Perceptions of the Effects of Augmented Reality in the Classroom

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ABSTRACT

Augmented reality continues to be lauded as a disruptive innovation in education. This research examines the perspectives of AR using educators who are Innovators and First Adopters in Roger's Diffusion of Innovation Scale. Attitudes towards AR were examined through a survey that included Likert-scale items and open-ended qualitative items. Results appear to show that educators were largely using downloadable AR apps, but found them highly engaging and enjoyable with students. A few teachers indicated that they or their students were also creating AR using a variety of platforms. Inferential analyses were also employed, but found no differences between groups. Issues and challenges in using AR are also discussed.

Keywords: Augmented Reality, Student Engagement, Student Enjoyment, Innovators, First Adopters

reality (AR) has frequently been touted as a disruptive innovation in education (Fernandez, 2016, Fonda & Fonda, 2018). Scholars (Dong, & Si, 2018) predict a future where students see 3D animals emerging from their mobile devices enabling them to better understand their features, movements and habitat. Similarly, literacy educators see a future where students use their mobile devices to make picture books come alive through graphics that bring life to the story (Green & McNair, in press). Social Studies investigators pose a learning environment where students can see beyond a decrepit building to its noteworthy place in history (Johnson, et al, 2017).

Adoption of new technologies is often a lengthy, difficult process which may be explained by Rogers' (2012) Diffusion of Innovations theory. This theory seeks to explain how, why, and at what rate new ideas disperse throughout a society. Numerous educational technology studies have employed Rogers' theory as a means of explaining how and why teachers adopt digital technologies (Daher, Baya'a, & Anabousy, 2018, Lawrence, & Tar, 2018, Stieler-Hunt, & Jones, 2015). According to Rogers (2012), the main characteristics of an innovation that affects its adoption or rejection are the users' perceptions of five variables including relative advantage, compatibility, complexity, trialability, and observability. According to Rogers, innovations are not adopted simultaneously by all users in a social system but rather follow a bell shaped curve distribution with users falling into 5 categories including innovators, early adopters, early majority, late majority, and laggards. Each group has unique characteristics as seen below:

1) Innovators – the first 2.5% are those that seek out and embrace innovations and are willing to take risks. They are the gate-keepers and are quick to try an innovation (Miller, 2015, Ucus & Acar, 2018)
2) Early Adopters – the next 13.5% are highly influential within their social system and encourage others to adopt new innovations. They are respected by their peers and are judicious in making decisions regarding an innovation (Rogers, 2012).
3) Early Majority – representing the next 34%, are careful, deliberate individuals who are less willing to risk time or other resources. Early majority are followers of the early adopters but need solid proof of benefits before adopting a new technology (Wani & Ali, 2016).
4) Late Majority – accounts for the next 34%, are somewhat skeptical and likely to adopt an innovation when it has become the standard in the field. Peer pressure may also influence their decision to adopt (Soffer, Nachmias, & Ram, 2010).
5) Laggards - the final 16%, are traditionalists who are suspicious of new ideas and reluctant to adopt a change unless it becomes a necessity (Yuksel, 2015).

Once an individual encounters an innovation, the adoption process begins as they become aware and interested in the innovation, gather more information, and possibly experiment with the innovation to determine if the effort to adopt it is reasonable in terms of time and other resources.

One could argue that the adoption of AR into instruction in schools is very early in the adoption process and that those educators who are using it or advocating for its use fall into the Innovators or Early Adopters categories (Cavanagh, 2019). In education, the adoption of any technology tool is not necessarily bound to its newness and innovation alone, but to its effectiveness in engaging and motivating students and creating an enjoyable learning environment. Thus, the purpose of this paper is to investigate the perspectives of Innovator and First Adopter educators who are using AR and to explore the extent to which they see that it is creating innovative learning environments. This research was guided by the following research questions,

1) What are AR educators' perceptions of student interest and engagement when using AR and are there any differences between groups?
2) What types of AR tools are being used and how are AR-using educators suggesting that AR can be used in the classroom?
3) What are the challenges of using AR in the classroom?

LITERATURE REVIEW

Student engagement and motivation have always played a key role in successful learning and choosing the right engagement and motivation strategies will facilitate and improve the learning process for students. Instructors are finding innovative approaches in education, using various tools available to facilitate the learning process and improve the student engagement. Technology is becoming an important piece for effective strategies in schools. Computers, the internet, and video are examples of technology resources that are being adopted into the classroom. Another tool that teachers are using to teach their students is augmented reality. As technology improves and becomes integrated in school curriculum, augmented reality can have a place to improve the students' engagement and motivation.

