Testing An Assumption of the Potential of Homemade PowerPoint Games

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Abstract – Proponents of homemade PowerPoint games claim that students can gain a deeper understanding of the content based upon the act of constructing the game, writing a compelling narrative, and creating higher order questions or problems. However, results of recent studies into the effectiveness of homemade PowerPoint games have yielded no significant difference. The purpose of this study was to test the assumption that students are creating higher order questions by examining the games from one of these recent studies. Our results indicate that students are largely creating recall-style questions. As such, we recommend that homemade PowerPoint game proponents improve the instructional aids related to question writing within their project.

Proponents of the homemade PowerPoint game project claim that through the use of homemade PowerPoint games that students can gain a deeper understanding of the content (Barbour et al., in press; Rieber et al., 2008). These claims are based upon three beliefs: the act of students building or constructing something, the writing of the game narrative requires students to synthesis information, and the creation of challenging questions or problems by students based on the higher levels of Bloom's taxonomy. However, quantitative studies into the effectiveness of homemade PowerPoint games have yielded results of no significant differences (Barbour, Kinsella & Rieber, 2007; Clesson, Adams & Barbour, 2007; Parker, 2004).

We speculate one of the reasons for the lack of supporting evidence for students gaining a deeper understanding of the content is due to the fact that the questions they write for their PowerPoint games were not from the higher levels of Bloom's taxonomy. As such, this study was designed to examine homemade PowerPoint games to determine the levels of Bloom's taxonomy represented by the questions written by the students in one of these projects. This purpose lent itself to the following research question:

1. What levels of Bloom's taxonomy are addressed by the questions written for their homemade PowerPoint games by secondary students?

Literature Review

Parker (2004) described homemade PowerPoint games as having "game pieces, virtual or real game boards, and questions with correct and incorrect answers" (¶ 11). Essentially electronic board games that use the interactive, no-linear aspects of PowerPoint to provide a way to house and delivery questions or problems required for students to progress in their games. Proponents of the project advocate that the act of having students construct their own homemade PowerPoint games can lead to a deeper understanding of the content.

Wineburg (2001) believed that historical understanding could be measured on a continuum from merely storing factual information to analyzing and interpreting information. Modifying the original model to reflect this wider application, student understanding can be placed on one of four levels ranging from rationalizations by students that are based heavily on factual representations on the bottom end to students who are capable of analyzing and interpreting information in its original context on the high end. Proponents argue allowing students to construct

homemade PowerPoint games can help move students more successfully through these levels based upon three principles.

Learning is an active process that builds upon the student's existing schema, but is also grounded in meaningful, social contexts (Hooper & Rieber, 1995). The act of learning by constructing, or constructionism, allow for the 'building knowledge structures' irrespective of the circumstances of the learning" (Papert, 1991, p. 1). Over the past decade, a growing body of literature has supported the contention that children can learn in powerful ways when they are involved in the act of building projects (Harel & Papert, 1991; Kafai,1994, 1995; Kafai & Harel, 1991; Kafai & Resnick, 1996), such as constructing a homemade PowerPoint game.

Writing is also a common strategy used to assist learners. There is a growing body of literature, particularly in the sciences, that supports the hypothesis that those who write often and can write concisely about a topic tend to gain a greater understanding of the material than those who can't (e.g., Ambron, 1987; Collins, 2000; Kirkpatrick & Pittendrigh, 1984; Moore, 1993, 1994). In constructing a homemade PowerPoint game, students must write a storyline that gives players background information and context and setting, along with motivational elements that will help persuade them to play the game… all on single PowerPoint slide.

Finally, homemade PowerPoint games offer students the opportunity to generate questions or problems. Games are only fun when they are challenging. Therefore, students must learn to craft questions that are not too easy or not too difficult. Students who craft questions or problems based on more higher-order thinking instead of mere recall of facts soon find that they often strike the right level of challenge. Researchers have established that students who write higher-order questions are able to process original information better (Rickards & DiVesta, 1974; Wong, 1985). The proponents of homemade PowerPoint games have based their instructional materials associated with writing appropriate questions on the taxonomy of educational objectives (Bloom, Englehart, Furst, Hill & Krathwohl, 1956).

Methods

Prior to beginning the coding, all six researchers coded, and then compared and discussed a single PowerPoint game to ensure consistency in our individual coding. Individuals, working independently, coded each question in every game based upon the level of Bloom's taxonomy it addressed. This meant that each researcher coded questions from 21 games and that questions from each game were coded by two different researchers. Our hypothesis was that the finding of no significant differences from earlier studies with secondary students who have created homemade PowerPoint games was due to the fact that students created games with questions that only addressed the lower levels of Bloom's taxonomy. Upon completion of the coding, the researchers had a level of consistency of 96.5%.

The games created by the approximately 100 students in Barbour et al. (2007) were submitted to the publicly available homemade PowerPoint game database. The students in Barbour's study were enrolled in a US Studies course at a mid-western high school. The researchers downloaded a total of 64 games and this formed the sample for our study. The vast majority of games had 30 questions, although there were some that had a few as 20 and as many as 45. In total there were 1885 individual questions coded.

