THINKING Classroom

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MISSION STATEMENT

Thinking Classroom serves as an international forum of exchange among teachers, teacher educators, and others interested in promoting democratic teaching practices. The publication encourages professional development, research, and reflection. *Thinking Classroom* features articles that foster learner-centered teaching strategies including critical and creative thinking, active and cooperative learning, and problem solving. The journal also publishes articles about the institutional structures that support these practices.

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The International Reading Association is a nonprofit service organization dedicated to improving reading instruction and promoting the lifetime reading habit. The Association publishes professional books and five professional print journals: *The Reading Teacher* (about learners ages 1–12), the *Journal of Adolescent & Adult Literacy, Reading Research Quarterly, Lectura y Vida* (in Spanish), and *Thinking Classroom* (also published in Russian as *Peremena*). The Association also publishes the electronic professional journal *Reading Online* (http://www.readingonline.org) and a bimonthly newspaper for members, *Reading Today.*

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Departments

Features

Look Who's Talking

THE QUESTION:

When my class is working in groups, sometimes it is hard for me to keep them focused on the assignment. What can be done to make group work more efficient and effective?

Tim Fredrick

9th Grade English teacher at Thurgood Marshall Academy, Harlem, NY; Adjunct Instructor at New York University's Steinhardt School of Education; and MetLife Fellow in the Teachers Network Leadership Institute, USA

Many teachers put students in groups, but do not realize that the skills necessary for successful participation in a group are complex and must be taught. It is best to start small and have students work first in pairs, and then move up to threes and fours. At the same time, students must be taught group process strategies for making sure the groups work. In particular, they need to understand how to get a group back on topic, and how to disagree without causing conflict. The skills necessary for work in small groups are essential to success in life, but students do not just "pick them up" as they go along. Teachers must teach these skills. If this means that at times the curriculum must take a back seat for half a class or even a full class, the time will be well spent and the overall curriculum goals will be met more quickly and with fewer headaches.

Another common mistake teachers make is that they are unclear about what they wish to accomplish with the group work. No single type of group, and no single type of activity, is effective in every situation. For example, if your main goal is for students to improve their social skills, the groups should be made up of students who do not normally interact, and the activity must be simple, yet lend itself to constant interaction. If students are working on a short-term project, which lasts for a lesson or two, groups should be made up of students who vary in ability, and the activity should allow for different types of skills to be used. For long-term projects, it is best to allow students to select their own groups and have some choice in their project theme or subject.

Group work is difficult, and for many students can test both their social and their academic skills. The most important element in helping students succeed in groups is for the teacher to be visible—to provide guidance and assistance—at every step of the group work.

Ondrej Hausenblas

Assistant professor of Czech literature, Pedagogical Faculty of Charles University, Prague, Czech Republic

Whenever I prepare an assignment for group work, I require that the group produce some written or visual material (or perhaps a performance of some kind) that may be presented to others. It is always useful to include suggested roles for the members of the group: Either provide a list of possible roles; or just recommend that they themselves should define useful roles according to the goal. It is good if the assignment is designed so that each role has specific responsibilities, so everybody can see how the roles were distributed and fulfilled.

I must also consider carefully why I want my students to work in groups. Group work must lead to some outcome that an individual could not produce alone. For example, the study of literary fiction is always conducive to work in groups. Usually this consists in revealing multiple perspectives on the same work, or exploring an issue in several possible directions that are combined into a complex understanding in the end.

Students working in groups can easily lose their focus if the assignment is too easy for them, or if they do not understand that they need to go beneath the surface of the topic. I try to guard against this in planning my assignments, and make sure they are easily comprehensible. It is also good to have a follow-up activity prepared for those groups who finish ahead of time (because they are smart, or because they did not go into much depth). The follow up will show how smart they actually were, and bring them renewed concentration.

