tsinakos 2015; Kerawalla et al. 2006), in which creativity is an important antecedent of moral imagination (Whitaker and Godwin 2013). Through AR technology, users can feel virtual objects as if they really exist in the real environment, so making it easier for students to imagine and understand the consequences of their actions and how they affect the interests of stakeholders. Understanding the consequences of each action taken will increase moral imagination, namely the ability to imaginatively consider alternative actions and the consequences of those actions, by paying attention to the interests and feelings of others. (Johnson 1993). The greater the moral imagination is, the higher the moral sensitivity will be and ultimately this will shape ethical behavior (Moberg and Seabright 2000).

The use of innovative techniques aim to "leverage" wisdom in the process of understanding the relationship between theory and the real world, and encourage the fostering of collaborative ethics learning (McDonald et al. 2015). Specifically, this study examines if the use of AR-based behavior simulation, as an innovative technique for learning ethics, is able to improve people's moral imagination.

2 Literature review and hypotheses development

2.1 Moral imagination

The construct of moral imagination is defined as the ability to identify moral conflicts that are bound in a situation, and determine the stakeholders that are likely to be

affected by the situation, by developing alternative solutions from a moral perspective (Whitaker and Godwin 2013). Moral imagination, according to Vidaver-Cohen (1997), is the ability to develop new and imagined interpretations of unusual alternative solutions. Johnson (1993) stated that humans do not make decisions based on universal law, but rather they use moral imagination as a reflection of the dilemma in every situation. In other words, moral imagination is the ability of individuals to explore the role of the dilemma, and then provide alternative solutions so the impact will be felt by more than one party. Scholars in the area of ethics have found moral imagination is a critical capability for innovative decision making, that needs to be learnt to help a person to avoid morally questionable actions and to allow a person to make decisions that contribute positively to the welfare and social enterprise of others (Caldwell and Moberg 2007; Moberg and Seabright 2000; Werhane 1998, 1999, 2002).

Moral imagination is drawn from the conceptualization of pragmatic ethics, which focuses on one's everyday life experiences that are historically and socially embedded (Fesmire 2003; Krebs and Denton 2005). Moral imagination includes at least four processes: (1) The ability to break away from the current role, situation and context. (2) To be aware of the type of scheme or action chosen in a particular context. (3) To creatively imagine new possibilities, to find new ways or alternative solutions to solve the ethical dilemmas that occur. (4) The ability to evaluate the old context and scope and find new possibilities. In other words, moral imagination is not only about awareness of the moral implications of one's actions but also the ability to reframe the situation and create moral alternatives to overcome the problems that occur (Werhane 1998).

Theoretically, moral imagination is related to a systemic multiple perspective approach, which consists of: (1) Focusing on the network of relationships and patterns of interactions between stakeholders compared to individual components. (2) The analysis of several perspectives. (3) Understanding several perspectives, including managers, communities, companies, countries, law, culture, institutional backgrounds, history, and other networks. (4) Evaluating perspectives by using several questions: Who are the stakeholders that should be prioritized? Who are the stakeholders that should not be prioritized? What are the stakeholders' values? What are the good and bad impacts for stakeholders? (5) Pro-active leadership in the system and the initiation of structural change (Werhane 2002).

2.2 Teaching technique in ethics education

In studying ethics, passive learning and active teaching methods can be used (O'Leary and Stewart 2013). Passive learning is learning that does not actively involve students (Dewey 1938). Passive ethics training is recommended for absolute moral reinforcement. Some passive technical examples in ethics training for accountants include lectures with notes, exercises, guest lecturers, examinations, vignettes and watching videos (O'Leary and Stewart 2013).

Active teaching techniques are the incorporation of active and participatory learning (Hawtrey 2007). Active learning has the characteristics of the delegation of some responsibilities and controls from the teacher or instructor to the students, to make decisions about what material will be learned and how they will learn (Adler and Milne 1997). Active learning includes class discussions, case studies, group work, and role playing. With the development of technology, active learning can use computers for

such things as interactive games, computer-based behavior simulations, and case studies (O'Leary and Stewart 2013). Previous research has found that active learning does increase people's ability to make ethical decisions (O'Leary and Mohamad 2008).

2.3 Business ethics simulation learning

One method of active learning is the use of simulations. Simulation is all of the artificial environments that are created to enhance one's experience of certain realities (Bell et al. 2008). Simulation-based learning (SBL) comprises of artificial environments created to instill certain competencies, such as attitudes or skills, which will improve the performance of the trainees. SBL is a training approach that provides opportunities for participants to develop and practice the competencies needed, and get feedback (Salas et al. 2008). There are three main categories of SBL: role-playing simulation, physical-based simulation, and computer-based simulation (Summers 2004).

Effective ethics learning is learning that helps students to have the skills needed for making ethical decisions (Simola et al. 2010). Jagger et al. (2016) found that learning ethics using case-based visual simulations was able to build concepts and ethical decision-making skills. According to Salas et al. (2008), there are several advantages of simulation-based learning: (1) It shortens the learning time. (2) It is able to provide a complex reality model that enables training participants to practice their skills and competencies. (3) It provides a balance between the complexity of the real world and the simplification of training strategies (Salas et al. 2008). (4) It provides a (relatively) risk-free environment for learning.

