Academical: A Choice-Based Interactive Storytelling Game for Enhancing Moral Reasoning, Knowledge, and Attitudes in Responsible Conduct of Research

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Abstract Responsible conduct of research (RCR) is an essential skill for all researchers to develop, but training scientists to behave ethically is complex because it requires addressing both cognitive (e.g., conceptual knowledge and moral reasoning skills) and socio-affective (e.g., attitudes) learning outcomes. Both classroom- and web-based forms of RCR training struggle to address these distinct types of learning outcomes simultaneously. This chapter presents a pair of experiments providing initial evidence that playing a single brief session of *Academical*, a choice-based interactive narrative game, has positive effects on all three key RCR learning outcomes. Our results highlight that utilizing a choice-based interactive storytelling game is a uniquely effective way to holistically address RCR learning outcomes that drive ethical research behaviors.

Key words: Academical, interactive narrative, learning, engagement, ethics

1 Introduction

Responsible conduct of research (RCR) comprises fundamental ethical topics that inform all aspects of the research process, making it an important concept that warrants study of and improvement to existing training tools [Kalichman, 2014]. However, ethics in research can be complicated by many factors such as power dynamics and marginalized identities [Melcer et al., 2020a, Melcer et al., 2020b]. As a result, RCR requires understanding a variety of perspectives and dilemmas that impact under-

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lying research ethics [Kalichman and Plemmons, 2007, Shamoo and Resnik, 2009]. This makes topics such as RCR difficult to teach due to the complexity of applied ethics and ethical decision-making [Bouville, 2008], the need for moral reasoning [Schmaling and Blume, 2009], and the lack of existing educational tools that are motivating and foster critical thinking [Kalichman, 2014]. While past work has attempted to address these issues through alternative learning approaches such as group mentoring [Whitbeck, 2001] and role-playing [Brummel et al., 2010, Seiler et al., 2011], these issues have still remained largely unaddressed—resulting in ill-defined content, format, and goals, as well as minimal evidence for effectiveness [Kalichman, 2013]. Furthermore, traditional educational RCR tools suffer from a notable lack of user engagement and motivation with students [Kalichman, 2014].

Conversely, in the context of educational games, choice-based interactive storytelling is a popular format for narrative videogames [Friedhoff, 2013, Murray, 2018, Salter, 2016]. There have even been educational interactive narratives designed specifically to teach issues related to ethics [Hodhod et al., 2009], although they have yet to be evaluated for effectiveness. Interactive storytelling (and educational games in general [Keehl and Melcer, 2019, Melcer et al., 2017, Melcer and Isbister, 2018]) have also been shown to increase engagement/motivation and learning for more rote topics with clearly defined answers and educational outcomes, such as in the areas of STEM [Rowe et al., 2011, Weng et al., 2011, Zhang et al., 2019]. However, past work has not fully examined the capabilities of choice-based interactive storytelling games in teaching more ambiguous concepts such as moral reasoning and ethical decision-making.

Interactive storytelling games may be an effective supplemental training tool for addressing the above issues with RCR education. Specifically, we hypothesized that the choice-based, role-playing nature of interactive storytelling games could be employed to improve student engagement as well as cognitive and socio-affective learning outcomes. As a result, we created *Academical*, a choice-based interactive storytelling game for RCR education that allows players to experience a story from multiple perspectives and practice ethical decision-making (see Figure 1). In this chapter, we discuss the design of *Academical*, and provide results from a pair of initial studies evaluating the game's efficacy for teaching RCR learning outcomes. The first study compares our web-based game with traditional web-based educational materials from an existing RCR course at the University of Utah with respect to their engagement and efficacy for teaching RCR knowledge and moral reasoning skills. The second study explores whether *Academical* can also improve attitudes about RCR and how players' engagement with the game relates to their attitudes. We conclude with a discussion of combined results from both studies and their implications for the usage of choice-base interactive storytelling games for holistically teaching both cognitive and socio-affective learning outcomes of ethically complex content.

