

**SMART READING INSTRUCTION FOR ESL LEARNERS IN THE CONTENT**

**AREA: SMARTBOARDS AND INTERACTIVE LEARNING**

by

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## **Abstract**

Turbill (2003) describes how some principals have “lamented that in spite of each classroom in their schools having at least one computer, teachers of the early years in particular, were reluctant, even resistant, to the integration of computers into their literacy curriculum” (p. 256). The growing resistance towards technology has motivated the writing of this paper. This graduating paper focuses on English as a Second Language (ESL) content reading vocabulary, technology and SMARTboards. As it was discovered in the literature, there is an overwhelming need for teachers, who teach ESL, to reevaluate the way they instruct their ESL students in reading. Research indicates that students need to be intentionally taught vocabulary (Kern, 1989; Laufer, 2003; Gunderson, 2009). “Both English and information technology are tools-to allow individuals to participate fully in society” (Warshcauer, 2002, p. 456). One tool that can be used in the classroom is a SMARTboard. The literature surrounding Interactive Whiteboards has indicated that students have a positive perception of them (Beeland, 2002; Schut, 2007; Hall & Higgins, 2005). This paper explores the possibilities of using SMARTBoards to teach content reading vocabulary in an academic core subject.

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## **SECTION ONE: INTRODUCTION**

### **Background of Study**

Language is the air that we breathe and the water in which we swim. It comes as naturally to us as seeing the sky or digesting our food...But what if we suddenly had to breathe different air or swim in different waters? (Hill & Flynn, 2006, p. 1)

English as a Second Language is a complex and fascinating field of study. I imagine that many students have struggled daily with “breathing different air and swimming in different waters,” because learning English is very much a struggle.

For the past four years since becoming a teacher, I have reflected on the concept of English as a Second Language (ESL). Although English was never my second language, I believe that I have good understanding of what it means to be ESL. Recently I decided to learn French; I remembered how tired and frustrated I had been after each class. It felt like I had not been able to learn anything. I came out of that experience with a great appreciation for my teachers and a better understanding of how my students felt in my own classroom.

I was born in Canada. I come from an immigrant family. My family started immigrating to Canada from China in the year 1912. Both my mother and father were ESL students. Like others before and after them, they struggled to learn a new culture and language. My family was fortunate enough to be one of the success stories of immigrant families. Unfortunately even during my short teaching career I have seen that not every single immigrant student has a successful story.

For the four years prior to coming to graduate school I had been teaching in Calgary. During this period of time, I had worked at an ESL school. The majority of my students were immigrants or refugees from various countries in the world. Having a multilingual class has

brought many challenges to me. I find that I was constantly negotiating and renegotiating my teacher identity to meet the needs of my students (Norton, 2000). My students came to Canada from all over the world and many arrived with little or no English. If they did speak English, it was often intelligible. Unfortunately, because of the multilingual nature of my classroom I was often unable to speak the other languages present in the classroom.

As I considered what I was going to write for this paper, I reflected on my last teaching experience in a grade five and six classroom. As I stated in my previous paragraph, my students came from different parts of the world. Many of them were learning English for the first time and had been in Canada for only a very short time. As a result I had reading levels in my classroom from kindergarten to grade eight. I often commented to my colleagues that it was like teaching a school house classroom. With so many reading levels, as a classroom teacher, I wondered how I could best help my students learn to read. It was apparent to me that this was a very difficult task especially for one teacher.

I had always thought that as a grade five and six teacher I was a content area teacher. My job was to teach the curriculum, the content. Like other teachers, I did not believe that it was my job to teach reading as well (Vacca, 2002). After having such a diverse class, I quickly realized that it is every teacher's job to teach reading, no matter what grade level you are teaching.

Once I became a graduate student at the University of British Columbia (UBC) I continued to have an interest in the concept of ESL reading. I wondered how I could better help my ESL students become more proficient readers. I became curious about what researchers were learning with regards to this area. Was there information out there that I did not know about? Was there a better way to teach my students reading?

One of my many identities is a technology teacher. It became apparent to me during my teaching experience at my last school that technology was a valuable tool to help with my instruction. I used a variety of technology in my classroom including SMARTboards and distributed learning (Desire 2 Learn). I was determined to help my students become 21<sup>st</sup> Century learners. It is my belief that in order to better prepare my students for their future, I need to equip them with the necessary tools for the future; one of these tools being technology.

As a technology teacher, I often engaged in informal conversations with other teachers in my school about using technology in their classrooms. It was apparent that I was often an advocate for the usage of various digital media. After many conversations with my colleagues, I noticed a definite resistance to the usage of technology in the classroom. Many of my colleagues were reluctant to use technology because they did not have proper training. Some of my colleagues commented that they found technology unreliable and difficult to use. Other colleagues told me that they could teach the same things without it and there was no reason to complicate the process. These various conversations were often frustrating to me because I have a strong belief that digital media is a very powerful tool that can be used to aid learning.

My technology ideas were confirmed when I started my graduate program. From my various class readings, I was excited to learn that researchers had found that technology was indeed a valuable tool to use to teach and aid in learning a second language. In particular I remember reading an article in my first semester at UBC where a researcher described how the internet had helped two girls become more confident in terms of their English language ability (Lam, 2004). These studies and many others that I read during my program made me feel empowered. I was relieved to learn that perhaps I had been doing something right in the classroom.

In the past, I used a SMARTboard on a daily basis in my classroom. I became so dependent on it that I remember one incident when the bulb on my LCD projector burnt out and how my teaching day had been disrupted by this issue. It had been very difficult to teach without my SMARTboard because it had become a vital part of my teaching practice. From my various informal observations I noticed how excited my students became because of my usage of a SMARTboard. Many students often commented to me about how much they enjoyed how interactive the SMARTboard was. It offered my class many opportunities to be actively engaged in their learning. I am excited about learning about other possibilities to use this tool in my ESL classroom.

My research interests are very much connected with ESL and technology. I am interested in learning more about how technology can aid in the learning of ESL. This paper is a wonderful opportunity for me to share what I have learned regarding ESL reading and SMARTboards. I hope I can pass on this knowledge to other educators.

### **My Questions**

The following questions will be investigated:

1. How can technology, and specifically SMARTboards, support English as a second language reading in the content areas?
2. In what ways can SMARTboards support content reading vocabulary in the academic core subjects in an English as second language classroom?

## **Theoretical Framework**

My theoretical framework consists of two major frameworks: Mohan's Knowledge Framework and Universal Design of Learning (Mohan, 1986; Mohan, 2001; Rose & Meyer, 2002).

Mohan's Knowledge Framework (KF) focuses on language as medium of learning (Mohan, 1986; Mohan, 2001). The KF takes on a systemic functional linguistic perspective. Specifically the framework sees language as a discourse in terms of social practice. "Within the KF perspective, we start with a general analysis of a social practice and then look at the role of language and discourse within the social practice or activity" (Early, 2001, p. 159). Mohan's (1986; 2001) also describes the concept of "knowledge structures." Specifically he describes how knowledge structures can help to make content comprehensible. Knowledge structures can be represented visually using a graphic. It is important to stress that the KF is not a teaching methodology. Because this framework is not a teaching methodology, I am choosing to also include another theoretical framework in this paper.

Universal Design of Learning (UDL) is best described as how technology can meet the needs of every learner (Rose & Meyer, 2002). Universal Design was originally a framework used in architectural design where the idea was to "create structures that [were] conceived, designed, and constructed to accommodate the widest spectrum of users" (p.70). The concept was later evolved into an idea for learning where it was proposed that educators provided students with a variety of options in order to meet their individual learning needs. With the emergence of new digital media it is becoming easier for UDL to become feasible. The UDL framework indicates that teachers need to consider multiple formats, different student needs, and student interests when planning their lessons.

The next section will explore the literature on ESL reading, technology and SMARTBoards.

