# EXAMINING THE CHARACTERISTICS OF LITERACY PRACTICES IN A TECHNOLOGY-RICH SIXTH GRADE CLASSROOM

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**ABSTRACT**
The technological revolution and transformation in schools transforms the practices of literacy and poses tremendous challenges to literacy educators and researchers to rethink their basic tenets, to integrate technology and literacy in creative and productive ways. The aims of this study are to examine the characteristics of literacy practices in a technology-rich sixth grade science classroom, and to analyze the new patterns of literacy that appear within the classroom from three theoretical stances, described by Bruce (1997) as Oppositional, Utilitarian, and Transactional (Bruce, 1997). The goal of this analysis is to understand how the technological revolution changes the understanding of "literacy" and "being literate," and what educators may encounter as classrooms become more technologically rich.

**INTRODUCTION**
We have entered a new millennium in which human beings encounter one of the most dramatic technological revolutions in history, one that is changing everything from the ways that we work, communicate, and spend our leisure time. The technological revolution centers on the computer, information, communication, and multimedia technologies, is often interpreted as the beginnings of an post-industrial or postmodern information society which assigns education a central role in every aspect of life to develop students' abilities for critical thinking, reflection, and the capacity to engage in discourse, cultural transformation and moral-political action. (Kellner, 2000, 2003; Luke, 1998; Simpson, 1995; Zimmerman, 2000). In this age, teachers are asked to prepare students for a future world whose citizens will have to combine old and new skills and old and new knowledge in ways we cannot fully imagine (Feenberg, 1999; Labbo & Kuhn, 1998; Webster, 1995). Educators discuss and debate what and how students should be taught in the information age, and the use of technology in education has become one of the most important aspects of the debate (Kellner, 2003; Kinzer & Leu, 1997; Lemke, 1994; Luke, 1998; McLaren, et all, 1995).

According to Kerr (1996), before entering into the process of implementation, teachers and administrators should be very clear about how technology will be used to enhance teaching and learning in schools. On the other hand, Burniske and Monke (2001) argue that

> It is no longer question of "should we introduce computer technology to our classrooms?" I am afraid that "choice" has already been made for us. The question now is "How should we integrate this technology for educational purposes?" (p.236)

Kerr also criticizes an approach to technology in education that "puts hardware (or even software) in first place will ultimately lead to impoverished schools (in the moral, not the financial sense) where students learn things that are unimportant but possible- to learn." (p.4). According to Kerr, schools that want to become involved with technology are providing computers, buying and installing programs, getting hooked up to the internet without consideration of what these might be used for. Kerr states that:

> We tend to ask of technology can it do X?, but rarely seem to bring ourselves to ask, Do we really want it to do X? Why do we want it to do X? The issues of what technology is "good for" are often ignored or postponed until there consideration has become a moot point. (p.4)

The technological revolution and transformation in schools also transforms the practices of literacy and poses tremendous challenges to literacy educators and researchers to rethink their basic tenets, to integrate technology and literacy in creative and productive ways, and to restructure the literacy instruction to respond constructively and progressively to the technological and socio-political changes that we are now experiencing (Kellner, 2003; Kinzer & Leu, 1997; Lemke, 1994; Leu, Karchmer & Leu, 1999).

The aims of this study are to examine the characteristics of literacy practices in a technology-rich sixth grade science classroom, and to analyze the new patterns of literacy that appear within the classroom from three theoretical stances, described by Bruce (1997) as Oppositional, Utilitarian, and Transactional (Bruce, 1997). The goal of this analysis is to understand how the technological revolution changes the understanding of "literacy" and "being literate," and what educators may encounter as classrooms become more technologically rich. In this

study, I define "a technology-rich classroom" as one equipped with multiple technology resources such as computers, televisions, Internet connection, printers, software, multimedia tools, etc. for teachers and students to incorporate technology into their classroom activities that actively engage students in learning their subject matters. Rather than analyzing the effectiveness of using technology in the literacy activities, this study mainly focuses on what characteristics define literacy in a technology-rich classroom in order to find answers to following questions:

- What is the notion of literacy as social practices in a technology-rich science classroom?
- How does technology-rich environment affect literacy as a practice?
- Are there any new patterns of literacy that appear within the classroom?
- What stance can we as educators held in order to understand what we may encounter as classrooms become more technologically endowed?

**HISTORICAL CONCEPTIONS OF LITERACY PRACTICES**

Literacy is increasingly deictic: the definition of what it means to be literate continuously changes as new information and communication technologies appear and as people come up with new uses for these technologies (Kinzer & Leu, 1997; Lemke, 1994; Leu, Karchmer & Leu, 1999). Because of this deictic character, the function of literacy has never been static; it continually changes in different historical, cultural, and technological contexts. In earliest societies, literacy was a way to record animals, crops, and taxes (Boyarin, 1993; Diringer, 1968). A hundred fifty years ago, literacy was defined as the ability to sign your name. In 1920's literate persons were expected to be able to read and retell literal information from a text. In an industrial world, literacy was seen as a means to accurately transmit production information from top to bottom in a hierarchically organized company (Baker, 2000).

In the postmodern information age, the natural and static definitions and understandings of literacy have changed as we move away from a view of literacy as an autonomous, individually acquired cognitive skill toward a view in which literacy is seen as culturally bound, dynamic, meaning-making practice. This is a view in which literacy is considered as a fundamentally social, moral and political process rather than as a cognitive activity (Bakhtin, 1981; Freire, 2001; Lemke, 1989; Vygotsky, 1986). This view, especially as expanded by recent social constructionists (e.g., Gee, 1992; Bruffee, 1984; Ward, 1994), replaces a cognitivist analysis of literacy which is largely derived from the traditional Cartesian thinking with a socio-cognitivist view that understands literacy as a fundamentally socio-political and dialogical accomplishment. In this sense, literacy practices and their meanings are always under the influence of a particular context; they embody and transform particular ways of thinking, acting, and knowing within specific communities (Gee, 1992).

