An increasingly large involvement of computers in educational settings, such as classrooms or households, has brought about many concerns and issues in the topic of educational technology. Questions arise as to the effectiveness of using a media such as computers for teaching basic skills to young children at an elementary level. These concerns include difficulties in using the software, distractions that cause students to wander off task, and additional skills required to perform activities. One of the reasons there is skeptism is that it is hard to determine the educational value of much of the software out there. Many popular programs that reinforce skills for elementary students are not as effective as some may think they are. Jump Start 2nd Grade is a popular program used to promote basic skills in reading, math and other areas. While this is a very interesting and useful program in many ways, the design of the interface and activities in the software impose a cognitive load on students that makes the program useful in reinforcing basic skills, but inappropriate for teaching them to children at a grade two level.

The cognitive load of any educational task is of great concern because of the constraints on the human working memory. Research indicates that people can only pay attention to a limited number of things at once (Bruning, Schraw & Ronning, 1999). Because of this, students really need to learn how to focus their attention to what they are learning and not get distracted by other things. Distraction and information overload are two central causes of information loss in working memory (Bruning et al. 1999).

Younger students in particular are vulnerable when it comes to this, as they are continually learning so many things and do not fully understand how to focus. Anyone who has walked into a primary classroom can see this. It is very easy for students to become distracted by what is around them and wander off task. This inability to pay attention is a large factor of increased cognitive load in learning because students try to pay attention to multiple things at once. This can cause an overload in working memory. There is only a certain, limited amount of effort and memory capacity available at once (Bruning et al. 1999). This implies that instruction should be designed so that possible distractions are limited. Students should be prevented from wandering off task.

Instruction should also be designed in such a way that it is easy to pay attention not only to the task at hand, but relevant problem characteristics. Students at this age have problems with this due to the complexity of the tasks imposed on them (Paas & Van Merrienboer, 1994). When a task is involves too many concepts, there is too much information to choose from. Students become unsure of what the focus of their lesson is and the working memory becomes overloaded with information. Prior knowledge also becomes a factor in the cognitive load of a task. If students are already familiar with a concept or have already obtained a certain skill that another student has not, ~~their~~ they will be able to manage more than in working memory at once. ~~cognitive load will be much higher~~. For example, a student that is knowledgeable about computers and has had experience working with them before will have a much easier time learning the concept that a computer program is trying to teach. The knowledge base

of how to work computers is already there and therefore they have less to learn. If the tasks that students are asked to perform requires additional skills that they must think about and work with, the cognitive load of the task increases and the amount of learning declines (Bruning et al. 1999).

Jump Start 2nd Grade is an example of a computer program that imposes a high cognitive load on students. The creators of the software claim that the program will allow students to practice writing and composition, build grammar skills, learn correct sentence structure, explore U.S. geography, develop higher math skills, increase vocabulary, and build knowledge of music and social studies (Knowledge Adventure Company). Right here there is an obvious issue concerning cognitive load. Look at how many different subjects are covered in one piece of software. Some parents and teachers will look at the many areas covered by the program and think that it is an amazing way for students to learn the basics in these areas. However, I would argue that there is too much information presented here. The cognitive load is greatly increased by having so many things for the students to learn. As stated previously, students will have difficulty working with and remembering information if there is too much of it, especially those that are not confident with certain academic areas. An opposing view to this could be that the many subjects in one program will bridge concepts together and allow for connections to be made. The creators of Jump Start claim that, "The subjects are interwoven throughout the activities just like in a classroom" (Knowledge Adventure Inc.

Non-issue

1996). Yes, different subjects are included in different activities during one day. However, concepts are usually worked individually. It may be okay to practice already obtained skills this way, but not to grasp the skills. Because of the design of the activities in Jump Start 2nd Grade, students must switch back and forth between their knowledge of math and reading in one lesson. For example, the Log Ride and the Bone Vault require students to solve a math and spelling problems. This causes high cognitive load because the students must switch back and forth between knowledge bases and find the information that is relevant. There is too much information to work with. This will only reinforce math and reading skills for someone who is fairly confident in these areas. It will likely frustrate those students who have difficulties because they are experiencing cognitive overload due to a lack of prior knowledge in certain areas.

