Slate-boards to Notebooks: From Rote to Note
Implications on Literacy and Education

Timeline

3500 BC (Mesopotamia)
- the first script (writing)
    - words differ from pictures (which were used for millennia previous to this) in that they represent an object, not an 'utterance' ("words that someone says or is imagined to say") (Ong, 1982, p.83)

AD 105 (China)
- paper invented
- originally called 'tapa' and named 'paper' after the invention reached Europeans, who mistook the origin and thought it came from Egyptian papyrus (i.e. 'paper') (Haven, 2006)

8th century AD
- paper making in the Middle East (Haven, 2006)

1300
- paper mills all over Europe
- one master and five assistants could make 2500 sheets of paper a day (Haven, 2006)

1798
- Nicholas Low Robert invented the first automatic papermaking machine (Haven, 2006)

Late 1700's (Europe and America)
- students use individual slates for daily lessons (Concordia Online Education, 2012)
    - slate mining occurred in the Northeast United States
        - as the West began to expand, the railroad allowed for easy transportation of the slate to schools in the new areas (Fernley, 2008)
    - personal slate-boards were small pieces of slate bound by a wooden frame to strengthen and protect from cracking (Fernley, 2008)
    - written on using a smaller piece of slate
        - eventually replaced with soft limestone chalk (easier to use on the slate boards, easier to clean) (Fernley, 2008)
    - markings could be erased with a rag
        - eventually replaced with felt erasers (absorbs more chalk dust to keep it out of the air) (Fernley, 2008)
- paper and ink available but were expensive and hard to come by (Concordia Online Education, 2012; Fernley, 2008)

- slate was economical but inefficient since teachers had to copy lessons onto each individual slate (Concordia Online Education, 2012)

1800 (Scotland)

- James Pillans (headmaster of the Old High School of Edinburgh) wanted a larger space in which to display large maps, so he connected his student's smaller slates together to form one large field (Buzbee, 2014)
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1801 (America)

- George Baron (West Point math teacher) used the large field of connected slates to display formulae to large audiences (Buzbee, 2014)

1809

- every public Philadelphia school was using the strung-together slates as a large-field display in classrooms (Buzbee, 2014)
- these large blackboards served as "a flexible and versatile visual aid, a device that was both textbook and blank page, as well as a laboratory, and most importantly, a point of focus" (Buzbee, 2014)
- "students no longer simply listened to the teacher; they had a reason to look up from their desks" (Buzbee, 2014)

1820

- a paper cutter introduced to cut paper into small, manageable sheets (Bakewell, 2014)

1840

- blackboards manufactured commercially (Buzbee, 2014)

1850

- all schoolhouses had a blackboard

1930

- the chalkboard (green porcelain-based enamel surface) first used (Buzbee, 2014)
- the green color cut down on the glare

1934

- first spiral notebook (Popular Science, 1934)

1960's

- chalkboards (green porcelain-based enamel) – lighter, durable (Concordia Online Education, 2012)

Historical Context

The invention of various types of technology depends on the needs of the culture, and the evolution of technologies into new types depends on the successes and shortfallings of the previous transition species. These new technologies have the potential to supplement the technology or completely replace an established technology. The dominant technologies of the literate era includes the papyrus roll, the codex, and the printed book; technologies such as slate tablets and chalkboards are considered secondary technologies because they fulfilled a need that couldn't be met by any of the dominant technologies (Bolter, 2001). Although writing itself has been around for millennia, the use of slate boards and paper to record writing has evolved both gradually and simultaneously. Paper was first invented in China in 105 AD and was made using small bits of tree bark and cotton rags. This ancient paper was originally called 'tapa'; it wasn't until the tapa made it to Europe where the Europeans mistook its origin and thought it came from the Egyptian papyrus (i.e. 'paper') (Haven, 2006). It took several hundred years for the paper-making materials to become the present-day plant-based fibers.

