ABSTRACT

In this paper, we analyze the phases of development that led to the creation and design of a web-based application constructed to support the acquisition and practice of expert writing skills for adolescents. We first discuss our design objectives and the significance of this product for young writers beginning to engage in the production of research papers and argumentative essays. We then review the literature that served as a basis for our design rationale, and outline how this knowledge transformed the processes of design and re-design. Finally, we discuss the iterative nature of our creative process and the potential impact of our work on emergent writers and the educational technology design community.

DESIGN OBJECTIVES & SIGNIFICANCE

In this project we sought to design a web application which engages students in critical reading and writing, so that they can learn to produce argumentative papers through a carefully scaffolded process. We chose to target adolescents – ages 15 to 18 in sophomore, junior or senior classes – who are enrolled in honors or advanced placement English courses where research papers and argumentation are curriculum requirements. However, we hope that this tool may also be used in other humanities courses, like history or philosophy. We also believe this tool could be used to help students entering college who do not have extensive experience in critical analysis, but are required to write papers with complex arguments for their classes,

Adolescents will most likely use this product at home in order to complete their homework assignments. Depending on the availability of computer work-stations and internet connectivity at the site, however, the tool may also be used in classrooms for in-class writing assignments and peer review.

Based on our experience at the school site and the revision of multiple drafts provided by the teacher whose classroom we observed, we found that there exist several weak points in the writing process for emergent writers. During our site visit, we found that although students were competent at generating multiple drafts of an assignment, the changes between drafts most often consisted of the addition of more text, and not the reworking of ideas or argumentation. Even students who were able to formulate complex arguments themselves were either unable or unwilling to critically analyze the works of their peers. We also observed that although students routinely and voluntarily participated in some kind of pre-writing exercise before their in-class writing assignments, this process was cursory. Students generated ideas using maps, outlines, or free-writes at their discretion.

We had several important founding goals in our product design. First, we wanted students to continue using their lower-order writing skills, such as providing local revisions on sentence structure and grammar. But we also wanted to create a product that would support the development of higher-order writing skills; we wanted students to engage in in-depth analysis of their own work and that of their peers. The tool had to be
created using a non-linear framework that would allow students to navigate through
different stages of the writing process from ideation to creation to revision. However, we
did not want to provide any writing or web search features which would distract or
detract from the writing task. We accomplish this in our design by:

- Providing a customizable toolset for students to analyze age-appropriate examples
  of argumentative writing
- Creating frameworks for discussion to allow students to share their analyses with
  each other
- Supporting the idea-generation process in a variety of modalities
- Allowing students to submit their preliminary work to the teacher for one-on-one
  review
- Allowing students to submit their draft iterations to each other for peer review
- Integrating Internet research tools into the product for easy reference

Our methods in accomplishing our design goals through an online interface indicate
additional requirements regarding our user base. Both students and teachers must be
computer literate, meaning, they must have a moderate-degree of fluency with basic
computer interactions. They must be able to boot up a computer, connect to the internet,
and launch a web browser, such as Internet Explorer or Mozilla Firefox. They must also
be familiar with the universal Cut, Copy, and Paste commands on their system (PC or
Mac). In addition, the users must be familiar with basic web-standard interfaces, such as
a message board, and controls, such as text boxes, pull-down menus and buttons –
elements that would appear on a web form or login screen. Any screen-specific
commands or functions will be supported through the use of help text, but support for
basic web navigation will not be addressed in the system. These requirements may limit
the reach of our product to classrooms whose students have developed a high-degree of
computer and Internet literacy at school or at home, and teachers who already have
technology integrated into their critical pedagogy. This limitation could be addressed in a
later round of development, where the online toolset is accompanied by printable
resources for students and teachers.

Scenario

In order to guide our development of our product, we created the following scenario:

Jennifer is a 16 year-old AP English student. She is a strong reader, but has trouble
developing robust arguments about the literature that she reads in this class. She has a
high-speed internet connection at home and her own computer for school work. She
publishes her own personal blog, and is a competent typist. Her teacher has just begun to
use this product with the class to help all of the students plan their arguments for their
next writing assignment.

Ms. Rodriguez is a Junior-level AP English teacher. She has noticed that although her
students possess relatively strong technical skills in writing, they are not developing
strong or unique arguments for their critical writing, and they are not showing
significant development between drafts. She is fairly confident with her own computer skills and uses the Internet frequently, but she is worried that the internet provides a series of problems ranging from excessive information to sites which would only lead to cheating and plagiarism. She decides to give this product a try in her classroom for the next writing assignment on Chinua Achebe’s Things Fall Apart.

In the weeks following up to the first writing assignment, Jennifer uses the product to capture her notes on Things Fall Apart by Chinua Achebe. She logs in quotes, chapter summaries, and ideas as the class reads the book chapter by chapter in her “My Notes” section.

As the class moves through the book, Ms. Rodriguez logs in a number of close-reads and character analysis assignments for discussion through the system.

The students log in to the product every day and contribute to the weekly online discussion. As the discussion process continues, Ms. Rodriguez’s inputs become less visible and guided. Students should increasingly learn to navigate through the application and establish their own rules and discussion topics.
Through her personal notes and on-line class discussions, Jennifer starts to focus on the portrayal of women in the novel, especially Chielo, the high priestess. When the character analysis essay is assigned by her teacher, Jennifer decides to ideate on this topic.

Jennifer enters the Ideation Module, where she has several options about how to start generating ideas. Jennifer decides to start with doing a character map of the women in the novel in the Mapping Mode. She can navigate between modules to reference the class Discussion Boards or her Notes.

Then Jennifer performs a free-writing exercise to get her initial ideas down “on paper.” She then highlights some key passages in her own writing to bring into the “Outline” mode.

She reworks her topics and quotes into an outline form, and then submits her initial outline for review by her teacher. Ms. Rodriguez provides written feedback through the system and encourages Jennifer to start her first draft, which is due in a week and a half.
Jennifer then imports her outline into the Creation Module and starts building out a first draft character analysis. She works on it a little bit each day for a week, before publishing it through the system for peer review in small groups.

Within a week, she gets feedback from her peer group and Ms. Rodriguez.

As she works on the next two drafts, Jennifer can move through all of the modules in the system as she pleases, pulling content in from one mode to another as she continues to construct her analysis. When she has completed all of the required drafts, she submits her final draft through the system to her teacher.

Through the development of this scenario through storyboards, we were able to imagine some additional relevant features as indicated through our initial brainstorming, our teacher interview, and our review of the literature. Some other key technological features that were not made explicit in the scenario-development or prototyping process are as follows:

**User Management/Small Groups**

There would have to be a security protocol in place that would protect each individual student’s work until they choose to share it with their peers. A simple database-driven user management tool would allow a teacher to create and distribute a username and password for each individual student within a class, and allow the teacher to manage multiple classes. This will also allow for all student-generated content to be marked with the student’s name, thus making individuals responsible for their own content contributions. The peer review is intended to take place in small groups of three to four students, in order to offset “information overload” as the student attempts to
synthesize a variety of comments. This tool should also allow the teacher to determine the members of each small group, although this process could be automated by the system if desired.

**Ubiquitous Teacher Access**

The teacher or teachers of a given class section should have access to ALL content entered by the students into the system at all times. Provided this is known to the students, this should mitigate the temptation to cheat through this system, or to use the communication channels for anything other than relevant course work. We discussed implementing a curse-word screener that could replace any curse words entered by the students into the system with alternate characters, such as asterisks, and send a notification to the teacher. A feature like this should be carefully tested, however, as some legitimate texts may contain expletives, and we would not want the system to send distracting and superfluous messages to the teacher.

**Customization Features**

We intend for the teacher and students to be able to add in prompts, which we have labeled the “Rhetorical Problem” for the different phases of an assignment or project. Although the system can be populated with generic prompts, ideally the teacher would customize the prompts to relate directly to the assignment at hand. In addition, we would like for the teacher to be able to enter in their own examples for analysis in the Recognition section. Ideally, this could include text, pictures, or videos alone or in combination. The interface for this feature would need to be carefully designed in order to be usable for our computer literate teachers, and useful for more advanced computer users. For further discussion of the import of analysis of writing examples, see DESIGN RATIONALE.

**Online Resources**

In our final prototype, we demonstrate how the Resource Bar might be implemented. This is based on the Microsoft Office “Research” interface. We imagine that the system would be linked into a number of existing online databases, such as dictionary.com, thesaurus.com, and the Encarta Encyclopedia, which would allow for the search results to be shown within a single, integrated interface. There may be other online resources that are not searchable, however, that could be linked within the Resource Bar. The system could be populated with a number of standard resources, such as the MLA. There should also be a method, however, for the teacher to choose online resources that he or she would like for her class to use in general or for a specific assignment. These links could also be incorporated into the Resource Bar. For further discussion of the use of Online Resources, see DESIGN RATIONALE.
Tips

We imagined that the Tips Bar would function much like the Resource Bar, but it could contain two different sets of information. The first set would be help text on the technical use of the application. The second set would be tips on the activity itself. Additional prompts could be incorporated as additional scaffolding for the writing process. These tips would be contextual to the individual screen that the student is working in. An example of a tip that could appear on the Ideation Free-write screen would be: “Free-writing is a good way to get your initial ideas out on paper. Just type out everything that comes to mind on this topic – you don’t have to worry about grammar, spelling, or punctuation at this point.” Another example: “If you are stuck, try giving yourself a time limit for the Free-write. Just keep typing until your time is up – don’t worry if what you write doesn’t seem to make sense. You can go back and review when your time is up and see if there are any interesting ideas that you would like to write more on.” Again, the idea of incorporating both system help text and contextual activity scaffolding would need to be subjected to user testing – it is important that students (and teachers) find the information that they need as quickly as possible.