Buck (2014) defined simulation as a symbolic representation to replicate behavior systems. Behavioral simulation in business ethics is a simulation that uses a symbolic model of a business entity or process, to mimic the situation of business actors when making business decisions where the decision has ethical implications. LeClair and Ferrell (2000) provided empirical evidence that behavior simulation can improve ethical decision-making skills. Behavioral simulation was found to be an effective learning method for business classes, because it is experiential learning that brings the concept of textbooks to life (Hofstede and Minkov 2010). Further, Buck (2014) stated that behavioral simulations aim to: (1) Provide an understanding of the complexities of business ethics by feeling the challenges of doing business in a morally complex and ambiguous environment. (2) Increase the ability to recognize and articulate the ethical implications of business decisions by experiencing a conflict between the goals of maximizing profits and responsibilities to stakeholders. (3) Enhance the ability to see business decisions from various stakeholders' perspectives. (4) Cultivate caution and humility when criticizing other people's moral decisions when the person is in a dangerous, complicated and ethical dilemma, so as to avoid hindsight bias.

In summary, the previous discussion suggests that simulation-based learning enhances the ability to view business decisions from the viewpoints of the various stakeholders. These capabilities will improve the moral imagination, which is the ability to imagine the impact of an action on the interests and feelings of others. Therefore, the following hypothesis will be tested:

H1: There is a significant difference in moral imagination between the groups who are trained using behavioral simulations compared to who are not trained.

2.4 Augmented reality (AR) technology for education

The increasing use of mobile devices has led to the increased use of AR technology in various fields such as medicine, tourism, industry and education (Mekni and Lemieux 2014). AR is a technology that combines real and virtual objects in a real environment interactively, in real time and synchronizes real and virtual objects with each other (Azuma 1997).

Garzón and Acevedo (2019) conducted a meta-analysis of the effectiveness of AR in learning. Their results of the meta-analysis show AR technology is more effective than other technological resources (for example, videos, images, animations, video conferences), traditional lectures (curriculum-based teaching and lecture-based teaching), and traditional pedagogical resources (no multimedia resources) (Garzón and Acevedo 2019). Augmented reality has a strong influence on learning outcomes when performed in an informal, rather than a formal, environment (Garzón and Acevedo 2019).

AR has 3D components and videos that can help students better understand the learning content (Yoon 2012) and AR also helps understand abstract concepts and unobservable phenomena (Wu et al. 2013). Earlier research found AR technology provides many advantages when applied to the world of education (Cheng and Tsai 2013). For example, AR helps students explore the real world (Dunleavy et al. 2009), AR facilitates the understanding of things that cannot be easily observed with the naked eye, by displaying virtual elements (Wu et al. 2013).

The use of AR causes the students to become more immersed in the learning environment (Chang et al. 2014). AR facilitates students practicing making their own decisions (Muñoz-Cristóbal et al. 2015). Augmented reality has a big influence on undergraduate students, compared to primary and secondary education level students (Garzón and Acevedo 2019). AR increases students' motivation and helps them obtain better investigative skills (Sotiriou and Bogner 2008) and improves their learning performance (Chang et al. 2014; Chiang et al. 2014). Based on the several advantages provided by AR, the behavior simulations developed in this study use AR technology. An AR-based simulation is the use of symbolic models using AR technology that aims to replicate system characteristics through the use of simple object representations.

2.5 Augmented reality-based media effect on behavior

The model of the theory of interactive media effects explains that media characteristics are correlated with human psychology, which then translates into immersive experiences which ultimately impact on affective, cognitive and behavioral responses (Sundar et al. 2015). There are two main characteristics of AR: interactivity and augmentation (i.e. combining virtual objects with physical environments) (Javornik 2016). The interactive characteristics of computer-based media are one of the most crucial features (Eveland 2003; Fortin and Dholakia 2005; Liu and Shrum 2002; Novak and Hoffman 1996).

The concept of interactivity was developed on two sides: the media features and user-based perceptions (Mollen and Wilson 2010). Feature-based interactivity emphasizes features as a driver of interactivity, or interfaces functionality that enables the synchronization of communication (Steuer 1992; Sundar 2004). Whereas user-based interactivity emphasizes the perceptions of the technology user's experience (Cyr et al. 2009). Previous research showed that interactivity has a strong impact on consumer responses, through mediating consumer experiences, such as immersion, enjoyment

and trust (Gao et al. 2009). High interactivity will result in higher loyalty (Cyr et al. 2009). Van Noort et al. (2012) showed that user-perceived interactivity on computer-based media had an impact on cognitive, behavioral and emotional responses. Javornik (2016) tested the augmentation effect of AR and found that augmentation affected the user's attitude, cognition and intention to use it again, and to tell friends about it.

2.6 Augmented reality media effect on moral imagination

AR has the ability to change the learning process. Academics argue that actions are needed to incorporate AR into the modern education system (Yuen et al. 2011) because it can produce the optimal augmentation for the learning and teaching environment, which will have a large impact on increasing the students' creativity and future academic careers (Billinghurst et al. 2001). Students can interact with virtual content, which strengthens their imagination, creativity, involvement, motivation and learning (Karamanoli and Tsinakos 2015; Kerawalla et al. 2006). AR can be combined in various ways such as AR books and AR games. AR books can combine the real and virtual worlds and present interesting digital content through 3D images and sound, as a refinement to traditional books. Users can immerse themselves in the material in books that can encourage imagination, creativity, and work by reading (Tomi and Rambli 2013). The use of AR in games not only increases collaboration, creativity and imagination, but it is also a source of acquiring knowledge (Moschini 2008). The use of AR in learning increases levels of independent thinking, creativity, and critical analysis (Bower et al. 2014).