Although computers and supporting technologies have any number of uses, which transforms the notions of literacy and its practices in today's classrooms, what every student needs to know and be able to do with technology still remains as an important and unresolved question. Bruce (1997) argues that there are at least seven stances to analyze the role of technology in literacy and education. These stances are:

1-*Neutrality:* no stance toward technology is needed. Advocates of this stance argue that "literacy is about feelings and ideas; technology is about things. Texts and objects are separate realms" (p.2). They admit that technologies are potentially valuable, and technology is a valid area of study, but they do not connect "either specific technologies or technology studies to its primary concerns about the life of texts" (p.2).

2- *Opposition*: Technology removes us from reality, from the world therefore technicizing society will progressively destroy the last bit of our humanity. Advocates of this stance stand in opposition or resistance to technology. For them, "the inevitable uses of technologies for surveillance, regimentation, and social stratification far outweigh the alleged benefits" (p.2).

They argue that in the modern era, technical sphere, which is subjected to the demands of system preservation and technological revolution, superseded the practical sphere where ideal speech and communicative action is possible, therefore we lost our ability of questioning our lives, and we became the machinery of modernity (Baudrillard, 1981; Ellul, 1980; Eco, 1986).

In his *One-Dimensional Man,* Marcuse (1964) also argued the decline of revolutionary potential and the development of new forms of social control in advanced technological societies. He criticized that advanced high-tech societies created false needs which integrated individuals into the existing system of production and consumption. Mass media, advertising, industrial management, and political economy of the signs reproduced the existing system and attempt to eliminate negativity, critique, and opposition. The result was a "one-dimensional" universe of thought and behavior in which the very ability for critical thinking and oppositional action was disappeared. He claimed that in the one dimensional society, individuals are ideologically blinded to the technological domination they suffer.

3- *Utilitarian:* technology provides marvelous new information processing and communication tools for teaching and learning that can improve literacy education (Garner & Gillingham, 1996; Handa, 1990). The advocates of this stance argue that the benefits of blending technology with education are obvious. And, computers and the Internet are powerful tools that can improve many aspects of life to some extent.
4- *Skeptical:* This view acknowledges the pessimistic side of utilitarianism, but does not see great dangers in technology. Advocates of this stance might say, "I've seen many so-called 'marvels'; show me that technology really makes a difference and I'll begin to listen more." (p.3).
*5- Transformational*: new technologies will replace or radically transform the basic definition of literacy. This stance sees the end result of this transformation as essentially positive. Advocates of this stance argue that our task then is to understand and guide this transformation (Soloway, 1993; Spender, 1995). In extreme versions, this stance can be described as a faith in the transformative powers of the new.
*6- Aesthetic*: technology leads to changes that the course is not easy to predict. This stance is similar to what Rosenblatt called the "aesthetic response" to reading. Advocates of this stance see new information technologies as affording rich opportunities for creativity in literacy instructions. They argue that for students using new technologies in literacy activities is "a paradigm shift as artists move from using the computer to create or reproduce art to accepting electronic representations per se as finished art" (p.4).

On the other hand, Bruce (1997, 1998) offers a seventh view, a Transactional – Ecological model, in effort to effectively analyze/criticize the integration of technology and literacy. According to Bruce (1997), "Everything about technologies, their design, distribution, use, and even the way we interpret their effects, are ideologically embedded. Moreover, as we analyze, discuss, and use technologies, we change them." (p. 292). Therefore, technology and literacy transact in multiple ways, mutually influencing one another:

> Within this theory, the actual process of interpreting experiences is *transactional*. This means, in short, that each encounter with phenomena is a unique event, neither wholly determined by external processes nor independent of them. In the case of literacy technologies, a transactional account tells us that technologies do not transform or determine literacies, nor could they ever be irrelevant to literacy practices. (p.303).

**EMERGING CONCEPTIONS OF THE CHARACTERISTICS OF LITERACY PRACTICES WHILE USING TECHNOLOGY**

Although very few research studies have been conducted to illustrate the characteristics of literacy practices in technology-rich settings, some characteristics have been identified by the studies in which researchers employed at least one of the theoretical stances mentioned above to analyze and interpret the data. One common characteristic is the social aspect of literacy that extends socio-linguistic notions of literacy by noting that the computers projects and presentations in the literacy activities are not merely reflections of an individual's ideas, but socio-culturally constructed activities. Results of these studies also demonstrate that the social aspect of literacy allows students to share their ideas with each other, and thus to learn how to use computers quickly and easily (Ehman & Glenn, 1991; Lue, 1996; Shen, 1996; El-Hindi, 1998). Another common characteristic is that reading is a non-linear activity in hypermedia environments; traditional views of literacy instruction, guaranteeing some degree of control over the literacy activities by using decontexualized published books and other traditional literacy materials, do not exist in non-linear hyper-textual literacy environments (Leu & Leu, 1997; Tierney, Kieffer, Moss & Harris, 1997). Finally, findings of the research studies commonly refer to students' use of multiple sign systems in technology-rich classrooms (Labbo, 1996; Labbo & Kuhn, 1998; Baker, 2000; Baker, 2001). These studies commonly identify three sign systems, which are used by the students in their technology related literacy activities: 1-textual, 2-visual, 3- auditory. (Shen, 1996; Baker, 2000; Baker, 2001). Findings of the studies also commonly argue the importance of the critical usage and evaluation of the sign systems, which are subject to the political and ideological interpretation and critique (Watts, 1997; Reinking, 1998, Alvermann, 1999, Baker, 2000).

On the other hand, the general shortcomings of these research studies on the characteristics of literacy practices in technology-rich classrooms are threefold: First, the results of the studies do not demonstrate multiple "realities" of integration of technology and literacy because of their single approach theoretical stance in data generation and analysis. For example, while Alvermann (1999) employs an oppositional stance towards analyzing the characteristics of literacy practices, Baker (2000) uses only a transformational stance in order to identify the new characteristics of literacy in a technology rich classroom. Second, these research studies generally fail to illustrate whether the characteristics of literacy practices in a technology-rich classroom are different from the characteristics of the literacy practices in a traditional classroom. For example, Watts (1997) does not clearly identify how the semiotic nature of a traditional literacy instruction is different from the semiotic characteristics of literacy practices in a technology-rich classroom. Finally, the studies do not explicitly discuss

the affects of moral-political concerns, and socio-cultural backgrounds of the researchers and participants on the findings of the studies.