Peer Review Commentary

The flow of peer review commentary is not highly developed in this round of prototyping. Questions still remain about the final step of the process – how does the student integrate comments submitted by their peers into the next draft of their assignment? We experimented with this in our proof-of-concept prototype, but there may be additional affordances that could be built into the system. A compare and contrast features, which allows the student to compare commentary between reviewers, or a synthesis feature which allows the student to integrate all comments into one view could be useful. At the very least, the student should be able to gain access to a printable version of the commentary, which is obliquely referenced in the button set shown on the prototype. For further discussion of the Peer Review process, see DESIGN RATIONALE.
DESIGN RATIONALE

Introduction

Throughout the process of research and design, we had one crucial question in mind: How can we create a technological tool which bridges the gap between critical thinking and ideation to the act of writing? We searched for literature in the following categories: 1) cognitive studies on writing and/or adolescent development, 2) theoretical works by critical pedagogues and teacher-educators, and 3) articles on the effects of new technologies on literacy and development. Interestingly enough, the works of developmental psychologists, critical pedagogues, and advocates of new technologies held significant recurrent themes: Overall, we found a strong criticism of the ability of traditional schooling to engage students in the critical thinking necessary to construct an argument. We also saw a desire to engage students in a type of literacy which would present reading and writing as acts of problem-solving in which students have to constantly (de)construct knowledge to obtain meaning. The literature in these fields also revealed that high order writing skills are not the privilege of the few, and can be taught through modeling, collaboration, and explicit scaffolding of the process (Byrnes, 2001; Chandler-Olcott & Mahar, 2003; Flower & Hayes, 1981; Labbo & Reinking, 1999; Lee, 1999).

In this section of the paper we provide a synthesis of the findings which directed our design process. We begin with a discussion of the literature on writing, cognition and adolescent development. Throughout this discussion we integrate the theories and works of critical pedagogues who have developed techniques for teaching critical thinking and literacy skills in progressive classrooms. We then look at research on how current technological tools can help support different stages of the writing process. Finally, we explain how our product integrates cognitive theories, critical pedagogy, and a variety of technological resources into our web application designed for writers who are beginning to experiment with argumentative writing.

Writing, Cognition & Critical Pedagogy

High Literacy & Cognitive Development during Adolescence

In the 1980s after a series of studies on writers, Linda Flower and John Hayes constructed a series of models to describe the cognitive processes that help writers translate their knowledge into the act of writing (Byrnes, 2001). Through the use of protocol analyses (or think-alouds), developmental psychologists have since determined a series of characteristics and behaviors expert writers have in common (Byrnes, 2001; Flower & Hayes, 1981; Pea, 1987). Several studies have begun to identify the ways in which skilled writers manipulate textual information more effectively than novice writers. For example, expert writers tend to have a larger repertoire of sentence constructions and grammatical devices they have accumulated through extensive practice in critical reading and writing. In Cognitive Development & Learning Instructional Contexts, James Byrnes explains,
Thus, to revise a document, writers have to engage in (a) critical reading of what they have written, (b) problem solving and decision-making (i.e., identification of a problem, consideration of alternative ways to fix it, etc.), and (c) text production (i.e. translating these intentions to the revised text) (pp. 190).

This connection between critical reading and critical writing appears to be crucial (Byrnes, 2001; Flower & Hayes, 1981). Expert readers have the ability to see through the conventions of text and pull out structural analyses. That is to say, expert readers can clearly point to the part of the text where the argument is written, and then highlight the evidence the writer has provided to support that argument. Expert readers can also evaluate if the evidence supports the main argument or not; they can then choose to believe parts of the argument, or the whole argument, because they have critically analyzed the logic and flow of the text. Expert readers tend to be able to carry this skill into their own writing (Byrnes, 2001). Expert readers can identify the flaws in their own logic and argumentation and are therefore able to fix problems in a meaningful way. For individuals with high literacy skills the entire process of reading and writing becomes an exercise in problem-solving. These writers constantly engage in a process of inquiry in order to produce their work (Byrnes, 2001; Eisner, 1994; Lee, 1995). Individuals with high literacy skills learn to constantly ask questions such as: What is the argument? What is the evidence? Does the evidence prove the argument? How can this argument become stronger?

During adolescence people acquire this ability to think systematically, logically, and hypothetically, and are thus able to engage in the cognitive processes required of expert writers. However, this is contingent on whether students receive the proper guidance through the writing process or not (Byrnes, 2001; Cole & Cole, 2000; Lee, 1995). The research of Piaget and other developmental psychologists on “formal operations” explores the ways in which adolescents begin to exhibit complex forms of thinking (Cole & Cole, 2000). One example of critical thinking in adolescents in the Western world can be seen when young people first come to realize and verbalize the discrepancies between the ideals adults espouse and what they actually do (Cole & Cole, 2000; Lee, 1995). Young people are usually able to verbalize when they see injustice, discrepancies in logic, and irrational actions. However, it is important to note that even though adolescents may be able to verbalize the conclusions to which they have arrived – and even explain how they arrived at those conclusions – this does not mean the individual is able to translate this knowledge to paper (Byrnes, 2001; Flower & Hayes, 1981). Writing, then, presents a series of unique challenges for teachers of adolescents who must engage students in these complex cognitive processes.

Like thinking, the process of writing, is not linear. Although the process of writing is typically thought of in terms of three step-by-step stages – pre-write, write, and re-write – expert writers actually move fluidly through the three processes in a recursive manner (Byrnes, 2001; Flower & Hayes, 1981). The process of critical writing requires this constant movement between phases of writing if the final product is to reflect a
cyclical thinking process in a linear fashion. Furthermore, knowledge of topic, audience, genre, and language can further confound the writing process. Writing, then, becomes a complex act of balancing information, as well as problem-solving strategies (Byrnes, 2001; Cole & Cole, 2000). As one expert explains,

Developmental studies show that, with age, children become more knowledgeable about topics, audiences, genres and language. However, the major change which seems to occur is not so much the acquisition of these forms of knowledge as much as children’s ability to consciously reflect on and manipulate this knowledge (Byrnes, 2001, pp. 185).

During adolescence, the increase in long-term memory has a tremendous effect on the ability of children to manipulate information and strategize effectively when solving problems (Cole & Cole, 2000). While educators have no control over the development of long-term memory, the literature shows that students who acquire knowledge and are instructed to use that knowledge in different ways become more effective problem-solvers (Byrnes, 2001; Cole & Cole, 2000).

**Teaching High Literacy Skills**

When teaching high literacy skills, educators must first carefully scaffold the process during early stages of learning, and later provide a space for students to become independent readers and writers (Bereiter & Scardamalia, 1987; Byrnes, Eisner, 1994; Freire, 1970; Knudson, 1990; Lee, 1995). One expert educator of literacy explains,

Teachers must begin by assessing their students' writing competence in terms of this knowledge [expert writing knowledge – our insert]. Do the students have knowledge of the strategies involved in prewriting, writing, and revising, or are they dependent upon the teacher to participate in the activities with them? Teachers of beginning students (novice writers) may have to participate, but they should gradually withdraw from the process of writing so that students have opportunities to use the information associated with the writing task (Knudson, 1990, pp. 92).

Unfortunately traditional schooling makes students constantly dependent on teacher input. Teachers perform a lot of the initial cognitive processing of writing such as establishing the topic, finding supporting arguments, and providing evidence. Often all that is left for students to do is to organize the material the teacher has provided into a somewhat coherent piece of writing. This “banking” system of education prevents students from acquiring the skills and independence necessary so that they become individual thinkers and critical consumers of information (Bereiter & Scardamilia, 1987; Freire, 1970; Giroux, 1978; Knudson, 1990; Lee, 1995). Critical pedagogues in the fields of literacy stress the importance of making reading and writing skills explicit through constant evaluation and inquiry. That is to say, teachers must clearly explain why they engage in certain behaviors, and ask students to do the same. For example, if the teacher states “Social inequity is wrong” she must explain why she made the statement, provide
evidence for the statement, and explain how she went through this reasoning process (this is similar to protocol analysis and think-alouds). Students must also be pushed to engage in the same type of cognitive exercises; they must learn to find an argument, provide evidence, and explain their reasoning process (Byrnes, 2001; Knudson, 1990). However, it is crucial for teachers in progressive settings to become “invisible” as students learn to analyze material and produce pieces of writing independently. While collaboration and peer evaluation remain crucial components at all times, the amount of collaboration and teacher input should decrease and change in nature as students become liberated writers.

**Writing, Cognition & New Technologies**

*Word Processors*

When word processors were first introduced into the market, there was a great deal of excitement because this new writing tool would free people from “lower order” tasks of writing such as having to worry about spelling, sentence structure, or running to the shelf to find a dictionary. Through integrated writing aides, word processors were expected to allow writers to focus on “higher order” tasks such as goal-setting, solution strategizing, and organizing (Bangert-Downs, 1993; Pea, 1987). Word processors have in fact made writing easier by facilitating certain processes during writing and revising, but it is still hard to determine to what extent this tool has changed the ways humans think, write, and think about writing. Research on the effects of word processors on literacy has been difficult to interpret. Numerous studies have shown that people who use word processors do write more, but it has been difficult to establish if writers and the quality of their products have changed or not (Bangert-Downs, 1993; Byrnes, 2001; Pea, 1987).

Numerous researchers have argued that various variables play into the successful use of this writing tool, including: writer’s strategies, keyboarding skills, prior computer experience, instructional interventions, as well as the social and cultural organization of the learning environment (Bangert-Downs, 1993; Byrnes, 2001; Labbo & Reinking, 1999). Some researchers make a case for the addition of automated writing prompts to these programs in order allow for new level of interaction between the writer and the tool, but it is unclear if these prompts would only result in producing highly-uniform products which lack original thought and critical analysis (Bangert-Downs, 1993; Knudson, 1990; Pea, 1987).