2 Background

2.1 Interactive Storytelling and Learning

Prior work has argued for interactive storytelling's power in terms of evoking empathy [Bratitsis, 2016, Salter, 2016, Samuel et al., 2017],[1] providing therapeutic benefits [Dias et al., 2018, Starks et al., 2016], and enabling learning experiences through educational games [Camingue et al., 2020, Danilicheva et al., 2009, Melcer et al., 2015, Nguyen et al., 2018, Weiß and Müller, 2008]. Specifically, narrative/storytelling is an important element that can be incorporated into educational games in order to maintain and increase students' motivation [Dickey, 2006, Padilla-Zea et al., 2014, Rowe et al., 2011], with some suggesting that integration of a good story into an educational game will determine its success or failure [Göbel et al., 2009]. Interactive storytelling has been incorporated into a number of educational games focusing on topics such as history [Christopoulos et al., 2011, Song et al., 2012], STEM [Danilicheva et al., 2009, Weng et al., 2011, Zhang et al., 2019], and bullying [Aylett et al., 2005, Watson et al., 2007]. However, the majority of research on educational interactive storytelling games has focused on adaptivity [Göbel and Mehm, 2013, Kickmeier-Rust et al., 2008], interactivity [Song et al., 2012, Zhang et al., 2019], emergent narrative [Aylett et al., 2005], player and knowledge modeling [Magerko, 2007, Rowe and Lester, 2010], narrative planning and generation [Hodhod et al., 2011, Riedl et al., 2008, Wang et al., 2016, Zook et al., 2012], and the game creation process itself [Christopoulos et al., 2011, Diez and Melcer, 2020, Spierling, 2008]. As a result, there is comparatively little work evaluating the impact of an interactive storytelling approach on learning outcomes, especially for topics such as RCR with ethically complex concepts that require a variety of perspectives.

2.2 Responsible Conduct of Research Training

Training scientists to recognize and engage in good ethical behaviors is critical to improving the quality of research, encouraging healthier workplace practices and increasing the general public's trust in the scientific process. The importance of RCR is such that many major funding agencies, such as the National Institutes of Health (NIH) and National Science Foundation (NSF), explicitly require researchers supported by their grants to receive RCR training [NIH et al., 1992, Plimpton, 2009]. However, concepts utilizing applied ethics, such as RCR, can prove difficult to teach due to the complexity of problems faced by researchers and the many underlying perspectives involved in such dilemmas [Shamoo and Resnik, 2009]. Currently, the NIH provides a guideline of nine core RCR topics [Kalichman, 2016]: 1) *conflict of inter-*

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[1] Though see [Pozo, 2018] for a critique of this notion.

est, 2) *human and animal subjects*, 3) *mentoring*, 4) *collaboration*, 5) *peer review*, 6) *data management*, 7) *research misconduct*, 8) *authorship and publication*, and 9) *scientists and society*. Past research on RCR education has ranged from issues teaching ethical theories underlying RCR [Bouville, 2008] and identifying metacognitive reasoning strategies that facilitate ethical decision-making [Kligyte et al., 2008, Mumford et al., 2008] to the use of group mentoring [Whitbeck, 2001] and role-playing [Brummel et al., 2010, Seiler et al., 2011] for improved training efficacy. However, there is still a notable engagement issue within current RCR education, and a serious need for a variety of tools to improve discussion, engagement, and critical thinking [Kalichman, 2014, Kalichman and Plemmons, 2007]. As a result, an interactive storytelling approach may prove effective for increasing motivation and fostering deeper critical thinking.

2.3 RCR Learning Outcomes

According to RCR training experts, being able to successfully navigate ethical dilemmas requires mastery of a combination of distinct learning outcomes, including 1) relevant conceptual knowledge (e.g., sensitivity to societal expectations), 2) moral reasoning skills (e.g., judgement of possible solutions) and 3) positive attitudes about RCR (e.g., motivation to behave ethically) [Antes et al., 2010, Bebeau, 1993, Kalichman and Plemmons, 2007]. The logic follows that teaching cognitive skills is only useful if the student also has the affective motivation to apply them [Kalichman, 2014]. Reviews examining the pedagogical efficacy of RCR training methods strongly recommend that learning activities should be engaging and promote thoughtful consideration and discussion of relevant ethical issues [Kalichman, 2014]. For instance, role-play provides an engaging opportunity for students to embody contending perspectives on an issue, making it one of the most promising discussion methods for improving comprehension and execution of ethical behavior [Brummel et al., 2010]. Much research has shown that role-play is capable of training each of the three learning outcomes—knowledge, moral reasoning skills and attitudes—that drive improvements in behavior [Rao and Stupans, 2012]. Unfortunately, traditional role-play activities are relatively resource-intensive because they require experienced guidance from an instructor combined with substantial time spent with a partner to practice necessary skills [Cook et al., 2017, Feinstein et al., 2002]. However, there is growing evidence demonstrating the advantages of virtual training simulations over live-action role-play for preparing workers to navigate challenging workplace scenarios [Spencer et al., 2019]. This chapter highlights the potential for interactive narrative games to provide an easily accessible single-player form of digital role-play that is still capable of holistically training both cognitive and socio-affective RCR learning outcomes. Notably, this has not yet been empirically demonstrated for existing online RCR training tools.