This research study aims to examine the characteristics of literacy practices in a technology-rich sixth grade science classroom, and analyze the new patterns of literacy appear within the classroom from three stances, which are Oppositional, Utilitarian, and Transactional, in order to help teachers see multiple "realities" of integrating technology into literacy instruction.

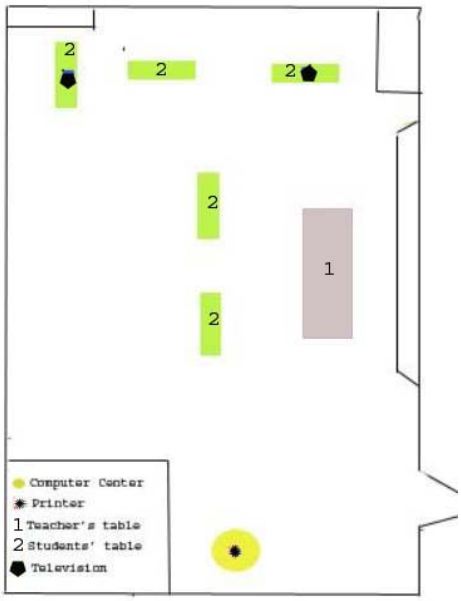
## METHODOLOGY

### Setting

I conducted this study in a sixth grade alternative school science classroom located in the Midwestern United States. This school provides "alternative" programs for "at-risk" students in grades 6-12 who are under threat of expulsion from their home schools, either because of disciplinary, chronic disruptive behavior problems or academic and social "failure". When I conducted this research study in 2002-2003, more than 80% of the student body was African American, 5% was biracial, approximately 13% was White, and 1% each was Asian American and Latina/o. 80% of the students participated in the free/reduced lunch program, but in fact, almost every student had a working class socio-economic status.

In this study, my research focused initially on a single technology-rich sixth grade science classroom equipped with 30 laptops with wireless connectivity and multiple technologies including 1 printer, 2 televisions, 1 VCR, 1 digital camera, 1 CD writer, in the school (see pictures 1 and 2 for a general classroom view, and Figure 1 below for a floor plan of the classroom). In addition, the students in the class could access materials found on CD-ROMs, the World Wide Web, videotapes, as well as textbooks, magazines.

**Figure 1**
**Floor Plan of the Fourth-Grade Classroom**




## PARTICIPANTS

The principal of the school, one science teacher, and 6 sixth grade "at risk" students participated to this study. The principal, Mr. Smith[1], a middle class Japanese American, was an experienced teacher and administrator. He had taught K-12 classrooms for 8 years and worked as a principal for 4 years. The science teacher, Mr. David, was considered to be an exemplary science teacher by his colleagues and principal. He was a white middle class American. He had taught K-12 classrooms for 6 years. The sixth grade class consisted of 5 male, 1 female student. 4 male and the female students were African American, and 1 male student was a white-European American. The reading test scores of all students participating in the study were under the average test scores of the school district, the state, and the nation.

## DATA GENERATION AND ANALYSIS

Consistent with qualitative research methods (Hammersley & Atkinson, 1995), I generated data from multiple sources including artifacts (i.e., animations, multimedia slide shows, written reports, web pages, textbook, CD-

ROM articles, students' work samples, etc.), observations, formal-semi-structured and informal interviews, field notes, and documents (i.e., science curriculum, students' portfolios, school's demographic information, etc.). I audiotaped and transcribed the all formal-semi-structured interviews and some of the informal interviews.

This study is both an "inductive" and "deductive" research study: There was a continual interplay between beginning with the theoretical stances and checking those against data, and starting with the data and moving toward "grounded theory" (Glaser & Straus, 1967). It means that I did not simply employ the three theoretical stances described by Bruce as Oppositional, Utilitarian, and Transactional, to analyze the characteristics of literacy practices in the classroom. Instead, I developed three categories, which are "communicative", "pragmatic", and "semiotic" characteristics of literacy practices emerged during data generation to further explain/refine/challenge the theoretical stances.

In this study, I also employed Lincoln and Guba's trustworthiness techniques for credibility. Lincoln and Guba (1985) suggest several techniques to increase the trustworthiness of the data generation and analysis: First, they suggest a prolonged period of participant observation in order to: (a-) learn the culture; (b-) test for misinformation; (c-) build trust; and (d-) identify silent elements relevant to the inquiry. In this study, I was a participant observer for more than 40 hours during three months. Second, I triangulated my data sources (i.e., teacher, students, assistant), my data sets (i.e., observation notes, videotapes, audiotapes, students' work samples, etc.) and my data analysis techniques (i.e., grounded theory, theoretical stances, heteroglossic text production). The triangulation of the data sources and data sets allowed me to confirm my findings until redundancy is established. Third, I purposely looked for disconfirming information so I could revise my hypotheses accordingly. For example, I reviewed my field notes daily, and debriefed with the professor and research group in my qualitative research class at the university in order to refine my hypotheses and methodological decisions. Fourth, the debriefers read my final report of the project, and offered further suggestions for revisions. Last, by conducting this continual process of generating, refining and in some cases refuting themes, hypotheses, I developed a systematic way to analyze data.

In this study, I had also several data analysis goals. Particularly, during the first weeks, I analyzed the data to determine the criteria for when literacy activity began and ended; this criterion became my data generation unit. Especially, following Baker (2000), I defined a literacy activity as any action by a student when a sign-system such as alphabetic text, animations, videos, graphics, sound effects, or audio recorded explanations played a role in accessing, socially constructing, or expressing meaning. With my data generation unit defined, I started data generation when Mr. David gave the students their new assignments. Data generation concluded when students presented findings to the class.