*Web Searches & the Information Superhighway*

The Web also generated a great deal of excitement when researchers began to understand the immense amounts of possibilities for communication and education available on this platform. The Web (unlike paper or the book) provides an interactive form of communication; we can receive enormous amounts of information and we can become active participants in adding information. The Web also provides a means for groups of people scattered across the world to have discussions about topics of shared interest, allows for the exchange of ideas and opinions at a fast rate, and presents multiple points of view and information. New tools and social protocols are constantly developing for people to communicate with each other online (Brown, 2000; Egan, 2000; Turkle,
A research scientist at Xerox involved in education using new technologies even states,

…with the Web, we suddenly have a medium that honors multiple intelligence – abstract, textual, visual, musical social, and kinesthetic. As educators, we now have a chance to construct a medium that enables all young people to engage in their ideal way of learning (Brown, 2000, pp. 12)

The Web then, provides a new platform for education which traditional schooling cannot. According to researches like the one cited above, the web presents a set of possibilities that require new types of literacy in which navigating through a great deal of (mis)information becomes a new type of literacy in it of itself (Brown, 2000). The internet presents a unique set of problems which can be “solved” by trying out different combinations, and scaffolding the processes. It is crucial to note that hyper-text communications are not linear or static. Online reading and writing communications require that users navigate through multiple platforms that have animation, links, text, photos, movie clips, three-dimensional graphics, and numerous windows (Chandler-Olcott & Mahar, 2003). The entire medium requires that users deal with material that loops backs and forth, and reacts (or refuses to react, as the case may be) according to the commands of users. Judgment is essential in making one’s way through massive amounts of information; often students do not know the difference between a site with information which can be trusted and a site with information which has been plagiarized or falsely fabricated (Chandler-Olcott & Mahar, 2003; Labbo & Reinking, 1999; Wineburg, 2003). Young people, then, need to learn to engage with new media by exploring in a productive manner which fosters critical analysis of ideas and information posted on the internet.

**Blogs, Chat Rooms & Online Collaboration**

Websites which promote online collaboration present a new social space for adolescents to engage with information. More than any other technological tools, blogs, chat rooms and sites for online collaboration bring together adolescents to a platform in which they can discuss their realities, construct new identities, and create pieces of expository writings with the help of peers (Chandler-Olcott & Mahar, 2003; Egan, 2000; Turkle, 1997). An important aspect of the creation process is the induction rite which is often seen in these sites:

A number of studies have shown that more knowledgeable members of a community of practice or activity socialize novice members into the use of technological tools... In addition to helping novices learn to use technological tools, communities of practice or activity systems often establish standards for technology-mediated products that promote work of a certain quality on members’ parts (Chandler-Olcott & Mahar, 2003, 362-3)
Blogs and chat rooms are community platforms where users mediate meaning and teach other how to interact with the space (Chandler-Olcott & Mahar, 2003; Egan, 2000; Turkle, 1997). Users of these interfaces teach each other how to navigate the sites and construct complex products – whether those are graphics, animation, stories, or arguments. Users in these types of interfaces engage in both competitive behavior and in acts of altruism (Turkle, 1997). Young people strive to create original products better than those of their peers, but also help each other crack codes and solve complex problems.

**Integrating Theory & New Technologies in Our Re-Design(s)**

While many of our initial design decisions were based on technological concerns and features that we as experienced writers would have liked to see in a web application, as the research process progressed we found ourselves constantly re-viewing and re-designing our initial story-boards to address the needs of novice writers. In this final discussion of our design rationale, we would like to discuss how theories of adolescent development, practices of critical pedagogy, and studies on current software applications informed our product re-design(s).

Our first major concern arose from the amount of intervention the teacher should have in the web application. While we wanted the teacher to be present at all times, we did not fully understand how her participation would be mediated in this space. After a lot research, we finally decided that teacher participation and scaffolding would work on two distinct levels of improving literacy skills. On one level, the teacher would be engaging students in critical analysis of the content being discussed in class in order to produce pieces of critical writing. On another level, the teacher would be engaging students in computer literacy which would allow for students to capitalize on a variety of technological resources. In the spirit of establishing “cognitive apprenticeships” we realized that teacher scaffolding and participation would have to be high at the beginning, and then decrease as students took control of the site and learned to navigate the space independently. As an individual’s high literacy skills begin to develop, peer-review (and some degree of teacher mentoring) would provide important feedback to the individual writer, without having to rely completely on a mediating teacher.

Our second major concern arose when we began to discuss “distracters.” One of our main priorities became creating a useful platform that would help students stay focused on the writing task. The research on literacy development showed that one of the main skills expert writers must learn is to establish a writing goal and series of sub-goals that feed into a comprehensive argument (Byrnes, 2001). Novice writers tend to stray from the main writing goal as they lose focus of things such as the rhetorical problem, audience, flow of argument, and supporting evidence. We constructed a space labeled “Rhetorical Problem” on every page of our web application. The idea behind having this constant reminder present was to address the problem of long-term memory and support the idea that a clear goal must be present at all times. In addition, we found it crucial that students be able to keep focus on their main writing assignment while pulling information from their notes on other folders. While in the Creation phase, information would not
overlap or obscure the student’s main writing task, thereby keeping constant engagement with the writing goal.

Finally, we realized we were opening the door for the greatest technological “distracter” of all time: the Internet. We realized that word processors and the Web provide a unique opportunity to engage with great deal of information, but we wanted to help guide the process. We wanted the students to be able to learn to deal with specific types of information on sites such as on-line dictionaries, thesauruses, encyclopedias, newspapers, etc., as well as sites with philosophical writings and literary criticism. The sources included had to be pertinent to the research and writing of argumentative papers. However, because we were targeting trusted websites this did not mean that the web application would not provide for conflicting versions of the “truth.” In fact, we found it crucial that students engage with conflicting narratives and opposing arguments, so they would engage in critical analysis. We wanted students to begin exploring government websites, university postings, as well as projects created by other high school Humanities students online. We wished for students to gain the ability to judge the usefulness of any given website by analyzing who posted the information and for what purpose. For this portion of the web site teacher and peer collaboration once again became essential so that users become engaged in conversations about the validity and usefulness of the information to the task at hand. We wanted to constantly play on the idea that students would “initiate” each other into the writing process and share information, as they would on any other blog. Through explicit statements of what expert writers would have to offer to novice writers, we believed this web application would enable the type of modeling necessary to literacy acquisition.
DESIGN PROCESS

Our design process included iterative rounds of brainstorming, research, and prototyping. Although we engaged in the three activities of immersion, scenario development, and prototype development, we did so in a non-linear fashion that best suited our needs as designers, our access to information sources, and the development of our vision. Following is a chronological outline of the steps we took in the development of the final prototype.

Our initial vision was to provide a tool for high-school students to develop their writing process. Here is how we both narrowed and elaborated on that vision through our design process.

Groundwork

We started our creative process by brainstorming a list of features that would support the writing process and a list of behaviors or interactions that the technology could support, but that we wanted to avoid. Following are some examples:

<table>
<thead>
<tr>
<th>What to incorporate:</th>
<th>What to avoid:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Discussion Board: an asynchronous method to discuss the readings and class assignments</td>
<td>Attacking people instead of ideas: destructive commentary communicated through the system</td>
</tr>
<tr>
<td>Online Resources: Links, MLA, searches, dictionary and thesaurus, how-to guides</td>
<td>Plagiarism from online resources: must not make it any easier through this system than on the web</td>
</tr>
<tr>
<td>Anchors and Examples: A way to analyze example writings for form, structure, and style</td>
<td>Cheating through the system: must not be able to copy and paste from example writings posted to the system</td>
</tr>
<tr>
<td>Peer Review/Editing: a way to review other student’s work online and make comments</td>
<td>Information Overload: must not have too many people proving peer feedback on the same paper</td>
</tr>
<tr>
<td>Guided Experience: there should be a clear navigation path through the system as the writing task develops, but students should be able to revisit steps at will</td>
<td>Distracting Features: must not include superfluous features that distract from the writing process (formatting features, etc.)</td>
</tr>
</tbody>
</table>

We also talked about the potential audiences and contexts where our system might be used. Audiences included students, teachers and parents. Contexts included at home, in the classroom, and in a school computer lab. For the purpose of this prototype, we decided to focus on students as the primary audience, and teachers as a secondary audience. We also imagined the students using this system primarily at home for their homework, as opposed to in class.

We also talked about the type and level of high school writing we wanted to target. Here we decided to focus on AP English writing. In most high schools, this is the
level at which writing process, as opposed to writing mechanics, becomes the focus of instruction.

We did a preliminary experiment with mocking up the peer-review flow, as we thought it was the most innovative of our feature ideas. Creating visuals of that interaction flow helped us better conceptualize the system as a whole, and discuss potential issues that might come up in the peer-review process.

Images from Proof-of-Concept Mock-up

Immersion

The groundwork phase gave direction to our research. We delved into the literature on multi-media design for children, and searched for writing resources targeted at high-school and university students online. Here we found additional guidelines for both our design process and our actual product.
We then had an opportunity to observe a Junior-level AP English classroom at Santa Teresa High School in San Jose. The students were working on an in-class writing exercise. We were given access to their pre-writing work, and saw the diversity of methods that students used to generate ideas and outline their initial arguments. When we interviewed the teacher, we were told that this is typically the most difficult process for the students throughout the year. We then decided to turn our attention to the ideation module, in order to provide support for planning and argument development. We decided to incorporate our work on peer review to incorporate discussion into the ideation process.