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## **SECTION 2: LITERATURE REVIEW**

It is now understood that the ability to read and furthermore to understand what is written, is critical to future academic success thus, in classrooms around the world, teachers place particular emphasis on teaching reading to their students. For English as a Second Language (ESL) students, learning to read is particularly difficult. In order to help these students, both teachers and researchers are interested in learning more about ESL reading. However, even though research suggests that ESL students need targeted strategies to learn to read ESL students are placed into mainstream classrooms and taught reading using programs that are designed for native English learners (Gunderson, 2009). One emerging trend which offers hope to mainstreamed ESL learners is the integration of educational technology as a support for teaching reading. Additionally, by including technology as part of their practice, teachers are providing students with the necessary tools for the future. One type of technology that appears to have particular potential in the teaching of ESL learners is SMARTboards, computer interactive whiteboards. SMARTboards in an ESL classroom have been shown to be an innovative and a powerful tool for language acquisition (Gerald et al, 1999).

The intent of this review is to acquaint the reader with the major studies and theoretical works relevant to the area. To that end, the present section has three parts: Part one discusses ESL reading (specifically content reading vocabulary). Part two explores the role of technology in supporting ESL learners. Finally, part three discusses the ways in which SMARTboards can engage and motivate learners.

### **English as a Second Language Reading**

Reading research has evolved over the years (Grabe, 1991). In the early 1960s reading was seen as a reinforcement of oral language instruction; however during the late 1960s this

view changed. Due to the increased enrolment of ESL students in schools, there was an overwhelming need for researchers to look into ESL reading and how to prepare ESL students for successful academic careers. This need continues to grow as more immigrants enter our schools. There is a growing recognition that reading is the most important skill for ESL learners and this has caused researchers to conduct more studies in the field. ESL reading research has been very much shaped by L1 research.

Researchers in the past have looked at phonological awareness, vocabulary and reading strategies (Kamps, et al., 2007; Jongejan, Verhoeven & Siegel, 2007; Jimenez, Garcia & Pearson, 1995). Researchers have emphasized how crucial it is that ESL students are given small-group reading instruction early in their journey (Kamps, et al., 2007). Jongejan, Verhoeven and Siegel (2007) describe how phonological awareness should be taught in the classroom. In Jimenez, Garcia & Pearson's (1995) study the results indicate that vocabulary should be emphasized in the teacher's practice. There appears to be a clear consensus in the L2 reading literature mentioned above that reading needs to be taught to ESL learners.

Gunderson (2007) describes how ESL learners are at least 2.5 or more years behind in their reading when compared to their L1 peers. As mentioned previously most of the research on ESL reading has been shaped by L1 research. One of the main goals of ESL reading research and instruction is to look at what a good L1 reader is doing and how best to get an ESL student to that developmental stage (Grabe, 1991). However, as Gunderson (2007) argues issues concerning L2 reading are a lot more complicated than reading in an L1. ESL learners "usually begin to learn to read before they have acquired the vocabulary normally associated with beginning readers" (Gunderson, 2007, p.35). Unlike L1 readers, some L2 readers are not coming



with vocabulary or a knowledge of grammar; this puts them at a huge disadvantage when compared with their L1 peers.

Cummins (1999) discusses the concept of CALP (Cognitive Academic Language Proficiency). In particular he mentions how not all aspects of language can be explained by a standard global language proficiency. Cummins also discusses how CALP is developed throughout schooling. Classrooms that promote bilingual students' CALP should focus on language, message and usage; this emphasizes the importance for teachers to teach language (i.e. vocabulary) to their students when teaching reading.

Gunderson (2009) explains that content reading is the “instruction that equips learners with strategies to read and comprehend text” (p. 213). He further describes how “content reading instruction involves teaching the special reading skills needed to read, comprehend, and learn from textbooks used in classes such as social studies, mathematics, biology, physics...[or the academic core subjects]” (p. 215). Content reading is difficult for ESL students for a number of reasons. The complexity of the vocabulary and the subject matter, with the combination of learning English, makes content reading extremely difficult for ESL students. Because of the diverse issues surrounding content reading and ESL learners, it becomes apparent that all teachers are teachers of reading, not just reading teachers (Vacca, 2002). Dreyer and Nel (2003) touch on how important academic texts are for ESL students especially as they move upwards in their schooling. They explain how many of these students go into higher education not prepared to meet the reading demands. “In order to meet the reading needs of students within the 21<sup>st</sup> century, educators are pressed to develop effective instructional means for teaching reading comprehension and reading strategy use” (Dreyer & Nel, 2003, p.350).

In Johnson's (1982) article and study, she described how vocabulary development was considered an important part of reading comprehension. Often it is essential for ESL students to learn the vocabulary in order to fully understand the text. Graves and Watts-Taffe (2002) describe the concept of Word Consciousness: "Word consciousness refers to awareness of and interest in words and their meanings" (p. 144). Students who are word consciousness have a keen sense of the words in their environment. These students are aware of the function of words, how to use them appropriately and are also aware when they encounter new words. Word consciousness is critical for the success of L2 learners when acquiring vocabulary. It is also a critical component of reading comprehension. Successful readers have acquired the skill of word consciousness.

Unfortunately many students come to schools disadvantaged. Gunderson (2009) describes how many refugee students often have no or little formal schooling and due to their past experiences their potential to succeed in an English society is very low. Research has however indicated that focusing early on vocabulary is of benefit to these learners.

In Gersten and Jimenez's (1994) case studies of three ESL teachers it was discovered that by building a shared vocabulary in the classroom it was beneficial to the students. Also, it was mentioned that multiple modalities was important when teaching ESL students. Jimenez, Garcia and Pearson's (1995) case studies on bilingual readers was particularly fascinating. The results from this study indicated that proficient bilingual readers used vocabulary to comprehend the text. It is interesting to note that these proficient readers also code switched between two languages in order to build meaning. The less proficient readers in the study did not use as many reading strategies when compared to the more proficient readers. Both of these studies highlight the importance of emphasizing vocabulary instruction and reading strategies in the classroom.

“Reading in any language is cognitively demanding, involving the coordination of attention, memory, perceptual processes and comprehension processes...reading in a second language can place even greater demands on these components, making reading less efficient” (Kern, 1989, p.135). In L2 reading, word recognition can hinder the comprehension of a text because the learner’s attention is not focused on interpreting the text. According to Kern (1989) many of the L1 reading strategies that the learner has learned may become unfunctional in the L2 context because the L2 reader will find that numerous words are unfamiliar to them. He further explains that the “[L2 readers] are most attentive to the surface structure of the language, and because their word recognition skills do not seem to be automatized until advanced levels of study, they are often not able to allocate sufficient cognitive resources to carry out higher-level interpretive processes effectively” (p. 136). It becomes apparent from Kern’s research that one way to aid in the L2 reading process is to directly instruct reading strategies and vocabulary to improve L2 students’ reading comprehension.

Mohan’s (1986) knowledge frame work discusses how language is used as medium of learning. “When the learners’ second language is both the object and medium of instruction, the content of each lesson must be taught simultaneously with the linguistic skills necessary for understanding it” (Snow et al, 1989). Again, the scholars and researchers are emphasizing that vocabulary should very much be a focus in the classroom. By learning the language you are providing access to the content. Snow, Met and Genesee (1989) suggest in their article that “definitions, paraphrasing, and additional oral examples of the...[academic core subjects such as Math or Science] concepts can be used to reinforce the acquisition of both the language functions and vocabulary associated with key concepts (p. 209). It is also suggested that by integrating

language and content instruction that it indicates an inclusion of higher order thinking skills in the ESL classroom.

Laufer (2003) conducted an influential study on whether or not vocabulary should be taught explicitly. Reading in both L1 and L2 has been investigated by scholars to be a major source for vocabulary development. It has also been claimed that “noticing or attention to the new material is an essential condition for learning” (p.568). However, as it has been discovered by scholars, L2 learners do not always recognize new words as being new. These students have not developed word consciousness (Graves & Watts-Taffe, 2002). According to Laufer (2003), there are several reasons why L2 learners may not recognize unfamiliar vocabulary. First, these learners may be too involved with figuring out the entire overall message of the text to really notice all the vocabulary present. Second, the learner’s attention may be distracted by other unknown words.