Others goals included forming provisional categories, searching for provisional patterns, and developing and refining these categories.

**MY ROLE AS A PARTICIPANT-OBSERVER**

At the beginning of the study, my aim was to be a participant observer, an active member of the community in the classroom. On the other hand, during the first few weeks, my role was more of an observer than a participant in order to be more familiar with the setting, student names, schedules, activities and classroom culture, and to build a mutual trust with the students and teacher in the community. However, after two weeks experience in the classroom, I realized how difficult it was to be a member of this community. First, as a white working class international researcher from Turkey, I was more of a stranger than an "outsider" for the students. As a stranger studying a foreign community of which I lack familiarity, I initially experienced a "culture shock" which typically makes prominent questions about why members of the community act and/or believe the way they do. Bringing to the setting my own ideas and experiences developed a contrasting framework or perspective for me to question how the members perceive, interpret and adapt to their reality. At the same time, I began to struggle to gain the confidence and acceptance of participants. My initial feelings of being different, marginal, and uncomfortable with students as a newcomer-stranger to the group made my job even more difficult.

My first day experience in the school was a good example to demonstrate the difficulty of being an active member of this community. On my first day, I went to the classroom early. Only the science teacher, Mr. David, was in the classroom. I introduced myself to him, and then he gave me some general information about students, and the process of integrating technology into the classroom instruction. Five minutes later, sixth graders came to the classroom, and there were only five of them in the class, and I asked Mr. David where other students were, and he told me that "this is the class." I was surprised, because I had never seen a sixth grade classroom with only five students before. The students took their laptops from the computer center and sat on their chairs. When I was preparing to introduce myself to the class, one of the students asked Mr. David whether I was a probation

officer or not. Mr. David looked at me and smiled, and then turned to the students and told that I was a probation officer. After hearing Mr. David answer, I was shocked. I didn't know what I could do in this situation. Two minutes later, Mr. David told students that he made a joke, and I was a researcher from the university who wanted to analyze the integration of technology in their classroom. I wasn't sure whether students were satisfied with this explanation, or not.

This incident helped me realize that how surveillance, and punishments in these students' lives affect every aspects of their school life, and their relations to "others." I sat on a chair and began to observe the class and take notes. Five minutes later, I realized that the students were so curious about what I was writing about, because they were looking at my notes instead of doing their projects. After Mr. David announced a ten minutes break, one of the students came to me and asked me some questions about my notes and me. I told him that I was an international student at the university, and gave him some information about my research project and myself. I think the students were satisfied with my explanation. And, I also decided not to take field notes in the classroom until gaining these students' trust and acceptance.

After the first day's experience, I realized that I should do something in order to develop a mutual trust between the students and me. The best way for me to do this is to speak to the students with their own languages. Over the next few days, I observed that these students use the computers to play rap songs and to download pictures of some famous rap singers and NBA basketball players. Some of my African American friends at the university also gave me some information about popular culture of African-American adolescents. And, I began to listen to rap music and watch NBA games and popular music programs of Black Entertainment TV. The students were surprised, may be shocked after hearing stories and news about rap singers and NBA players from me. Two weeks later, I think I developed a mutual trust with students and became an active member of the community. Even, two of the students wanted me to be their mentor and I began to participate to all classroom activities as a mentor. Learning about the students' culture also helped me to identify the cause or causes of their struggles against formal education. It was an educative experience for me to see how the students represent their struggles against the formal education while singing rap songs in the classrooms, and developing their own languages and activities in the school community. These cultural experiences also force me to reconsider my view of educational practice and schooling. I realized the importance of culturally relevant curriculum even in science education from my experiences in this classroom. I also learnt how students' identities and cultural background affects their understanding of literacy and their use of technology in the classroom, and what kind of educational strategy could be used by teachers to improve their students' literacy abilities, and school achievements.

My experiences in this alternative school also affected my interpretation of the research data and findings. Although I tried to represent multiple perspectives and points of views to show the complexity of implementing technology into the classroom instruction, my cultural interactions with students and school culture forced me to emphases more on a critical stance towards the analysis of the integration of technology into science instruction in the classroom.

## FINDINGS

Three characteristics of literacy practices emerged during data generation and analysis: (a) Literacy as a Communicative Practice, (b) Literacy as a Semiotic Practice, and (c) The Pragmatic Notion of Literacy Practices.

## LITERACY AS A COMMUNICATIVE PRACTICE

The Online Oxford English Dictionary (http://www.oed.com) defines "communicative" as: "open to familiar intercourse; sociable; not stiff or reserved; ready to communicate information, not restricted to the private use of any person or persons." During data analysis, it became evident that the students' use of hyperlinks and instant messenger programs that were displayed on the computers consistently match with the definition of the Oxford English Dictionary: the literacy activities were open to and shared by members of the community. For example, during an informal interview, I asked 4 students who were communicating with each other by using an instant messenger program that:

> Mustafa: Mark, how did you find that animation?
> Mark: Adam and Bryn sent me several links to find these animations in the chat (messenger).
> Nina: Yes, I can also see the links on my screen.
> Bryn: Yes, everybody can see this information if they are in the chat (messenger).
> Mustafa: I don't see any animations in your power point, April. Why don't you use them also?
> April: Well, I wasn't here, yesterday, when they learn to use the messenger. I don't know how to log in.

During a formal interview, the science teacher, Mr. David also stated that:

> There is an initial set up time to try to learn computers. But I usually let students explore how to use the software programs on their own. For example, they learnt how to use Power Point, when they do their projects. I help them when they had a problem they can't solve. They also look at each other's projects on the computer screen, and then ask each other to learn how to put pictures, animations, graphics, and background colors to their presentations by using the messenger program.