Example Artifacts from Site Visit

Our discussion after the site visit also lead us to a model of the writing process that we wanted to develop our prototype around: Recognition, Ideation, and Creation.
In order to make visible our thinking on the cycle of Recognition, Ideation, and Creation, we then developed a user scenario that described a student’s first pass through each module in the cycle. Developing this scenario further clarified our implicit design goals. We looked to our preliminary research and expanded our search for literature on the cognitive development of adolescents as pertain to their engagement with the writing process. Developing the storyboard to go along with the scenario brought to light a few unanswered questions about the functionality of the system and the interaction flow. These activities prepared us to develop the final prototype.

The final prototype reflects the integration of our research and design iteration. Navigational elements, button placement, and the inclusion of Rhetorical Problem prompts on every screen were some concerns that were addressed in the final prototype. See FinalPrototype.ppt for final click-through.

**Workflow, Roles and Responsibilities**

The most important aspect of our design process was the amount of time that we spent collaborating on the design goals. This laid the foundation for both the theoretical research and the iterative design of our product. We revisited our goals at each stage of the process in order to create a combined vision to reference in the different aspects of our work. We relied on Amelia’s previous experience as humanities teacher to give direction to the preliminary research. Meri’s previous experience as an information architect and interface designer was helpful in understanding how the key aspects of critical pedagogy could be implemented in an online context.

After our site visit, Amelia took the lead on reviewing the literature that pertained to writing, cognition, critical pedagogy, and how our target user group is using technology. Meri took the lead on interpreting the requirements that had been gathered into a unified interface that would integrate the key strategies we hope to employ in this
product. We had the opportunity during several working sessions to work in parallel on these tasks while sitting in the same room. This proved to be useful because we were able to consult with each other on our tasks and solicit feedback in a timely manner. This propelled our efforts as we were able to unify our efforts and remain true to our shared vision.

Design Literature

In our design process, we found the available design readings to be relevant at various stages of the project. We used the Rapid Prototyping process as described by Druin (1996) to develop our design. Although we have gone through several ideological iterations of our design, the final product, should it be developed, would benefit from using an iterative approach, where the design would be made into a functional prototype that could be used for testing with students and teachers (Druin, 1996). We also employed the tactic of the site visit as indicated by Hanna et al. (1999) as a method to get to know the needs of our user group through observation. We also incorporated some of their UI guidelines such as making instructional text available at all times, as represented by our “Tips” toolbar. Finally, we gained insight on the role of research in the development of our prototype from Lieberman (1999) as we incorporated the latest findings from cognitive research on the writing process into our design. Within the context of this project, we were unable to plan or implement any longitudinal assessments of our product, but this could be incorporated into a next generation prototype of this product.
POTENTIAL IMPACT

Past research in writing and cognition has shown that language determines the way in which humans interpret their identity and experience. Multiple developmental studies – as well as philosophical, historical and political writings – have established that the availability of the book changed the way literate cultures conceived speech, understood knowledge, managed information, shared ideas, and mediated thought (Applebee, 1984; Byrnes, 2001; Eisner, 1994). In the 1980s when new writing technologies emerged, researchers and educators argued that the computer would have a similar – if not greater – impact on literacy, thinking, and the future of humanity (Bangert-Downs, 1993; Labbo & Reinking, 1999; Pea, 1987).

Word processors, the internet, email, blogs, and sites for online collaboration have since become the focus of a series of studies which analyze how technology is affecting the way people think, learn, write, and define their identities. Although, a variety of writing platforms are currently available in the market we wished to design a unique product which would integrate many of the features available in both word processors and sites for online collaboration. As previously mentioned, we focused on a design which would help develop the skills necessary to create the type of analytical papers required in advanced humanities courses at the high school level, and in college. We saw our web application as a tool for scaffolding the processes of creating an argument, gathering evidence, organizing ideas, revising content, and producing a paper.

Several key aspects of our design process afforded the creation of a technology design that was developmentally appropriate for our potential student users. After laying the initial groundwork, we delved deeply into the research available on cognitive development of teenagers as pertains to writing and literacy. We also had an opportunity to observe a classroom and interview a teacher, which were both important activities as they greatly impacted the final design. Finally, by collaborating and working in parallel, we were able to rapidly provide each other feedback and remain in sync as we divided tasks.

Through this process, we have distilled several key design principles that may be relevant to future design efforts. These include:

- Including team members with experience in education and technology is essential
- Consulting with experts in the domain is valuable
- Observing the users perform or participate in offline activities can help inform the design of online activities
- Reviewing existing systems can provide inspiration for new features and functionality
- Becoming conversant in the research and the literature available on the domain is critical for supporting cognitive development
- Starting with the pedagogy first affords the design of systems that support both students and teachers

As designers, we believe that the computer is in fact having a tremendous impact on the way young people write and create. We also believe that the computer has the
potential to break through some of the constraints of traditional schooling, if it is properly used. And most importantly, we believe that all young people have the capacity to produce writing which reflects critical analysis. Although, our product is now primarily designed for students in advanced humanities courses, it would be very interesting to see how a product such as this one could be used in classes which are not tracked as “honors” and “advanced.” Through careful prototyping and testing this product could potentially be used in developmentally appropriate ways at various levels, and perhaps even for courses outside the scope of the humanities. Because this tool engages students in explaining and scaffolding their thought processes it would be interesting to how this would play out in the explanation of scientific experiments or mathematical reasoning.
Bibliography (Main List):


- Overall summary: This article examines the different studies that have been done in terms of writing and reasoning. Although there are various traditions/arguments that link the ability to write and the ability to think, our knowledge of how this process actually evolves is still very limited. We also have very limited information on how writing can help an individual learn more about a particular topic.
- Writing and the ability to write has became a major issue in education in response to the *Nation At Risk* report
- Generally accepted nation: Good writing and good thinking walk together hand-in-hand
- Pg. 577:

  The role of writing in thinking is usually attributed to some combination of four factors: (a) the permanence of the written word, allowing the writer to rethink and revise over an extended period; (b) the explicitness required in writing, if meaning is to remain constant beyond the context in which it was originally written; (c) the resources provided by the conventional forms of discourse for organizing and thinking through new ideas or experiences and for explicating the relationships among them; and (d) the active nature of writing, providing a medium for exploring implications entailed within otherwise unexamined assumptions.

  - Research on writing/thinking has been remarkably slow; Applebee provides two reasons why this is so
    - 1st reason: Rhetorical writing has been seen as a process of writing to persuade an audience. What becomes in this type of writing is the ability to persuade an audience, rather than the understanding of the topic at hand.
    - 2nd reason: We don’t fully understand how writing about a topic increases knowledge about that particular topic.

The Cultural Consequences of Literacy

- Western society → syllogism, Enlightenment philosophy → deeply rooted in the idea that written language allows for certain types of communication/thinking that oral language does not
- Mention of studies in Russia (early 20th century with illiterate peasants) & study done Senegal (area where English, Arabic and Vai are taught in different settings for different purposes)

Writing as a Reasoning Process
• Historical background on the infusion of rhetorical practices (as practiced by Aristotle) into the act of writing

The Writing Process

• 1970s protocol think-aloud study with 8 12\textsuperscript{th} graders \(\rightarrow\) lots of data and research done since to show the recursive nature of writing
• 1908s \(\rightarrow\) flood of studies trying to understand the writing process as a heuristic search and a problem-solving activity
• writing is a learning process
• Flower & Hayes studies \(\rightarrow\) really helpful in understanding the process of writing, but their studies don’t analyze the products of writing. We know a lot of how writers write, but not about what they actually end up writing.

Writing and Reasoning in School Contexts

• NAEP \(\rightarrow\) results of tests show that schools are doing a pretty good job of teaching lower levels of literacy (i.e. grammar, spelling, etc.)
• 1980s \(\rightarrow\) increased emphasis on understanding and higher order thinking, but little of this is actually seen in classrooms (my question: how does one measure this?)
• 590: “Students do little extended writing, and when they do, it tends to involve a process of recitation rather than reasoning.”
• We don’t know if (or how) writing actually improves thinking

Individual Effects

We have yet to develop a convincing research base for the argument that writing activities can make a significant contribution to the development of higher level reasoning skills. There have been few studies that have directly addressed this question, and the related literature suggests that, to the extent that writing is related to reasoning, the relationships will be complex rather than straightforward. Progress in this research seems to require two changes in our current paradigms. First, we must shift from a general focus on the effects of writing toward a more rigorous conceptualization of the functions that writing can serve, each of which might be expected to have a different relationship to the development of reasoning skills. (This shift is equivalent to that needed in the intercultural studies of the effects of literacy). Second, we must develop models of writing that more explicitly take account of topic knowledge and of the interaction between the writing process and the goals of the writing event. The separation of process and product, though perhaps a needed step in the development of our research, seems now to be a major stumbling block to further progress.

• The relationship between writing and reasoning is very complex \(\rightarrow\) we have just begun to understand the processes involved in both

- Question: Does word processing in the context of writing instruction facilitate the enhancement of writing skill?
- Past research: 1) Language use determines the ways in which humans interpret their experience, 2) Availability of books changed the way literate cultures conceived speech, understood knowledge, managed information, and thought
- Research on word processors has been difficult to interpret; people write more, but does the writing change in quality?
- Computers can manage and manipulate visual symbol systems in new ways
- The relationship between the computer and the human is diological (?) people can get information from the computer & manipulate text in new ways
- How does this relate back to their prior social and cultural context?