Laufer (2003) makes two distinctions between two types of vocabulary acquisition in her study which is significant to know. She explains incidental vocabulary acquisition as “the acquisition of vocabulary as a by product of any activity not explicitly geared to lexical acquisition” (p. 574). “Intentional vocabulary acquisition, on the other hand, refers to an activity aimed at committing lexical information to memory” (p. 574). In this particular study Laufer discovered that a word was most likely to be learned when taught intentionally and practiced in a productive word-focused activity when compared to learning vocabulary through an incidental reading activity. This discovery has a huge impact on pedagogy because it tells an educator that vocabulary should be taught explicitly to a student in order to obtain the best results.

Incidental vocabulary in L2 language reading was discussed by Hucklin and Coady (1999). Hucklin and Coady claim that much of an L2 learner’s vocabulary is learned incidentally

and this is usually done during reading activities. The process of incidental vocabulary is not completely understood, there are still many questions that have not been answered in this field of research. An important variable to incidental vocabulary is a learner's attention: "In incidental vocabulary acquisition, the learner's attention is focused primarily on communicative meaning, not on form" (p.183). A learner's guessing ability while reading is very much enhanced by what is taught in a classroom. Teachers should be spending more time in their classrooms teaching vocabulary; again explicitly teaching vocabulary is most beneficial to L2 students.

What is the significance of a dictionary when teaching vocabulary? Are dictionaries effective in aiding with learning new vocabulary? Knight's (1994) study on bilingual dictionary use while reading is a particular fascinating one. The students used computers to read various L2 passages. Some of the students were given the access to a computerized bilingual dictionary, while other students were not. Vocabulary and reading comprehension tests were given before and after the tests. It was determined from the results that students, who were given access to a bilingual dictionary, learned more but also obtained higher reading comprehension scores when compared to the other students who guessed from context. There is an important implication from these results, that is, teachers need to re-examine their practices of having L2 students guess word meanings from the context of the text; bilingual dictionary usage should be encouraged instead.

Lomicka (1998) conducted a study regarding glosses: "Glosses provide a short definition or note in order to facilitate reading and comprehension processes for L2 learners" (p. 41). In her study, Lomicka had two particular questions she wanted to have answered. First, she wanted to discover how multimedia annotations aided comprehension of text. Second, she wanted to know how the type and number of glosses consulted during a reading activity compared with the

comprehension achieved. Previous research in this area had discovered that when students engaged in incidental vocabulary acquisition activities the learning was higher when there were marginal glosses, or a dictionary available. It was also discovered previously that students were able to recall more when given visual graphics. In Lomicka's study she discovered that glosses were very helpful especially when associated with an image. The study also found that when students were given definitions in their native language it helped the learning process. The implications are clear from this study that ESL teachers should be encouraging the use of bilingual dictionaries in the classroom and providing reading material with image glosses is beneficial.

Turbill's (2001) study on technology and literacy in a kindergarten classroom is an interesting one. Turbill discussed the many difficulties a teacher was faced when implementing technology as part of her literacy practice. It is important to note that many of the issues faced by this particular teacher and researcher have very much been resolved or improved because of improvements in recent technologies (i.e. faster internet connection and computers). There were however positive aspects of technology integration in this study. First, some of the ESL students were able to engage in active conversations regarding the texts as a result of technology. Students also were very much motivated to learn because of the new technology. However, Turbill concluded that "the teachers in this project indicated in their interviews that they could quite easily teach their students to read and write without the use of the computers" (p. 273). Although the last statement is valid, technology is very much a tool that should be used in the classroom. In the next section, technology will be discussed in more detail.

## **Technology**

There has been a growing resistance by some towards technology. Turbill (2003) describes how some principals have “lamented that in spite of each classroom in their schools having at least one computer, teachers of the early years in particular, were reluctant, even resistant, to the integration of computers into their literacy curriculum” (p. 256). Teachers have a preconceived notion about what will and will not work in their classrooms but as Turbill (2003) argues “the need to integrate technology into the curriculum becomes increasingly more urgent as we move into the 21<sup>st</sup> century” (p. 256).

Prensky (2001) describes how “today’s teachers have to learn to communicate in the language and style of their students” (p. 4). Our students are digital natives rather than digital immigrants (Prensky, 2001). Although, Prensky’s ideas are a neat way of putting technology into perspective, it is important to not essentialize. Many teachers are also digital natives and are not necessarily digital immigrants. However, what is valuable from Prensky’s ideas is that students are changing and educators need to adopt different perspectives regarding education as a result of these changes.

Warschauer (2002) discusses how “both English and information technology are tools-to allow individuals to participate fully in society (p. 456).” He furthers his discussion by suggesting that everyone involved in language education (students, teachers and policy makers) should be actively trying to master technology rather than passively using it. “Language teachers must not only use e-mail to promote English teaching but also teach English to help people learn to communicate effectively by e-mail (p. 455). Warschauer furthers his argument by saying that “language professionals who have access to an Internet computer classroom are in a position to teach students valuable lifelong learning skills and strategies for being autonomous learners”

(p. 457). It becomes apparent that as a language teacher you need to be teaching the skills necessary for your students to succeed in the 21<sup>st</sup> century. Technology is very much ingrained in our society and linguistic landscape (Dagenais et al, 2008). Technology is also a valuable tool and commodity that should be used when available.

The information technology (IT) movement continues to happen despite opposition (Cummins, 2002). Cummins argues that “our [tasks] as educators in general, and as language educators in particular, should be to access the potential of IT to improve the human condition. As educators we are committed to drawing out the potential of the students we teach; as language educators, we strive to increase students’ capacity to use language to fulfill their personal goals and contribute to their societies” (p. 539). He furthers his argument by discussing how we as educators need to look into the possibilities of IT, and not just from a language teaching perspective of improving language acquisition, but look into ways to improve the social fabric of our global communities. Cummins does not dismiss the potentials of IT to promote language learning, stating that when used with pedagogy it becomes a valuable tool.

Kress’s (2001) discussion on technology is very exciting. He describes how new media (screen) is dominating over old media (books). He explains how reading has changed in this new age and how there are different expectations of a reader as a result of new media. “New forms of reading, when texts *show the world rather than tell the world* have consequences for the relations between makers and remakers of meaning (writers and readers, image makers and views)” (p. 140). Reading cannot be explained using one theory. Kress says that “the increasingly and insistently more multimodal forms of contemporary texts [available because of new technology] make it essential to rethink our notions of what reading is” (p. 141). This idea that the screen is dominating over books indicates that teachers need to consider new ways of teaching. As Kress



explains: “the social power of the screen is now such that its influence reaches all sites of representation” (p. 160). Students are constantly being exposed to these new media in their daily lives; educators need to start becoming aware of these technologies.

New literacies are described as “literacies...[that] include the skills, strategies, and insights necessary to successfully exploit the rapidly changing information and communication technologies that continuously emerge in our world” (Leu, 2002, p. 313). These types of literacies are constantly changing because new technologies are constantly emerging. Due to all of these changes, it crucial that teachers are helping their students learn how to learn technologies of literacy. Part of educating our students about technologies of literacies is teaching them how to become critical consumers of the information they come in contact with. Leu describes how it is important to realize that “new literacies build on but do not usually replace previous literacies” (p. 315). This is a valuable point because technology is not meant to take over but rather as Warshcauer (2002) describes technology should be a tool for language learning.

There have been several studies conducted indicating that technology is a valuable tool to aid ESL students when learning English. In particular I would like to discuss Lam’s (2000; 2004) work. Lam conducted two cases studies. Both studies described ESL students interacting on the internet. In Lam’s (2000) study, she described a boy named Almon. Almon learned English online while socializing with other peers online. From this study it is clear that investment is the key and it influences the success and failure of a L2 learner, in Almon’s case, his investment allowed him to become a better communicator in English and communicate his thoughts in a different register of English (online dialogue) (Norton, 2008). It is critical to note that Almon indicated he felt it was easier to express himself in written dialogue online then saying his

thoughts in person, this idea appears to be a theme within studies of ESL and technology. The internet has been providing a non-threatening platform for individuals such as Almon to participate.