From a utilitarian stance, the communicative characteristics of literacy practices allow students to share their ideas with each other, and thus to learn how to use internet and computer technology quickly and easily. It also gives the students the idea of working in a group, and importance of collaborative learning. According to Vygotsky (1978), students are capable of performing at higher intellectual levels when asked to work in collaborative situations than when asked to work individually. My classroom observations helped me to realize that the active sharing or dialogical communication among students with computer technologies helped students develop their social communication skills and create a friendship culture in their classroom activities, and thus improve their understanding of the science projects through dialogical tutoring by using messenger program. When I asked Bryn what he thought about the group projects and presentations, he stated that

> I think this way of learning is really useful; this is because we help each other to understand topics like "rock cycle" and "crystal formations". Another advantage is that we get to know each other and establish good relationships to help each other in the future.

From a transactional stance, the communicative characteristics of literacy practices extend Socio-linguistic notion of literacy by noting that the computers projects and presentations in this classroom were not merely reflections of an individual's ideas. The students in this classroom know that they have an audience, and they were also aware of that they could view others' postings and projects at any time and get ideas from them, thus when they did their projects on the computers, they considered their audience and their ideas. Therefore, while computer technology change and transform the literacy practices, the rules and speech genres created by the communicative characteristics of literacy practices affect students' ways of using computers to produce compositions and projects. For instance, during a science project on "weather and the earth's atmosphere", the students analyzed the formation of clouds, and water cycle, and then they went to their seats to brainstorm their own weather-related topics for further exploration. Mr. David circulated, discussing topics with each student. If students' topics were sufficient and appropriate, Mr. David told them they could begin drafting using the computer and word-processing software. Before the students present their topics, they were expected to get feedback from other classmates. At the end of the writing process, the students printed out and published their work. These publications were then used during power point presentations, and handed out for classmates to further discuss the issue.

Bryn's "the types of clouds" project was especially a good example to illustrate how literacy and technology were integrated within the collaborative science project. The class had just completed a project about the water cycle, and Bryn had worked with Nina to investigate the creation of clouds. Like other groups, Bryn and Nina had silently read textbooks to identify information they wanted to know more about and had searched for information in a variety of classroom and library resources. They had then created a power point presentation to use while presenting to the class.

After all the groups had reported their findings, Mr. David gave the students web links to read about the water cycle and the heating of the earth. He invited the students to write about the water cycle together to create a class presentation. Bryn, like his classmates, used his word processor and imported graphics and pictures to create a diagram about the water cycle. Before Bryn printed his diagram to add to the class presentation, he invited two classmates, Adam and Nina to look at his diagram from his computer screen. In the following excerpt from the dialogue in this group, Adam and Nina take turns reading aloud and suggesting changes (italics represent text from Bryn's diagram):

> Nina: What is the *"jet stream"*? (points to the screen).
> Adam: I don't know.
> Bryn: Oh, a strong wind that move east.
> Nina: You (Bryn) need to write it there. (points to the screen).
>
> Bryn edits his text.
> Adam: *"Can the mesosphere have clouds"* You should, um... (points to the screen).

> Nina: *"Can the mesosphere have clouds"* Oh, put a question mark right there [points to the screen].
> Bryn: Ok! (puts a question mark.)
>
> Bryn edits his diagram.
> Nina: Is this a stratus cloud? (points to a picture on the screen).
> Bryn: No, it's a cumulus cloud.
> Nina: But, it is horizontal, and layered., um.. cumulus clouds should be puffy in appearance. They look like large cotton balls.
> Bryn: Oh, you are right!
> Adam: You need to find another picture for cumulus clouds.

During this science project, the communicative characteristics of literacy practices did foster collaboration, which resulted in valuable interactions among the students. They analyzed, edited, and revised the presentation together and published it while using computer technologies. In creating their presentation, Bryn, Nina and Adam used a computer with word-processing and graphics capabilities; they also used the computer to print their final draft. In this way, the science project in this classroom integrated literacy skills and technology. In this project, the computer screen and software applications such as word processor, power point, etc. became a communicative space for these students to edit, revise, print and publish their literacy products. While the computer screen as a communication sphere transformed the students' perception of literacy practices, the students' usage of the computer screen and software applications identified these computer technologies as literacy tools.

However, the communicative characteristics of literacy practices did not always have a positive effect on the classroom instruction. Based on my classroom observations, I realized that the teacher had spent at least half of class time for getting students ready for a new topic, and explaining them how to use computers for their projects during the first three weeks of the semester. Most of the time in the class, there was little time remaining for students to work on and complete their projects, and thus generally they left the classroom without completing their projects. The teacher always had a hard time to get students' attention to the projects. During an informal interview with Nina and Bryn, I asked them why most of time the students in the class did not want to work on their projects. They stated that visiting entertainment web sites, listening to rap songs, and playing games on the computers are much more attractive and entertaining than doing their "boring" projects. My classroom observation also gave me the same impression: in general, because of the content and nature of science instruction which were very Eurocentric, representing white-middle class values, it was very difficult for Mr. David to find a relation between the language of the science projects and students' home (cultural or daily) languages. The students in the classroom generally did not see the importance of these science projects for their future. When I asked Adam why he unwillingly participated in the science projects and performed poorly in quizzes, he gave me an interesting, but important answer:

> Well, we perform poorly in the class projects, 'cause we all have it thought up in our heads we're supposed to be dumb, we might as well go ahead and be dumb. And we think that most of the things we learn here won't help us in real life anyway.

These students were also aware that they were already labeled as "at risk", or "problem" students or "failure," in the school and society, and they were usually behaving in the class based on these labels or stereotypes. It seems to me that the students did not see "success" as an option for their futures. I also witnessed a number of collaborative science activities in which students showed a lack of engagement and sometimes *collective resistance* against the classroom activities. In these activities, the students were actively, although often unconsciously, engaged in the process of developing collective resistance and group identity. It was also very interesting experience for me to observe how powerful this collective resistance and group identity are for these students to develop their self identity in the classroom. When I asked Nina why her classmates showed a lack of engagement to science activities, she stated that

> Everybody wants to be like everybody else… Nobody really wants to be themselves, be what they are and do what they can do.