  Cognitive tools do not “educate” in the sense that tutorials do. Tutorials have implicit or explicit educational objectives and provide specific guidance and practice to achieve those objectives. Tools, on the other hand, must do one or more of the following to be instructionally significant (Salomon, 1988):

  1. Enable students to mindfully attend to more complex mental tasks by performing simpler, time-consuming mental tasks;
  2. Provide implicit or explicit models of information representation, processes, or strategies;
  3. Strategically present choices that require the mobilization or acquisition of specific knowledge for selection; or
  4. Strategically present questions, comments, or signals to stimulate the use of metacognitive skill.

- the computer is supposed to aid in “lower order” tasks in order to free the human to take care of the “higher order” tasks required to write (higher order tasks: goal setting, solution strategizing, organizing)
- software has been developed to integrate prompts into the writing process → how these prompts help isn’t known yet
- word processors make writing easier by facilitating quick change, but do they change how human think and write?
- the literature on wordprocessing is hard to interpret
- Do students write better with the use of word processors?!? IT DEPENDS on how the tool is used and for what purposes
- Variables: writer’s strategies, keyboarding skills, prior computer experience, instructional interventions, teacher goals, social organization of the learning environment, school & community culture
- conclusions: wordprocessors do help facilitate certain aspects of writing (especially technical low order skills), but no research has shown that these programs actually improve high order literacy skills (without the aid of prompts)

- Introduction: High literacy has historically been a privilege for the elite
- High literacy: develops linguistic and verbal reasoning abilities, helps define literary standards and sophistication, aims to give leaders of society the appropriate moral values and precepts
- U.S. school systems → stuck in the low literacy model which only requires basic reading and writing (for communication rather than argumentation or persuasion)
- Teacher C (high literacy teacher): Makes use of external prompts, modeling and peer cooperation. This teacher wants students to learn how to master the writing process and take on writing tasks independently. She also fosters communication between peers so that ideas may be re-generated. Teacher C constantly poses problems for students to solve.
- Teacher C model is only beginning to emerge
- Only the model used by teacher C has the potential to make high literacy available for students who do not already come from environments of high literacy
- High literacy teachers are driven by the idea that students should be independent beings capable of producing written text on their own. The main goal of this type of teacher is to teach skills that will enable liberation rather dependency.
- 15: high literacy is perceived to be something which only a few can attain; it’s reserved for an elite of gifted children
- 17: expert writers do the following → finds site which requires modification, formulates a solution, fixes the problem
- self-regulation is crucial in writing → students can be taught this skill
- expert writers have clear strategies and goals set out to be accomplished (like good orators)
- knowledge can be attained from the experience of doing something like solving a math problem or writing a persuasive argument
- Teaching high literacy skills → cultural upgrading of the educational system
- 22: students have to be motivated to write. Even if you give students great assignments, chances are they will turn the assignment into a routine process of knowledge telling (rather than analysis)
- 23: students have to interact with text for high literacy to occur
- model C requires a new type of teacher


- 436: “…a realistic and complete psychology of writing must include affective as well as cognitive phenomena.”
- Written discourse → considered the quintessential representation of thought
- Writing has level of sophistication
436: “We assess cognitive maturity through such syntactic features as t-unit length and incidence of subordination; or such rhetorical features as elaboration of argument, versatility of diction, and critical thinking.”

436: “Skilled critical thinkers transcend the printed word and the here and now. They arrange and rearrange. They decide what belongs and what doesn’t. They make inferences. They exercise possibilities. They remember. They predict.”

Writing demands that thought be put into linear patterns, even though thinking isn’t necessarily linear.

437: when we hear a sentence we don’t remember exact words; we extract meaning from the sentence. “...we build an interpretation from verbatim wording, but then get rid of it, leaving only the gist or interpretation”

437: conceivable rhetorical mode and discursive form. Writing, too, is an exercise in inclusion and exclusion, a lesson in decision making and choice. It is the basis on which we make those selections that determines cognitive style and writing style. And, as I will trace later, such choices link language to affect.

The research on writing leaves out the importance of affect in the writing process. There is very little talk about how emotions play a role in language building and construction. Emotions Brand mentions: apathy, disequilibrium, alienation, despair, commitment.

1980s → Hayes & Flower led the way in the research on the cognitive psychology of writing.

think-aloud protocols were used to gather information on the cognitive processes of writers.

when people follow protocols in writing a lot of ideas are wasted (I’m confused. She’s writing against protocols, but if you throw out protocols and guided writing... how exactly do you write?)

441: THIS IS POSTMODERNISM AT ITS BEST → The problem, according to Brand, is that the cognitive model has been used to rank skilled vs. novice writers. This creates the idea that some writers are better than others.

Brand’s argument → Understanding the impact of emotions during the writing process may help us understand why writing problems arise. If we understand how emotion plays into the writing process, perhaps we can help students deal with those emotions as they write.

There is little research on how personality affects the type of writing people produce or the processes in which people engage while writing.


**Introduction:**

- Four kinds of knowledge: 1) knowledge of topics, 2) knowledge of audiences, 3) knowledge of genres, 4) knowledge of language.
• Writers set goals for their writing
• Critical reading is necessary when revising
• As children get older they gain the ability to consciously reflect and manipulate knowledge
• Older children are more likely to create goals for their writing than younger ones
• Good writers are usually good readers
• Writing environments affect the writing process

The Nature of Writing

• **Characteristics of the Writing Environments:** Context or situation in which people write. The context changes depending on whether the individual is writing on paper or on a computer. Another significant variation is the presence of collaborators in the writing process.
  - 187: “…writers continually re-read what they have already written in order to set the stage for the next portion of the text”
  - 187: Children write very differently when the collaborate with a teacher than when they collaborate with a peer

• **Characteristics of an Individual Writer:** Examines four variables
  - #1 **Motivational aspects of writing:** Writing is goal-directed. Changes in goals changes the writing output.
  - #2 **Knowledge Structures in Long-Term Memory:** Successful writers store 5 types of knowledge in their long-term memory → knowledge of task schemas, knowledge of topics, knowledge of audiences, knowledge of genres, knowledge of language. Writers need to be able to think about how their writing will affect the reader (is the material too complex, too simple, etc.)
  - #3 **Writing-Related Cognitive Processes:** 3 important cognitive processes that help writers write → text interpretation, reflection, text production. Reading to evaluate is crucial in the writing process.
    - 190: “Thus, to revise a document, writers have to engage in (a) critical reading of what they have written, (b) problem solving and decision-making (i.e., identification of a problem, consideration of alternative ways to fix it, etc.), and (c) text production (i.e., translating these intentions into revised text).
  - Novice writers tend to focus on local problems such as revisions of sentences. Expert writers notice local and global problems; that is, expert writers look at logic, flow, argument, etc.
  - #4 **Component of Working Memory:** It’s important to be able to remember what you wanted to write (phrase, sentence, expression, etc.) while putting words to paper/computer. If the process is interrupted the words/ideas are gone. Better writers tend to have better memory for this.

The Development of Writing Skills

• 193: “…older students use heuristic search to guide their generation of ideas”
• 194: Heuristic search: You first think about categories of information, then you pull out all of the knowledge you have about the category. Write an essay about women in the 20th century → you pull out all the information you have about women and the 20th century
• 194: there is a lag between being able to recognize a good story and being able to write one
• the older you get, the more information that you have → this greatly influences what you are going to be able to write
• 195: Across various age levels, most students can all summarize about a topic and write. Students have a much harder time doing compare/contrast assignments or analytical writing.
• 195: most developmental researchers focus on narrative and expository writing
• 196: few researchers have looked at argumentative writing → applebee 1990; greenwald, 1999 → the older you are the better writing becomes in this category
• 196: writing requires that you imagine your audience and that you hypothesize how this audience would respond to your writing
• 198: “…children were always found to know more than they demonstrate in writing”

WRITING PROCESSES (based on 1980 Hayes & Flower model)

• #1 PLANNING: (199) “Because children do no write from goals and plans, they tend to generate ideas by way of associative thinking rather than heuristic search and often do not organize these ideas in any way. As a result, their stories, essays, and arguments often lack conceptual coherence let alone rhetorical coherence.”
• #2 TRANSLATION: (199) older children have better vocabulary and ability to write cohesive sentences and complex ideas
• #3 REVISING: (199)

**Revising.** The literature on developmental trends in revising has revealed four main findings. First, children, adolescents, and inexperienced college students do very little of it (Fitzgerald, 1987; Scardamalia & Bereiter, 1986). Second, when students do revise, the vast majority of changes are superficial rather than conceptual or organizational. That is, students are more likely to focus on specific words, spelling, or grammar than on deeper issues such as goals, plans, and overall intended meanings (Fitzgerald, 1987; Scardamalia & Bereiter, 1986). Third, the main reason why children tend not to revise is that they have trouble detecting problems in the first place (especially in their own writings; Bartlett, 1982). When problems are pointed out to them, children can at times be quite good at making appropriate changes (e.g., Beal, 1990), though some studies have found that the changes do not always improve the quality of the text (Scardamalia & Bereiter, 1986). Fourth, a further constraint on children’s revising may be that they lack sufficient memory capacity for dealing with multiple issues of content and quality at the same time. When an adult guides them through revisions in a “scaffolded” way, the quality of revisions improve (Scardamalia & Bereiter, 1986).
Comparisons of Skilled and Less Skilled Writers

- skilled writers manipulate verbal information better → can reorder words into meaningful sentences; can reorder sentence into meaningful paragraphs; are faster than their peers in writing
- good writers tend to be better readers
- expert writers: have larger repertoire of sentence constructions & grammatical devices;
- 202: “…good writers spend a great deal of time creating goals and organizing their ideas before they write, poor writers show little evidence of explicit planning and goals. As a result, they tend to “jump right into” the task of writing and their work demonstrates less sophisticated organization…Experts are also more likely to comment on how their goals and plans change in the midst of writing.”
- Expert writers are more likely to revise
- 206: “…in the case of instruction on revision, there are studies that show that the quality of children’s revisions can be significantly improved by removing the “executive control” aspect of revision. In particular, if children are walked through a fixed number of revision steps (e.g., stop, evaluate, diagnose, choose a tactic, and carry it out), they are able to revise more efficiently that if left to their own devices”
- 207: there is very little guidance when it comes to writing. Teachers usually don’t give feedback on content/argument; they tend to comment on grammar and structure. Usually students are not asked to revise assignments they turn in. “In sum, then, we should not be surprised to learn that students do not write well because they are not given the type of instruction that could foster acquisition of writing knowledge and skills.”
- 207: Review of study on approaches to writing → providing students with examples of good and bad writing helps them identify what parts of the piece of writing are good or bad → this helps provide models of writing
- 207: same study “The “inquiry” approach consists of presenting students with structured data and having them use the data in their writing. Responses to the data can range from simple reporting and describing to generalizing and hypothesizing. It is the thought that the use of date probably helps students create plans, organize their thoughts, and circumnavigate problems associated with content generation.”
- 207: if students are to learn how to write they should do most of the intellectual process


The Psychological Achievements of Adolescence
644: Theorists on adolescence: Adolescents acquire the ability to think systematically, logically, and hypothetically.