3 Academical: A Choice-Based Interactive Storytelling Game

Academical is a work of choice-based interactive storytelling [Koenitz et al., 2015, Mawhorter et al., 2014, Mawhorter et al., 2018] that was created using the Twine authoring framework [Friedhoff, 2013, Salter, 2016]. The game comprises nine playable scenarios, each pertaining to a specific topic in RCR [Kalichman, 2016]. These scenarios are adapted (with permission) from a series of existing educational RCR role-playing prompts [Brummel et al., 2010, Seiler et al., 2011]. Figure 1 shows screenshots taken during gameplay in a web browser.
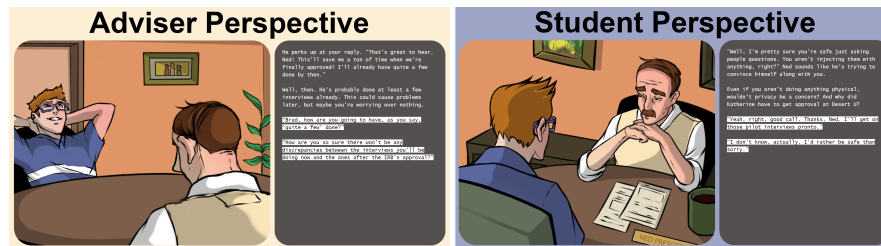

Fig. 1 Two perspectives and corresponding choice points from *Academical*'s first scenario, "The Head Start." In this story, the player can role-play as an adviser or a graduate student struggling to navigate the human subjects research approval process. The two highlighted text blocks from each scene represent the player's dialogue options for their character.

Each playable scenario in *Academical* centers on a conversation between two stakeholders in the RCR issue at hand, one of whom is controlled by the player—in the sense that they select dialogue options for that character. By virtue of these choices, the player will ultimately reach one of several possible endings, a subset of which represent successful navigation of the situation. Upon reaching a good ending for the first character, the player then unlocks the other interlocutor and replays the scenario from that person's viewpoint. In turn, reaching a good ending for the second character in a given scenario unlocks the next scenario/RCR topic.

At the outset of the project, we decided that the format of choice-based interactive storytelling—which allows a player to experience a story from multiple perspectives and replay scenes to see how different actions play out—would demonstrate the complicated nature of RCR to students in a compelling way. In adapting the role-playing prompts, we sought to show how seemingly obvious answers around questions of research ethics can be complicated by factors such as power dynamics and marginalized identities and experiences. Instead of cleanly delineating right and wrong answers, *Academical* showcases complexity and uncertainty to provoke questions around how courses of action could have unexpected consequences. In turn, while all successful paths through the game's scenarios represent the player character acting responsibly, not all of the situations reach clear resolutions. Specifically, many scenarios feature paths that appear to represent obvious solutions, but ultimately lead to bad outcomes. Through replaying and selecting new options, the player explores the social concerns

encompassed in a given RCR scenario, which will lead to a richer understanding of the ethical complications that one can encounter while conducting research as well as aid future moral reasoning.

4 Experiment 1: Randomized Group Comparison Study

4.1 Methods

We hypothesized that the choice-based, role-playing nature of *Academical*—which is specifically designed to highlight how research ethics can be complicated by many factors such as power dynamics and marginalized identities—would be 1) more engaging, 2) as effective as traditional RCR educational materials at developing knowledge of RCR concepts, and 3) result in stronger moral reasoning skills. In order to explore these hypotheses, we conducted a between-subjects study comparing our choice-based interactive storytelling game approach with web-based educational materials from an existing university RCR course. The study consisted of two conditions: 1) a group that read through two modules of the web-based educational RCR materials covering peer review and authorship; and 2) a group that played two chapters of *Academical* covering peer review and authorship content.

