

An Exploratory Study of Preservice Teacher Perception of Virtual Reality and Artificial Intelligence for Classroom Management Instruction

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Classroom management skills are crucial for teacher effectiveness. Classroom management instruction in the twenty-first century may increasingly benefit from technological advances in virtual reality (VR) and artificial intelligence (AI). This exploratory study of preservice secondary school teachers ($n = 41$) at a public university in the southeastern United States adds to a gap in the literature in this emerging field of the potential application of VR and AI to classroom management instruction as part of teacher education programs. Specifically, this study examines preservice secondary school teachers' perceptions of VR and AI and their potential as tools for classroom management instruction.

Keywords: teacher education, classroom management instruction, artificial intelligence, virtual reality, preservice teacher perception

Introduction

Classroom management has long been an especially complicated course to teach because of the many variables that affect preservice and in-service teachers' classroom management skills. Classroom management courses are critically important for preservice teachers to learn about the processes, skills, and practice of the changing dynamics of effective classroom management. These management skills can be taught (Hardin, 2012; Marzano, Marzano, & Pickering, 2003). This study adds to the literature by providing an examination of preservice teachers' perception of virtual reality (VR) and artificial intelligence (AI) and the potential for improving instructional coaching using these technologies for augmenting classroom management instruction.

Literature Review

The use of virtual reality as a tool for learning is an emerging field and is recently

part of studies related to classroom management (Hudson, Voytecki, Owens, & Zhang, 2019; Lugin, Latoschik, Habel, & Roth 2016; Mahon, Bryant, Brown, & Kim, 2010; Pas, Johnson, Larson, Brandenburg, Church, & Bradshaw, 2016; Pilgrim & Pilgrim, 2016; Smith & Klumper, 2018). This increase in interest in the potential for VR or mixed-reality as tools for teaching and learning in educator preparation programs is in parallel with what Chadha (2019) noted about the increase in online asynchronous learning with what Tanner, Quintis, and Gamboa (2017) discussed as a call for multimodal instructional coaching formats and Ludlow's (2015) discussion of future applications of virtual reality tools for K-12 education. There is substantial potential for the use of virtual reality as a tool in teaching classroom management to preservice teachers in what is more of a blended synchronous and asynchronous coaching model rather than direct instruction model. This study adds to the literature on preservice

secondary teachers' perceptions of AI and VR.

The study of VR for classroom management instruction began in the first decade of the twenty-first century. Hudson et al.'s (2019) study focused on preservice undergraduate teacher candidates' experiences with classroom management through mixed-reality simulations. Smith and Klumper (2018) discussed the use of the Virtual Avatar Learning Experience (VALE) at Dakota State University with preservice teacher candidates and how participants viewed the effectiveness of VALE for practicing classroom management scenarios. Mahon et al. (2010) discussed the use of the *Second Life* online software program for simulating classroom management scenarios. These studies found that virtual reality simulations were a very helpful supplement to classroom management instruction.

The use of VR has also primarily focused on behavior management. Pas et al. (2016) studied the use of VR for a mixed-reality environment to mitigate behavior issues among students with Autism Spectrum Disorder (ASD). Pas et al. (2016) found that their "preliminary evidence of the potential impacts of a teacher-focused coaching model to support students with ASD . . . combined with mixed-reality simulated practice may be an effective approach for promoting both teacher and student behavioral change" (p. 3650). Studies by Lugin et al. (2016) and Pilgrim and Pilgrim (2016) made similar suggestions based on their findings.

Important to understanding the potential of VR and AI is to ascertain preservice teacher perceptions of technological concepts and tools. A case study of 41 preservice teachers conducted in Australia examined perceptions of the potential usefulness of VR for the K-12 classroom but not for teacher education (Cooper, Park, Nasr, Thong, & Johnson, 2019). Another study of preservice teacher perceptions of technology use for a

teacher preparation program that was in the United States was McGrail et al. (2011), though that study only tangentially refers to virtual reality, specifically *Half Life* that Mahon et al. (2010) discussed in relation to VR's potential in education. Piro and O'Callaghan (2019) explored the concept of mixed-reality simulations more recently with a qualitative study of preservice teachers' use of mixed-reality simulations in a teacher preparation program. Our study adds to the literature as a study of preservice teachers' perception of both VR and AI as essentially connected concepts for potential usefulness in designing an interactive VR training module as part of a classroom management instruction course in a teacher preparation program.

