Effectively Utilizing PowerPoint in a Bilingual Math Lesson

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Overview

The use of PowerPoint presentations is a medium that has been around since 1987 (Wilkipedia, 2008). It is a popular means used to help organize and highlight important information. A vocal critic of PowerPoint is Edward Tufte (2003) who contends that there is much more ill use than anything beneficial that can be derived from PowerPoint slide shows. For one, all too popular is the presenter reading off of PowerPoint slides, leaving the audience to fathom having someone read the slides verbatim when they can read them for themselves. A second scenario for the use of PowerPoint presentations is to have slides with bulleted items and the presenter elaborates on the bullets and gives further detailed information. Although this example is more advanced than the first scenario, it still lacks engaging the learner. Richard E. Mayer (2005), on the other hand, has taken a positive approach to PowerPoint presentations. One of the issues that Mayer points out is whether you want your presentation to be an *information presentation*, which merely presents information, or to be *cognitive guidance*, which is deeper in that it helps the audience organize and process the information presented (Atkinson, 2004). The latter is a more complex look at using PowerPoint and makes it necessary for the learner to apply the information they are being presented, thus committing it to comprehension. As such, the audience actually becomes a participant and engages in the material being presented and it becomes an interactive session. The focus of this paper is to demonstrate how an effective utilization of PowerPoint can actually enhance learning and lead to the processing of new information. This will be demonstrated via a bilingual math lesson on equivalent fractions taught by Jorge Limon of Garfield Elementary in Del Rio, Texas.

Memory

Sitting back and watching a PowerPoint presentation can be entertaining and informative. Audiences have always enjoyed keeping up with a lecture auditorially, but can now do so visually via PowerPoint. However, looking at how memory works, specifically working memory, it is easy to see how being given so much information in a small amount of time can be overwhelming to committing this information to understanding, much less to memory. According to most Educational Psychology books, including Woolfolk (2004), about 5-9 objects can be retained in working memory at any given time. In a typical PowerPoint presentation, many more than 5-9 items are introduced at one time. Therefore, an overwhelming amount of introduced material cannot be retained in a person's memory bank due to limited capacity. This is why one of the principles that Moreno &Mayer (2000) contend is critical is that extraneous information be excluded in a presentation slide. Irrelevant material takes up some of the energy needed for cognitive processing and actually takes away from the focus of the presentation. Once information is digested in working memory, then it can be engraved in long term or permanent memory and ultimately, can be utilized in an unlimited timeframe. In order to assist a person with committing information from PowerPoint presentations to both understanding and memory, several other principles have been found that can help ease this process. Some of these principles will be discussed in the sections that follow.

Meaningful Learning

Making a PowerPoint show interactive is definitely one of the first things that can be done to help a person retain newly introduced information. This allows the audience to integrate the information presented along with prior knowledge. Mayer and Moreno (2003) assert that the presentation should consist of active processing and should help the learner integrate the information presented along with existing cognition. This way, a person is able to mentally organize the information so that it is logical and has meaning to them.

Multimedia Design Principles of Fracciones Equivalentes

Following is an example of a PowerPoint presentation that follows basic concepts outlined by Atkinson and Mayer (2004). These concepts will be highlighted in a bilingual math lesson that teaches a child about fractions and asks the basic question "Which fraction is greater"? This PowerPoint application effectively uses well documented principles of multimedia design. This presentation shows a simple, visual and segmented approach to a lesson on Equivalent Fractions and considers the literature on cognitive psychology; more specifically how limited memory capacities of learners and dual-coding (auditory and visual) of the stimuli, influences the effectiveness of the PowerPoint design. Among the principles demonstrated are:

Coherence principle: People learn better when extraneous words, pictures, and sounds are excluded rather than included. Keeping the slides from being filled with information that can overload our working memory is a must. Irrelevant information distracts and takes away from the processing of new information. Although cute graphics and colorful backgrounds can be eye pleasing, they can also diminish the message that the PowerPoint presentation is trying to convey (Meyer & Moreno, 2002).