4.1.1 Procedure

Participants were told that the study was to explore different approaches to RCR education, and they would either play a game or read materials teaching selected RCR concepts. They then completed an online survey collecting demographic information (age, prior gaming experience, prior RCR experience, and so forth). Upon completing the survey, participants were randomly assigned to one of the two conditions (web materials or *Academical*). After completing the RCR training for peer review and authorship, participants then completed a post-test that assessed their 1) engagement with the training material, 2) quantitative knowledge of peer review and authorship RCR concepts and 3) qualitative moral reasoning skills for these same concepts.

4.1.2 Measures

Temple Presence Inventory, Engagement Subscale. Engagement is a critical aspect of the learning process [Kearsley and Shneiderman, 1998], drastically influencing a learner's motivation to continue interacting with a system and the educational content [O'Brien and Toms, 2008]. In order to assess participant engagement with the two educational RCR tools employed, we utilized the Engagement subscale of the Temple Presence Inventory (TPI) [Lombard et al., 2009]. The TPI has been validated for use with games [Lombard et al., 2011] and measuring game engage-

ment [Martey et al., 2014].

Peer Review and Authorship RCR Quizzes. To assess and compare how effective the two RCR tools were for teaching knowledge of peer review and authorship concepts, we utilized two quizzes from an existing online RCR course at the University of Utah. Each quiz consists of three questions around a respective topic, and each question is either true/false, yes/no, or multiple choice.

Qualitative Assessment of Moral Reasoning. To assess and compare how effective the two RCR tools were for teaching moral reasoning skills, we utilized qualitative test materials from a previous study that evaluated the effect of role-play on RCR learning outcomes [Seiler et al., 2011]. These test materials included two RCR-themed short stories obtained from the Online Ethics Center for Engineering and Research and three short answer questions that the previous study designed to characterize a student's ability to 1) analyze a moral problem, 2) consider the viewpoints of all individuals involved, and 3) propose solutions and anticipate their possible short- and long-term consequences. Participants first read and wrote responses to the short story about peer review, then answered the same three questions for the other scenario involving authorship. After completion of the study, two of the authors scored these answers using the behaviorally anchored rating scale (BARS) method (see [Melcer et al., 2020a] and [Seiler et al., 2011] for more information on the authors' coding procedure.

4.2 Results

4.2.1 Participant Demographics, Prior Knowledge and Experience

A convenience sample of 28 university graduate and undergraduate students—the standard target populations for RCR training—were recruited for the study (age: μ=24.8, σ=7.6). There were 10 female, 14 male, and 3 non-binary participants, with 1 declining to disclose gender. During the study, participants were randomly assigned to one of the two conditions: web materials (**14 total**; 3 female, 2 non-binary, 8 male, 1 decline to answer) and *Academical* game (**14 total**; 7 female, 1 non-binary, 6 male).

According to a series of independent samples t-tests, participants in the two conditions did not differ with respect to age, prior game experience, or prior interactive story experience (all p values >= .12). Similarly, none of the participants reported prior RCR training in the past 2 years. Therefore, we can assume that participants in both groups had similar prior RCR, game, and interactive story experience.

4.2.2 Engagement with RCR Training Tools

An independent samples t-test revealed a significant difference in favor of *Academical* for participant engagement (see Table 1; p = .029, r = .4), suggesting that a choice-based interactive story game is a more engaging experience for RCR training than traditional web reading materials.

Table 1 Post-test results for engagement, RCR knowledge and moral reasoning skills.