In Lam's (2004) other case study it explored the online language socialization of two teenage Cantonese speaking immigrants to the United States. The two cousins were recent immigrants to the United States. Both girls were struggling to establish an identity in their new society while learning English. As a result they sought an online chat room to develop their fluency in English. The case study findings indicated that the two students' experiences with English in an Internet chat room could be considered a type of language socialization. Perhaps the most significant finding in terms of technology was that the participants demonstrated a new confidence when speaking English after participating in the chat room discussions. These findings have definite implications for teachers. Teachers should reconsider how technology impacts ESL learning both inside and outside of the classroom. Many students are using the internet at home and developing their English abilities online as a result. Lam's work (2000; 2004) indicates the impact technology has on the language learning process. If students have access to the internet or other technologies they will be provided with different opportunities to learn ESL.

With the increase usage of technology in the classroom it becomes apparent there is a need for both knowledge and training.

The missioner is defined as a teacher who not only understands the technology but also has the ability to see how it could be used to advantage and frequently develops software to meet a variety of learning situations that convince both teachers and students of pedagogic advantage. ( Glover, et al, 2005, p.157)

Although a missionary in every school may not be possible, it brings up an interesting concept of having an expert teacher in every school. Perhaps there is really not a need for a computer software designer, as the definition of a missionary implies, but rather a technology teacher available to provide assistance in the classroom and also engage in critical discussions with other teachers about how to use technology effectively.

It is recognized that technology is not always a reality (Labbo & Reinkling, 1999). Some schools and students will just not have the resources to afford technology. There will always be inequity in terms of access to information technology (IT) among schools, cities and countries (Cummins, 2000). “Certainly technology cannot be integrated with literacy instruction if it isn’t available. However, when this reality predominates, the issues of technology and literacy are driven by the assumption that good things will happen when hardware and software are available, with little if any attention being given to its actual use or to creating conditions that may facilitate its use“(Labbo & Reinkling, 1999, p. 481). It is obvious that no matter the situation whether or not you have access to technology in your classroom there will be issues. However, as the literature is disclosing, it is crucial that educators are educated about technology because it is having a large impact on the world around us. In next section we will explore a tool for the classroom, SMARTboards.

### **SMARTboards**

SMARTboards are interactive whiteboards (IWB) or electronic whiteboards: “IWBs...are large, touch-sensitive boards, which controls a computer connected to a [LCD] projector” (Smith et al, 2005, p. 91). The LCD projector projects the image from the computer onto the SMARTboard. The IWB then behaves similar to a touch-screen computer monitor. SMARTboards also allow for individuals to draw or write on the board using four coloured

electronic pens. The boards can be mounted to a wall or be portable. Lessons presented on the SMARTboard can be saved and revisited later.

Prior to reviewing the various SMARTboard studies that have been conducted, it is important to be critical of the information presented. Many of the studies conducted on SMARTboards are “often...informal and little information is included about the research methods used...[there are few] rigorous studies describing the impact of IWB use on learners’ attainment or documenting actual changes in classroom interaction” (Smith et al, 2005, p.92). However, it is crucial that we review the SMARTboard research presented in order to get an “overall impression of the findings and critical questions such findings raise” (p. 92). Also by reviewing the research we are able to discover the limitations of these studies and perhaps future studies will be conducted to learn more. However, the issue of future research is out of the scope of this paper.

Beeland (2002) conducted a study concerning student engagement with IWBs. Beeland explains that the engagement of a student is one of the most important factors of teaching. He also explains that IWBs allow teachers to deliver lessons in three different modes: visual, auditory and tactile. IWBs are changing the way students and teachers use technology in the classroom. Beeland used questionnaires to assess students’ motivation and engagement with IWBs. It was discovered that “most of the students indicated that they liked being able to touch-activate applications on the boards, as well as being able to write on it with pens or even with their fingers” (p. 4). Student results indicated that they felt that they learned better when using an IWB and could understand the teacher more easily. However, there were some limitations to the IWB used. First, students mentioned how the board needed to be oriented again when the board or projector cart was bumped. They also commented that it was difficult to read the board

because of the shadows casted as result of a hand blocking the light on the LCD projector.

However, even with these limitations it appeared that the consensus was that the IWB increased student engagement and motivation.

Schut (2007) conducted an interesting study on her students' SMARTboard perceptions in a Biology classroom. This study was conducted in a secondary setting. Students from two different classes were given alternating instruction between traditional and SMARTboard instruction. Students were also required to journal about their thoughts on each lesson. Schut indicated that from the available research published that it becomes very clear that technology is not being used effectively. "Technology integration in schools does not occur overnight; it is a process" (p.18). It is apparent that some individuals believe that technology by itself will improve learning, however, it actually is a tool to aid in the learning process. It is clear that teachers need to be properly trained in order for new technology to be used effectively in the classroom; not having technical support is a major barrier to teachers using technology in their classrooms.

In her study, Schut (2007) discovered that on the whole students had positive perception of the SMARTboard. It was noted that individual students felt that the SMARTboard stimulated learning. Students also felt that the multimedia presentations shown helped with their learning of the science concepts. Schut's study touched on several limitations with the SMARTboard. First, since the SMARTboard required a computer, there were some technical difficulties (i.e. internet access). Another limitation that was mentioned was the fact that when the IWB or projector was bumped the SMARTboard had to be reoriented. Some students were not as skilled at using the SMARTboard and had difficulties writing and moving objects on the board. A final complaint was that sun glare caused difficulty in reading the writing on the IWB.

Hall and Higgins (2005) conducted a study on the primary school students' perceptions of IWBs. Students, ages ten and eleven, were interviewed in focus groups. The groups were made up of mixed genders. The results indicated that the students had a good perception of the IWBs. The students felt that the IWBs offered variety when compared to the traditional whiteboard. Some students indicated that the plain whiteboard was "boring" when compared with the IWB. Students also enjoyed the multimedia capabilities of the IWBs. Similar to Schut's (2007) study, students in this study did not like the technical problems with the IWBs (Hall and Higgins, 2005). They complained that the IWB was hard to view when in direct sunlight. They also mentioned that when the IWB was bumped they would have to reorient the board. The researchers indicated in their discussion that "students, nevertheless, like teachers, may need to develop and maintain their skills, knowledge and confidence with technology through regular use over time" (p.109). Students need to be given opportunities to use technology in the classroom in order to become more proficient users.

Wuerzer's (2008) study focused on limited English proficient (LEP) students in second grade. She wanted to see how these students achieved literacy using a SMARTboard daily over an eight month period. Because of the socioeconomic status of her students, many of them were only exposed to technology at school. Two classes were used in this study; consisting of 15 students in all. One classroom used a SMARTboard and the other classroom was taught in a more traditional way. Only six females were selected for this study; three in each class. It is questionable why the researcher made this choice since it appears there could be a possible gender bias. However, the researcher indicated that students were selected based on English proficiency ability in order to allow for a fair comparison. Students were evaluated using various assessment tools. When examining writing samples, students who used a SMARTboard in their

classroom “were more consistent in the number of words used and the number of words spelled correctly” (p. 9). The results also indicated that students who used the SMARTboards were more engaged in their learning.

Mechling, Gast and Krupa (2007) conducted a study on the impact of SMARTboards on sight word reading. The students involved in this study were cognitively disabled. There were three students involved in all (two males and one female). The goal for these students was to increase their functional sight word vocabulary. Content was presented to the students in both text and photographs. It was discovered that the SMARTboard increased correct reading and matching of each set of target words. In previous research it had been determined that computer-assisted instruction was effective way of teaching students with disabilities; however in this arrangement students were being taught in a one to one setting. The SMARTboard proved to be an effective way of instructing a group of students.

### **Summary**

The literature has revealed several important messages regarding ESL Reading, Technology and SMARTboards. Content reading instruction prepares learners with strategies to read and comprehend the text (Gunderson, 2009). ESL learners are usually learning to read before they have acquired vocabulary and they are at a disadvantage when compared to L1 learners (Gunderson, 2007). Vocabulary should be taught intentionally (Laufer, 2003; Hucklin & Coady, 1999). Bilingual dictionaries and visual glosses are helpful aids when teaching vocabulary (Knight, 1994; Lomicka, 1998).