Results

Based upon our coding, we found our hypothesis was valid.

Table 1. Our anlysis

Bloom's Category	Number of questions coded	Percentage
6 – Evaluation	0	-
5 – Synthesis	0	-
4 – Analysis	0	-
3 – Application	6	0.1%
2 – Comprehension	233	6.2%
1 – Knowledge	3543	93.7%

As indicated above, none of the students wrote questions that addressed any of the three higher levels of Bloom's taxonomy.

The vast majority of questions that we analyzed were written to address the "Knowledge" level of Bloom's taxonomy. For example, a common style question we reviewed might be:

Who was the cold war between?
A) The United States and England
B) The United States and Cuba
C) The United States and The Soviet Union
D) The United States and The Netherlands

Or:

How did the cold war get its title?
A) Both sides were harsh to each other
B) Both sides were afraid, fought "indirectly" – outcome of nuclear weapons would destroy everything
C) People lived during poor times during the war
D) The cold war was a terrible war and wasn't talked about

In both of these examples the answer is obvious to any student who has reviewed the material and only requires that students simply recall that information. However, 93.7% of the questions we reviewed were at this level.

The second category of questions we coded was at comprehension level. For example, the following questions would be consistent with questions we reviewed from this category.

How are the French and Indian Wars, the Third Carnatic War, and the Seven Years' War, all connected to each other?
A) The Third Carnatic War in Asia lead to the French and Indian Wars in America, and then those lead to the Seven Years' War in Europe
B) The Seven Years' War in Europe lead to the French and Indian Wars in America, and those lead to the Third Carnatic War in Asia
C) The Seven Years' War in Europe lead to the Third Carnatic War in Asia, which lead to the French and Indian Wars in America
D) The French and Indian Wars in America lead to the Seven Years' War in Europe, which later lead to the Third Carnatic War in Asia

Or:

Which of the following is NOT stated in Articles IV-VII?
A) The Constitution is at the top of the ladder in the Supremacy clause
B) Constitution cannot be amended
C) States cannot discriminate against other states
D) Cannot flee state if you commit a crime

Comprehension questions like examples presented primarily focus on understanding of meaning. This level required slightly more cognitive effort than knowledge level and approximately 6% of the questions were determined to be at this level.

The final of questions we coded was at the application level. In our analysis, there was actually only one question where both coders agreed that the question fell into this level.

Read and Interpret then answer the question.

SECTION 2. JUDICIAL DISTRICTS The State is divided into five Judicial Districts for the selection of Supreme and Appellate Court Judges. The First Judicial District consists of Cook County. The remainder of the State shall be divided by law into four Judicial Districts of substantially equal population, each of which shall be compact and composed of contiguous counties. (Source: Illinois Constitution.)
SECTION 3. SUPREME COURT - ORGANIZATION The Supreme Court shall consist of seven Judges. Three shall be selected from the First Judicial District and one from each of the other Judicial Districts.

How many judges in the Illinois Supreme Court are from the district that Mclean County is in?
A) 3
B) 1
C) 7
D) 4

Application level questions aimed to measure usage of a concept in a new situation. In this instance, the student provided two pieces of information and the individual responding to the question would have used that information to answer the question. Less than 1% of the questions were identified at this level.

When the purpose of an instructional activity is to promote deeper understanding through the creation of higher-order questions, these results demonstrated that the current activity was not successful in generating these higher levels of thinking.

Discussion

While it appears that the proponents of homemade PowerPoint games have created adequate instructional aids for teachers on learning the necessary feature of creating action buttons and on how to construct a homemade PowerPoint game, the resources available to both teachers and students on how to prepare the desired type of questions is lacking. At present, there are three documents on question construction available at the homemade PowerPoint games website (see http://it.coe.uga.edu/wwild/pptgames/) for teachers to use:

1. Bloom's Taxonomy (http://it.coe.uga.edu/wwild/pptgames/resources/blooms_taxonomy.pdf)
2. Bloom's Taxonomy Guide to Writing Questions (http://it.coe.uga.edu/wwild/pptgames/resources/bloom_questions.pdf)
3. Question Frames for Developing Higher-Level Questions (http://it.coe.uga.edu/wwild/pptgames/resources/question_frames.pdf)

All three documents provide a description of the various levels of Bloom's taxonomy, along with a selection of question verbs or prompt associated with that level. For example, the "Bloom's Taxonomy" document provides the following description and verbs for the knowledge level:

Skills Demonstrated
- observation and recall of information
- knowledge of dates, events, places
- knowledge of major ideas
- mastery of subject matter

Sample Performance Verbs: list, define, tell, identify, label, collect, tabulate, quote, name

While the "Bloom's Taxonomy Guide to Writing Questions" document provides the following for the comprehension level:

Useful Verbs	*Sample Question Stems*
explain	Can you write in your own words...?
interpret	Can you write a brief outline ... ?
outline	What do you think could of happened next ... ?
discuss	Who do you think ... ?
distinguish	What was the main idea ... ?
predict	Can you distinguish between ... ?

restate	What differences exist between. ..?
compare	Can you provide an example of what you mean ... ?
describe	Can you provide a definition for ... ?