Research Design Method

A survey instrument was developed to gather data on preservice teachers' perceptions of virtual reality as a technology for potential use in learning about classroom management through simulations while considering related factors such as perception of artificial intelligence (AI) and learning style (see Appendix A). *Statistical Package for the Social Sciences* (SPSS) software was used to test hypotheses based on Likert-type scale prompts.

Research Questions

The guiding research questions were: (1) What are preservice teacher perceptions of artificial intelligence (AI) and virtual reality (VR)? And, (2) What is preservice teacher perception of the potential use of VR to learn about classroom management? These researchers also hypothesized a covariance between participants' perception of VR and AI's increasing importance for education with their response to whether they liked learning from watching movies. This final research question: (3) Is there a mean difference in participants' perception of AI

based on their level of agreement with VR and AI being increasingly important concepts and tools for schools, controlling for whether they like learning from watching movies?

Survey prompt 3 (“Are there any movies that come to mind when you think about artificial intelligence? If so, list up to two”) was linked to prompt 12 (“I generally like learning from watching movies”) in the survey instrument with a thematic assumption that participants who indicated a preference for learning from watching movies might tend to be more interested in the potential for AI and VR because of watching movies usually being an individual audio-visual activity while VR applications also tend to be an individual audio-visual process.

Participants who choose to participate signed the informed consent statement and submitted it to the designated file folder separate from the folder they turn in their survey so that the two items could not be linked together. Procedures for averting undue influence included the informed consent statement that was read aloud at the beginning of the class. The PI placed a folder at a desk that is on the opposite side of the room and verbally announced to students that they were to turn in their copy of the survey to the folder.

This study of preservice secondary school teachers ($n = 41$) in 2019-2020 at a public university in the southeastern United States provided data for the development of a prototype interactive VR classroom management instruction module in preservice teachers’ classroom management course. The participants in this study were preservice teachers in a baccalaureate degree program pursuing licensure to teach English language arts, social studies, mathematics, music, art, and physical education.

Limitations

The survey instrument that was designed for this study has extended response items for some of the prompts, but those were not evaluated for this study because of this study’s focus on the quantitative data derived from the Likert scale prompts. While this study is generalizable within the university it was conducted for preservice teachers intending to teach secondary school, it is not generalizable to the preservice secondary teacher population across the United States as a whole. A quantitative survey instrument was used because this study was intended to establish preservice teacher interest in using VR for classroom management instruction as well as their perceptions of AI and learning styles. A positive result with correlations between any one or more of those factors would then prompt this research team to develop a prototype Interactive Virtual Classroom Management Scenarios (or IVCMS) Module for the preservice secondary teachers in this research team’s university. The data from the survey helped establish the direction for the development of a prototype IVCMS Module for potential use with the university’s learning management system.

Results

Gender was not statistically significant in participants’ responses in any way ($N = 41$ where female $n = 26$ [63%], male $n = 15$ [37%]). Participant’s self-identified their gender to an open-response prompt on the survey. All participants indicated either female or male. There was no association between participants’ gender and their perception of artificial intelligence ($r = .170$, $n = 41$, $p = .287$). There was no association between participants’ gender and their perception of virtual reality’s potential benefit for learning about classroom management ($r = -.122$, $n = 41$, $p = .448$). There was no association between participants’ gender and their assertion

regarding virtual reality and artificial intelligence being increasingly important concepts and tools for schools this century ($r = .166, n = 41, p = .298$).

There was no association between participants who indicated having seen movies about artificial intelligence and their perception of artificial intelligence. The Pearson correlation between participants who have seen movies about AI and their perception of AI is $-.034$, which is negative, is interpreted as a small effect size (Cohen, 1988), and is not statistically significantly different from 0 ($r = -.036, n = 41, p = .821$). Thus, the null hypothesis that there is no association (that the correlation is 0) is not rejected at the .05 level of significance.

There was no significant correlation between participants who indicated having seen movies about artificial intelligence and their perception of virtual reality's potential benefit for learning about classroom management ($r = .270, n = 41, p = .087$). There is no association between participants who indicated having seen movies about artificial intelligence and their assertion regarding virtual reality and artificial intelligence being increasingly important concepts and tools for schools this century ($r = -.056, n = 41, p = .730$). There is no association between participants who indicated that they used virtual reality technology in the past five years and their perception of artificial intelligence ($r = .027, n = 41, p = 0.867$). There is no association between participants who indicated that they used virtual reality technology in the past five years and their perception of virtual reality's potential benefit for learning about classroom management ($r = 0.018, n = 41, p = .911$). There is no association between participants who indicated that they used virtual reality technology in the past five years and their assertion regarding virtual reality and artificial intelligence being increasingly

important concepts and tools for schools this century ($r = .062, n = 41, p = .701$).