Quantitative Measures	Web		Game		Sig	ES	
	μ	σ	μ	σ	p	d	r
TPI Engagement (out of 42 — 6 items)	23.4	9	30.1	6.1	**.029**	**.87**	**.4**
Peer Review Knowledge Quiz (3 items)	2.14	0.77	2.93	0.27	**.002**	**1.4**	**.56**
Authorship Knowledge Quiz (3 items)	2.36	0.75	2	0.79	.23	-.47	-.23
Qualitative Measures	μ	σ	μ	σ	p	d	r
Identify Issues (2 topics)	6.93	1.9	8.57	1.6	**.023**	**.92**	**.42**
Describe Viewpoints (2 topics)	4.71	2.8	7.36	2.5	**.016**	**.99**	**.44**
Propose Solutions (2 topics)	4.71	2.3	7.14	2.3	**.015**	**1.1**	**.47**
Total Score (out of 30 — 6 items)	16.4	5.7	23.1	4.7	**.004**	**1.3**	**.54**

4.2.3 RCR Learning Outcomes

Peer Review and Authorship RCR Quizzes. A series of Wilcoxon rank sum tests showed that participants in the *Academical* condition scored significantly higher on the peer review test (see Table 1; p = .002, r = .56) and comparable to the web materials for the authorship test (n.s., p = .23). This suggests that, in terms of short-term learning, a choice-based interactive story approach is overall more effective than traditional educational materials for developing knowledge of certain RCR topics.

Qualitative Assessment of Moral Reasoning. A series of Wilcoxon rank sum tests showed that participants in the *Academical* group scored significantly higher overall on the qualitative tests of moral reasoning (see Table 1; Total Score: p = .004, r = .54). Combining the scores across the two scenarios revealed that these participants had similarly significant improvements for all three aspects of moral reasoning (Issues: p = .023, r = .42; Viewpoints: p = .016, r = .44; Solutions: p = .015, r = .47). A series of independent-samples t-tests similarly highlighted that the *Academical* group also demonstrated better overall moral reasoning skills for each scenario (Peer Review: p = .015, r = .44; Authorship: p = .0028, r = .53). These results indicate that, with respect to short-term learning, a choice-based interactive story approach is more effective than traditional educational RCR materials for developing moral reasoning skills necessary to properly employ RCR.

5 Experiment 2: Correlational Study

5.1 Methods

For the second study, we hypothesized that 1) a choice-based interactive narrative game (i.e., *Academical*) would improve participants' attitudes towards RCR and 2) participants' reported engagement playing the game would predict their post-game attitudes about RCR. In order to explore these hypotheses, we conducted a quasi-experimental within-subjects study measuring one group of participants' RCR attitudes before and after playing a single short session of *Academical* to compare with their feelings of engagement with the game.

5.1.1 Procedure

Study participants were required to 1) complete a pre-game survey assessing demographics and attitudes about RCR, 2) play the *Academical* game, and 3) complete a post-game survey gauging knowledge and attitudes about RCR and their feelings of engagement with the game. All participants were recruited from an undergraduate course offered through the engineering department at UCSC (a Tier 1 research institution). Participants were informed of the study through email and offered extra credit toward their class grade in exchange for completing the study. Participants were also told that the purpose of the study was to test the efficacy of a new RCR training program. Participants accessed the surveys and game using the same methods as the previous *Academical* study—through their preferred web browser on their personal computers and without any supervision beyond automated data collection. Two of the nine possible scenarios were selected for students to play through (i.e., peer review and authorship). Participants were instructed to play through each character at least once in each scenario—equating a minimum of 4 total playthroughs (2 per module)—before completing the post-survey. Nine of the 69 participants that successfully completed all parts of the study reported that they had received prior RCR training and were excluded from analysis. Of the 60 remaining participants, there were 41 males, 16 females and 3 non-binary. The average participant age was 20.6±2.2 years (median: 20, range: 18-29), which is a typical age for students starting to engage in research and consider applying to graduate school.

5.1.2 Assessment Tools

Temple Presence Inventory, Engagement Subscale. See Section 4.1.2.

RCR Attitudes Survey. To assess *Academical*'s efficacy for improving attitudes about RCR, we created a short survey using a list of attitude goals that are highly recommended by RCR instructors [Kalichman and Plemmons, 2007]. This survey

included six items (two questions and four statements, see Table 2) with possible responses along a 7-point Likert scale indicating level of agreement. To assess within-subject changes in these attitudes, participants completed the same attitude survey before and after playing the game.