Based on the model of the theory of interactive media, media characteristics have an impact on affective, cognitive and behavioral responses (Sundar et al. 2015). The characteristics of AR media are that interactivity and augmentation have a large impact on increasing creativity (Bower et al. 2014; Karamanoli and Tsinakos 2015; Kerawalla et al. 2006; Moschini 2008).

The social cognitive theory (SCT) provides a theoretical basis explaining the role of individual differences in a person's ability to recognize moral problems. Based on the SCT, Whitaker and Godwin (2013) found that creativity is an important antecedent of moral imagination. In a decision-making process, creativity allows individuals to imagine and produce more alternative decisions, and to imagine the impact of each alternative on the stakeholders. Creativity increases one's ability to articulate alternatives and to imagine empathically the impact of the alternative actions on the interests of others. Therefore, creativity can facilitate the process of moral imagination (Johnson 1993; Werhane 2002).

In summary, the previous discussion provides information that media characteristics have an impact on affective, cognitive, and behavioral responses. The characteristics of AR media are its interactivity and augmentation, which have a large impact on increasing creativity as this is an important antecedent of moral imagination. Therefore, the following hypothesis will be tested:

H2: There is a difference in moral imagination between the group who are trained using AR -based behavior simulations compared to those who are trained using paper-based behavior simulations.

3 Research method

3.1 Research design

In order to get a deeper understanding of how augmented reality affects moral imagination, we adopted an experimental method. This experimental method is used to investigate a phenomenon by manipulating the conditions and eliminating the different effects of the noise variables, to show the pure effect from the manipulation (Opp 1970). In other words, this method allows us to control the variables of interest (AR-based simulation, paper-based simulation, and no simulation), and permits us to make cause-and-effect conclusions. This will increase the internal validity of this study.

This study employed a 3 × 2 experiment method; three training modes (AR-based behavioral simulation, paper-based behavioral simulation, and no training) and two times (time one and time two) between and within-subject factorial experimental designs. Time one is when the participants attend the first training (none of the subjects get a treatment) and time two is after the training was completed (after some participants get a treatment, either an AR or paper-based simulation; and some get no treatment, i.e. the control group). For the between-subject design, the subjects were randomly assigned to the three groups. Additionally, each participant filled out a pre- and post-survey. In the pre-survey, the participants were asked to complete a moral imagination test. After the pre-survey, the participants received simulation-based ethics behavior training. This training was conducted for 2 weeks; the material provided was related to ethics theories, the ethical decision-making process, stakeholder analysis, corporate governance, and corporate social responsibility. After the ethics training, each participant responded to the measurement of moral imagination. An improvement in the measurement of moral imagination is calculated by comparing the increase in scores (post test - pre test) between the three groups. In the within-subject design, we compared the difference between the pre-test and post-test scores for the subjects' moral imagination.

3.2 Subjects

The study's subjects are 147 students who have taken a business ethics course. The subjects were randomly assigned to the treatment and control groups. In the treatment group, which is the group that received training, the participants were further divided into two groups. Group 1 was given a case of behavior simulation using AR technology; whereas group 2 was given a paper-based behavior simulation. A paper-based behavior simulation uses symbolic representation to replicate a system's behavior using

Table 1 Treatment conditions

	Treatment conditions	Frequency	Percentage
1	Augmented reality (A)	47	32%
2	Paper based (B)	52	35%
3	No training (C)	48	33%
	Total	147	100%

Table 2 Descriptive Statistics of Individual Characteristics

Training format	Gender		Age		Work experience		GPA	
	Male (%)	Female (%)	Mean (year)	SD	Mean (year)	SD	Mean	SD
Augmented reality (A)	7.69%	92.31%	20.42	1.27	0.32	0.56	3.81	0.50
Paper-based (B)	7.69%	92.31%	20.08	0.88	0.23	0.45	3.75	0.68
No training (C)	26.08%	73.92%	20.06	0.87	0.29	0.46	3.85	0.55

just a pencil and paper, without computer technology, while an AR based simulation uses AR technology. The control group was comprised of students who did not attend ethics training based on the behavioral simulations. Table 1 shows the number of participants in each group.

Table 2 illustrates the individual characteristics in both the treatment and control groups.

Post hoc analysis (not presented in Table 2 shows there is no difference in age between the group of students taking AR-based behavioral simulation training (A) and the group of those taking paper-based behavioral simulation (B) ($t = -1.53$; $p = 0.13$). Likewise, there is no age difference between group A and group C (the group not participate in the training) ($t = -1.64$; $p = 0.11$). There is also no significant difference in work experience between groups A and B ($t = -0.87$; p 0.38) and between groups A and C ($t = -0.29$; $p = 0.77$). Finally, there is no significant difference in GPA between groups A and B ($t = -0.53$; $p = 0.61$) and between group A and C ($t = 0.381$; $p = 0.74$).