Augmented Reality

Augmented Reality (AR) is "a technology that allows computer-generated virtual imagery information to be overlaid onto a live direct or indirect real-world environment in real time." (Lee, 2012, p. 13) AR adds information to a real environment such as the classroom to improve student engagement as well as content understanding. AR has been used for visualization, training, entertainment and education and is becoming more readily available as technology improves (Sural, & Osmangazi, 2017). Today, technology is becoming powerful enough to deliver AR experiences through smart phones, tablets and other electronic devices that are used on a daily basis.

The affordances of AR offer numerous benefits to student learning. Many of the AR apps provide a 3D exploration of the topic. These 3D images nurture learning and enhance students' ability to visualize complex and abstract concepts by allowing students to analyze an object's spatial relationships. Through the 3D images, the student is better able to conceptualize the physical dimensions of the object and their relationships to other objects in the field. In addition, many apps enable learners to physically manipulate the AR objects adding a kinesthetic element to the learning (Billinghurst, & Duenser 2012). Many apps, for example, allow the learner to view the AR object from multiple angles or to zoom in on a feature or to even to change a feature (Diaz, Hincapié, & Moreno, 2015). These tactile experiences can help with understanding the content and provide yet another channel for storing information. By using multiple pathways (visual, auditory, and kinesthetic) augmented reality offers learners a multi-sensory learning experience. Shams and Seitz (2009) argue that multi-sensory learning environments reduce cognitive load by chunking information from different modalities into short-term memory and facilitate long-term representations. AR, thus, generates learning that stays in the student's memory longer than traditional non-digital resources of even 2D digital resources such as electronic books or video views (Castellanos & Perez, 2017).

AR also is adaptable to a variety of pedagogies and instructional content. Game based learning is one way students can use AR to learn basic school subjects like chemistry, mathematics and physics (Boletsis, & McCallum, 2013, Tobar-Muñoz, Fabregat, & Baldiris , 2015, Enyedy, Danish, Delacruz, & Kumar, 2012). AR systems offer solutions for learning difficulties like "visualizing unobservable phenomenon such as spinning of the Earth." (Wu et al., 2013) Alternatively, students will have an easier time understanding the parts of a molecule from a 3D representation of the molecule than from a page in a science book. The simplicity of using AR to teach complex subjects creates an effective and interactive experience for the learner which can lead to highly engaged students.

Student Engagement

Student engagement has increasingly been defined as a critical characteristic of high quality teaching and learning. Student engagement is defined as the "the degree of attention, curiosity, interest, optimism, and passion that students show when they are learning or being taught, which extends to the level of motivation they have to learn and progress in their education" (Great Schools Partnership, 2016, para 1). Student engagement is a multidimensional construct that includes three intertwined elements: Cognitive engagement, Behavioral engagement, and Emotional engagement. (Davis, Summers, & Miller, 2012). Cognitive engagement is described as the students' investment in their learning through thoughtfulness and willingness to exert the necessary effort to comprehend and master complex ideas and difficult skills (Fredricks, Blumenfeld, and Paris, 2004). Cognitively engaged students contribute to their achievement by drawing on strategies to organize new information, link it to previous knowledge, and monitor and evaluate their own learning (Bircan & Sungur, 2016). Behavioral Engagement is characterized as the actions that the student is taking with regard to lesson and their participation in the learning task (Fredricks, Blumenfeld, and Paris, 2004). Students who are behaviorally engaged complete required tasks and actively participate in class (Marks, 2000). Emotional engagement is related to student attitudes (both positive and negative) towards the learning task, teachers, the school, and the willingness to do work (Fredricks, Blumenfeld, and Paris, 2004). Emotionally engaged students enjoy the learning materials, find pleasure in the tasks, and continuously increase their efforts to maximize their learning (Oga-Baldwin, & Nakata, 2017, Singh, & Srivastava, 2013).

Engaging students in their learning affords numerous benefits to the school. Assor (2012), for example, asserts that engaged students have more positive feelings about studying. Finn and Zimmer (2012), Skinner, Pitzer, and Steele (2016) emphasize that student engagement contributes to student persistence in the face of academic challenges. Finally, Skinner and Pitzer (2012) stress that engagement is "a robust predictor of student learning, grades, achievement test scores, retention, and graduation" (p. 21).

