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The Study of Implementing Augmented Reality Assessment on Lower-Grade Life Curriculum

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Abstract. Most assessment in Taiwan is implemented through paper-based tests and it is the main way to grade learning achievement. However, lower grade students are usually not capable of comprehending lots of information quickly and perform well when they are requested to finish paper-based tests. For some students of cultural disadvantage or handicap, even it may result to underestimate students' learning potential. Therefore, we would like to further investigate what type of assessment could improve the above. To this end, augmented reality (AR) assessment is applied to lower grade students to better current paper-based tests. In this study, students will participate in AR assessment and use some cards to interact with a computer. We had several meaningful findings from our questionnaires and successfully covered AR technology in assessment. Results of our test show that AR assessment can indeed be a proper way to grade lower grade students' achievement. This study will be also a useful reference for computer-based assessment and e-learning.

Keywords: dynamic assessment, augmented reality, e-learning

1. Introduction

Assessment is a subjective value judgment, that is, assessors explain and judge quantitative number according to some standard [1]. The common way to assess learning achievement by educators is traditional assessment. Traditional assessment is applied to grade students by writing. According to quantitative numbers of assessment, assessors will be able to explain and make the value judgment; moreover, assessors apply the remedial teaching by these paper-based tests. Notwithstanding it is easy and helpful to use, it may underestimate learning potential of students of cultural disadvantage or handicap [2]. In order to atone for above insufficiency of traditional assessment, dynamic assessment was produced.

"Dynamic assessment" was first used by Feuerstein in 1979. Dynamic assessment is opposite to traditional static assessment. Feuerstein thinks that dynamic assessment is not used to assess students' knowledge, skill, or experience, but to know development, change, and preparation of students. The goal of dynamic assessment is to assess students' potential development standard and realize theirs' ability in life questions. The process of dynamic assessment is pre-test, teaching, and post-test. Comparing with traditional assessment, assessors add teaching and post-test when they execute dynamic assessment. Consequently, because of teaching intervention dynamic assessment provides lots of usable information for teaching [3]. In this study, we would like to investigate dynamic assessment in depth and combine augmented reality technology in lower-grade life curriculum. We create a novel way of assessment to improve assessment. In the end, we also resolve the phenomenon of underestimating students' potential by using AR [4][5][6] technology to reduce students' cognitive load during their tests.

2. Method

2.1. Participants

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There were 230 first-grade students who have few experiences about information knowledge participating in this experiment. They participate in AR assessment after finishing life curriculum of ten weeks.

2.2. The questionnaire

This questionnaire is designed to realize students' viewpoints of AR assessment. It includes two parts: the first part is "the suitability of AR assessment" and the second part is "the feeling of accepting AR assessment".

2.3. Procedure

This study went through three steps. First, we created movie clips in advanced. The movie clips are about questions of assessment.

Second, we design the system of AR assessment which included movie clips for students to interact. The AR assessment is one of the blockade-running assessment activities in this experiment. During the AR assessment activity, they use AR markers to interact with a computer and try to answer questions in movie clips. As shown in Figure1.Finally, students were asked to finish the assessment activity and end off the activity with a questionnaire.

Figure1. An AR assessment environment in a classroom

2.4. Descriptive Statistics and Data Mining

We collected students' viewpoints about their background, the suitability of AR assessment, and the feelings of participating in AR assessment by questionnaire. Questionnaires were examined by several experts and first grade teachers, so they have expert validity. We used Crobach's α as this questionnaire's reliability. Furthermore, Carmines and Zeller [7] point out a good educational test must at least be above .80 reliabilities to make it worth using. In this study, this questionnaire's α is .82, so this questionnaire has a good reliability.

Data analysis is divided into two parts. We use SPSS statistics software to analyze data and present statements about analytic conclusion in order to get initial understanding of students' viewpoints. Also, we use web graph [8] of data mining [9] to analyze data in depth and get relationships between questions.

3. Data analysis

We adopted descriptive statistics and data mining to analyze data. The descriptive statistics are used to explain data from SPSS to obtain an initial conclusion and then we use web graph of data mining to analyze the data in depth.

Web Graph is used to show the strength of relationships between values of two or more symbolic fields. The graph displays connections by using varying types of lines to indicate connection strength. Strong connections showing that the two values are strongly related are represented by a heavy line. Medium connections are represented by a line of normal weight. Weak connections are represented by a light line. If no line is shown between two values, it means either that the two values never occur in the same record or

that this combination occurs in a number of records below the threshold value. A trial and error method was used to set up the threshold value. In this experiment, the value for strong links was set at 176 and the value for medium links was set at 156.