The screens of this lesson are clean and simple with few extraneous visuals as shown in figure 1.

Signaling principle: People learn better when the words include cues about the organization of the presentation. Signaling involves pointing out important information that is needed to process as is shown in figure 1. In addition, including a clear heading helps identify what the main idea of the slide is.

Effective use of color coding and other visual cues in this lesson makes connections between information units and mathematical functions. The headline asks the question, "Which fraction is greater?"

Segmenting principle: People learn better when a multimedia lesson is presented in learner-paced segments rather than as a continuous unit. The information should be broken down and presented in smaller units, instead of on all at once. When this is done, the learner is able to digest one segment at a time before going on to the next. This keeps a person from becoming overwhelmed with an overload of new information.

Figure 2 depicts the slide show demonstrating a gradual, incremental introduction of knowledge units. With each successive click, relevant information is highlighted and commands the attention of the learner.

Individual differences principle: Design effects are stronger for low-knowledge learners than for high-knowledge learners. Likewise, design effects are stronger for high-spatial learners than for low-spatial learners because they are able to hold and manipulate mental images in their mind. According to cognitive theory of multimedia learning, students with high spatial ability are able to hold the visual image in visual working memory and thus are more likely to benefit from contiguous presentation of words and pictures (Moreno & Mayer, 1999). This visual example would be more effective for visual and high-spatial learners.

The same information is presented using a bar graph in figure 3 to visually demonstrate the concept concerning which fraction is greater. In this case, instead of demonstrating how to mathematically figure out the problem, a visual display is depicted that makes the answer evident and reinforces the child's grasping the concept of equivalent fractions.

Multimedia principle: People learn better from words and pictures than from words alone. In order to help manage this concept, PowerPoint presentations should use both words and pictures. People have dual-channels, which are separate capacities for processing visual and verbal material. The concept of *dual channels* explains how cognitive scientists believe that our mind processes information in two different channels. One is for verbal and the other is for visual material. If we can tap into both of these

areas, it makes it easier for learners to make a connection using graphics, including clip art and photographs. These visuals help demonstrate the point that you are trying to make.
Figure 3 is a clear and obvious example of a visual representation being more effective than a purely textual example in showing which fraction is larger. The horizontal bar graph visually demonstrates that 2/4 is greater than 1/3.

Creating "Funcciones Equivalentes" Lesson in PowerPoint

(see Figure 2)

These directions show how to create the animations demonstrated in the slides. These basic steps are repeated in the succeeding slides. There are multiple ways to do this. This is just one approach.

1. Begin with the end in mind. So that you know the final mouse click of the slide will look like figure 1.
2. Next, sketch a storyboard sequence of the slide showing what each successive click of the mouse will introduce.
3. Create all of the elements of the completed slide as shown in the final scene.
4. Once all the elements have been created, begin adding the animation to each element according its mouse click sequence as shown in the following steps.
5. The "Open slide" needs no animation since it automatically appears when the slide is opened.
6. To add animation for the "First mouse click," select one of the yellow circles, click the Animations tab, then Custom Animation.
7. On the Custom Animation window, select Add Effect > Entrance > More Effects > Appear.
8. Select the second yellow circle and do the same.
9. Notice however, that the animation to the second circle will occur on a Second mouse click, so change the animation setting to "Start with Previous" from the drop down box.
10. Repeat this for each element on the slide until you have completed the animations for each of the five mouse clicks. The final, properly animated slide will look like what is shown in figure 1.