As Nina mentioned, these students do not want to be labeled as "different" in their classroom community. They would rather underachieve and fit in among their peers than excel and risk being not accepted to the group.

On the other hand, the science teacher, Mr. David, and the principal, Mr. Smith perceived the integration of technology into classroom activity as a control tool to eliminate the "negative" affects of the peer pressure and group resistance in this classroom. In one of the interview, Mr. Smith stated that

> With integrating technology into the classrooms,….students will get I think and I would hope is just more personalized education… This personalized education will help these kids increase their scores and school achievements.

By using technology in the classroom activities, these students were forced to choose between the individualistic ethos of the school system or the collective ethos of their group identity. In many occasions, the group identity shaped the students' behaviors and prevailed against the individualistic ethos of usage of computer technology in the classroom.

In one of the interviews, Mr. David also stated that he did not get any training about culturally relevant science curricula, and how to use computer applications in the science projects to improve students' awareness about cultural diversity. After reading the state standards and science curricula, I also realized how difficult it was for Mr. David to find balance between formal expectations of state, school administration, parents, and socio-cultural expectations and needs of the students in limited class time. Based on my observations, from a macro perspective, the school characteristics that played an unconstructive role as hindering the effective integration of technology and literacy instruction in this classroom can be identified as inflexible schedules; narrow curricula; a priority focus on basic/lower-order skills; inappropriate, limited, and rigid instructional strategies and classroom practices; inappropriate texts and other instructional materials; over-reliance on state standards and standardized tests to make instructional and curricular decisions; isolated literacy practices; and the teacher and administrator's utilitarian beliefs and attitudes toward students and technology.

**LITERACY AS A SEMIOTIC PRACTICE**

The results of the several research studies revealed that students in the technology-rich classrooms use multiple sign systems in their literacy activities (Labbo, 1996; Rowe, 1994).

During an interview with Mr. David, he gave me some examples of usage of multiple sign systems in the classroom activities. He stated that

> I think with the computers, you can get more in depth, and you can come up with different kinds of projects at the end of whatever unit that you are doing. For example, we study up on the solar system. Well, I can write a report by hand and maybe draw some pictures, or photocopy some pictures, and put them into a nice portfolio, and have my little science project on the planets. Whereas with the computers, I can get nice colored pictures, I can make a Power Point Presentation (PPP) out of it, I can add sounds and animations to the presentation and give it to the class. Or I can make a self-running demo in which solar system can be displayed in a simulation.

From a utilitarian stance, this example and Bryn's "water cycle" project may illustrate that via using computer technology, the students are learning how to effectively use multiple sign systems including textual, visual and auditory in order to represent their ideas. The possibility of using multiple sign systems in the classroom instruction positively transformed the students and teacher's perception of reading and writing, thus redefined the literacy and what it means to be a literate. In this technology-rich classroom meaning of being literate is transformed into the ability of using multiple computer related sign systems to understand and represent their worlds.

On the other hand, during an interview, the principal, Mr. Smith, expressed his concerns about shortcomings of usage of sign systems in the classrooms, although he was a strong supporter of integrating technology into every aspect of a school day. He stated that

> I think we have to be careful about not leading technology become a kind of just an entertainment center for the students. I think that we have seen that happens in classrooms that teachers are showing movies, animations, or simulations and that what they say was a good instruction. And yet, there was no discussion of the movie, there was no follow up of the animations, and animations were purely entertainment. The same thing can be happened with high technology that you bring in is that it could be a great entertainment center for kids

> that would be one of the shortcomings if the teachers aren't monitoring and supervising real use of technology as a teaching tool.

From an oppositional stance, Mr. Smith's concern may remind us that technology would be an entertainment tool, rather then a learning tool, if students and teachers do not critically evaluate and analyze the semiotic characteristics of literacy practices in their classroom activities. For example, on many occasions, the students found conflicting or inaccurate information for their projects in the large number of computer sources available to them. And, most of time the students were confused whether relevant information could be obtained from these computer sources they located. For instance, while one student was researching the water cycle, he found three different diagrams of the cycle which explain the process of "water cycle" differently on the web. Mr. David then discussed with this student the need to examine the age of the information source and to confirm information in two or three sources.

In an interview with Mr. David, we also discussed how usage of sign systems affects literacy practices in the classroom:

> Mustafa: After observing your classroom, I realized that there is less reading and writing but more visual activities. What do you think about that?
> David: Yes! It's probably good. I think it makes our classroom active and more dynamic. It increases students' concentration on the topic that we study. For example, I tell the students "we need pictures of clouds." And they search the web and pictures of the clouds. No reading involves, and we just find pictures of the clouds. But, next day, I tell them "Well, we have to associate those clouds names with the pictures you have got, and we will put them into a Power Point Presentation®," something like that. And following that day, I tell them "Now, you are gonna tell me a little bit about these types of clouds." It started with more visual kind of idea, but…

From a transactional perspective, Mr. David's example makes it possible to argue that while multiple sign systems transforms the characteristics of literacy practices, at the same time, while using them, the students and teacher also identify and transform the meaning of signs and sign systems in literacy activities. For example, on many occasions, some internet sources the students found for their projects in the classroom were "flashy" but had little content to convey. Some students thought that making a flashy animation or multimedia presentation showed an adequate presentation of their science topic. For instance, in a science project on the structure of the Earth and earthquakes, Adam simply downloaded two different earthquake animations from a web page. His work was complete, he felt -- he would simply show his classmates a slide show of the two different animations. When Mr. David asked about the earthquakes, Adam was unable to explain why they had different configurations and effects on the Earth, or where (in which layer of the earth) earthquakes occur. Mr. David warned the students about the need not only to find animations or other sign systems in information sources but also to produce compositions and presentations that communicated that sign systems. This classroom activity reminded me that sign systems could be used for educational purposes, if they analyzed critically. On the other hand, it is also possible to argue that sign systems could also manipulate or oversimplify the educative notion of literacy practices, if they are not critically examined. In this classroom activity, both the nature of the computer related sign systems, and the students' perceptions and usage of these signs mutually affected and transformed the literacy practices.