3.3 Stimulus

Behavior simulation is built on two axioms: simulation is the best way to teach ethical principles to students; and this can be achieved by presenting ethical dilemmas to students (Buck 2014). This scenario is based on ethical dilemma situations that might be encountered by a financial department's employees in the business world. The scenario was developed by the researchers, and based on a real case in a public company: "Whistleblowers: Heroes or Prize Hunters?"[1] The case contains an ethical dilemma faced by a financial controller (FC) who is involved in money laundering and is a fugitive from the police. In his escape abroad, the FC also took important company documents and internal data relating to tax evasion cases carried out by the public company. The FC faces two choices, whether the FC will choose to become a "hero" by becoming a whistleblower for the corporate tax evasion cases or choose not to become a whistleblower. The participants perform simulations as the FC and are asked to choose one of the two options Fig. 1.

If a participant chooses the option to become a whistleblower, then the participant will surrender himself to the police, undergo the due legal process, and receive a suspended sentence even though he and his family face death threats because he provided evidence of the company's crimes. If a participant chooses the option of not

[1] The case is in Indonesian language as the participants are Indonesian; it is available upon request.

Fig. 1 Situation if participants choose to become whistleblowers

becoming a whistleblower, then even though he can run away with the stolen money, he will continue to be an international fugitive Fig. 2.

After making a choice, the participants are required to identify the impact of their chosen actions on the state, society, family, shareholders, directors, company employees, and other stakeholders. Several distinguished faculties in the field of ethics have reviewed the scenario and assess that the case represents the reality.

This study uses a AR-based behavior simulation, developed by the Research Institution of the Yogyakarta State University, Indonesia. This innovative technology

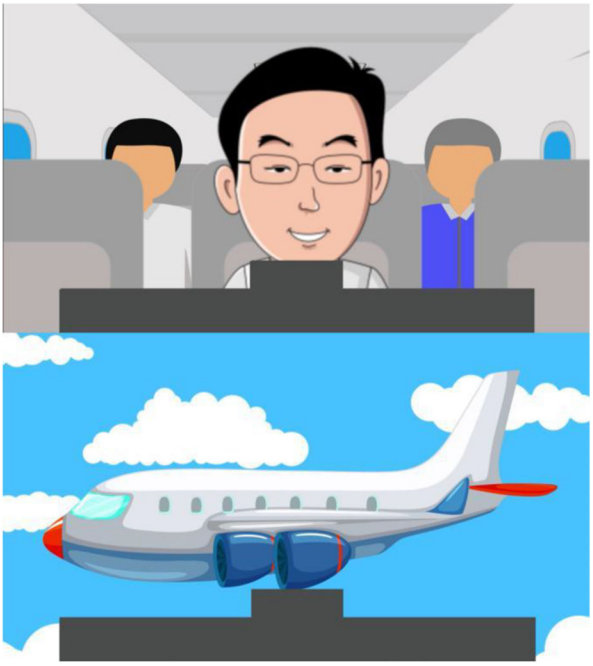


Fig. 2 Situation if participants choose not to be a whistleblower

has obtained a copyright from the Ministry of Law and Human Rights of the Republic of Indonesia, with the copyright number being No. 00122829.

3.4 Development of AR-based behavioral simulation

The application's development used the ADDIE Instructional Design and refers to Branch (2009) with five main phases, namely: Analyze, Design, Development, Implementation, and Evaluation. The analysis phase is to determine the problem and the appropriate solution to improve moral imagination through AR-based behavior simulation. This stage includes data and content needs identification, functional requirements, and specification needs analysis. In the specification analysis, we use Android-based devices with different series, ranging from Kit-Kat to Pie version and various screen dimensions.

For the design phase, in the Unified Modeling Language (UML), a use-case diagram is used to summarize the details of the system's users (also known as actors, who in this study are the participants), and the participants' interactions with the system. The use-case diagram for the development can be seen at Fig. 3.

The development stage uses Adobe Premiere CS6 to create the video and animation for the content. Corel Draw X7 and Adobe Photoshop CS6 are used for designing the interface and Unity 3D for processing the video, animation, program scripts and other technical aspects. Vuforia SDK (Software Development Kit) is employed in the development as a plugin on unity that allows us to scan the image.

Before the implementation, the application was tested for its functionality, compatibility and performance. The result of those tests reveal the application works well and is compatible for use on the different android devices and had a good performance related to the memory and battery's efficiency. Implementation is carried out for students who take business ethics training. Finally, an evaluation was needed to evaluate whether AR-based behavioral simulations enhance students' moral imaginations.