3.1. Descriptive Statistics

The content of the questionnaire includes two parts: the first part is "the suitability of AR assessment" and the second part is "the feeling of accepting AR assessment". Because our participants are first grade students who were foreign to Likert way five-point scale, so we used the two-point scale for graded answers, respectively, 1 agree and 2 disagree. We have Table 1 about descriptive statistics of the questionnaire below. In Table 1, the mean of questions are all below 1.5. In other words, all students present positive attitudes towards these questions.

Table1. Descriptive Statistics of the Questionnaire

Questions	Mean	Std. Deviation	N
2. The Suitability of AR Assessment			
2-1 Do you like blockade-running assessment?	1.08	.267	230
2-2 Do you like the assessment way of first mission?	1.26	.438	230
2-3 Do you clearly understand the contents of the movies?	1.10	.304	230
2-4 Could you answer questions about every movie clip of first mission?	1.12	.325	230
2-5 Do you feel easy about the assessment way of first mission?	1.06	.230	230
3. The Feeling of Accepting AR Assessment			
3-1 Do you feel funny about AR assessment?	1.09	.292	230
3-2 Do you feel easy for operating it?	1.19	.392	230
3-3 Do you want to use AR assessment to learn?	1.16	.370	230
3-4 Do you want to use AR assessment to learn again?	1.14	.344	230
3-5 Are you willing to share AR assessment with other people?	1.18	.388	230

3.2. Data mining

In the experiment, we carried out an investigation on it. Besides descriptive statistics, we also hoped to understand the hidden relationships between questions. Therefore, web graph of data mining was applied to find out relationships. The conclusions are shown in Figure 2 and Figure 3. We illustrated the first 10 results in Figure2 and Figure3 from strength to weakness as follows:

- Students who like blockade-running assessment feel easy about the assessment way of first mission.
- Students who feel easy about the assessment way of first mission feel funny about AR assessment.
- Students who clearly understand the contents of the movies feel easy about the assessment way of first mission.
- Students who like blockade-running assessment feel funny about AR assessment.
- Students who like blockade-running assessment clearly understand the contents of the movies.
- Students who can answer questions about every movie of first mission feel easy about the assessment way of first mission.
- Students who feel easy about the assessment way of first mission want to use AR assessment to learn again.
- Students who like blockade-running assessment can answer questions about every movie of first mission.
- Students who clearly understand the contents of the movies feel funny about AR assessment.
- Students who can answer questions about every movie of first mission feel funny about AR assessment.