Technology should be used as a tool in the language classroom (Warshcauer, 2002). The screen is now dominating over books, as a result teachers need to start reconsidering how they

teach (Kress, 2001). With new literacies emerging, teachers need to help their students learn these new technologies of literacy (Leu, 2002). One type of technology that can be used as a tool in the classroom is a SMARTboard. SMARTboards are engaging and motivating to students (Beeland, 2002; Schut, 2007; Hall & Higgins, 2005). SMARTboards are effective to use with students with a variety of different learners (Wuerzer, 2008; Mechling, Gast & Krupa, 2007).



### **SECTION 3: CONNECTIONS TO PRACTICE**

Prior to coming to Vancouver I taught in a small inner city English as second language (ESL) elementary school in Calgary. My students came from all over the world. The school population consisted of eighty-seven percent ESL students and over thirty-seven languages. Many of my students were new immigrants to Canada. Other students were refugees who had never had any schooling prior to coming to Calgary. In my classroom, every student was an ESL learner. In addition to having ESL students I had several students who were learning disabled. I had reading levels from kindergarten to grade eight. It was often very frustrating to meet the needs of all my students. It became a daily battle trying to figure out what best to do to help all of my students.

It was shortly after becoming a teacher that I became a technology teacher. In my own practice I began to see how effective technology was to aiding my ESL learners. I began experimenting and using a variety of technologies with my class. In particular I used a SMARTboard on a daily basis. As a result of having this amazing tool in my classroom, I watched as my kids became more engaged in their learning. Students often commented on how much fun learning was because we had a SMARTboard in our classroom. I remembered how motivated my students were when I taught a lesson using the SMARTboard and multimedia. The interactive nature of the SMARTboard appeared to have a very positive effect on my ESL students; even my most shy student would volunteer to answer questions on the SMARTboard. I found my ESL students interacting and talking more as result of using a SMARTboard in my classroom.

Once I surveyed my students in class to find out how many of my students had a computer at home or access to one. I was amazed to find out that all of my students had a

computer at home or access to one. It became clear to me that, if my students were already using computers on a daily basis at home, then I needed to use this available skill and prior knowledge. It was obvious to me that technology spoke to my students. They were all familiar with how to use a computer and spoke enthusiastically to me about their online activities. They were always excited when I came back from professional development courses with new ideas to try out in the classroom. Technology made learning fun. I knew that I was getting my best learning results when I used my SMARTboard to instruct my students.

My personal goals, therefore, are to find ways to use technology to aid the learning of my ESL students. In this section of my paper I have designed a part of a science unit plan. It is designed for intermediate to late elementary students. In particular I am focusing on a grade five Alberta science unit on Electricity and Magnetism. I have a special reason for choosing this unit. When I first started teaching at my ESL school, I taught this particular unit to my students without technology. At that particular time, I was pulling out a group of grade five students for science instruction. I remember working with two students who were brand new to Canada and had no English. They struggled with the vocabulary and reading required of them because they had not acquired the language to complete the tasks. It is with these two students in mind, that I have designed this particular unit. It is my hope that this unit will address the needs of the above students and those many ESL students who like them are beginning English language learners.

### Unit Overview: Alberta Grade 5 Topic A: Electricity and Magnetism

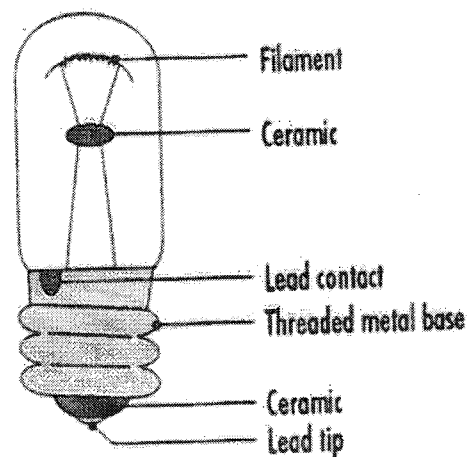
Lesson Topics and Major Concepts	New Vocabulary	Activities on SMARTboard	Assessment Strategies
<i>Demonstrate that a continuous loop of conducting material is needed for an uninterrupted flow of current in a circuit. (Alberta Education, 1996, p. B.25)</i>	<ul style="list-style-type: none"> <li>Light bulb</li> <li>Light bulb holder</li> <li>Batteries</li> <li>Wire</li> <li>Parts of a Light Bulb</li> <li>Parts of a Battery</li> <li>Electrons</li> <li>Circuit</li> </ul>	<ul style="list-style-type: none"> <li>Looking at parts of a light bulb and battery</li> <li>Be able to create a simple circuit</li> <li>Discussion on what happens when a circuit is connected</li> </ul>	<ul style="list-style-type: none"> <li>Quiz on the parts of a Light Bulb</li> <li>Quiz on the parts of a Battery</li> <li>Observation and Anecdotal notes</li> </ul>
<i>Draw and interpret, with guidance, circuit diagrams that include symbols for switches, power sources, resistors, lights and motors. (Alberta Education, 1996, p. B.25)</i>	<ul style="list-style-type: none"> <li>Switches</li> <li>Resistors</li> <li>Voltmeter</li> <li>Ammeter</li> <li>Variable Resistor</li> <li>Motor</li> <li>Galvanometer</li> </ul>	<ul style="list-style-type: none"> <li>Learn the schematic diagrams symbols for light, resistors, switches, batteries etc.</li> <li>Draw schematic diagram and learn to interpret drawings as a class.</li> </ul>	<ul style="list-style-type: none"> <li>Draw and interpret schematic drawings on the SMARTboard</li> <li>Quiz on schematic diagrams symbols</li> <li>Fill in the blank sentences on the SMARTboard</li> </ul>
<i>Demonstrate that a continuous loop of conducting material is needed for an uninterrupted flow of current in a circuit. (Alberta Education, 1996, p. B.25)</i>	<ul style="list-style-type: none"> <li>Continuous current</li> <li>Closed circuit</li> <li>Open circuit</li> </ul>	<ul style="list-style-type: none"> <li>Be able to interpret the schematic diagrams and make predictions about whether or not a light bulb will light or not.</li> <li>Demonstrate what a closed and open circuit is. How could a switch make this happen?</li> </ul>	<ul style="list-style-type: none"> <li>Draw and Interpret if a light bulb will light on a SMARTboard</li> <li>Observation and Anecdotal notes</li> </ul>
<i>Understand that short circuits may cause wires to heat up, as well as waste the limited amount of energy in batteries. (Alberta Education, 1996, p. B.25)</i>	<ul style="list-style-type: none"> <li>Short circuit</li> </ul>	<ul style="list-style-type: none"> <li>Demonstrate and discussion on what a short circuit is</li> <li>Jeopardy as a class covering all concepts learnt to date.</li> </ul>	<ul style="list-style-type: none"> <li>Observation and Anecdotal notes</li> </ul>

## Unit Plan Discussion

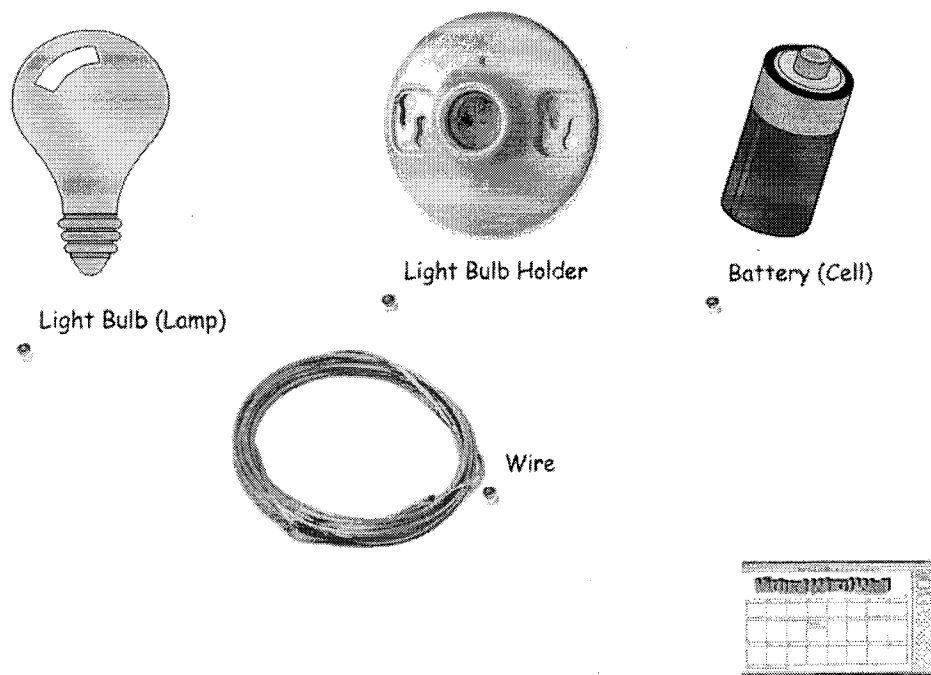
My unit plan was designed with simplicity in mind. The slides are white in colour to draw the students' attention to the graphics and words on the screen. All of the graphics were carefully chosen. I did not want to overwhelm my students with too much information so I have attempted to keep the content on each page to a minimum. I tried to use language at a grade five level. It was important to me to use the correct terminology to describe the science concepts. When teaching this unit I will provide each student with a handout copy of the slides so that they can make notes or review the concepts on their own if necessary. Students will also be encouraged to ask questions and ask for assistance when needed.