Student Interest and Engagement through AR

Although many technologies have been employed in instruction, much of the success of any learning technology depends on its ability to interest and engage students in learning. Numerous studies have been conducted on these dimensions in augmented reality. Erbas & Demirer (2019) found in an investigation of 9th grade biology students that while there was no difference in academic performance between the control and the experimental group that included AR experiences, researchers' observations showed interest in the course increasing over time in the experimental group. In another study (Pérez-López, & Contero, 2013), researchers studied the use of AR as a cognitive tool supporting anatomy instruction in third grade. Students in this study indicated that they preferred to use AR technology and that they were better behaved in the class as a result of the AR. Other studies also pointed to AR creating interest in the lesson (Bursztyn, Walker, Shelton, & Pederson, 2017, Qamari, & Ridwan, 2017, Yeung, Fung, & Wilson, 2012).

When students' interest is aroused in an instruction, this fosters and deepens student engagement in learning. Many studies have examined the concept of student engagement through AR with positive results. Kamarainen, et al. (2013) researched student learning and student engagement using the geo-location ECOmobile app during a field trip where students studied water quality at a pond. The app triggered questions to be investigated when students reached points around the pond. Students then used probeware and Ti-Inspire calculators to collect data. Throughout this experience, teachers reported high levels of student engagement.

Similarly, Lindgren, Tscholl, Wang, & Johnson (2016) also reported high levels of engagement among middle school students studying the gravity and planetary motion. In this study, the AR provided an immersive environment with a whole-body interactive simulation of an outer space field that was projected onto the floor and walls. Students used their body to load virtual asteroids onto a spring and predict their movement in and around the planets in the AR projection. Engagement was measured through a set of questions. Significance was found on four dimensions of the construct of engagement between the experimental group that used the AR and the control group who used the same simulation on a desktop screen. High levels of engagement have also been reported in other studies using AR as an instructional tool (Dunleavy, Dede, & Mitchell, 2009, Liu, Horton, Olmanson, & Toprac, 2011, Huang, Chen, & Chou, 2016).

Challenges with AR

There are issues that are involved with using AR in the classroom. One issue could be the maintenance required for the devices using AR. Device failures such as GPS error or software lag can become frustrating for the students and the teacher. Wu et al. (2013) explain that the "learning activities associated with AR usually involve innovative approaches such as participatory simulations and studio-based pedagogy" (p. 46). This approach contrasts the teacher-centered instruction and could also limit the amount of content that can be covered. Along with the content instruction, the teacher will also need to instruct the student on how to use the innovative technology. Often, students unfamiliar with AR can become overwhelmed and this may cause some confusion among them.

METHODOLOGY

This study used quantitative and qualitative research methods to determine teacher's and administrator's perceptions of the effect of AR on student interest and engagement in the classroom, the ways that it was being used, and the challenges that they faced. The issue of reliability is an important part of research when analyzing data. (Efron & Ravid, 2013) The reliability includes how the data is gathered and what tools are used to collect it. Surveys are one of the most efficient ways to gather information for research. The internet allows a far greater reach with these surveys and allows more educators to participate. The measurement of the learning experience for students came from surveys sent to various teachers that are currently using AR in their classroom. The information gathered from these surveys measured their perceptions and attitudes toward using AR with their students. Respondents also gave their input on the types of AR they were using and how they were implementing it in the classroom. Finally respondents shared the challenges they faced in using AR.

Respondents

Instructors from several educational backgrounds were surveyed on how they felt using AR in the classroom. The survey was up on SurveyMonkey for approximately a month. During that month, several people visited the site and SurveyMonkey recorded their visit as a possible participant. Therefore, surveys were attempted by 47 respondents, however only 35 respondents completed the survey. The respondents were largely an older group with 26 of the respondents reporting that they were age 41 or older. The majority of the respondents were teachers in schools with 65% reporting that they taught at K-12 while 23% reported that they were in administration. The other category included Instructional Technology Coaches, an Instructional Coach, and 1 Special Education teacher. The respondents were largely suburban with 54% reporting that they lived in a suburban setting. The majority of the respondents, 77%, reported that they had more than 11 years in education. They largely perceived themselves as experienced in using technology with 66% reporting that they perceived themselves as having Advanced technology skills. Finally, they were sporadic users of AR (a Few times a year, 29%, and Often, a few times a semester, 23%). All of the demographic data is reported in Table 1 (Appendix).