The additional skills required also create cognitive overload. In activities such as the Log Ride and the Rocket Ship, hand-eye motor skills are a larger focus than the math and science skills that are supposed to be taught. A student who is not good at computer games will have to concentrate on their hand-eye motor skills instead of math or science. The additional skills increase the cognitive load by adding uneccessary things to think about as well as creating distractions. Attention could be placed on shooting the aliens instead of learning about the planets. In fact, the Rocket Ship only asks one question that is science related, and then the student gets rewarded by flying in to outer space and

shooting aliens out of the sky. This distraction prevents students from focusing on the relevant problem, which inhibits learning.

There are many other activities that allow for distraction to occur easily. There is very little direction given in the software and there are a lot of fun things to do. Students could focus on playing with the keyboard in the music room, making the bee fly around the clubhouse, or find other non-educational ways of using the software. There is a lot of room for students to just play. An opposing argument could be that students learn by simply playing. The problem is that there are so many distractions and ways of playing that students are likely to engage in the fun activities without benefiting in an educational way. The distractions and many activities could cause students to jump from activity to activity, without spending enough time to actually practice their skills. There is a link here to cognitive load with respect to choices. The students have so many things to choose from that they don't know where to begin. The program gives a little bit of direction, but not enough to prevent students from wandering off task. Once they go in multiple directions, an overload in working memory may occur, due to the amount of information being presented. Students may stop learning and perfecting skills and just play. One critic's reaction to the software was that it was not appropriate for children who have a difficult time with paying attention, such as children with ADD or ADHD, because of the lack of structure that the program has (Kids Domain, 2000). This lack of

structure will not only effect kids with such disorders, but other children as well. As discussed earlier, many students at a grade two level have difficulties staying on task.

In addition to the lack of direction provided a lack of instructions is an issue as well. Many of the activities are difficult to figure out. One student that I worked with using this program had troubles with the Ice Cave and asked me for help. Even I had a difficult time figuring out what to do, and this program is meant for children ages seven to eight. Prior knowledge of how to use grids is required, which many students may not have. This increases cognitive load drastically, because the student is now focussing on how to work the computer and the grid instead of how to do the math problem.

The cognitive load of any task is important in terms of learning because the lower the cognitive load, the more the student will learn, as less space in their working memory is occupied. Jump Start 2nd Grade is a informative piece of software that has the potential to enhance learning basic skills. However, the lack of task direction, the requirement of additional skills such as hand-eye motor skills and working with grids, and the multiple concepts dealt with at once increase the cognitive load of students' working memory. This software could be very useful for students who want to practice their basic skills and have fun while doing so. However, I would not recommend using this program to teach material, as the cognitive load imposed by aspects of the program is too high.

**Comments on your paper:**

Position Paper Grade: 47/50

Breakdown--

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|---|---|
| Issue | 10/10 |
| Position | 15/17 |
| References/Evidence | 12/12 |
| Closing Summary | 5/5 |
| Quality of Writing | 5/6 |

Comments--

You made a remarkable improvement on your draft. I'm pleased to tell you that this paper turned out to be one of the best in the class. You present both a clear issue and a clear position. You define cognitive load accurately and apply the concept well to your review of the JumpStart program. My main conceptual criticism of the paper as it stands now is that your argument on pages 3-4 about the number of "subjects" in the program causing overload is not well presented. I haven't worked with JumpStart, but if it has a number of different activities in it and each one is on a different topic, than your overload argument doesn't fly. I think to make this passage of the paper work better, you would need to provide a brief description of some of the activities in the software. For example, what is the Long Ride activity? What do the kids do in it? How is spelling and mathematics knowledge used/required within this same activity? You need to show the reader how the program makes students "switch back and forth between knowledge bases". On a technical note, your prose was clear, but could use more polish. The paper was 1 page over the limit, and I think some tightening of the prose would have fixed that (or made it close). Very good work overall though.