In this unit plan I am attempting to focus on building the science vocabulary of my students. As I discussed in my literature review, Gersten and Jimenez's (1994) discovered that by building a shared vocabulary in the classroom it was beneficial to the ESL students. The first lesson in my unit plan starts with an introduction of the terminology, specifically the parts of a light bulb and battery.

The parts of a Light Bulb



As you will notice from the screen capture, there is a word wall gloss included at the bottom of the page. I have created a virtual word wall. The key vocabulary in this unit is included on this virtual word wall. Students can click on the word and it will be linked to a visual, written, and auditory definition. If the definition is not available on the virtual word wall there is a link provided on the page to an online dictionary. The online dictionary website also provides an auditory option where students can hear the word pronounced. I have included word wall glosses on most pages of my lessons. As you will recall, in Lomicka's (1998) study she discovered that glosses were very helpful especially when associated with an image.



The screen capture above is an example of a definition page on the virtual word wall. When students click on the word “wire” on the virtual word wall, they will be hyperlinked to this particular page. Students are given a visual definition or a written definition. Student can also listen to the word and definition read to them by clicking on the sound link. By teaching vocabulary in my unit this way I am attempting to build word consciousness (Graves & Watts-

Taffe, 2002). Also, I am creating visual knowledge structures to make content more comprehensible (Mohan, 1986; 2001). I am also hoping by providing my learners with both visual, written and auditory options, I am meeting the needs of all my learners (Rose & Meyer, 2002).

In my lessons I have attempted to digitalize the usual classroom learning tasks onto the SMARTboard. Technology has to be used as a tool in the classroom and I am hoping to use a SMARTboard in this capacity (Warshcauer, 2002). In the past I had an actual word wall in my classroom. As a class we would add words to it as we learned them. Students would write a word on a sheet of paper and then write the definition of that word on the back of the same sheet of paper. The paper was then taped to our class word wall; when students were unsure about a word they could consult the word wall. I wondered if I could create something similar on the computer. The virtual word wall is what I envisioned a digitalized word wall would look like. Throughout the unit there is an option for students to add definitions to the virtual word wall.

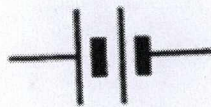
My unit is designed in a way that introduces the basic vocabulary and then builds on this vocabulary each lesson. In particular I try to give students opportunities to review the concepts learned throughout the lesson. For example, in the screen capture below you will notice that I am providing the students with an opportunity to review the concepts learned during the lesson. In this particular example students can drag the correct symbol to the word it represents. Students can also review the vocabulary taught by clicking on the word wall gloss at the bottom of the page.



## Let's learn the Schematic Diagram Symbols!

Match the correct symbol with the name.

Cell



Lamp



Resistor



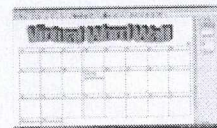
Ammeter



Voltmeter



Check your answers!



By doing activities such as the one above, I am giving students an opportunity to interact with their peers. In a traditional classroom, if students were to be doing an activity such as the one above, they would most likely be seated at their desk and not interacting with their peers. The activity would most likely be a paper and pencil one and there would be little opportunities for cooperative learning. From my experience, ESL students benefit from opportunities to interact with their peers. I enjoy encouraging social interaction among my students. The SMARTboard provides students with an opportunity to learn as a group.

As research has indicated students enjoy opportunities to interact with the IWB (Beeland, 2002). In my second lesson, I provided students with a chance to interact with the SMARTboard. Students were asked to draw a schematic diagram using the information given. As you will notice from the screen capture below, students were again given a word wall gloss option. This activity is a great informal assessment tool for the teacher as you can quickly gain a sense of



whether or not your students are learning the concepts taught based on whether or not they can draw the correct schematic diagram.

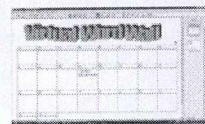
### Practice Drawing Schematic Diagrams!

Have these three items in your schematic diagram:

Lamp

Cell

Switch



One of the final review activities is a Jeopardy game. In the past I did a similar activity with my students as an end of a unit game but without a SMARTboard. I would use large poster boards and put the categories and numbers on it. From personal experience this activity is a great way to review the concepts learned as a class. It is also an activity that encourages interaction among my students. I tried to replicate the paper and pencil activity of Jeopardy on the SMARTboard. In my SMARTboard jeopardy game students are able to select from two categories of questions. If they click on the category number they will be hyperlinked to another page which will contain a question. From this question page, they can click a link to find the answer to that question. As you can see from the screen capture below, the questions are geared

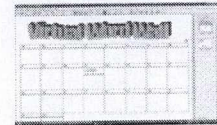
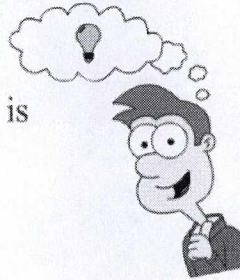


towards reviewing the vocabulary taught in the previous lessons. Students are also provided with a word wall gloss, in case they need assistance.

300

**Question:** The light bulb goes on, this is a open or closed circuit?

**Answer**



### **Limitations of this Unit Plan**

One of the major limitations of my unit plan is that I am not actually teaching this unit to a group of students. It would be interesting to determine whether or not by digitalizing the learning process if I am going to obtain the learning results I am hoping for. I am aware that even if I am teaching this unit on the SMARTboard, students will still need to use paper and pencil to solidify the concepts taught. Technology is not the solution to all my teaching needs. It is important teachers recognize that technology is only one of many tools that can be used in the classroom. Also, students should be given opportunities to actually use batteries, light bulbs and wires to create circuits. I do not believe that just practicing on a SMARTboard is enough to learn a concept especially when it comes to scientific concepts.



Unfortunately even with the advancements in software, I don't believe that the software quite captures the essence of creating a circuit. For example in my fourth lesson I explained the idea of a "short circuit." I struggled to find the right pictures to describe this concept. I believe that this particular idea when taught needs to be reinforced with actually connecting the batteries, bulbs, and wires. As you will recall from my literature review, multiple modalities is critical for ESL students (Gersten and Jimenez, 1994). It becomes apparent that a SMARTboard unfortunately cannot provide all of these modalities.



## **SECTION 4: CONCLUSION**

The purpose of this paper was to explore the research surrounding ESL content reading vocabulary, technology and SMARTboards. In the past L2 reading research was very much influenced by L1 reading research (Grabe, 1991). Even with the latest developments in the field of L2 reading, teachers are still using L1 instructional techniques and programs on ESL students (Gunderson, 2009). There is an overwhelming need for teachers, who teach ESL, to reevaluate the way they instruct their ESL students in reading. It becomes apparent in the research that reading strategies should be taught to ESL students. Literature also indicates that students need to be intentionally taught vocabulary (Kern, 1989; Laufer, 2003; Gunderson, 2009). Glosses, word focused activities and bilingual dictionaries are strategies proven to have positive effects on ESL reading (Lomicka, 1998; Laufer, 2003; Knight, 1994).

