Poster Type (Idea)

Application of Cognitive Load Theory to Interactive Notebook Design

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Student notebooks have long been a tenant of agricultural education (Newcomb, McCracken, Warmbrod, & Whittington, 2004). Among the best practices listed by Newcomb et al. are that students have the same type of notebook, that teachers instruct students on how to take notes, and that teachers find meaningful ways for students to take notes. Additionally, teachers are encouraged to find ways for students to utilize their notebooks which help students see their value. While current research on note taking indicates there is no single solution which will improve learning in all situations, several convergent themes emerge from the literature. Taking notes is better than passive listening, a greater quantity of notes tends to be better, verbatim notes do not improve understanding, explicit teaching of note-taking improves learning, adding drawings and sketches improves comprehension, and over or under taxing of cognitive load decreases learning (Brazeau, 2006; Bui, Myerson, & Hale, 2013; Katayama & Robinson, 2000; Kiewra, Benton, Kim, Risch, & Christensen, 1995; Kobayashi, 2006; Mueller & Oppenheimer, 2014; Wammes et al., 2019).

Graphic organizers and other techniques which reduce the long-hand recording of lectures improves student application of learning by reducing cognitive loads and making connections between principles more direct (Katayama & Robinson, 2000). Katayama and Robinson (2000) found advantages for partial notes over complete notes and for graphically organized notes over outlined notes. Both the elimination of outlines in favor of graphical organization and providing partial notes over complete notes are conditions interactive notebooks (IN) provide for students. IN combine many of the benefits of traditional notebooks along with several benefits a traditional notebook does not offer.

How it works/Methodology/Program Phases/Steps

IN combine several strategies previously listed to engage students, provide organized structure, and focus student attention. Care must be taken to adjust the content of the IN and the time necessary to assemble any glued in components so that learning is maximized, and the notebook does not become an art project. Cognitive load theory (CLT) was applied to the design and implementation process of creating an IN designed to teach parliamentary procedure skills to novice audiences (Chandler & Sweller, 1991). CLT suggests that repetition between graphical and print sources is not beneficial. CLT also focuses on maximizing but not overloading working memory. Working memory overload occurs when new items cannot be readily coded into current schema. Parliamentary procedure (PP) is one instructional area where students' current schema cannot readily integrate the material since the content is outside most students' prior experience.

The design process for the IN began by trying to find graphical representations which could be utilized to help students make connections between content and their current schema. Cutouts, diagrams, and graphical organizers were used to cover the foundational principles of PP. Once the pages were constructed, content was analyzed to find ways to help students encode the new information. Graphical organizers were redesigned and color coded to help distinguish different classes of motions from each other (ex. pink rectangles vs purple ovals). The document was then piloted with a group of six students practicing for the PP Leadership Development Event. The initial IN took over eight hours to assemble with no time devoted to instruction or reflection. The authors quickly realized that the IN curricular value was overshadowed by the sheer volume of time needed to assemble the many components.

Following the initial pilot, many of the page's cutouts were changed to integrated pages which could be printed with as many background components in place as possible to reduce the time requirements. Rather than having students cut out rectangles from pink paper and glue them

in place, now a rectangle outline was utilized which needed only be colored in. Content heavy pages which utilized large elaborate cutouts were simplified and reformatted to eliminate the complexity and further reduce cognitive loading. A revised notebook was again presented to the pilot group of students which could now complete the assembly portion of the notebook in less than an hour. This was deemed an acceptable amount of time given the length of the document and the IN was sent out to teachers for further piloting. The IN was posted on an open source document server and teachers were sent links to the site through both email and Facebook.

Following the initial distribution to teachers, comments led to further refinement and the addition of more content on some of the pages (form and example statements). Following the posting of the revised document, a second notification was sent out via email and Facebook, and a workshop was held instructing local teachers on the IN, how the components were assembled, and answering general questions on the curricular content of the various pages. At this time, a completely assembled IN was scanned and published along with the student and teacher edition on the open source website.

Future Plans/Advice to Others

Teachers are busy and continually look for quick and affordable ways to augment their curriculum. In the seven months since the initial distribution of the links, over 400 teachers from nearly every region of the country have downloaded the IN. This suggests a need for additional IN's on a variety of agriculturally related topics. Given our experience in creating and distributing this IN, we have the following recommendations for developers:

1. Start with blank pages and sketch content and design possibilities in an easy to shuffle format as the initial ideas and structure did not mirror the final product.
2. Reduce busy work for both student and teachers, make as much printable as possible, but make paper usage as efficient as possible.
3. Reducing cutting and gluing of components reduces material and time costs. It also allows for more reflection and schema integration by teachers and students.
4. Integrate a variety of instructional methods, not just foldables. We added sections which illustrated Cornel Notes, sample minutes and agendas, and charts/tables.
5. Look for places to reduce cognitive load by eliminating duplication in print and graphics.
6. Post documents for teachers to utilize and provide comments for revisions and improvements.
7. Create documents which are easily adaptable to local needs. An editable table of contents and single stand-alone content on pages allows teachers to quickly select the pages they need without having to edit and revise the page.

Costs/Resources Needed

Time to develop the IN was the only cost associated with the creation of the notebook. IN blogs and teacher websites provided inspiration for shapes, cutouts, and design possibilities, but open source shapes were selected to be able to make the resource free to teachers on completion. Good office productivity software made design easier. Google Doc and Slides were not used due to technical limitations they represented. As free office software improves, this may no longer be an associated cost to produce an IN.

The final resource needed was a pilot group. Being able to interact with end-users while they worked on the IN provided valuable insight not available during the initial design phase of the project.

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