5.2 Results

5.2.1 RCR Attitudes

In order to gauge whether playing *Academical* could improve participants' attitudes about RCR, we conducted within-subject comparisons of pre- and post-game attitude ratings. For each participant, we averaged the six attitude scores to find an overall attitude score for both test-points (Pre: 5.3±0.9; Post: 5.9±0.9; Change: 0.55±0.7). A series of Wilcoxon sign rank tests revealed that, after playing *Academical*, participants on average reported a significant improvement in agreement with every individual item in the attitudes survey (see Table 2; all p<0.01; effect size range of d = 0.35-0.57, which are small to medium). This analysis also showed that participants' averaged overall attitude score also increased significantly after playing the game (Rank sign test: r = 0.31, p < 0.001; effect size d = 0.65, which is medium). These results confirmed our first hypothesis and demonstrate that playing a short session of *Academical* can significantly improve a variety of important attitudes about RCR.

Table 2 Participants' attitude score before and after playing a single short session of *Academical*.

	Pre		Post		Sig	ES
Attitude Survey Items	μ	σ	μ	σ	p	d
(1) How important is RCR training to you?	4.2	1.5	5.0	1.5	**<.001**	**.49**
(2) How important do you think RCR training should be for researchers?	5.7	1.2	6.3	1.0	**<.001**	**.57**
(3) Research ethics is serious and deserving of the attention of all researchers. †	6.1	1.0	6.5	0.9	**.01**	**.35**
(4) Researchers have a personal responsibility to model and promote RCR. †	5.5	1.1	6.1	1.0	**<.001**	**.51**
(5) Researchers have a responsibility to society. †	5.6	1.2	6.0	1.1	**<.001**	**.37**
(6) Excellence in research includes RCR. †	5.6	1.2	6.2	1.0	**<.001**	**.55**
Overall Attitude Score	5.3	0.9	5.9	0.9	**<.001**	**.65**

† Items borrowed from [Kalichman and Plemmons, 2007]

5.2.2 Engagement Correlations with RCR Attitudes

Participants on average reported an engagement score of 26.9±6.6 out of a possible 42 points (median: 28; range: 7-42), showing that this cohort varied greatly in their feelings of engagement with the game. First, Spearman correlations revealed that engagement did not predict participants' pre-game attitude scores (r_s = 0.16, p = 0.23). In contrast, we found that engagement was significantly correlated with post-

game attitudes (r_s = 0.41, p = 0.001, moderate strength)—confirming our hypothesis that engagement would predict post-game attitudes. Engagement was also correlated with participants' change in attitude (r_s = 0.27, p = 0.04, weak strength). Together, these results indicate that after playing *Academical*, participants changed their RCR attitudes to more closely align with their feelings of engagement with the game.
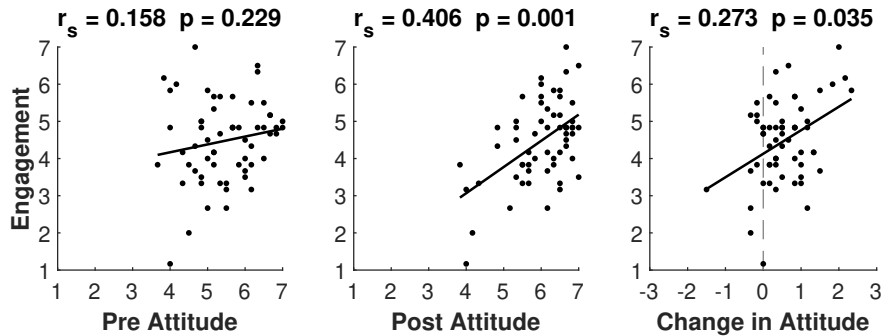

Fig. 2 Participants changed their RCR attitudes to more closely align with their feelings of engagement with the game. For simpler visual comparison with the overall attitude scores, engagement scores are reported here as the average (rather than the sum) of the six survey items. Non-parametric Spearman correlation coefficients are provided above each result.