There were several significant correlations resulting in the rejection of several of the null hypotheses. The following findings are stated based on the semantic style used by Lomax and Hahs-Vaughn (2012). We reject the null hypothesis that there is no association between participants' perception of artificial intelligence in general with their level of agreement with virtual reality being beneficial for learning about classroom management ($r = .512, n = 41, p = .001$). The Pearson correlation is significant at the 0.01 level (2-tailed). We reject the null hypothesis that there is no association between participants' perception of artificial intelligence in general with their level of agreement with virtual reality and artificial intelligence being increasingly important concepts and tools for schools this century ($r = .562, n = 41, p = .000$). The Pearson correlation was significant at the 0.01 level (2-tailed). We reject the null hypothesis that there is no association between participants' having used virtual reality technology in the past five years and whether they like learning from watching movies ($r = .461, n = 41, p = .002$). The Pearson correlation is significant at the 0.01 level (2-tailed). We reject the null hypothesis that there is no association between participants' having used virtual reality technology in the past five years and whether they like learning from individual projects ($r = .327, n = 41, p = .039$). The Pearson correlation is significant at the 0.05 level (2-tailed). We reject the null hypothesis that there is no association between participants' level of agreement with virtual reality potentially being beneficial for learning about classroom management and their interest in virtual reality simulations for learning more about classroom management ($r = .442, n = 41, p = .004$). Pearson correlation is significant at the 0.01 level (2-tailed).

An analysis of covariance (ANCOVA) was conducted to determine if there is a mean difference in participants' perception of AI based on their level of agreement with VR and AI being increasingly important concepts and tools for schools while controlling for whether they like learning from watching movies. Independence of observations was not met because this model is being applied within the same group of participants who are split into subgroups based their response to whether they agreed or disagreed with liking to learn from movies. However, independence of observations is not necessary since the observation is about the same group, though they are considered different subgroups based on their response to the prompt that is the covariate in the model. Furthermore, according to Levene's test, the homogeneity of variance assumption was satisfied [$F(3, 37) = .528, p = .666$]. Aside from the independence of observations, the other components of the model are satisfactory. The assumption of normality was tested and met via examination of the residuals. Review of the S-W test for normality ($SW = .959, df = 41, p = .144$) and skewness (-.122) and kurtosis (.012) statistics suggested that normality was a reasonable assumption. The boxplot and histogram suggested a relatively normal distributional shape (with no outliers) of the residuals. The Q-Q plot suggested normality was reasonable. In general, there is evidence that normality has been met. Linearity of the dependent variable with the covariate was examined with a scatterplot. Overall, the scatterplot of the dependent variable with the covariate suggested a positive linear relationship.

The results of the ANCOVA suggest a non-statistically significant effect of the covariate, participants like learning from movies, on the dependent variable, participants' perception of artificial intelligence in general ($F_{\text{likes learning from movies}} =$

$.579; df = 1, 36; p = .452$). However, more importantly, there is a statistically significant effect for participants' perception that AI and VR are increasingly important ($F_{\text{VR and AI increasingly important}} = 6.064; df = 3, 36; p = .002$), with large effect size and very strong power (partial $\eta^2_{\text{VR and AI increasingly important}} = .336$, observed power .939). The effect size suggests that 34 percent of the variance in participants' perception of AI can be accounted for from their perception of VR and AI becoming increasingly important this century when controlling for their preference to learn from watching movies. There was an observed power of 94 percent, which is considered a strong level of power (Cohen, 1988).

Discussion

The significant correlations show an interesting pattern that indicates an association between participants' tendency toward extraverted group learning or introverted individual learning approaches. The more favorably participants viewed virtual reality (VR) technology for potential use in learning classroom management, the more favorable was their perception of artificial intelligence (AI). As participants' perception of the importance of VR and AI for schools increased, their perception of AI in general tended to be more favorable. If participants indicated that yes, they have used VR tech in the past five years, they tended to like learning from watching movies. If participants indicated that yes, they have used VR tech in the past five years, they tended to like learning from individual—not group—projects. If participants indicated that yes, they would be interested in using VR simulations for learning more about classroom management, they tended to strongly agree that VR can be beneficial for learning about classroom management.

