Laaman, L., & Jay, J. (2015). Student constructed visuals to enhance learning. *The Researcher, 27*(2), 34-37.

Student Constructed Visuals to Enhance Learning

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Abstract: This paper describes a study involving drawings and diagrams and their relatedness to higher achievement scores within a college level course for prospective teachers. A comparison of exam scores between two groups showed that course participants who constructed drawings and/or diagrams scored higher than participants who constructed definition pages.
***Keywords*:** Visuals, drawings

The purpose of this study was to document any impact on achievement that one instruction and learning strategy—drawing/diagramming—had on achievement within a college level science course for prospective teachers. The visual-spatial modality of drawing and diagramming was chosen because it is not, per se, the norm or standard that is utilized for instruction and learning in American institutes of higher education (Gardner, 1999), and currently there is an emphasis on accommodating a more diverse student population with more diverse methodologies. Further, Boss (2008) suggests that learning will be enhanced for *all* students when more visual learning tools are infused within instruction.

Review of Relevant Literature

Visual learning is a teaching and learning strategy that has proven successful in raising student achievement and attitude in many different disciplines (Novak, 1991). When ideas, concepts, data and other information are made visual or constructed through images, graphics, and/or drawings, students become more engaged within the learning process itself. Over forty years ago, Ausubel (1968) suggested that teachers do *not* have to dramatically alter the basic and prevalent lecture/presentation mode of instruction in order to help their students attain higher achievement—he claimed that the infusion of more visuals within instruction would lead to meaningful learning. Ausubel noted that verbal learning, with appropriate visuals embedded within instruction, would help students clarify their thinking, integrate and structure new knowledge on their existing knowledge, organize and critically evaluate material more effectively, and, as importantly, would keep them engaged within a lesson because it included a multisensory and multimodal approach to learning.

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In today's high-technology and visual-based schooling many educators have infused high-technology visuals into their instruction. There are software packages being used by educators that have synthesized the best principles of visual-based instruction modules. For example, PowerPoint, Prezi, Keynote; also, there are www sites that serve to develop individuals' visual-spatial abilities and, in turn, lead to users' increased academic success (Brittan, 2004). These computer-based visual tools that accompany content—whether they are professionally produced or produced by a novice teacher—can have a powerful place within instruction, and in some cases are necessary in order for true, meaningful learning to occur.

Dye (2000) described a number of positive student attributes that are enhanced when visual, graphic organizers were incorporated into instruction: (a) comparisons can be seen, (b) key components can become evident, (c) students see the links between information and concepts, and (d) teachers can better organize their own instruction so that learning is better sequenced. However, some researchers (Lane & Wright, 2005) suggest that until there is *interactivity* built into the medium that a teacher is teaching through then one can really *not* hope for maximum learning from course participants. They noted that there is a paucity of research on PowerPoint and other software presentation visuals and any effect it may have on achievement and/or attitudes. However, they also noted that there was a major difference in achievement gains in their study between course participants who *received* visual instruction and those who were engaged in *constructing* visual models. Their advice to instructors was to put *students* to work on the construction of classroom visuals—because it enhances their own learning and engagement.

Frankel (2006) claimed that both visual thinking and visual activities are keys to holistic understanding. She described how her students' drawings and diagrams regarding the topics under study were excellent examples of the creative ways which individuals utilize in order to understand subject material. For example, in drawing and explaining molecular bonding in compounds some students drew animals, spaceships, and people in place of the molecules, and they used metaphors in their explanations. Frankel has utilized this "picturing to learn" technique in universities, high schools, and middle schools, and notes that drawings can give us a far deeper conceptual understanding of course material. Further, she notes that by studying drawings we can better target misunderstandings and revise instruction to accommodate our students when needed.

Pillsbury (2006) showed that students with little prior knowledge of a topic/concept, and/or with misconceptions about science facts or ideas, can benefit through drawings and diagramming. The diagramming technique that Pillsbury has utilized (at middle level, high school, and college level) is carried out individually by students on a 10-meter-long paper scroll and it documents all of the concepts that have been taught and learned (and then diagrammed by students) during the academic semester. He noted that in his teaching career there has been no other technique that he has utilized to teach students that has been so well received or more successful; this fact implies that both attitudes *and* achievement can be enhanced when visuals such as noted above are infused within our teaching.

Timelines utilized in history class can show the linear progression of ideas and events; concept maps utilized within science class can show how concepts are linked to each other in hierarchical patterns; concept webs utilized in language arts class can highlight the components that come together to make up a text; typically, these types of visual tools contain written language and *not* drawings and/or diagrams. As noted above, there is very little research that has been done in the drawing/diagramming area, and if indeed it enhances learning; this prompted our interest in the current research study.

Method and Practice

The participants in this study were enrolled within one of two sections of a class. A coin flip determined which class was assigned the experimental group and which would then be the control group. Initial equivalence of the two groups was established through a comparison of mean scores from two (2) multiple-choice exams given within the class prior to the current study.

Our typical class session begins with the instructor advance organizing the day's topic through lecture (including computer software presentations), and demonstrating major concepts with models. Then, cooperative groups of students (there are typically 4-5 students in each group) complete a learning activity at their table; materials required to complete each activity, and a task card including specific directions, are at each table so the instructor does not have to give verbal directions to each individual group. After each cooperative group completes their activity they then demonstrate it for the whole class; all of these smaller learning activities are related to the main overriding topic of the day. Finally, instructor clarification where needed, and student comments and discussion conclude the lesson.

For out-of-class assignment, control group participants were provided with an instructor generated list of terms related to concept knowledge that was covered within the lessons presented. They were to construct and turn in a definition page that included all of the terms. The experimental group participants were provided with the same instructor generated list of terms related to concept knowledge that was covered within the lessons presented (exactly similar to the control group list). They, however, were to construct and turn in a page(s) that included drawings and/or diagrams that illustrated each of the terms.

Results

Achievement scores were obtained from each group through an instructor generated post-test relating to the concepts studied within the lessons taught. It should be noted that the post-test was a multiple choice test that contained no drawings nor diagrams, so as not to favor the experimental group in any way. The mean score of the experimental group was higher than the mean score of the control group in this study (Experimental Group n = 24, M = 79.96; Control Group n = 22, M = 76.41).

A qualitative/survey component was not included within the study in order to document experimental group participants' attitudes regarding the drawing/diagramming assignment. However, the enthusiasm that was witnessed from participants turning in the assignment insinuates that attitudes were very positive regarding the strategy. Further, the drawings/diagrams themselves were not scrutinized for thoroughness, errors, and/or possible misconceptions. In the future, more attention needs to be paid to this aspect of the strategy to ensure that students have minimal gaps in their conceptual understanding of topics under study.

IMPORTANCE TO THE FIELD

Both experimental and control groups received identical instruction that included many visuals and demonstrations within class. Following Lane and Wright's (2005) advice, students were put to work constructing drawings and diagrams related to the content under study. The experimental group achieved a higher mean score due to participants' higher engagement with the content, and because more than one modality was utilized in their assignment—cognitive content review accompanied by physically drawing and/or diagramming the content. If the pattern of higher exam scores documented was consistent throughout a semester in which drawings and/or diagrams were incorporated, then one could make a strong case for infusion of more student constructed visuals and visual assignments being part of the curriculum.

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