With the emerging 21<sup>st</sup> century, teachers are beginning to recognize the significance of technology in the classroom. Unfortunately some teachers are still not integrating technology into their practices. As Kress (2001) describes the screen is dominating over books. How we read has been revolutionized by the emergence of technology. Warshcauer (2002) argues that technology should be used as a tool by educators, students and policy makers. Technology is by no means a replacement for traditional approaches; however it should be used as a supporting component when instructing ESL students. SMARTboards is one tool that can be used when instructing students.

The literature surrounding IWB has indicated that students have a positive perception of them (Beeland, 2002; Schut, 2007; Hall & Higgins, 2005). Students have enjoyed the interactive nature of the technology. They have also expressed how much more exciting learning is because of the multimedia capabilities of the IWB. SMARTboard research has indicated positive gains



for both limited proficient students in English and learning disabled students (Wuerzer 2008; Mechling et al, 2007).

What emerged from my literature review was a unit plan to teach ESL content reading vocabulary. The ideas for this unit plan are very much shaped by ideas to teach students for the 21<sup>st</sup> century. Throughout my teaching career and my masters degree program I have become passionate about how technology can aid in the ESL learning. It is my hope that this unit plan encompasses some of the ideas I have learned throughout my practice and education.

Throughout this masters program I have had many opportunities to grow in my practice. I have taken every opportunity to learn more about my field of study. I am excited about the prospects of returning to a classroom and shifting research into practice. It will be exciting to finally have an opportunity to witness what I have learned in a classroom setting. I continue to have a strong belief in teaching students for the 21<sup>st</sup> century and plan to use technology as a tool in my everyday practice.

### **Suggestions for further research and practice**

There is a need for more research on how a SMARTboard can benefit ESL students and the educational implications. Unfortunately the literature was quite limited in this aspect. Studies such as these will benefit teachers immensely. It will provide insights into areas where SMARTboards could benefit students' learning.

There is also a growing need for teacher education in technology. Unfortunately some schools are given the technological resources but due to lack of training teachers are not using the technology available. As a technology teacher, I have made it part of my professional practice to provide professional development opportunities for fellow teachers. It is my hope that other technology teachers will also take on these leadership opportunities.



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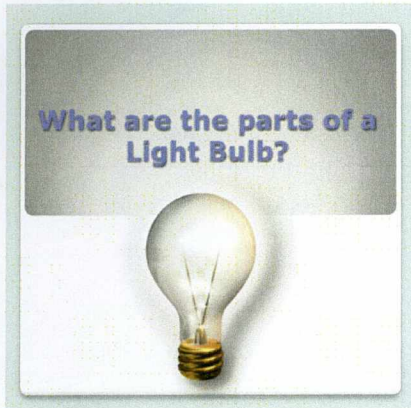
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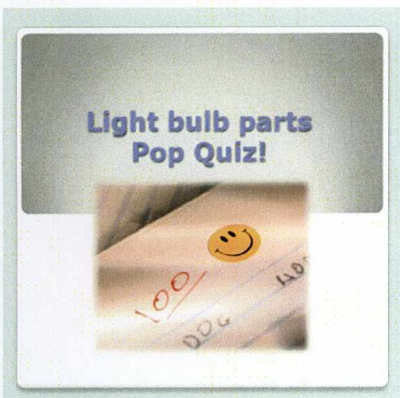
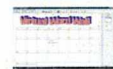
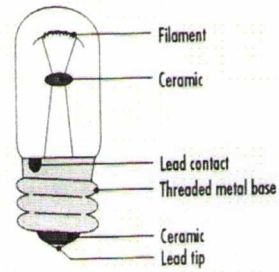


## Appendix A: SMARTboard Electricity and Magnetism Unit Plan

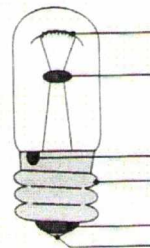
### Lesson 1



The parts of a Light Bulb

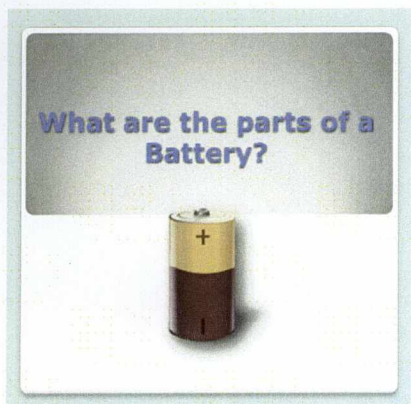


Match the names of the parts!

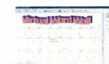
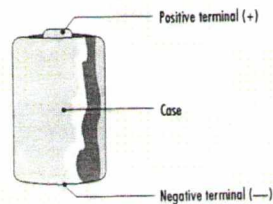


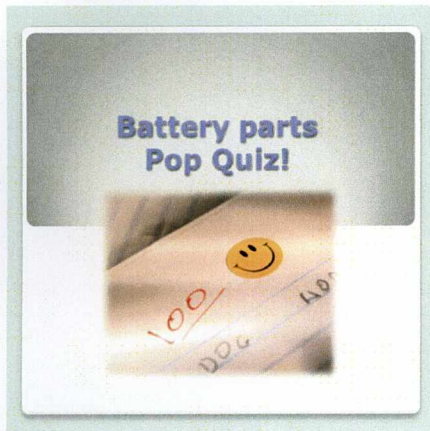
- Filament
- Ceramic
- Lead Contact
- Threaded Metal Base
- Ceramic
- Lead Tip

Check your answers!

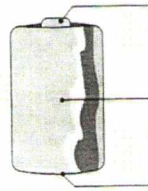


The parts of a Battery





Match the names of the parts!

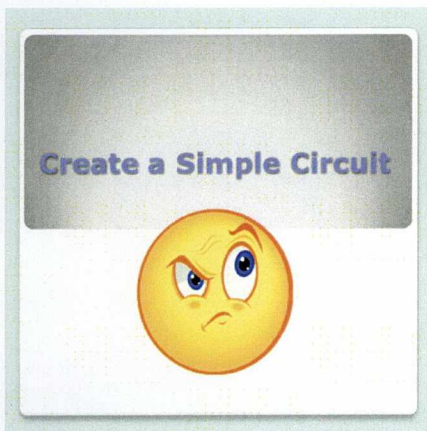
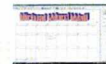


Positive terminal (+)

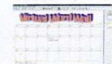
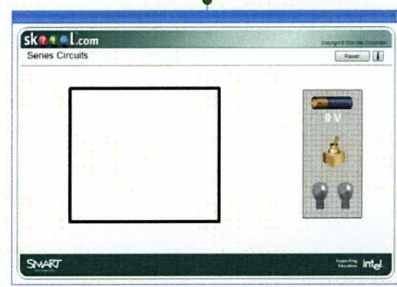
Case

Negative terminal (-)

Check your answers!



Create a simple circuit! Make the light bulbs light up!



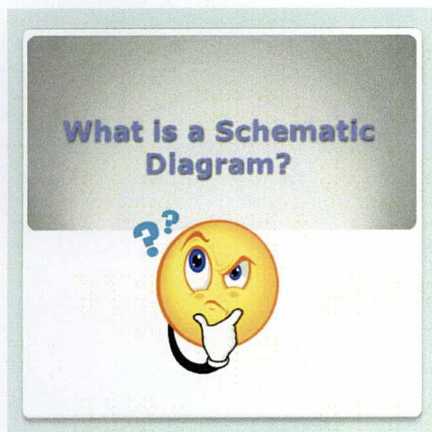
Test your knowledge!  
(Complete the sentences with  
the words below)

- 1) \_\_\_\_\_ is a part on a light bulb.
- 2) \_\_\_\_\_ is a part of a battery.
- 3) There is a \_\_\_\_\_ and \_\_\_\_\_ terminal  
in a battery.

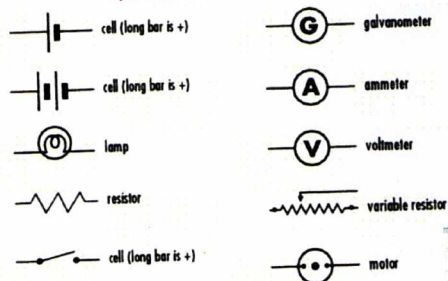
Positive	Case
Negative	Filament



## Lesson 2

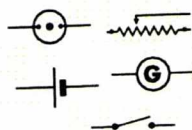


What are the Schematic diagram symbols?