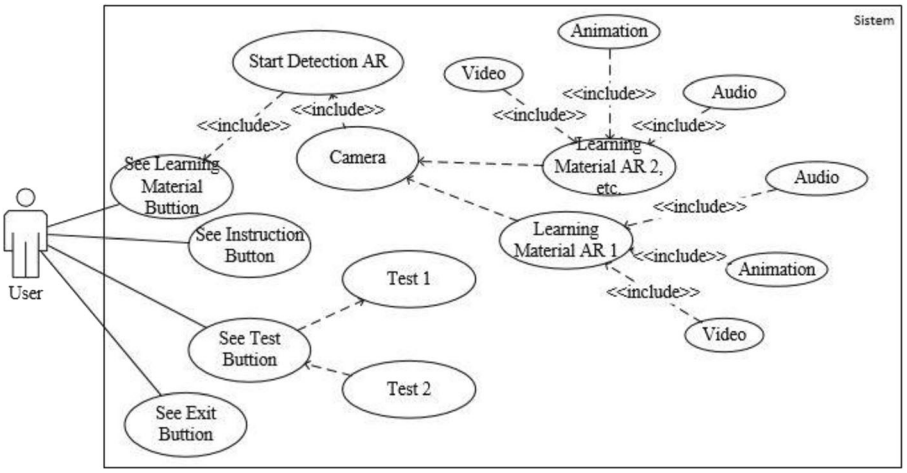


Fig. 3 Use-case diagram

3.5 Moral imagination measure

The operational definition and the measurement of moral imagination is adopted from Whitaker and Godwin (2013). Moral imagination is defined as the ability to identify moral conflicts, to develop alternative solutions from a moral perspective, and to determine the affected stakeholders. Each participant is given a case containing an ethical dilemma in a particular business, and then the participants are asked to imagine that they are in a position to make a decision. Finally, the participants are asked to answer the following three questions: (1) Make a list of the actions that they will take in the situation with ethical dilemmas. (2) Describe the moral issues that are important to consider when making decisions on the actions they choose. (3) Identify who will be affected by their decision and how they will be affected.

As the measurements used are open-ended responses, coding is required to transform the qualitative data into quantitative data that can be used for the subsequent statistical analysis. Three coders (one of the researchers and two assistants) undertook the coding. All the coders were extensively trained in order to facilitate a shared mental model. The coders independently assessed the participants' responses. If there was a discrepancy between the coders, a consensus was sought via discussions. After reaching an agreement, the aggregate score of the three coders was used as a measure of moral imagination for each participant Fig. 4.

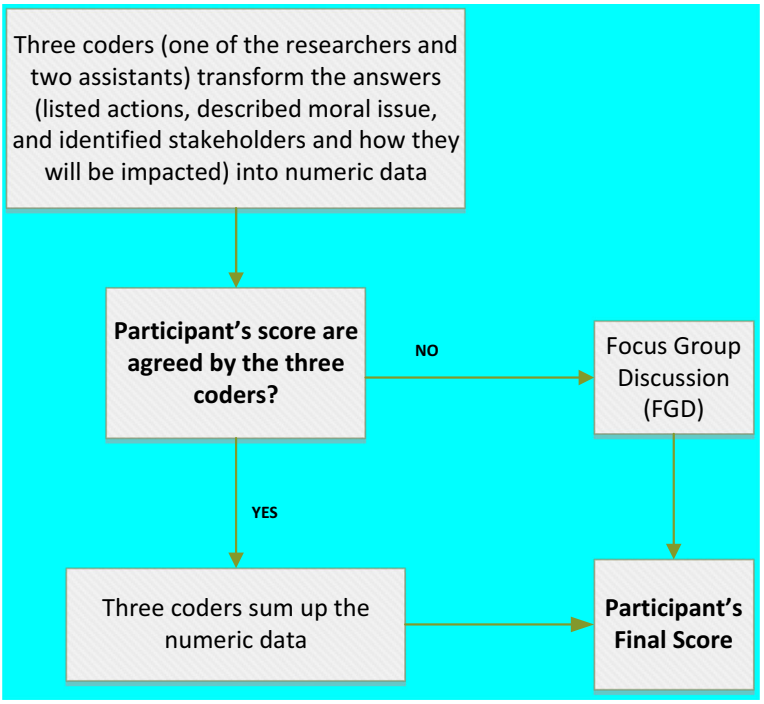


Fig. 4 Flow chart model for moral imagination's measurement

4 Results

4.1 Hypotheses testing

To test the hypotheses, ANOVA was used to compare the average scores of the participants who took AR-based behavior simulation training, paper-based behavior simulation training, and no training.

There are no significant differences for the average moral imagination at the start of the experiment (time one) between the treatment groups (A, B) and the control group (C). The moral imagination difference of group A and B for time one is not significant (mean difference = 0.03; $p = 0.98$), the difference of group A and C is also not significant (mean difference = 0.13; $p = 0.85$). Likewise, the difference in moral imagination of group B and C is also insignificant (mean difference = 0.16, $p = 0.89$). This is consistent with our expectations, because the ethics training stimulus did not exist at time one. Therefore, we are confident that if there are any differences in moral imagination at time two, they are caused by our treatment.

The results of our ANOVA analysis are presented in Table 4. The results of between-subject tests are shown in Table 4 panel A. The table shows there is a marginally significant effect of the ethics training methods ($F = 2.46$; $p < 0.10$) on moral imagination (See panel A). Within-subject tests (Table 4 panel B) reveal there is a marginally significant effect of the time variable ($F = 3.22$; $p < 0.10$) which indicates an increase in the participants' moral imagination between time one and time two. From Table 4 panel B, it can also be seen that the variable of the ethics training method is significant ($F = 7.55$; $P < 0.01$), indicating there are differences in the moral imagination among the participants who participated in the behavioral simulation and no training. The interaction effect of ethics training methods and time is significant ($F = 3.87$; $p = 0.05$). This indicates that the participants who participated in the ethics training method using behavioral simulation had a greater increase in their moral imagination from time one (mean = 8.08; SD = 3.85) to time two (mean = 10.28; SD = 3.03) for the AR-based simulation, and from mean = 8.11; SD = 3.71 in time one to mean = 9.38; SD = 3.17 for the paper-based simulation than the increase for those who did not receive any form of behavioral simulation training from time one (mean = 7.95; SD = 2.16) to time two (mean = 8.08; SD = 2.12), see Table 3. Therefore, Hypothesis 1 which states