**THE PRAGMATIC NOTION OF LITERACY PRACTICES**

The Online Cambridge Dictionary (http://dictionary.cambridge.org/) defines "pragmatic" as: "practical; dealing with practice; solving problems in a realistic way which suits the present conditions rather than obeying fixed theories, ideas or rules." During data analysis, it became evident that the teacher and students' uses of computers and supporting technologies in their classrooms activities consistently matched with the definitions of the Online Cambridge Dictionary: the teacher and students dealt with the daily classroom and instruction problems primarily by finding practical solutions and new methods adapted to the existing circumstances while using computers and supporting technologies in their classrooms activities.

In this classroom, I identified four types of new pragmatic uses of computers and supporting technologies during data generation and analysis. These are: 1. support for individual learning, 2. for group learning, 3. instructional management, and 4. administration.

1. Applications to individual learning included following computer related activities, which particularly focused on drilling students on particular skills. These activities were: using CD-ROMs or the Internet to find

resources not available in the school, word-processing, and demonstrating simulations of projects, creating visual stories in the classroom.

2. Group learning applications included following major computer related activities which particularly focused on collaborative learning in this science classroom: using e-mail to support group communication, using the power point to allow group presentations on a classroom project, and providing collaboration in collecting related texts, sounds and visual effects.

3. Applications to instructional management included following major computer related activities which particularly focused on students' assessments: integrating standards, managing student portfolios, and developing individual student learning plans.

4. Applications to administrative functions included following major computer related activities which particularly focused on classroom management and discipline: controlling students' behaviors and conversations by using some software programs such as "Discourse®", perpetuating technology standards in order to increase students' achievement in the tests.

From a utilitarian stance, it was apparent that the students in this classroom were not limited to textbooks, or to the school library; they also used technology resources such as video, CD-ROM encyclopedias, and the web. Many students in the classroom stated that they had expanded their knowledge of computer use and science because of their experiences with multiple and rich technologies in the classroom. The students specifically mentioned learning to be responsible not only for their own work but also for the careful handling of valuable equipment, which made them feel trusted. Further, it was apparent that they found using those technologies challenging and fun. When I interviewed students about use of multiple technology sources in their science projects, they stated that the search capabilities of digital sources of information made it easy for them to find the information they needed. When I asked why they used the web to find the information, they commonly responded as follows:

Bryn: It is quicker to search; you can also print it out, instead of writing it down.
Mark: You write it up what you want and the computers find it.
Nina: It is not hard to use.

In many occasions, my classroom observation also supported the students' responses. And, the students' usage of computer technology in the science project also demonstrates the expectations of the state standards and science curricula: finding and analyzing multiple, alternative and different data sources in the classroom activities can help students see multiple representations of "reality". It can help them see the world from multiple perspectives.

The use of computer technology in all of these ways resulted in the implementation of technology into every aspect of science activities in this classroom. It noticeably became impossible to think of a science activity without computer technologies in the classroom. And, the applications of these new information and communication technologies in the classroom transformed what it means to be literate: A variety of new forms of information and communication are available with new information technologies in the classroom; therefore, the students are required to learn how to efficiently exploit these forms to accomplish the tasks that the teacher and curriculum determine to be important. For example, if a student in the classroom did not know how to use the "Power Point®" program in the classroom activities, she was usually identified as an illiterate student by their classmates; even she had a sixth-grade level of reading.

From an oppositional stance, the pragmatic characteristics of literacy practices in this classroom require new forms of critical thinking and reasoning about the information that appears in the classroom activities. Traditional literacy instruction methods, guaranteeing some degree of control over the accuracy of information in published books, do not exist in this technology-rich classroom. As a result, while searching web for their projects, the students in the class sometimes encountered webpages with ideological or pornographic contents that profoundly distort the nature of information. This requires the students become "healthy skeptics" about the accuracy of information they encounter. From my classroom observation, such skills have not been a major issue in this classroom. When the students searched the web for their science projects, they usually found hundreds of links related and unrelated to their projects. And most of time, they did not know how to use these web pages and how to process the information they found on these pages. They usually expected the teacher to give them the appropriate web sites to complete their assignments. The first two or three weeks, the teacher directed the students to go some safe surf engines, and required them to specify their key words for the search in order to find appropriate information for their projects. But after two weeks experience, Mr. David realized that searching on the web, and eliminating information was a time consuming process for the students. Then he changed his teaching strategy and began to give students previously determined web sources for the science program. And,

so, classroom activities became more teacher centered than student centered in the class. It was also interesting experience for me to see that although students copied texts, animations, pictures, songs and other digital materials from the net, they did not cite the source of these materials in their presentations. They didn't have any idea about what copyright and fair use rules for using digital materials were.

From a transactional stance, the pragmatic characteristics of the new literacies in this classroom redefined the meaning of "being literate" that was quickly changing from an end state to an endless developmental process. In this context, the function of literacy in this classroom was not static; it continually changed. The teachers and students changed/redefined literacy and computer technologies when they used them. In the classroom, there was an undivided continuous transaction or interaction between students and their technology-rich literacy environment, and its ideological structure. Thus, the students were not "subjects" or "isolated individuals" in their classrooms; they were originally and continually tied to their environment, organically related to it, changing it even as it changed them. For example, when the students used the computer technologies for playing computer games, listening music, downloading songs etc. they redefined the purpose and usage of these technologies as entertainment tools, although the aim of the use of technologies in the classroom was for educational purposes.