Let's learn the Schematic Diagram Symbols!  
Match the correct symbol with the name.

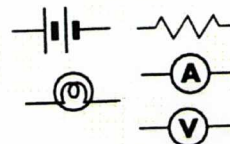
Galvanometer  
Motor  
Cell  
Switch  
Variable Resistor



Check your answers!

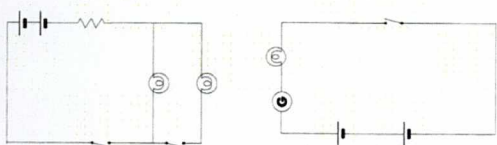
Let's learn the Schematic Diagram Symbols!  
Match the correct symbol with the name.

Cell  
Lamp  
Resistor  
Ammeter  
Voltmeter



Check your answers!

Examples of Schematic Diagrams

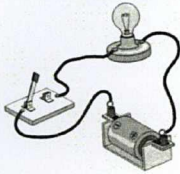


Practice Drawing Schematic Diagrams!

Have these three items in your schematic diagram:  
Lamp  
Cell  
Switch

## Practice Drawing Schematic Diagrams!

Draw a Schematic Diagram of this circuit!



## Lesson 3

### Review on Schematic Diagrams



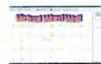
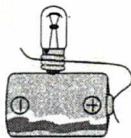
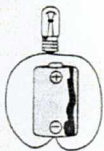
### Practice Drawing Schematic Diagrams!

Have these three items in your schematic diagram:

- Lamp
- Cell
- Switch
- Voltmeter



Do these light?  
Please explain why.



### Closed vs. Open Circuits



## Open vs. Closed Circuits



What do these two circles mean?



## Open Circuit



The circuit is open when the electrons are not allowed to flow continuously.

The circuit is open when you switch a light switch off.

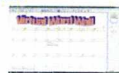


## Closed Circuit

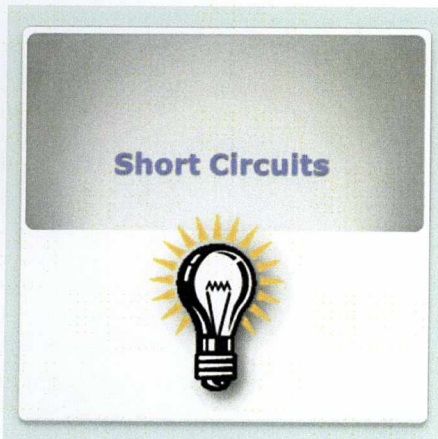


The circuit is closed when the electrons are not allowed to flow continuously.

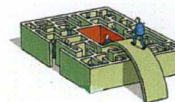
The circuit is closed when you switch a light switch on and the lights are on.



## Lesson 4

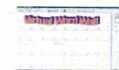


## ? What are Short Circuits?

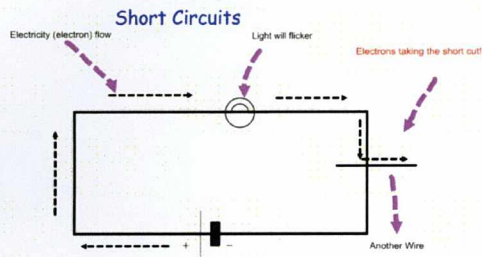


Like everyone, electrons like to take short cuts! If they are given a chance they will move down a shorter path.

How does this relate to a circuit?







## Electricity Review! Let's play Jeopardy SMARTboard style!



Draw the Circuit	Electricity
100	100
200	200
300	300
400	400
500	500

100

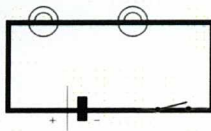
Question: Two lamps, 1 cell and a switch

Answer



100

Answer:



100	100
200	200
300	300
400	400
500	500



200

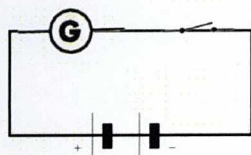
Question: 2 cells, 1 galvanometer, 1 switch

Answer



200

Answer:



**GOOD JOB!**



Current (A)	Resistance (Ω)
0.02	100
0.04	200
0.06	300
0.08	400
0.10	500



300

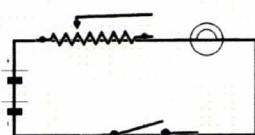
Question: 1 variable resistor, 2 cells, 1 lamp and 1 switch

Answer



300

Answer:



**GOOD JOB!**



Current (A)	Resistance (Ω)
0.02	100
0.04	200
0.06	300
0.08	400
0.10	500



400

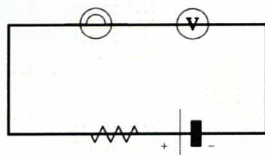
Question: 1 resistor, 1 cell, 1 lamp and 1 voltmeter

Answer



400

Answer:



**GOOD JOB!**



Current (A)	Resistance (Ω)
0.02	100
0.04	200
0.06	300
0.08	400
0.10	500



500

Question: 2 cells, 1 lamp and 1 ammeter

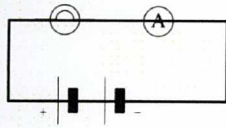
Answer





500

Answer:



Question No. 1 Score	Electronics
100	100
200	200
300	300
400	400
500	500

Question No. 1 Score	Electronics
100	100
200	200
300	300
400	400
500	500

100

Question: What is Electricity?

Answer



Question No. 1 Score	Electronics
100	100
200	200
300	300
400	400
500	500

100

Answer: The flow of electrons.



Question No. 1 Score	Electronics
100	100
200	200
300	300
400	400
500	500

Question No. 1 Score	Electronics
100	100
200	200
300	300
400	400
500	500

200

Question: When the switch is open, is this a closed or open circuit?

Answer



Question No. 1 Score	Electronics
100	100
200	200
300	300
400	400
500	500

200

Answer: Open circuit.



Question No. 1 Score	Electronics
100	100
200	200
300	300
400	400
500	500

Question No. 1 Score	Electronics
100	100
200	200
300	300
400	400
500	500

300

Question: The light bulb goes on, this is a open or closed circuit?

Answer



Question No. 1 Score	Electronics
100	100
200	200
300	300
400	400
500	500

300

Answer: Closed circuit.



Power (W)	Current (A)
100	100
200	200
300	300
400	400
500	500

400

Question: When electrons want to find the shortest path in a circuit, what is this called?

Answer



400

Answer: Short Circuit



Power (W)	Current (A)
100	100
200	200
300	300
400	400
500	500

500

Question:



What does this schematic symbol represent?

Answer



500

Answer: Motor



Power (W)	Current (A)
100	100
200	200
300	300
400	400
500	500

# Virtual Word Wall

## Virtual Word Wall

A	B	C	D	E	F	G	H
Ammeter	Battery	Circuit	Continuous Circuit	Electrons		Galvanometer	
I	J	K	L	M	N	O	P
			Light Bulb	Motor		Open Circuit	
Q	R	S	T	U	V	W	X
		Switch			Voltmeter	Wire	
Y	Z				Variable Resistor		



Light Bulb (Lamp)



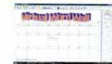
Light Bulb Holder



Battery (Cell)



Wire



Circuit

- Electrons
- are part of an atom.
  - The movement of electrons creates electricity.



Switch



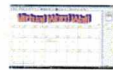
Voltmeter  
Measures electrical current in Volts



Motor



Ammeter  
Measures electrical current in Amperes.



Galvanometer  
A meter that can determine if there is an electrical current.



Variable Resistor

Allows you to be able to control the number of electrons moving in circuit



Continuous Current

The electrons are always moving in the circuit.



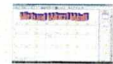
Open Circuit

The circuit is open when the electrons are not allowed to flow continuously. An incomplete path, electricity can not cross the break in the circuit.



Closed Circuit

The circuit is closed when the electrons are not allowed to flow continuously. Where the current flows from the battery through an electrical device providing power, and returning back to the battery.



### Short Circuit

When the current moves in a different path than it is supposed to. The current likes to move in the shortest path.