Table 3 Mean and standard deviations

Dependent variable Moral imagination	Time 1			Time 2		
	Mean	SD	N	Mean	SD	N
Training format						
AR-based (A)	8.08	3.85	26	10.28	3.03	21
Paper-based (B)	8.11	3.71	26	9.38	3.17	26
No training (C)	7.95	2.16	24	8.08	2.12	24

Table 4 Result of ANOVA

	Effect	F-value	Df	*p* value
Panel A				
Between-subject	Ethics Training Method	2.46*	2	0.08
Panel B				
Within-subject	Time (T)	3.22*	1	0.07
	Ethics Training Method (E)	7.55**	1	0.00
	T x E	3.87*	1	0.05

that there is a significant difference of moral imagination between the groups who are trained using behavioral simulations compared to those who are not trained, is supported Table 4.

Next, a post hoc analysis test is conducted to find out whether the AR-based or paper-based behavioral simulation, or no training groups differ significantly in their moral imagination. The results of the post hoc analysis in Table 5 show that there are significant differences in the moral imagination between the participants who did not participate in behavioral simulation-based training (no-training) and those who participated in AR-based behavior simulations (mean difference = 1.23; $p < 0.05$; see panel A). Participants who received AR-based behavioral simulation had higher moral imagination than those who did not attend the training. Paper-based behavioral simulation, however, did not succeed in increasing the moral imagination of the participants.

Further, Table 5 shows the difference in moral imagination based on the learning media used in the behavioral simulations. The table shows those who did ethics training using an AR-based behavioral simulation had a marginally significant higher moral imagination (mean difference = 1.06; $p < 0.10$; see panel B) than participants who participated in a paper-based behavioral simulation training. Therefore, Hypothesis 2 which states there is a difference in moral imagination between the group who are trained using AR technology behavior simulation compared to those who are trained using paper-based behavior simulation, is marginally supported.

Table 5 Post hoc analysis

Ethics training methods		Mean Difference	p value
Panel A			
No Training	Paper-based	0.17	0.77
	AR-based	1.23**	0.04
Panel B			
Paper-based	No Training	0.17	0.77
	AR-based	1.06*	0.07

5 Conclusion

This paper responds to the growing recognition of the importance of innovative learning that matches the millennial generation's learning styles. This study examines if the behavior simulation based on AR has an impact on increasing moral imagination. The results confirm that AR-based simulation-based learning can improve the moral imagination, compared to no simulation (no training). However, the result only marginally improves the moral imagination, compared to the paper-based simulation. These partially support Jagger et al. (2016), who said that behavioral simulations provide real experiences and present problems that occur in business practices, thereby increasing the students' immersion in learning.

The possible explanation for why the difference in the improvement of moral imagination between paper-based and AR-based simulations is only marginally significant, or at a level of $p < 10\%$, is because this study does not distinguish between the learning styles of the participants. O'Leary and Stewart (2013) and Proserpio and Gioia (2007) stated that the teaching methods should match with the learning styles to make teaching effective. Proserpio and Gioia (2007) classified learning styles as being verbal, visual, or virtual. It is possible that some participants who took part in the AR-based simulation have a verbal learning style, so that they did not really match the teaching method used.

6 Discussion

One of the challenges hindering business schools' efforts to instill ethical values in students is the lack of understanding of the relationship between ethics theory and its application in the real world. Therefore, innovative techniques in teaching and learning are needed. One of these innovative techniques is technology-based simulations that will provide more concrete experiences or learning practices by representing problems that occur in real business life to increase the students' immersion in learning.

This research provides a subtle contribution based on the theory of interactive media effects. Our findings indicate that the use of AR-based behavioral simulation can foster moral imagination. The interactivity and augmentation characteristics of AR media have an impact on behavioral responses. The use of AR technology enhances creativity (Moschini 2008), which is an antecedent of moral imagination (Whitaker and Godwin 2013). In ethical decision making, creativity enables students to imagine alternative actions for dealing with ethical dilemmas and how the impact of certain actions affects stakeholders. Creativity is able to increase the ability to imagine the impact of each action on others, therefore it can facilitate the process of moral imagination (Johnson 1993; Werhane 2002) .

This research also has implications for business-ethics education in three important areas. First, the use of virtual technology-based media is likely to be more suited to the learning styles of the new millennial generation; hence it can produce effective learning. This is evidenced by the moral imagination of participants who use AR-based media, which is higher than those who do not use it. Second, the use of AR-based learning simulation offers an environment that reflects the real business world