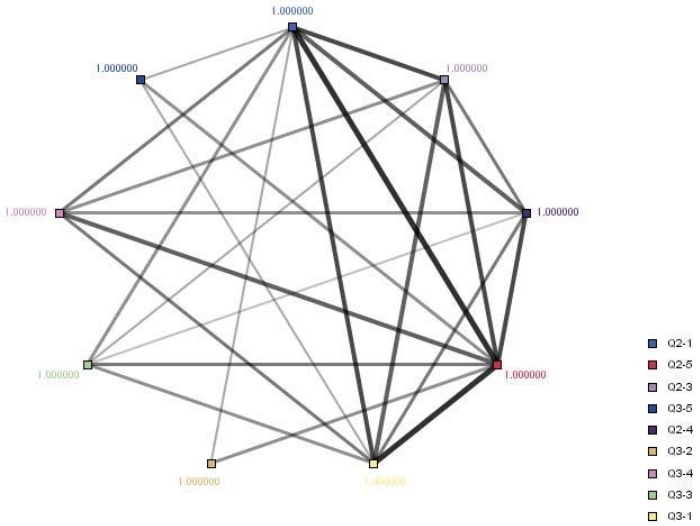

Figure2. Web graph of data mining in AR assessment experiment

Strong Links

Links	Field 1	Field 2
204	Q2-1 = "1.000000"	Q2-5 = "1.000000"
201	Q2-5 = "1.000000"	Q3-1 = "1.000000"
199	Q2-3 = "1.000000"	Q2-5 = "1.000000"
196	Q2-1 = "1.000000"	Q3-1 = "1.000000"
195	Q2-1 = "1.000000"	Q2-3 = "1.000000"
195	Q2-4 = "1.000000"	Q2-5 = "1.000000"
193	Q2-5 = "1.000000"	Q3-4 = "1.000000"
191	Q2-1 = "1.000000"	Q2-4 = "1.000000"
191	Q2-3 = "1.000000"	Q3-1 = "1.000000"
188	Q2-4 = "1.000000"	Q3-1 = "1.000000"
188	Q2-5 = "1.000000"	Q3-3 = "1.000000"
187	Q2-1 = "1.000000"	Q3-4 = "1.000000"
186	Q2-3 = "1.000000"	Q2-4 = "1.000000"
185	Q3-1 = "1.000000"	Q3-4 = "1.000000"
183	Q2-3 = "1.000000"	Q3-4 = "1.000000"
182	Q2-5 = "1.000000"	Q3-5 = "1.000000"
181	Q2-4 = "1.000000"	Q3-4 = "1.000000"
181	Q2-5 = "1.000000"	Q3-2 = "1.000000"
181	Q2-1 = "1.000000"	Q3-3 = "1.000000"
181	Q3-1 = "1.000000"	Q3-3 = "1.000000"
178	Q2-1 = "1.000000"	Q3-5 = "1.000000"
178	Q3-1 = "1.000000"	Q3-5 = "1.000000"
177	Q2-1 = "1.000000"	Q3-2 = "1.000000"
177	Q2-3 = "1.000000"	Q3-3 = "1.000000"

Medium Links

Links	Field 1	Field 2
174	Q2-4 = "1.000000"	Q3-3 = "1.000000"

Weak Links

Figure3**.** Links of web graph in AR assessment experiment

4. Discussion

In this research, we had 230 first-grade students consent to participant in the AR assessment. Students had to finish the AR assessment and fill out questionnaire. By descriptive statistics of questionnaires, we found students presented positive attitudes towards these questions. In other words, students actually are attracted by AR assessment and really can realize the contents of the movie clips. Besides it, we also found students feel easy for operating AR assessment. Moreover, students want to use it to learn and share it with other people. Afterward we analyze questionnaires by web graph, we found students who like blockade-running assessment feel easy and fun about AR assessment. In additional, these students can answer questions about every movie clip of first mission and want to use AR assessment to learn again. Students who can answer questions about every movie clip of first mission or clearly understand the contents of the movie clips feel easy and fun about AR assessment. In addition to it, they want to use AR assessment to learn again. Finally, they were willing to share it with other people.

Therefore, we understand blockade-running assessment which is a type of dynamic assessment truly attracted students. AR assessment is successful to add value to the blockade-running assessment activities.

The characteristics of AR assessment are fun and easy to operate which better students' learning behaviors. We also discovered AR assessment indeed can foster students' learning achievement and students are fascinated with its characteristics.

5. Conclusions and Recommendations

5.1. Conclusion

5.1.1. AR assessment is truly a helpful way to grade lower-grade students' learning achievement.

By questionnaires, we discovered most of students show they like the AR assessment. Then, they really realize the contents of the movie clips and can answer questions about every movie clip of AR assessment. Furthermore, we noticed that students who can answer questions about every movie clip of AR assessment or clearly understand the contents of the movie clips feel easy to operate and fun about AR assessment. It resolved the phenomenon of underestimating students' potential and reduced students' cognitive load when students using AR technology to test.

5.1.2. Fun and easy to use is the point for lower grade students

By results of web graph, students who like blockade-running assessment feel AR assessment easy to operate and fun. The point is students who can answer questions about every movie clip of AR assessment or clearly understand the contents of the movie clips feel easy and fun about AR assessment.

5.1.3. Lower-grade students like such AR assessment activity

Descriptive statistics of questionnaire show that students had positive attitudes towards these questions. They enjoy AR assessment. Besides, lower-grade students like blockade-running assessment and feel easy and fun about AR assessment as well.

5.2. Recommendation

We found AR assessment truly a novel and fascinating way to grade students' learning achievement for lower-grade students. In this paper we found our AR assessment indeed reduce impact of assessing theirs' learning potential, especially for first grade students. They like dynamic ways to assess, and what's more, the computer-based tests which combine augmented reality are more effective for kids. We have reason to believe that dynamic assessment combined with technologies is worthy to be studied. Our discoveries will be a useful reference for computer-based assessment and e-learning.

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