Participants who have used VR technology within the past five years tend to

want to learn more about classroom management through individual work—not group work—that lowers the risk of peer judgement from making mistakes in front of peers in classroom management scenarios. Watching movies tends to be an individual observational process. This further suggests how participants, who indicated a strong preference for learning from watching movies, have a favorable impression of the potential for using VR—which also tends to be an individual process—to learn the complexities of classroom management at a more individualized pace to pause, go back, fast-forward, and re-evaluate a given scenario after engaging with the scenario in real time. Using VR for classroom management can be beneficial for introverts as well as extroverts to engage with learning more about classroom management strategies in a scenario format that could also potentially integrate AI to respond to the participants' inputs or reactions.

Participants' preference for learning from movies is an important variable in this study because it suggests their level of comfort in learning individually from a virtual model with their interactions mediated through a computer screen. The assumption is that if participants like learning from movies then they are significantly more likely to perceive VR and AI as increasingly important tools for schools. While this assumption was confirmed by the results of the ANCOVA, the ANCOVA did not necessarily suggest that participants' perceptions of AI in general was always positive just because participants liked learning from movies and agreed that VR and AI are increasingly important tools. Just because VR and AI are increasingly important does not necessarily mean that participants significantly trust the technology, but they do consistently believe that VR and AI are increasingly important tools for schools this century, in which 93% of participants answered that they either are

neutral, agree, or strongly agree on the increasing importance of VR and AI potential for schools. The ANCOVA further suggests, then, that movies have influenced participants' perceptions of AI in ambivalent ways. Nevertheless, the data shows that far more of the participants perceive AI favorably (34 percent) rather than unfavorably (20 percent), with 46 percent being neutral, a further indication that movies are influencing participants' perceptions skewing toward a favorable perception of AI. Only 7 percent of participants (3 out of 41) indicated disagreement or strong disagreement to "VR can be beneficial for learning about classroom management," while a similarly low percentage of 15 percent (6 out of 41) indicated disagreement or strong disagreement to the prompt "I generally like learning from watching movies."

Virtual Reality is an innovative use of technology for improving teacher effectiveness. Teaching today is more complex than ever before; effective teaching is not a simple checklist. According to Darling-Hammond (2006) one essential component present in an effective teacher preparation program is a coherent alignment between coursework and clinical field experiences. However, there are limited opportunities for pre-service teachers to practice techniques learned in their preparation programs in actual classroom environments (Putman & Borko, 2000). In order for the coursework in a classroom management course to be effective and transferrable, preservice teachers must have increased opportunities to practice effective classroom management techniques in real-world environments and simulated real-world settings. The integration of VR can assist preservice teachers with the application of classroom management skills. As preparation programs work to more closely align course work and actual teaching

experiences, the use of VR can provide numerous classroom management scenarios that closely reflect actual challenges in classrooms.

Conclusion

This exploratory case study provides foundation for additional research into preservice secondary school teachers' perceptions of the potential use of using virtual reality and artificial intelligence for learning more about classroom management. There are potential implications for preservice teachers' self-efficacy in classroom management scenarios using VR and AI as that modality may provide for another way to learn the crucial skills of classroom management across the personality types. Movies affect preservice teachers' perceptions in ambivalent ways that skew toward a positive perception of AI which itself affects their perception of the potential benefits of using VR and AI to learn more about classroom management. The data suggests—at the least—a local trend that preservice teachers are interested in VR and AI for learning more about classroom management and that gender is not a statistically significant factor on perception of VR and AI. With this data, future research for generating more understanding on this format for instructional coaching of all preservice secondary school teachers can be conducted with this survey instrument and additional forms of data collection and analysis. Based on data collected, a prototype interactive VR classroom management scenarios module can be designed and implemented in an educator preparation program.

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Appendix A

Survey of Classroom Management Interest and Style (SoCMIS 1.1)

1. What is your gender?
2. How would you describe your perception of artificial intelligence (AI)?
3. Are there any movies that come to mind when you think about artificial intelligence (AI)? If so, list up to two.
4. Have you used virtual reality technology in the past five (5) years? If YES, please explain here.
5. Would you be interested in using virtual reality simulations for learning more about classroom management? Yes or No.
6. What is your perception of artificial intelligence (AI), in general? (5=favorable; 1=not favorable)
7. Virtual reality (VR) can be beneficial for learning about classroom management.
8. I consider virtual reality (VR) and artificial intelligence (AI) as being increasingly important concepts and tools for schools this century.
9. I generally like a variety of activities in class such as lecture, individual learning, and group collaborative learning.
10. I generally like mostly individual learning.
11. I generally like group collaborative learning.
12. I generally like learning from watching movies.
13. I generally like learning from lectures.
14. I generally learn from individual group projects.
15. I generally learn from group collaborative projects.
16. I consider myself to be creative.