References

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Figure 1

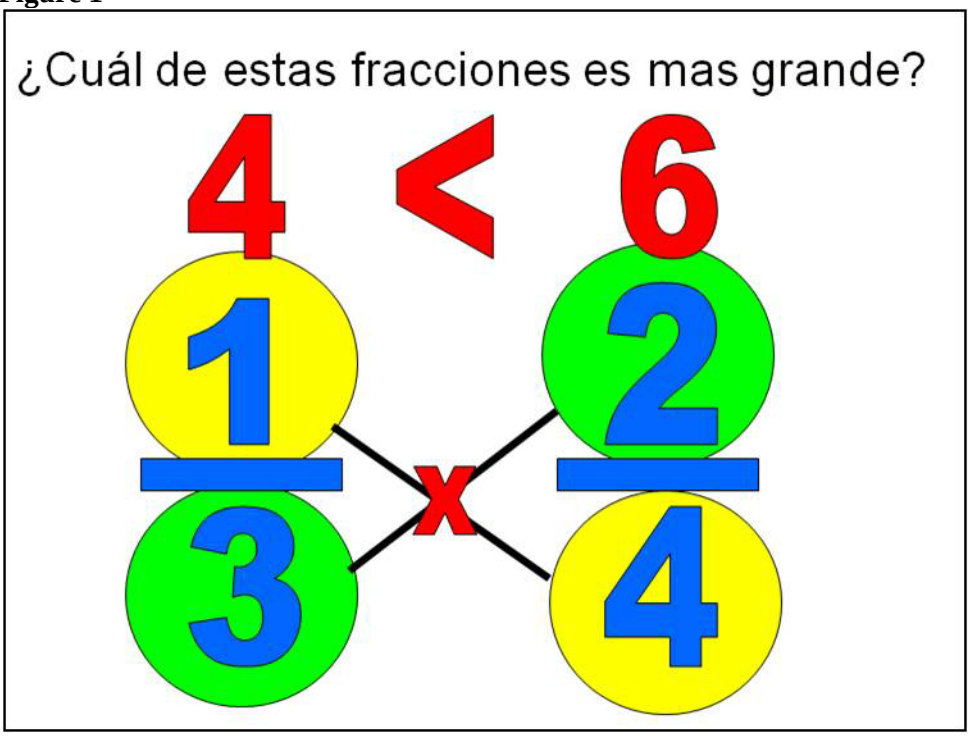

Figure 2

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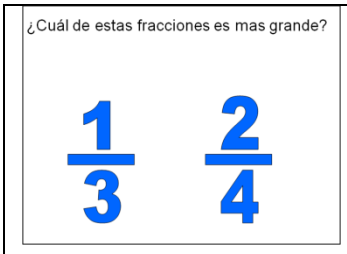
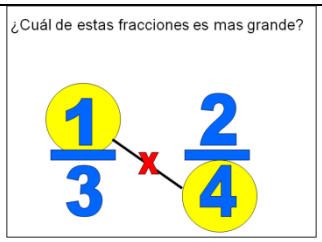
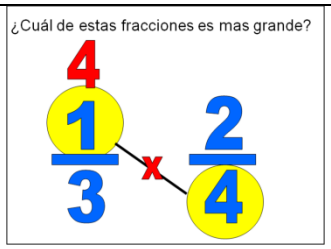
<tr><td>  </td><td>  </td><td>  </td></tr>
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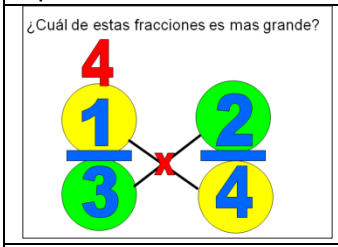
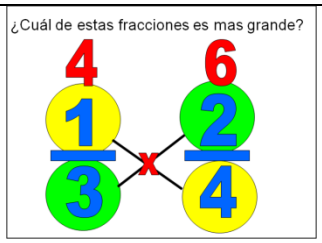
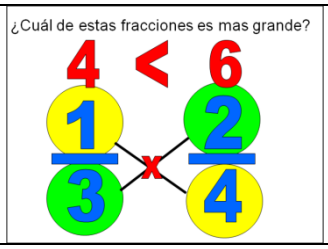
<tr><td>  </td><td>  </td><td>  </td></tr>
<tr><td>Third mouse click</td><td>Fourth mouse click</td><td>Fifth mouse click</td></tr>
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Figure 3