At the same time that paper-making was becoming industrialized, students in classrooms were relying on small pieces of slate reinforced with wood for strength and stability (Fernley, 2008) to complete daily lessons. Paper and pen were available for use at this point in history, but they were expensive and hard to come by (Fernley, 2008), whereas slate was the more economical option (Concordia Online Education, 2012). Slate is a metamorphic rock formed from the continuous exposure to heat and pressure over time on clay minerals (Geology, 2015). It is widely known for its use as flooring and roofing, and has historical uses such as billiard tables, cemetery markers, and chalkboards (Geology, 2015) for its durability, resistance to moisture, and ability to be broken into thin sections. Students would write on the slate boards using a smaller piece of slate, which could be easily wiped clean using a rag. The slate writing utensil was eventually replaced with soft limestone chalk, which was easier to use and clean, and the rag eventually replaced with a felt eraser, which could absorb more of the chalk dust to keep it out of the air (Fernley, 2008).

It was the year 1800 when a Scottish headmaster thought to connect students' slate boards on the wall in the front of the classroom in order to illustrate large geographical maps (Concordia Online Education, 2012). A year later, an American math teacher used the same idea to present large mathematical formulae to large audiences. A short 8 years later, every public school in Philadelphia was using the strung-together slates as a large-field display in classrooms, which served as "a flexible and versatile visual aid, a device that was both textbook and blank page, as well as a laboratory, and most importantly, a point of focus" (Buzbee, 2014). Students no longer had to just listen to the teacher and work independently at their desk; they had a reason to look in a common direction to learn together (Buzbee, 2014).

As the slate-board evolved into the blackboard (one large piece of slate), which evolved into the chalkboard (green, porcelain-based enamel surface), paper-making continued to become more prevalent and economical, soon being cut into small, manageable sheets (Bakewell, 2014), and eventually being bound by a helical piece of metal into a coil notebook common to today's students.

Educational Implications

Rote

The organization of classrooms and availability of teaching and writing technologies stipulated the use of rote memorization as a learning strategy. The student's seats were arranged facing the front so that the teacher could address the class, a design that Park (1937) attributes to a teacher-student command-obey relationship (p.28). This is not an environment that encourages understanding, but rather an atmosphere of tension and discipline. Students were expected to repeatedly practice the concepts at hand, which required a medium in which to practice skills such as penmanship and math skills, but also relied heavily on auditory practice to increase recall.

Note

The use of paper notebooks in the classroom didn't necessarily eliminate the need for rote memorization, but it did provide an alternate path in which to place more focus on other teaching and learning techniques. Note-taking has shown to increase the ability to recall information, especially information that is auditory (De Vesta & Gray, 1973), as well as improve a learner's attention while listening to an auditory lesson (Lin & Bigenho, 2011). The act of writing down information can be considered a learning tool since "it contributes to construct more significant and deeper levels of knowledge" (Castello & Monereo, 2005, p.269). The cognitive requirement of physically writing down information that is being heard activates cognitive processing of the information. As well, note-taking skills such as paraphrasing and elaboration can help students to better understand a topic (Castello & Monereo, 2005).

Cultural Context

Writing can be defined not only by the physical act of scribing words on a medium, but also by the "technical and cultural dimensions" (Bolter, 2001, p.72). Together, writing becomes a technology that influences culture in a myriad of ways including socially, economically, spiritually, academically, and educationally. As a technology, writing calls for the use of particular tools including a writing surface and a hand tool in which to inscribe words or symbols (Ong, 1982). Instead of the smooth surfaced machine-made paper and ball-point pens we use today, early writers had to be inventive (Ong, 1982).