Instrumentation

The survey was composed of 20 questions in three sections; the first 8 questions were demographic information, the second section investigated teacher perceptions of student engagement and interest with AR, and the last set of questions were open-ended questions where they shared their experiences with AR. Questions relating to teacher perceptions were Likert scaled from 1-5 with 5 indicating Strongly Agree and 1 indicating Strongly Disagree. Efron and Ravid explain that "the most common rating scales are the Likert-type scale." (2013) The responses in the survey ranged from Strongly Agree to Strongly Disagree. There were three open response questions for the respondents in which they wrote their responses in a few words or sentences.

Procedures

With permission from the IRB, the survey was posted to a variety of social media groups for teachers interested in AR. These included the ARVR Twitter Chat at Texas Computer Education Association, the Virtual and Augmented Reality Facebook Group, and the International Society of Technology for Education Virtual Environments Network. For each group, a post was made on their social media with a link to access and complete the online survey. The first page of the survey was a consent form which asked them to verify that they were over 18 and to consent. After agreeing to the consent form, the participant proceeded to the questions of the survey. This survey was intended to be about 20 to 30 minutes in length to complete.

Data Analysis

Data was downloaded from the Internet into a Spreadsheet and inspected for any anomalies. The data collected was first interpreted by finding frequencies and comparing the responses from the respondents. Statistical tests were applied to the data that was gathered from the surveys to investigate differences among groups of respondents.

RESULTS

Quantitative

In order to understand teacher perceptions of the effect of AR on student interest and engagement, 14 survey questions were administered that were grouped under Expertise, Student Engagement, and Student Interest. Results of these questions can be seen in Table 2 (appendix).

Inferential Statistics

In order to understand if there were any differences between various groups identified within the groups, various ANOVA analyses were performed.

There were originally a total of 47 respondents of those 35 named their gender; 26 female and 9 male respectively. An ANOVA was completed. Levene's test found equality of error variances so that even though there was not a normal distribution there was confidence in doing an ANOVA. On the dependent variable total expertise, hypothesis of differences between gender on expertise failed to be rejected. $F = .02$, $p = .92$, $p\eta^2 = .00$. The effect size is negligible.

The total of 34 respondents, 26 female and 8 male answered in student engagement section of the survey. An ANOVA was completed. Levene's test found equality of error variances so that even though there was not a normal distribution there was confidence in doing an ANOVA. On the dependent variable total student engagement, hypothesis of differences between gender on student engagement failed to be rejected. $F = .19$, $p = .67$, $p\eta^2 = .01$. The effect size is small.

The total of 35 respondents, 26 female and 9 male answered in student interest section of the survey. An ANOVA was completed. Levene's test found equality of error variances so that even though there was not a normal distribution there was confidence in doing an ANOVA. On the dependent variable total student interest, hypothesis of differences between gender on student interest failed to be rejected. $F = .06$, $p = .82$, $p\eta^2 = .00$. The effect size is negligible.

Differences on basis of age range dependent on expertise, ranges of 26 to 40 with 9 respondents, 41 – 55 with 16, 56 or older with 10, total of 35 responded. There was a normal distribution although Levene's test demonstrated unequal error variances but because the distribution was normal and an ANOVA is robust, the ANOVA was carried out. The hypothesis of differences between age based on expertise failed to be rejected $F = 1.41$, $p = .26$, $p\eta^2 = .08$, the effect size is moderate.

Differences on basis of age range dependent on student engagement, ranges of 26 to 40 with 9 respondents, 41 – 55 with 16, 56 or older with 9, total of 34 responded. There was a normal distribution and Levene's test demonstrated equal error variances so the ANOVA was carried out. The hypothesis of differences between age based on student engagement failed to be rejected $F = .99$, $p = .38$, $p\eta^2 = .06$, the effect size is moderate.

Differences on basis of age range dependent on student interest, ranges of 26 to 40 with 9 respondents, 41 – 55 with 16, 56 or older with 10, total of 35 responded. There was a normal distribution and Levene's test demonstrated equal error variances so the ANOVA was carried out. The hypothesis of differences between age based on student interest failed to be rejected F = .56, p = .58, $p\eta^2$ = .03, the effect size is small.