6 Overall Discussion

6.1 Using Interactive Narrative to Teach RCR Learning Outcomes

The results from these two studies evaluating *Academical* suggest that a choice-based interactive storytelling game design is effective as an RCR education tool. In the first study [Melcer et al., 2020a, Melcer et al., 2020b], participants who played the *Academical* game (n = 14) developed significantly higher engagement, stronger overall moral reasoning skills, and statistically equivalent or better knowledge scores for certain RCR topics compared to a group trained by an existing web-based university RCR course (n = 14)—highlighting the potential of choice-based interactive storytelling games for improving student engagement and learning outcomes within RCR education. In the second study [Grasse et al., 2021], participants (n = 60) reported significantly higher attitudes about RCR after playing *Academical*, demonstrating that playing the game, even for a short amount of time, can also improve relevant socio-affective learning outcomes. Together, these two studies show that *Academical* is an effective tool for training all three key learning outcomes (i.e., knowledge, skills and attitudes) that contribute to improvements in ethical behavior. Importantly, this collection of evidence indicates that the choice-based interactive

storytelling design of the *Academical* video game can successfully train both cognitive and socio-affective learning outcomes **simultaneously**, addressing the full breadth of distinct learning outcomes essential to RCR education in one tool. To the best of our knowledge, this is an achievement which has not yet been documented for existing web-based RCR pedagogy [Powell et al., 2007, Seiler et al., 2011].

6.2 The Importance of Engagement within Interactive Narrative

Game-based learning research has demonstrated that engagement can influence a student's motivation to learn [Clark et al., 2016, Noe, 1986], particularly for socio-affective outcomes like attitudes [Sabourin and Lester, 2013, Lustria, 2007]. Narrative has become an especially effective method for improving engagement and deep learning [Rowe et al., 2010]. Contrasted with the passive reading study strategy promoted by the majority of existing web training tools, *Academical* utilizes narrative role-play and interactive choices to foster engagement and challenge the player to successfully navigate various moral dilemmas common to scientific research. However, care should be taken to generalize *Academical*'s success across the interactive narrative game genre. Our results illustrate the importance of ensuring that an interactive narrative is engaging for the player, as post-game attitudes (r_s = 0.41, p = 0.001) and changes in attitudes from pre to post (r_s = 0.27, p = 0.04) were significantly correlated with participants' engagement. This highlights that merely using the interactive narrative medium does not guarantee that a story will feel immersive or engaging for all (or even any) readers. Therefore, it is crucial for designers of interactive narrative games to consider how aspects of their design impact engagement and employ various techniques to improve it. For instance, a lack of relatability to the content (either the characters or story) can cause players to disengage from the narrative [Green and Jenkins, 2014], so utilizing a demographically diverse cast of characters or enabling the player to personalize their character for the narrative could improve relatability and subsequently engagement. In order to help guide improvements to *Academical*, future work is required to fully explore which aspects of the game's design best facilitate players' engagement and learning [Revi et al., 2020, Kalyuga and Plass, 2009, Ryan et al., 2006].

6.3 The Benefits of Online Single-Player Interactive Role-Play

Studies have shown that live-action interactive role-play can help students practice moral reasoning skills, but when compared to playing a computer game, it is a relatively resource-intensive activity in terms of the time and energy needed to facilitate and evaluate the training process [Cook et al., 2017, Spencer et al., 2019]. Furthermore, role-playing with others in the physical world can be an uncomfortable or unproductive experience for some people, potentially compromising the learning

experience [Cook et al., 2017, Seiler et al., 2011]. In comparison, *Academical* is an engaging single-player role-playing experience that carries no social pressure, allowing students to explore multiple perspectives at their own pace. Furthermore, its digital nature means that all learners can play through the same training scenarios with the same dialogue options, and consequently their learning experience, learning progress and progression through the stories can be tracked far more easily than traditional role-playing scenarios [Feinstein et al., 2002]. Critically, the improved convenience of using *Academical* for ethical training has the potential to reach a far broader audience than live action role-playing, as well as enable larger and more controlled studies of its effects on RCR learning outcomes.

7 Conclusion

In this chapter, we described the design of *Academical*, a choice-based interactive storytelling game for RCR training that enables players to experience a story from multiple perspectives. We also presented results from two initial studies altogether demonstrating 1) *Academical*'s advantages over traditional web-based educational materials for teaching the full breadth of RCR learning outcomes and 2) the potential role of engagement for driving positive attitudes about RCR (and possibly cognitive learning outcomes as well). This work provides evidence supporting the efficacy of interactive narrative games for training ethics. More specifically, our results further elucidate the value of a choice-based interactive storytelling game, such as *Academical*, for teaching RCR and provide implications for the use of interactive storytelling games to improve learning outcomes of ethically complex content such as RCR.

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