The changes listed help adolescents into the transition to adulthood. “These same changes make it both possible and necessary for adolescents to engage in the complex forms of economic and sociopolitical activity on which the welfare of the community depends.”

Participating in society requires complex forms of thinking.

One way adolescents show that they have arrived at this stage of development is that teens become critical of received wisdom.

644: Adolescents notice the discrepancies between the ideals adults espouse and what they actually do.

Young people seek out ideals and heroes in the adult world, and through this process they discover the world as it is. They have to reconcile the ideal with the real through this process adolescents arrive at their own sense of identity.

No one is systematically logical at all times so... under what circumstances do adolescents begin to engage in this systemic logic?

Questions: Does chemistry require the same type of thinking as history? Does adolescent development have the same manifestations across different cultures?

Research on Adolescent Thought

Characteristics of Adolescent Thought

- **Reasoning hypothetically**: Adolescents think about a series of possible scenarios before acting. (i.e. What would happen if cheated on a test?)
- **Thinking about thinking**: Adolescents begin to think more about how and what they think, as well as how and what other people think.
- **Planning ahead**: Adolescents begin to think about their lives in the long term (i.e. How is taking AP Chemistry going to affect my chances of getting into college?)
- **Thinking beyond conventional limits**: Adolescents re-think fundamental issues of social relations, morality, politics, and religion. They try to figure out how do things right.

The qualities above can be seen through various contexts, but individuals vary widely in how much of each type of thought they engage with.

646: “But the fact that the quality of adolescent thinking is variable according to content and context has led others to doubt that the transition from middle childhood to adolescence brings about stage like changes in cognition.”

Formal Operations

- 646: “It was Piaget’s contention that changes in the way adolescents think about themselves, their personal relationships, and the nature of their society have a common source: the development of a new logical structure that he called formal operations...an operation is Piaget’s terminology is a mental action that fits into a logical system.”
• Formal operations: all possible combinations are taken into consideration when reasoning (this type of thinking/reasoning pertained to how scientists solved problems in a lab)

• 647: (box) “Adolescents display keen interest in abstract ideas and in the process of thinking itself”; “Young people are interested in universal ethical principals and critical of adults’ hypocrisies”

• 648: Adolescents begin to engage with deductive reasoning. If the specific premises of a complex argument are true, then the whole argument must therefore also be true. (syllogisms)

Variability in the Development of Formal Operations

• Different cultures place different roles/responsibilities on adolescents → this has an effect on the amount & extent of formal operations adolescents engage with

• 650: Great description of problem solving. Students were trained to solve a chemical problem. It turns out that the students who were trained, and later worked together to solve the problem were able to get to the solution at a greater rate than students working independently. Lesson: Collaboration enables students to solve more complex problems through reasoning together.

• Adolescents can be trained to solve complex problems

• Adolescents “are capable of the kind of systematic, logical manipulation of variables that is the hallmark of formal operations and can demonstrate this kind of thinking if they are given proper instruction and if the benefits of the systematic manipulation are clear.” CAVEAT: This is referring to instruction in solving scientific problems HOWEVER developmentalists claim the same thing when talking about writing as a problem-solving activity

• No differences found between males and females in formal operations

• Piagetian tests of formal operations don’t necessarily work cross-culturally

Alternative Approaches to Explaining Adolescent Thought

• 652: “Neo-Piagetian theorists focus on the way that changing memory capacities permit the development of more complex “central conceptual structures” and systematic thinking.”

• During adolescence: individuals have increasing memory capacity, expand in knowledge, develop more effective problem-solving strategies, increase in meta-cognitive understanding

• During adolescence, people have increasing memory. They can hold several variables/factors in mind when solving a complex problem

• 653: “…adolescents, in comparison with younger children, have become better able to retain information in memory while relating the components of a task to one another”

• improved skill in problem solving can be related to the acquisition of more powerful rules or strategies
• 655-656: “...when people are confronted with an everyday problem, their expectations about the outcome, rather than their underlying cognitive competencies, control the way they reason”
• Humans do not typically go through every possible combination of factors when solving problems → they take “short cuts” based on the type of problem they encounter. In some situations certain problem-solving sub-skills are more pertinent than in other situations.


The author provides a survey of design methods, including the waterfall approach, rapid prototyping, and the iterative process. The multi-disciplinary design team was also addressed. Of note is the fact that the author suggests that children themselves must be included in the actual design process for multimedia products for whom they constitute the target audience, and be engaged in a "participatory design approach." This approach implies that all efforts should be made to manage team dynamics so that each member of the team has input into the design project. Several prototyping techniques are outlined, including "Deal Me A Card," "A Day In The Life," and "Bag Of Tricks" - all of which can be used to create low-tech prototypes that maximize full team participation. It is important to use low-tech devices to create prototypes in order to fully involve all team members of various ages and technical expertise.

"creative individuals with varying expertise that are willing to work hard" (p 212) are the single requirement to be successful in the rapid prototyping process.


Cognitive Pluralism

"Cognitive Pluralism argues that one of the human being's distinctive features is the capacity to create and manipulate symbols." (p 79)

Importance of symbol systems:

1. They can stabilize thoughts and feelings
2. This stabilization makes in possible to reflect on the representation and change one’s thinking
3. Making what was once private, public, allows communication
4. Representing allows one to discover or invent the ideas, image, or feelings themselves
5. The features of the symbol system both constrain and make possible different types of meaning
"the ability to represent or recover meaning in the various forms in which it can be experienced should be a primary aim of schooling." (p 80)

Plurality of meaning => plurality of intelligence

Gardner: different ways of acting = "socially important ways of solving problems." (p 81)

"symbol systems not only have the potential to provide unique forms of meaning, they also have the potential to practice and develop particular mental skills. Without these skills, the meaning made possible through the various symbol systems will be unrecoverable." (p 81)

“the ability to read symbol systems that mediate meaning is critical if meaning is to be secured.” (p 82)

Using multiple intelligences or cognitive pluralism to construct activities in school may make education more equitable, providing that equal merit is assigned to all types of aptitudes.


- This paper introduces a theory of the cognitive processes involved in composing
- 366: “Writing is best understood as a set of distinctive processes which writers orchestrate or organize during the act of composing.”
- Traditional way of thinking of writing \(\rightarrow\) Pre-Write/Write/Re-Write OR The Conception/Incubation/Production
- 367: these are not clean-cut stages. In fact these things happen constantly throughout the writing process
- planning, writing, revising \(\rightarrow\) don’t occur in this order; we loop back and forth between the three as we compose a piece
- their model identifies THINKING PROCESSES common in writing rather than a linear process of writing
- they used protocol analysis \(\rightarrow\) think-alouds
- 3 units of the model \(\rightarrow\) the task environment, the writer’s long-term memory, and the writing processes
- 3 writing processes \(\rightarrow\) Planning, Translating, Reviewing (these are under the control of a Monitor
- 369: “…defining a rhetorical problem is a major, immutable part of the writing process. But the way in which people choose to define a rhetorical problem to themselves can vary greatly from writer to writer.”
- Problem: the access of information to fit the demands of a rhetorical problem
- 372:

In the **planning** process writers form an internal *representation* of the knowledge that will be used in writing. This internal representation is
likely to be more abstract than the writer's prose representation will eventually be. For example, a whole network of ideas might be represented by a single key word. Furthermore, this representation of one's knowledge will not necessarily be made in language, but could be held as a visual or perceptual code, e.g., as a fleeting image the writer must then capture in words.

- Planning → one word can evoke a series of images and ideas that may not necessarily be able to make it to paper through writing
- Organizing → helps make meaning

The process of organizing appears to play an important part in creative thinking and discovery since it is capable of grouping ideas and forming new concepts. More specifically, the organizing process allows the writer to identify categories, to search for subordinate ideas which develop a current topic, and to search for superordinate ideas which include or subsume the current topic. At another level the process of organizing also attends to more strictly textual decisions about the presentation and ordering of the text.