Of the total respondents 33 answered their educational assignments: Elementary 5, Secondary 11, Higher Education 3, Administration 9, Technology 5. An ANOVA was completed. Levene's test found equality of error variances so that even though there was not a normal distribution there was confidence in doing an ANOVA. On the dependent variable total expertise, hypothesis of differences between educational assignments on expertise failed to be rejected. F = 1.72, p = .17, $p\eta^2$ = .20. The effect size is large.

Of the total respondents 32 answered their educational assignments: Elementary 5, Secondary 11, Higher Education 3, Administration 8, Technology 5. An ANOVA was completed. Levene's test found unequality of error variances; so that even though there was not a normal distribution there was confidence in doing an ANOVA, because of its robust nature. On the dependent variable total students engagement, hypothesis of differences between educational assignments on student engagement failed to be rejected. F = .91, p = .47, $p\eta^2$ = .12. The effect size is large.

Of the total respondents, 33 answered their educational assignments: Elementary 5, Secondary 11, Higher Education 3, Administration 9, Technology 5. An ANOVA was completed. Levene's test found equality of error variances so that even though there was not a normal distribution there was confidence in doing an ANOVA. On the dependent variable total student interest, hypothesis of differences between educational assignments on student interest failed to be rejected. F = 2.54, p = .06, $p\eta^2$ = .27. The effect size is large.

Of the total respondents, 35 named their area; 8 rural, 19 suburban, 8 urban respectively. An ANOVA was completed. Levene's test found equality of error variances so that even though there was not a normal distribution there was confidence in doing an ANOVA. On the dependent variable total expertise, hypothesis of differences between area on expertise failed to be rejected. F = .39, p = .68, $p\eta^2$ = .02. The effect size is small.

Of the total respondents, 34 named their area; 8 rural, 19 suburban, 7 urban respectively. An ANOVA was completed. Levene's test found equality of error variances so that even though there was not a normal distribution there was confidence in doing an ANOVA. On the dependent variable total student engagement, hypothesis of differences between area on student engagement failed to be rejected. F = .45, p = .64, $p\eta^2$ = .03. The effect size is small.

Of the total respondents, 35 named their area; 8 rural, 19 suburban, 8 urban respectively. An ANOVA was completed. Levene's test found equality of error variances so that even though there was not a normal distribution there was confidence in doing an ANOVA. On the dependent variable total student interest, hypothesis of differences between area on student interest failed to be rejected. F = 2.20, p = .13, $p\eta^2$ = .12. The effect size is large.

Qualitative

Three questions were asked of the participants: What are three ways that AR can be used in your classroom or content area? What are your three favorite ways for using AR in the classroom? and What are some of the challenges of using AR in the classroom?

The majority of respondents for the first question suggested that they used AR in the science and math area: “science-looking at body systems, space exploration, and math-problem solving”. Some unique responses included kindergartners using “the Quiver app to bring their coloring to life”, “first graders using Blippar to create interactive bulletin boards” and “created a 3d virtual art gallery.” While most of the focus was on ready-made AR apps a few respondents also commented on creating AR via apps such as Aurasma/HP Reveal, Merge Cube, and Metaverse.

Respondents also commented on the pedagogies and strategies that they used with AR. Several reported that they use AR to “introduce a concept”, “set the context for learning” or “to activate prior knowledge”. They also reported that they found AR useful for visualization particularly for “examining structures we can’t get to” or “places we can’t go” (i.e. outer space). Respondents also noted that they were using AR for gamification by creating scavenger hunts. Finally, they found AR useful as a means of demonstrating student knowledge such as creating an interactive bulletin board or a virtual gallery walk.

There was also some confusion between AR and Virtual Reality. A few the respondents shared that they found AR useful for virtual field trips, a tool which is usually associated with Virtual Reality.

The respondents answered the third question citing cost as the greatest challenge followed by poor technology, lack of availability of equipment, time, and few apps/devices. An interesting note, two participants found students were not on task.

DISCUSSION

The majority of respondents perceive themselves as intermediate or advanced in the AR world and indicated that they perceive a high interest in AR content, student excitement, and student enjoyment. For this reason more administrators need to support the AR programs. This support could, according to the participants, take the form of funds, technology, devices and apps needed to support the program.

There are some areas that need to be restudied with a higher sample as they each had a high effect size. These include educational assignments, on total expertise, student engagement and student interest; and area on student interest. Small sample sizes sometimes end up in a type II error.