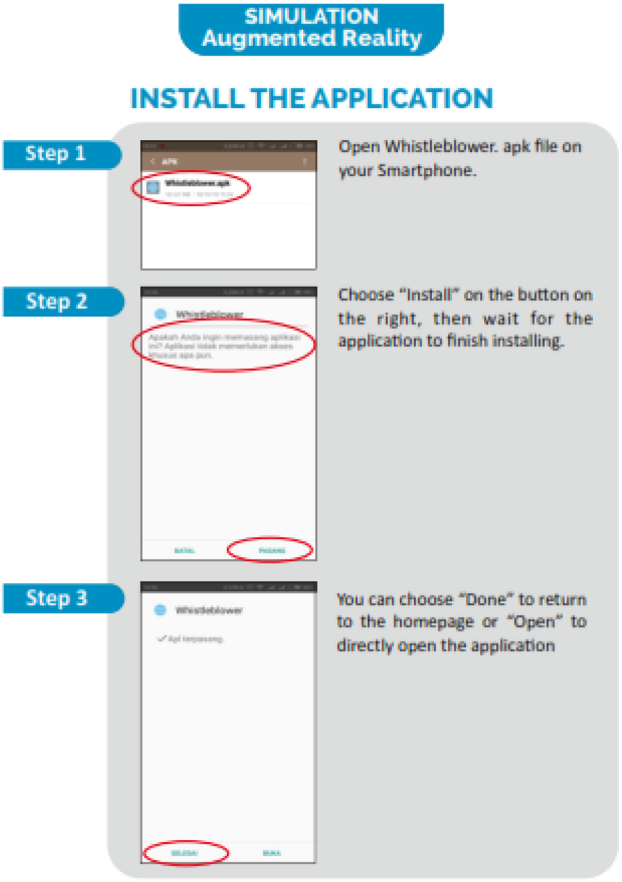
where students can experiment and understand the degree of ethical consequences of the actions selected. More importantly, students can apply ethics theories to solve ethical dilemmas in the business world without leaving home and/or school. Third, pragmatically, responding to the health and economic crises caused by COVID-19 recently, AR-based media enables students to conduct active learning without the physical presence of teachers or faculties. AR technology-based learning media can play a role in reaching students who currently have to study at home. This method provides opportunities for students to be more interactive in understanding the ethical dilemmas that occur in the work environment.

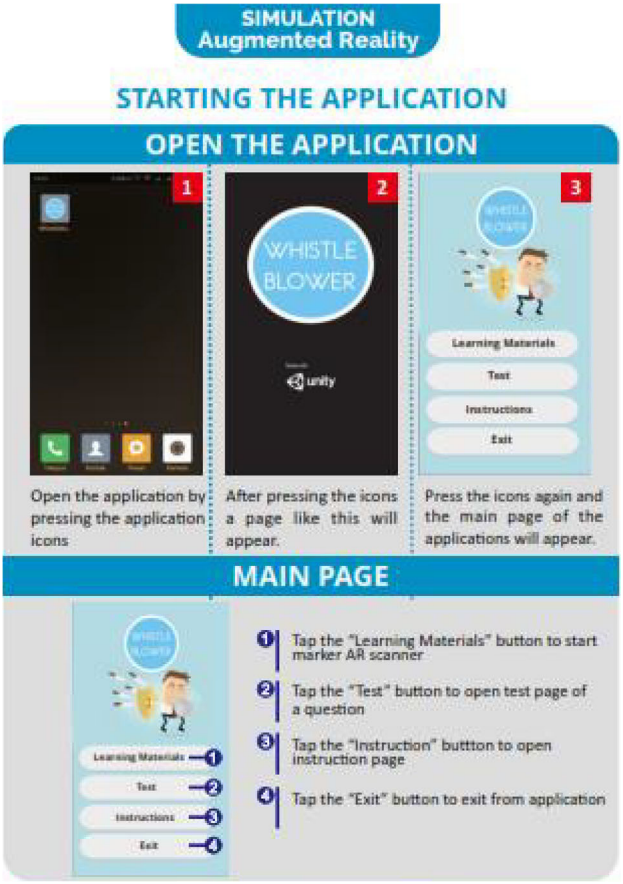
6.1 Suggestions for future research

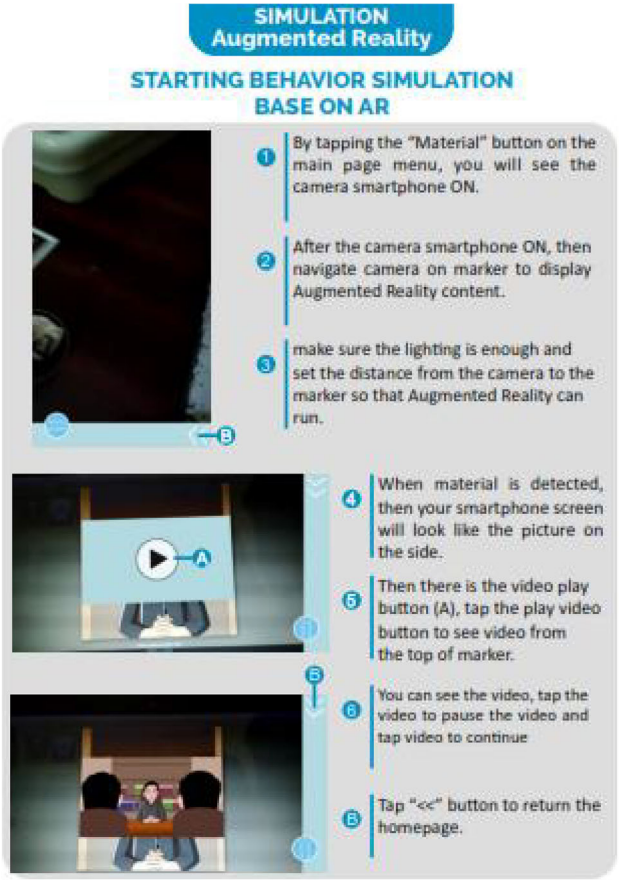
Future research can compare the effectiveness of AR-based behavior simulation with other forms of training such as games, interactive online training, or video style training. Additionally, any future study should consider the learning styles of its participants. Finally, in the current study, the scenario only used the whistleblower case. Other areas of ethics could be tested to expand the research's results.