- Translating → the process of putting ideas into visible language
- The writer’s task is to translate meaning
- As you get older the construction of sentences becomes more automatic, thereby enabling the translating process to become more fluid and the expression of ideas more complex
- Monitor → determines how and when the writer moves to another step in the process
- Some people write really polished versions of writings; other scaffold the process much more
- Writing is not a sequence of stages; it’s set of optional actions
- You can be at the planning stage during multiple parts of the process
- Writing utilizes an elaborate network of goals and sub-goals
- Goal-direction: necessary component of the writing process otherwise nothing could get done. Goals change during the writing process. Skilled writers know how to navigate the writing process so they don’t stray from the primary rhetorical problem. (this is a result of long-term memory)
- Goals operate on multiple levels. One goal could be “fix sentence” while another goal could be “provide counter-evidence”
- Writers create their own goals and sub-goals as they write; this is a fluid process that is absolutely necessary in order to produce
- Explore & Consolidate → writers think the same topic over and over before they translate. Even if they have translated, they read, think, process, then revise.

• Our current system of education constantly depends on what Freire terms the “banking” system of education.
• Our teaching methods become systematic, mechanical and hollow. We detach our students from the learning process by depriving them of consciousness and critical thinking.
• Chapter 2, p. 56:
  Implicit in the banking system is the assumption of a dichotomy between human beings and the world: a person is merely in the world, not with the world or with others; the individual is spectator, not re-creator. In this view, the person is not a conscious being (corpo consciente); he or she is rather the possessor of a consciousness: an empty “mind” passively open to the reception of deposits from the world outside.
• In a pedagogy which liberates, a teacher can not create a dichotomy between the objective (and universal) and the subjective (and human). If the educator focuses only on the objective reality, then she falls into the trap of only speaking in universals; if she rejects the objective then she only speak in particulars.
• The challenge, then, is to have objectivity and subjectivity be in a constant, fluid dialectical relationship. In other words, the teacher must not speak of the world as existing outside the student. Everything which the student comes into contact with becomes part of that student’s consciousness.
• The student has the capacity to reflect on the experience, internalize the object and the concept, thereby attaining true liberation.
• The final and crucial challenge for the teacher is the creation of a classroom in which an education for liberation is attained through problem-posing, not through problem-imposing.
• Liberation must occur through praxis; it is a fluid movement of action and reflection. And that is the greatest educational challenge all teachers must face: reaching the balance between theory and practice.


• WRITING → ACT OF THINKING
• CRITICAL THINKING → BASIS OF CRITICAL PEDAGOGY
• What critical education seeks to do
  o Achieve educational quality, access and excellence
  o Achieve social equity and freedom & justice for culturally diverse groups
  o philosophy & a methodology
  o celebrate diversity, autonomy and empowerment
  o More egalitarian for diverse populations
  o aims to analyze how social structures perpetuate inequality among marginalized ethnic groups, social classes, and cultural groups
  o inherently wishes to link schooling with means of liberation
  o acknowledges that education is not politically neutral
Gay calls the “pedagogies of possibilities” because of the value that through this type of education there can be hope for change

Students engage in discussions where they examine morality, ethics, sociopolitical action

Students must engage in discussion of democratic ideals

- Democratic principles must be present: critical analysis, multiple perspectives, cultural pluralism, social activism, counter-hegemony, sociocultural contextualism
- Democracy: Representation, equality, freedom, dignity, and justice
- Critical citizenship ➔ fight against passivity and social transmission
- Critical pedagogy ➔ how institutional ideology and cultural ethos of schools reflect and perpetuate the oppressive practices of society
- Democratic political systems ➔ require the active participation of an educated citizenry
- Social ethics? Community? consciousness?
- Pg. 166 “Schools must become places where everyone learns how their destinies are inextricably linked, inequities and injustices are examined candidly and critically, and a commitment to collective struggle to improve the quality of life is cultivated. Students from all social backgrounds, cultural groups, and abilities must be allowed to find their voices, reclaim and affirm their histories, develop a sense of individual and collective identity, and learn how to act upon their commitments to personal and social well-being.”
- Pg. 175 “If students are to maximize their potential for personal power and autonomy, they need to believe that they are capable and valued, experience academic success, and understand how and why the conditions of society directly affect their personal opportunities and possibilities.”
- Pg 177 ➔ knowledge is a form of cultural capital


This reading surveys best practices for incorporating usability research in the design of computer products for children found at Microsoft. The article surveys techniques such as expert reviews, site visits, surveys, paper prototypes and longitudinal tests, and puts them in context of a larger development process. The researchers also propose general guidelines that can be used when designing software for children as apply to activities, instructions, and screen layout. At the activity level, the importance of intrinsic motivation and the appropriate use of external rewards is emphasized. In addition, it is important to keep the child's development level in mind when deciding how to present instructions or help in using the software. The use of icons, cursor states, and rollover states to increase usability for children is also addressed.

Some key indications for our design work include: making instructional text available on demand at all times, relying on recognition vs. recall in icon design and navigation, and the use of site visits and paper prototyping as usability testing methodologies.

- Article begins by describing the teacher-centered classroom where writing is taught as a linear (rather than recursive) process
- In teacher-centered classrooms the teacher processes the information and then helps the students organize the content \( \rightarrow \) that is to say, students don’t engage in the process and strategies of writers (‘‘banking” system)
- The problem in teacher centered classrooms \( \rightarrow \) students stay dependent on the teacher for the writing tasks and topics, so they never learn to go through the entire writing process for themselves
- In a study with 6\(^{th}\) graders it was found that highly structured classroom practices led to “fill-in-the-blank” products \( \rightarrow \) the material was a lot less original
- Students in teacher-centered classrooms become recipients of information, rather than active participants in the writing/learning process
- What should teachers do? They have to engage in what Knudson calls “procedural facilitation.” The idea is to teach the *processes* and *routines* involved in writing so that students may eventually learn to go through the entire process themselves. This process relies heavily on collaboration between peers and other writing aides (teachers, parents, etc.)
- Students need to be shown/taught the strategies involved in writing
- Teachers of novice writers probably need to be heavily involved in the process during early stages of teaching, BUT teachers should gradually recede as students become more liberated to engage with the process independently
- Students should be given ample practice in writing for different audiences
- Teaching to write is a very complex balancing act. Students need to be taught procedures/strategies, but they must be also learn to go through the process without constant interference of teachers.


- Even with all the research done on literacy, teachers ultimately get to decide what happens in the classroom and if that research is implemented or not
- This article looks into the relation between literacy research and practice as it applies to new digital technologies
- Computers can provide opportunity for learning, but the technology will be used in different ways depending on the goals of the teacher (i.e. is the teacher using Whole Language in her practice or is the teacher more skills oriented?)
- There is variation inherent in the use of technology \( \rightarrow \) this is related to socio-cultural factors
• The authors focus on what the computer might do to literacy; rather than how computers/technology can be used to enhance literacy
• Engaging with printed material is different from engaging with digital material \(\rightarrow\) paper vs. computer screen
• Digital forms of reading and writing do in fact threaten the cultural centrality of books and other printed materials
• Technologies have frequently been portrayed as the anti-thesis of reading (which is really interesting considering how widely they are used for writing)
• Authors examine the potential goals, or reasons for integrating (or not integrating) digital technology with literacy instruction
• 481: their framework

The following five goals for integrating technology with literacy instruction make up our framework:

1. New digital technologies should be available for literacy instruction.
2. New digital technologies should be used to enhance the goals of conventional literacy instruction.
3. New technologies should be used to positively transform literacy instruction.
4. New technologies should be used to prepare students for the literacy of the future.
5. New technologies should be used to empower students.

• Technology should be put in schools and good things will happen as a result
• Equity is a major issue when it comes to technology; computer usage is becoming increasingly important in the work place. People need to have access to computers since an early age to become skilled in the use of technology.
• However, just because schools have access to computers it doesn’t mean that students will be exposed to high-order instruction on how to use computers
• 1986: Cuban \(\rightarrow\) providing new technologies isn’t enough; training is necessary
• early research in computer use was only geared to determine if people wrote more
• skill-oriented, drill-and-practice applications have dominated instructional software in writing
• What can we learn FROM the computer VS. what can we learn WITH the computer
• Can the computer help kids with the process of writing in any meaningful way? Can it help mediate revisions?
• Computers can increase the access to information, but we still don’t fully understand how students are processing that information
• Word-processing \(\rightarrow\) aids at different stages of the writing process
• Hyper-text, email, web \(\rightarrow\) conducive to increase collaboration
• Research is being carried out to determine the barriers to using technology effectively in the classroom

For example, in six case studies of teachers who successfully integrated the Internet with instruction, Garner and Gillingham (1996) found that the teachers shared several common attributes: (a) they were not didactic or teacher centered in their orientation, (b) they tended to view technology as a means toward an end, (c) they believed that students could succeed, and (d) they sought out alternatives to current practice.