The "Question Frames for Developing Higher-Level Questions" document only provides suggestions for the knowledge level, then the remainder of the hand-out is focused on Bloom's three highest levels.

In fact, there was not a single question included in our analysis that used any of the terms in the resources provided associated with the higher levels of Bloom's taxonomy. In examining the three hand-outs, verbs such as order, select, judge classify, identify, choose, and rate were all included as examples from the three highest levels that the students could have chosen from. Many of these verbs naturally lend themselves to multiple-choice questions, for example:

> Order the following events as they occurred during the first year of the American Civil War.
>
> 1. West Virginia Is Born
> 2. A Blockade of the South
> 3. Attack on Fort Sumter
> 4. The South Seizes Federal Forts
> 5. Lincoln's Inauguration
>
> A) 5, 4, 2, 1, 3
> B) 4, 5, 3, 1, 2
> C) 2, 3, 5, 4, 1
> D) 3, 4, 5, 2, 1

In this kind of question, the students need to first recall the actual dates the events occurred and then sequence them in the correct order. As all of these events happened within six months of each other in 1861, students could also use their knowledge about one event to determine whether another event was likely to come before or after. However, there was no evidence of this in our analysis.

The way in which Barbour et al. (in press) described the process for working with students to write their homemade PowerPoint game questions as:

> Students are introduced to the concept of different levels of questioning based on Bloom's Taxonomy. Students work in pairs to improve their three sample questions to ensure that the games will promote higher-order thinking skills rather than the basic recall of facts. Students are also encouraged to make sure questions relate back to the original story. Instead of, "What is the definition of inertia?" a game might ask, "Why will the riders on your roller coaster need to wear seatbelts?" This activity encourages students to write short answer and open-ended questions instead of simply multiple choice. (p. 17)

The teacher from Barbour et al. (2007), whose students' homemade PowerPoint games were included in this analysis, introduced the concept of different levels of questioning based on Bloom's taxonomy and provided all students with copies of all three handouts. Students created three sample questions and e-mail those questions to the teacher for feedback. As we were copied on that correspondence, we know that all of the sample questions submitted by the students were similar to the ones that we analyzed (in most instances those questions were included in the students' games and, as such, included in our analysis). We can also state that in each instance the teacher warned their students about creating an entire game using these kinds of questions because they were all knowledge and comprehension level questions, and that a good game would have the questions become increasingly difficult.

What was striking about this description was that the students were never exposed to examples of higher order questions in their content area. Bandura (1997) described that modeling can be an effective teaching tool because it has the potential to provide information about how the task should be performed. In this instance, it was never modeled to the students how to write a higher-level multiple-choice question in US history so they did not have examples in which to draw from. The Barbour et al. (in press) descriptions spoke of students working together to improve upon their questions. This would be consistent with Schunk (1991), who found that peer modeling was more effective than teacher modeling. However, the students have to be able to access examples from which to model – which were not provided in this instance.

In addition to static handouts provided on the homemade PowerPoint game website, there were also videos that teachers could use with their students (or that students could use directly). These videos were specifically related to the creation of the game headquarters, questions and the question feedback (i.e., all highlighting the skills required to hyperlink slides). We wonder what effects adding videos related to Bloom's taxonomy to these resources might have to the kinds of questions students were constructing. Would providing additional resources in a more interactive format have made a difference? We also wonder if it would not be possible for the proponents of homemade PowerPoint games to create additional static resources that provide specific examples from a variety of subject areas of questions or problems that focus on the higher levels of Bloom's taxonomy, and what kind of effect a resource of that nature would have had on how the teacher introduced that part of the homemade PowerPoint games project or, if simply provided directly to the students, would it have been enough modeling for them to have written better questions. This speculation on our part should inform future inquiry into the student creation of questions for their homemade PowerPoint games.

Conclusions

Of all the technology-based tools available in the classroom today, Microsoft PowerPoint is likely to be found in almost every school in America – and most teachers feel confident in their ability to use PowerPoint. And while there may be better game design tools, proponents believe that harnessing teachers and students familiarity and comfort with PowerPoint is a practical way to bring game design into the classroom. As such, the project has potential to overcome the scalability problem that most technology-based projects face when they seek widespread adoption in the K-12 environment. However, if the games designed by students are simply artifacts of rote knowledge, how much of the potential of homemade PowerPoint games are actually harnessed?

Based upon our results, it is clear that more work needs to be done to ensure that teachers are prepared to implement this example of technology integration into their classroom. Proponents of homemade PowerPoint games have done an excellent job creating support material for teachers and students to allow them to overcome the final technical hurdle to the construction of these games (i.e., the process of linking slides in a non-linear fashion). Nevertheless, more efforts needs to be focused upon providing the necessary professional development materials to assist teachers in training their students on how to get past the comprehension level questions, and how to construct truly higher order questions. Only when students are able to undertake all three of the assumptions made by proponents, will they be able to realize the true potential of homemade PowerPoint games.

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