The apps and AR ideas mentioned by the respondents are for the most part those that have been in use for several years. This would seem to indicate that while the respondents are innovating in the use of AR, they have not been able to move beyond traditional practices. However, there were some glimmers of hope as one of the respondents mentioned that they are pushing the boundaries by creating AR through platforms such as Metaverse. This would seem to mirror the slight shift in the field away from students’ only consuming ready-made apps to creating apps as a means of creative expression and demonstrating learning. Professional development is also a necessity in order to help more of these educators find new ways to move the boundaries in implementing AR.

Finally, the findings in this study are consistent with previous findings that AR encourages student engagement and student interest. However, the previous research studies were performed with complex, highly designed AR software tailored to specific education content and with robust curriculum designed to support the use of the software. The types of AR that the respondents indicated that they are using are commercial apps that are available through the Apple app store or Google play. While these apps focus on a specific content area as seen in the 4D Anatomy app which allows students to interact with various human anatomy systems, they are not aligned with NGSS standards nor do they provide extensive curriculum to assist in presenting it in instruction. The respondents in this study were inventive in creating instruction that supported the use of AR in their educational settings. Further, even though they were using much simpler AR platforms than their research counterparts, they still found AR to stimulate high levels of engagement and interest in their students.

Conclusions and limitations

The current study suffers from some limitations which may limit the generalizability of our findings. First, our small sample size of educators who use AR limited our ability to detect differences among the groups. With a larger sample in the future, we may be able to detect differences which could lead to a greater understanding of their significance. Educators in this study were self-described users of AR in instruction. Future studies may want to include some mechanism for verifying their status.

The positive outcomes from using AR outweigh the issues that currently exist. Using the AR technology in classrooms will facilitate and improve the learning process for students. Student engagement in the classroom has been an issue for teachers from the beginning and finding innovative ways to engage them in the content is crucial. As technology continues to improve, AR will have a positive influence in education to improve student engagement. This study will give an understanding to school districts, from the teacher's point of view, on how AR impacts and improves student engagement.

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APPENDIX

Table 1
Demographic statistics of the respondents.

	N	%
Age (Group)		
26-33	4	11
34-40	5	14
41-47	8	23
48-55	8	23
55+	10	29
Level (Group)		
Elementary	4	12
Secondary	11	31
Administration	8	23
Other	12	34
Gender		
Female	26	75
Male	9	25
Location		
Rural	8	23
Suburban	19	54
Urban	8	23
Years in Education		
Less than 1 year	3	9
1 to 5 Years	1	3
5-10 years,	4	11
More than 11 years	27	77
Perception of AR Skill		
Novice	2	6
Beginner	1	3
Intermediate	9	23
Advanced	23	66
Frequency of AR Use		
Occasionally (Maybe once a year)	13	9
Now and then (A few times a year)	10	29
Often (A few times a semester)	8	23
Frequently (Several times a semester)	4	11

Table 2
Descriptive Statistics

	Valid N	Missing N	Mean	Median	Mode	SD
How long have you used technology in the classroom?	35	12	3.57	4.00	4	.92
At what level do you perceive yourself in using technology in the classroom?	35	12	3.51	4.00	4	.82
How often have you used AR apps in the classroom?	35	12	2.09	2.00	1	1.04
Total Expertise	35	12	9.17	9.00	9	2.05
When I use Augmented Reality in the classroom, students are actively engaged in learning	35	12	4.29	4.00	4	.57
When I use AR in the classroom, students are on-task	34	13	4.21	4.00	4	.59
When I use AR in the classroom, students show interest in the content.	35	12	4.57	5.00	5	.56
When I use AR in the classroom, students ask questions about what they are learning	35	12	4.09	4.00	4	.74
Total student engagement	34	13	17.15	17.00	16.00[a]	2.02
Students enjoy working with AR as part of instruction.	35	12	4.49	5.00	5	.61
When AR is included in instruction, students are excited.	35	12	4.51	5.00	5	.61
Students look forward to the times when we use AR in the classroom.	35	12	4.34	5.00	5	.84
*Students find AR dull and uninteresting.	35	12	3.46	4.00	4	.61
Students have fun with AR in the classroom.	35	12	4.43	4.00	4	.56
Total Student Interest	35	12	19.31	20.00	21.00	1.89

a. Multiple modes exist. The smallest value is shown
*reverse scaled