The science teacher, Mr. David's use of a software program named as "Discourse®" in the classroom activities was also a good example to demonstrate the transactional relations among the teacher, students, literacy and technology. "Discourse®" is a monitoring software that aims to help teachers better manage their classrooms and curriculum. The program uses 1:1 computing to monitor student progress while delivering whole-class instruction that ensures full student participation. Teacher sends his questions to students' computers while teaching, and then view students' responses on teacher workstations with the program. Because teacher can see every student's real-time response, he can immediately determine student comprehension and adjust his instructional approach or change the progress of his lesson plan immediately. With the Discourse, teacher can track and document student achievement against his lesson plan and state standards. Teacher can also identify those students who may need individual guidance or instruction.
Mr. David defines his aim of using the software as follows:

> Discourse enables me to immediately access student learning via wireless technology. When I ask students a question, they respond and their answers appear on my laptop. This helps me to easily access the entire class at one time and provide instant feedback to each student. This unique software also helps me develop questions to send to my students via wireless mode. The program also allows me to save students' responses to disk, export them to other programs, or score them immediately. A variety of printed reports are also possible with this program.

In the interview, Mr. David also identified following advantages of use of the Discourse: It provides (a) active engagement, (b) high rates of student participation, (c) careful teacher monitoring of student learning, and (d) immediate, specific feedback to students about their learning.

On the other hand, my experience and observation in this classroom also allowed me to identify negative characteristics and disadvantages of use of this program. First of all, although the name of the program is "Discourse," the interaction between the teacher and the students during the use of this program generally was not "dialogical." Usually the teacher used the program to monitor the students' behavior in order to discipline students in the class. The use of Discourse helped Mr. David increase the silent time for the instruction in the classroom. The students rarely found time to talk to each other or to the teacher about their projects during the use of Discourse program. The program generally was used as an isolation tool to keep the students silent during the instruction time. Although Mr. David's aim was to use this program as a positive instructional tool, it turned to be a discipline tool which monitors students' behaviors and conversations in the classroom. By using this program, the students were forced to choose between the individualistic ethos of the school system or the collective ethos of their group identity. While the teachers' perception of the program as a positive tool change the meaning of this technology, the nature of the technology also altered the teachers' instruction, and his perception of classroom management, and technology and literacy.

**DISCUSSION**

The results of this study demonstrate that no single approach or methodology, which tends to treat technology in relation to literacy as a monolithic, one-dimensional topic and oversimplify its use or potential use in literacy instruction, can be adequate to identify the diversity and complexity of the characteristics of literacy practices. We need to look at the issues of integrating technology and literacy from multiple perspectives in order to genuinely understand what we may encounter as classrooms become more technologically endowed.

The findings of this study illustrate that integrating technology and literacy instruction can promote collaboration, develop students' awareness of audience, foster children's reading and writing abilities, and expand their use and perception of multiple sign systems. On the other hand, the findings also illustrated that students in a technology-rich classroom also need to learn how to analyze the quality of sources, to deal with conflicting or inaccurate information, to verify the accuracy of information, and to critically interpret and use multiple technologies and sign systems in their literacy activities.

The findings of this study also indicate that providing the technology for schools serving at-risk students is just the tip of the iceberg. At the school level, a major implementation problem is failure to provide teachers with adequate professional development in technology. Teachers need support not just for learning to use new technologies but also for acquiring skills in designing and implementing high-quality, culturally relevant, student-centered instructions. For teachers to understand the promise of computer technologies, they need time, administrative support, and a belief that their efforts are worthwhile.

The results of this study also demonstrate that the administrative effort of implementing technology into classroom activities in this alternative school would be described as a traditional-utilitarian effort. From this utilitarian perspective, integrating technology into the classroom instruction in this school can be defined as an objective, scientific, instrumental, top-down process. What makes the integration objective or scientific process is that it is the outcome of the application of utilitarian procedure that served as an instrumental tool to protect the integration from the contamination of students and teachers' subjective moral-ideological expectations and practices. Socio-cultural issues of the school culture and students' moral-political, social expectations were not considered as a part of the integration program. Although this utilitarian effort can be seen as a genuine attempt to eliminate the "digital divide" between haves and haves not in society, and as an opportunity for minority students to have an equal chance to compete for high quality jobs which require to know how to use multiple technologies in global market economy, the findings of this study indicate that the implementation would be failure if the integration process does not consider local discourses and socio-politic and economic expectations of community members. For an effective implementation of a reform project, understanding the micro-political discourses of school community, and the process through students come to see themselves as belonging to particular cultural and socio-economic group are important because it has tremendous bearing on creating a constructive school culture and academic success.

The three theoretical stances I employed in this study are only one possible set of approaches, I am therefore unable to state what other approaches might interpret the integration of literacy and technology in this classroom. Further studies are needed to investigate what other approaches define or identify the characteristics and new patterns of literacy practices in a technology-rich classroom. Further investigations are also needed to clarify whether similar findings might emerge in classrooms with limited or different technology resources, or with student populations that included children with other regions and different socio-economic status. However, I feel that the three theoretical stances I employed in this study are a useful set because they represent a consistent sequence of potential goals that might guide research and practice in the field of integrating technology and education.

**CONCLUSION**

Literacies continually emerge as new technologies are invented. So, the nature of literacy in technologically rich settings will most certainly continue to change. Therefore, future conceptions of the nature of literacy in technologically rich settings will be very different from the conception of the nature of literacy in today's technologically rich settings, i.e., my three categories generated to identify the characteristics of literacy practices in the technology-rich classroom.

This study contributes to the professional literature about the integration of literacy instruction and technology. Specially, this study provides insights into the integration of technology and literacy instruction that may be applicable to other settings and levels of resources. Further studies will help elucidate the value of these and other approaches to integrating technology and literacy instruction.

Consequently, the results of the study are specific time and context depended, and cannot be generalized. And, my definitions and interpretations of the theoretical stances to analyze the data in this study are subjective and mutable. On the other hand, I hope that the findings may help us as teachers realize that the function of literacy have never been static; it continually changes in different historical, cultural, and technological contexts. We as educators need to be ready for adjusting and transforming our literacy instructions based on these changes.

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**Notes**

[1] I have used pseudonyms for all participants of the study.

**Picture-1 Computer Center and laptops**


**Picture-2 General Classroom View**