At the time of their use, slate-boards were the economical and convenient choice of educational writing implements considering that paper was expensive and hard to come by (Concordia Online Education, 2012). The educational community required a writing space that teachers could display passages of text, students could practice their handwriting, and demonstrate competencies such as mathematics. The only downside to the small pieces of slate was their limited capacity for writing and their impermanence (could also be considered an affordance). Being able to write thoughts and practice writing skills allowed students to externalize their thoughts (Bolter, 2001) and increase their awareness and perception of the world itself (Ong, 1982). Ong (1982) argues that the act of writing, utilizing any technique, allows the writer to "regard the mind itself as a writing space" (p.57). When the writer formulates his or her thoughts in their mind, the physical act of writing merely embodies the writer's consciousness onto a medium that can be perceived by others. It essentially "makes our thoughts visible" (Ong, 1982, p.57) and allows for a mode in which to communicate with society.

As paper manufacturing became more economical and increased the availability worldwide, students were able to instead use personal notebooks to practice handwriting and demonstrate educational competencies. The impermanence of slate-boards required students to internalize most of their teachings and utilize the learning tool as a practice board. With the prevalence of paper notebooks, students were able to write information and build a repository of information that could be saved for reading later (Castello & Monereo, 2005).

The remediation, or evolution, of one technology into the next is dependent on the successful features of the older medium informing the characteristics of the newer medium. Bolter (2001) states that remediation is a process of cultural competition that requires "both homage and rivalry" among technologies in order to improve the old and create the new (p.87). In terms of the technologies of discussion, the blackboard remediates the personal slate for its size and ability to address entire groups; the chalkboard remediates the blackboard for its one-piece composition; the paper notebook remediates the personal slate for its reusability and retention of information. Each takes the best features of the technology before it and creates a new mode which functions to enhance the culture of its time.

Literacy Implications

According to Mayer (2002), there are two important epistemological goals: *retention* (the ability to remember information) and *transfer* (the ability to use knowledge to solve problems). These coincide with the six cognitive process categories of Bloom's Taxonomy (year?): remember, understand, apply, analyze, evaluate, and create. The first category, remember, is the simplest of the six, yet is also essential for the remaining five categories. Remembering fits into the first educational goal, retention, in that it relies on knowledge acquisition. The remaining five categories (understand, apply, analyze, evaluate, create) fits

into the second educational goal: transfer.

Rote

Rote learning is learning by acquiring knowledge (Mayer, 2002) and seems to be without insight (Park, 1937). Battino (1992) describes rote learning as acquiring knowledge "by verbatim memorization, and arbitrarily [incorporating] into a person's knowledge structure without interacting with what is already there" (p.136). Even though rote learning has been, and still is, made fun of for being inadequate for meaningful learning, the reality is that "[humans] learn by…listening, by repeating what they hear" (Ong, 1982, p.8).

Acquiring knowledge involves the ability to remember information, storing it in long-term memory, in order to recall it at a later time. As an example, rote learning would involve a student reading the content of a text carefully, going over the material and memorizing the key facts. This student, who has relied on rote memorization, would be able to successfully complete a retention test, but would be unable to transfer the information to solve a problem (Mayer, 2002). Rote learning has proven to be very useful in learning concepts such as the "rules of grammar, historical facts, the names of the presidents or Roman emperors, verses from the Bible or the Koran" (Park, 1937, p.27), but the concern with rote memorization is its limitations to the timely context of the information, as well as the importance of critically analyze the use of the information. Mayer (2002) says it well: "when teachers concentrate solely on rote learning, teaching and assessing focus solely on remembering elements or fragments of knowledge, often in isolation from any context" (p. 228).

Note

In contrast, meaningful learning is learning as a knowledge construction where students engage in learning, mental organization, and integration (Mayer, 2002). With the advent of paper notebooks, students were able to offset some of the cognitive functions previously preoccupied by rote memorization in favor of devoting more time to constructing meaning and understanding concepts, instead of simply recall, which leads to cognitive change (Castello & Monereo, 2005). With the critical information recorded in a notebook, students are able to place their focus on problem solving and applying the information, which enables students to reach the higher taxonomic categories of understand, apply, analyze, evaluate, and create. The ability to record notes in a personal notebook for later recall allows students the ability to analyze and store information, as well as improve recall and retention (Lin & Bigenho, 2011; De Vesta & Gray, 1973).

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