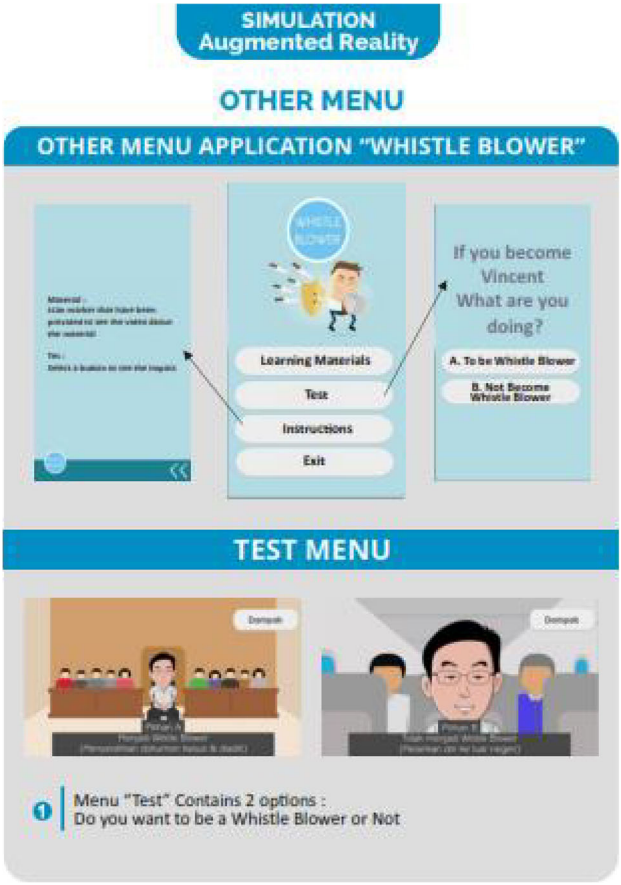
Appendix

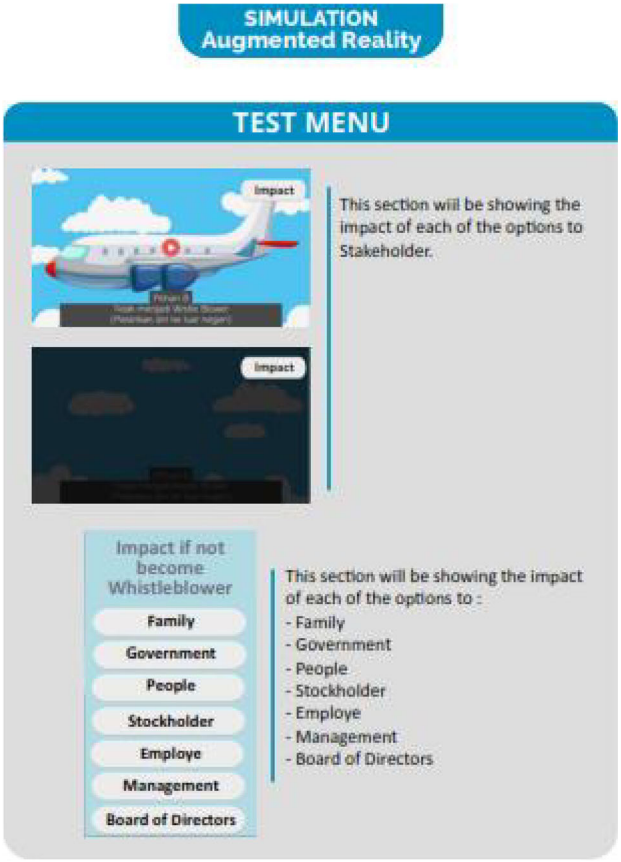
Manual of Behavior Simulation Based on Augmented Reality.




SIMULATION
Augmented Reality
STARTING THE APPLICATION
OPEN THE APPLICATION
1
2
3
WHISTLE BLOWER
unity
Learning Materials
Test
Instructions
Exit
Open the application by pressing the application icons
After pressing the icons a page like this will appear.
Press the icons again and the main page of the applications will appear.
MAIN PAGE
Learning Materials
Test
Instructions
Exit
Tap the "Learning Materials" button to start marker AR scanner
Tap the "Test" button to open test page of a question
Tap the "Instruction" buttton to open instruction page
Tap the "Exit" button to exit from application


SIMULATION
Augmented Reality
STARTING BEHAVIOR SIMULATION
BASE ON AR
By tapping the "Material" button on the main page menu, you will see the camera smartphone ON.
After the camera smartphone ON, then navigate camera on marker to display Augmented Reality content.
make sure the lighting is enough and set the distance from the camera to the marker so that Augmented Reality can run.
B
A
When material is detected, then your smartphone screen will look like the picture on the side.
Then there is the video play button (A), tap the play video button to see video from the top of marker.
You can see the video, tap the video to pause the video and tap video to continue
Tap "<<" button to return the homepage.


SIMULATION
Augmented Reality
OTHER MENU
OTHER MENU APPLICATION "WHISTLE BLOWER"
Learning Materials
Test
Instructions
Exit
If you become Vincent What are you doing?
A. To be Whistle Blower
B. Not Become Whistle Blower
TEST MENU
Menu "Test" Contains 2 options :
Do you want to be a Whistle Blower or Not



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