• Other bin of research → Technology will transform how we engage with literacy
• If adults are expected to engage with digital technology at work in a useful, purposeful way, then that could guide how we frame instruction of technological tools
• Technology is also seen as a tool for empowerment → there is research on the constructivist potential of technology (ties with critical pedagogy)
• Technology has been said to be a potential equalizer which will cut across gender, race, class
• 487: College professors disappointed with the “quick and superficial” nature of papers. Papers include a great deal of information, but no in-depth analysis
• 487: Pocahontas example → students gained new insight of the traditional tale by extracting and judging contradicting information from the internet
• internet → more sources are available, more point-of-views are available


• Reading-comprehension skills are not being adequately taught in language arts classrooms
• Teachers tend to use teacher guides too extensively, they teach skills in reading comprehension in isolation, and they dominate classroom discussions giving students “correct” interpretations of texts
• Article investigates how to make explicit instruction of important comprehension strategies needed to interpret fiction
• 608: reading comprehension strategies can be explicitly taught
• although there is a lot of research indicating that reading strategies can be taught, there is little research done on how to make teach students how to read → this problem is most acute for schools populated with students who are poor and have diverse ethnicities and linguistic capabilities
• reading can be posed as problem-solving
• signifying: a form of African-American discourse → this can be used in teaching students to pick up irony in literary texts
• cognitive apprenticeships → knowledge of how to interpret texts requires knowledge of the social world represented in literature
• signifying, proverbial use, narrative styles → can be used to bridge the gap between what students know how to do and what students need to learn how to do in order to interpret literature
• modeling, coaching, self-monitoring
• 622: “In a cognitive apprenticeship, the teacher models for the student, often verbally, the kind of thinking she or he sues to solve the problem. As the apprentice is engaged in practice, the expert or teacher coaches by commenting on the novice’s performance by evaluating, encouraging, and making specific suggestions for improvement or efficiency.”
• Students need to learn how to initiate interpretations and direct the course of classroom discussions
• Lee’s research: attempts to link incorporation of culturally specific content with a cognitive apprenticeship model of instruction in order to foster the development of critical thinking in reading


This reading reviews the many ways in which a researcher can add value to multiple stages of the product-development process for children's software. Of particular interest is the researchers role in developing and conducting studies that measure outcomes. Outcomes can be assessed longitudinally in a controlled manner by assessing the impact of the use of a given product by the actual users in a real setting over time. By setting up a control group and a test group, researchers can see if the product actually has an impact on children's behaviors and attitudes in a significant way. Although this article outlines many opportunities for a research to impact the design and production of these types of products, their ability to keep the team informed of the latest research, and the ability to perform longitudinal assessments is particularly relevant to our project.


This article

• provides background on the connection between writing and development of thinking.
• argues for the development of writing tools with direct the process of writing.
• focuses on the type of writing that is used to communicate, inform, persuade, instruct (not creative writing; although the process could integrate creativity?)
• talks about creating technological which would connect the writing process to the thinking process (and vice versa)
• gives history of tools (typewriters, word processors, etc.) developed to support writing
• describes new trends in a new phase of writing tools: “integrated writing systems that directly support the writer’s thinking during the component processes of text creation” (pp.282)
• reviews programs which aid in the writing process
• points to three areas which are still missing in writing software development. The programs do not have the following: constructive criticism, process expert to guide the writing process, there is no responsive audience (or collaboration)
• explains the development of research on writing
• outlines the guided processes involved in writing (i.e. people don’t just sit and write. there is a process of planning, translating, reviewing and monitoring)
• examines how the knowledge of expert writers can be made available to novice writers. examines how cognitive writing tools serve in this pedagogical enterprise.
• Speculates on the kinds of cognitive writing technologies that could further serve the creative work of the writer and the learning of writing skills

Excerpts:

• Connection between writing and thinking

• 278: “…the birth and development of writing systems throughout the world dramatically changed the content and processes of thinking and education. This move from orality to literacy wrought fundamental changes in the objectification of language…The creation of language as a permanent (written) rather than effervescent (spoken) physical form meant that it could be carefully analyzed and critiqued”

• thought became externalized through the process of writing

• learning to write has been tied to learning to think

• 278:

  With existing technologies, radically new cognitive writing systems can be developed that could significantly transform not only the future development of thinking, but the processes and content of education. The required hardware and software tools are available, prototype programs offer proof-of-concept demonstrations of some important cognitive support functions for writers, and, as we hope to illustrate, many thinking-for-writing functions could be directly facilitated by tools but are not. Most of the remaining barriers to creating such writing environments are conceptual and design problems rather than technological barriers.
• the technology should guide and not interfere with the writing process

• 279: Goals and central tenets to writing activities: “(1) to write is to think and reflect; (2) writing can help communication with others; (3) writing may make one a better reader; and (4) writing can give writers a better sense of their own voice.”

• 280: Writing as communication is a necessary skill in society. Writing to persuade, inform and instruct is a powerful skill to have. “…many people are frustrated by their inability to write persuasive or expressive documents. Some find it difficult to find structure in and remember the gist when reading – a skill that could be aided by writing experience.”

• 280:

Most current computer writing tools are designed for skilled writers; they are more like production tools for being a writer than for becoming one. This distinction is not a sharp one because current technologies do indirectly contribute to a person's becoming a skilled writer, for example, by making it easier to write more, and reread and revise more readily. But good cognitive writing technologies would not only be useful for text production, they would directly facilitate the development of the writer's skills. Once chosen, such cognitive tools should provide developmental writing environments for continual "becoming."

• 280: people become better writers as communicators

• 282: integrated writing systems that directly support the writer’s thinking during the component process of text creation

• most writing programs are for text product and for experienced writers; there are no programs which actually support the process of writing

• being able to alter text relatively easy has greatly helped aid the writing process

• 283:

The most recent developments in the third phase have been new programs designed to work with a word processor. They have primarily been directed at enhancing the text-production process. We shall review five major categories of enhancers: (1) text-analysis programs, (2) on-line writing supports such as thesauruses and spelling checkers, (3) prewriting and text-planning programs, (4) integrated report-writing software, and (5) laser technology page-printer and page-layout software systems. In describing these develop-
tools still represent slave technologies. Available writing tools have taken the place of typing support and, to a lesser extent, the copy editor, but they cannot serve as a constructive critic, writing process expert and teacher, responsive audience, or collaborator. The next phase in the evolution of writing technologies must begin to address these fundamental problems.

- 287: we need to better understand what expert writers do VS. novice writers

Writing technology has changed rapidly and in many directions during the past two decades, perhaps more than in the previous 200 years. However, the writing technologies developed thus far, no matter how superficially powerful, do not teach writing or explicitly help make a person a better writer. To understand the forms that cognitive writing technologies and related research should take in the future, we must consider what the novice or expert writer actually does with the available writing technologies.

- 288: Writing is a complex cognitive task. Constraints: structure, content and editing text. Writing is not a linear process.

- 288-289: mentions studies where writing is seen as a complex problem-solving activity. Writing is both creative and constraining.

- 293: definition of expert writers → expert writers are those who are recognize as such by peers in their field

- 293: many of the problems novice writers face result from the fact that they view writing as a linear process

- 294: Novice writers have a hard time finding/ generating ideas, organizing ideas. Novice writers tend to focus more on the structure of the language, rather than on whether what they are writing is coherent and the effect that it will have upon the reader in terms of content. Novice writers have a hard time finding organizational parts of text structures; expert writers tend to read and see the goals of the text, the ideas, how the text is organized, and the content. Novice writers fix formatting/grammar/etc.; they don’t focus on macro-structural changes.

- 295:

Cuing the student to state the text’s purpose or main point. Secondly, novices have difficulty self-monitoring just what their writing problems are, and getting access to techniques and methods for overcoming and managing them.
• 296: Revision has to go beyond sentence/paragraph restructuring. The hard part is get people to revise entire ideas in the writing process.

• 297: students have to be of a certain age (of a certain cognitive ability) to use a tool like ours

• 301: writing choices should take preferences over technological choices

• 301-302: Possible limitations  writers are used to thinking about writing in certain ways. “Habits and ways of thinking about writing – when it is done, how, and by whom – will, to some extent, be resistant to change. Furthermore, attitudes toward computational systems will influence the acceptance of computer-based cognitive writing technologies.”

• 302: how to encourage “trust” in writing? Writer should be able to put ideas on paper without being completely constrained by pre-conceived notions of what “good” writing styles entail.  by the same token, writers need to experiment with different models of writing. Especially beginners need to be exposed to different styles so they can mimic the writing.

• 302:

We need a literate society in which writing and reading are seen as valuable and pleasurable. Such a society would promote the idea of writing not only as expressive but as analytic—something to be critiqued, discussed, reflected upon, and improved. Otherwise there is too little spontaneous reviewing of texts for other than low-level linguistic standards; the writing that develops does not go beyond writer-based prose. Yet these critical activities need to take place in an atmosphere of trust. Texts are not right or wrong, but better or worse in relation to fulfilling the author’s goals. Critical judgments are thus seen as part of a constructive interaction between minds (Wason, 1983).

• 303:

Teachers, as well as children, need a cognitive process model of writing, one that emphasizes the flexibility of orchestrating writing subprocesses and the goal that each writer find the writing methods that best suit him or her. This “diversity” model of instruction would give teachers a different attitude about reviewing students’ writing; each draft could be seen as one stage in the development of a work, in which students are constructing in their minds the standards of the adult literary world that the teacher implicitly expresses through supportive criticisms.
• 304: students who write for an audience tend to care more about what they are writing (than when they do school assignments)

• 305: Writers need to “mobilize their trust” → students need to have confidence in what they say (technology can help support the creation of arguments, voice, style)

• 306: ideation problem

Generating Ideas

Many students have difficulty coming up with ideas for writing, and recovering from memory what they know already about a given topic. The private and group brainstorming and prewriting activities used in early writing courses (e.g., Boiarsky, 1982) to overcome these obstacles could be supported with computer technologies (Collins, Bruce, & Rubin, 1982). Discovery heuristic prompts and topic browsers are two types of major supports for generating ideas.

• 312-313: information on COLLABORATIVE WRITING TOOLS (ForComment, Docuforum)

• 316: LIMITATION → There is not a lot of research done on the affective and motivational side of writing. What is it that makes people write? Why do some people excel at it and others don’t? Is writing the only form of expressing thought, information, and argument?


• Students amass a ton of information from the internet, but when asked if they can tell the difference of what’s factual information and what isn’t they can’t give a straight answer.
• “In our new age of technology, every crackpot has become a publisher. The ability to judge the quality of information can no longer be considered “extra credit.””
• students have a lot of information which they receive from the media → this information is part of their curriculum, but students are not shown how to critically examine this information
• “Working through successive drafts of the cause-and-effect essay – making sure that paragraphs reflect a logical procession of ideas and that assertions are backed by evidence – is hard and inglorious work, but there are no shortcuts.”
• Students need to learn how to be informed readers, writers, and thinkers