Look Who's Talking

Maria Eliza Dulamă

Lecturer, Teacher Training Department of the Faculty of Psychology and Educational Sciences, Babes-Bolyai University, Cluj-Napoca, Romania

In my seminar for future geography teachers at the Babes-Bolyai University of Cluj, I often do small-group work followed by large-group work. In general, the seminars are attended by 30–50 students, seated in groups of four or five, in two rows of tables.

In order to avoid chaos, we have principles and rules for group activities, such as:

- *no one is allowed to interrupt others*
- *contributions to large-group activities need to be spoken loudly and clearly*
- *everyone should listen attentively*
- *fears need to be expressed aloud—they are useful in setting objectives*
- *everyone should be helped to feel safe in the learning environment*

For each group activity I assign clear roles: In small groups the teacher trainees play the role of students; when they make presentations in front of the large group, they play the role of the teacher, while their colleagues both play the role of the students and provide feedback from their point of view of student teachers.

Small-group tasks often last only five minutes, and are followed by brief presentations to the large group. I frequently vary my teaching strategies, and I always make my objectives clear to my students.

Michaela Liliana Ciuchi

Teacher of Economics, College of Economics "Ion Ghica" Bacau, Romania

Working in groups or teams doesn't replace individual study or lecture activities in the classroom, but can be used in conjunction with these methods. I have used this strategy especially in practical studies (for example, case studies of commercial firms, since I teach in an economics college). After analyzing my experiences, I think that working in groups is more efficient if each group member has clear objectives, the time for the group work is limited, and each team is managed by a coordinator.

The final results from each group must be shared with the other groups, and the best solutions chosen. It is also helpful to change the assigned roles in the groups every time, so all the students will play an active part. In fact, like all human activities, group work depends on good communication.

Zoltan Kovacs

Lecturer, Teacher Training Department of the Faculty of Psychology and Educational Sciences, Babes-Bolyai University, Cluj-Napoca, Romania

When I work with a large group of students, especially in my evening courses, it is not unusual for some of them to forget about the task at hand and start discussing something else among themselves. Of course this also bothers the rest of the students in the group. In these cases I analyze the reasons for the students' lack of focus and I try to find ways of engaging them. In the case of large groups, the problem may result from insufficient warm-up activity. Another possible reason is

a lack of internal differentiation within the group (i.e., not all the students have found a task suitable to their style of work). If students have the perception that they are all supposed to do the same thing, they may conclude that some can accomplish the task better than others, so there is no point in working in parallel. The solution I have found for this problem is to pay more attention to how roles are distributed among the members of the group, and to check each student's motivation for his or her assigned activity.

A question for the next *Look Who's Talking*:
We are all aware that both children and adults today are better at using a computer keyboard than writing by hand. Are handwriting skills still worth developing? Does typing rather than writing by hand affect one's ability to write thoughtfully?

Readers are invited to respond to this question by April 1, 2005. The editors will select items for printing. Please e-mail your answers, and suggestions for future questions, to bmichaels@reading.org

David Landis, Rysaldy Kalieva, Sanim Abitova,
Sophia Izmukhanbetova, Zhanbota Musaeva

Thinking Through Ethnographic Reading and Writing

Introduction

A group of my first-grade students wanted to know more about a new bridge that had been constructed in our town (see Figure 1). *They raised several questions about it: When, and by whom, was the bridge built? How high is it? How long is it? Who was the architect of the project? How many workers worked on it? Why was it built? When they came up to the bridge and examined it closely, other questions occurred to them. They noticed even the smallest details and wanted to know as much as possible. During interviews with people about the bridge, we received answers to the questions. And I was very surprised that I myself didn't know enough about the function of new bridge. It was interesting that students didn't get answers to their questions from me or from another teacher; instead they received them from people who lived in our town. I asked my students, "How can we preserve all this information?" "Everything should be written down," they answered. This is how we first began our writing. We wrote questions and their answers.*

(Rysaldy Kalieva, personal communication, 2003)

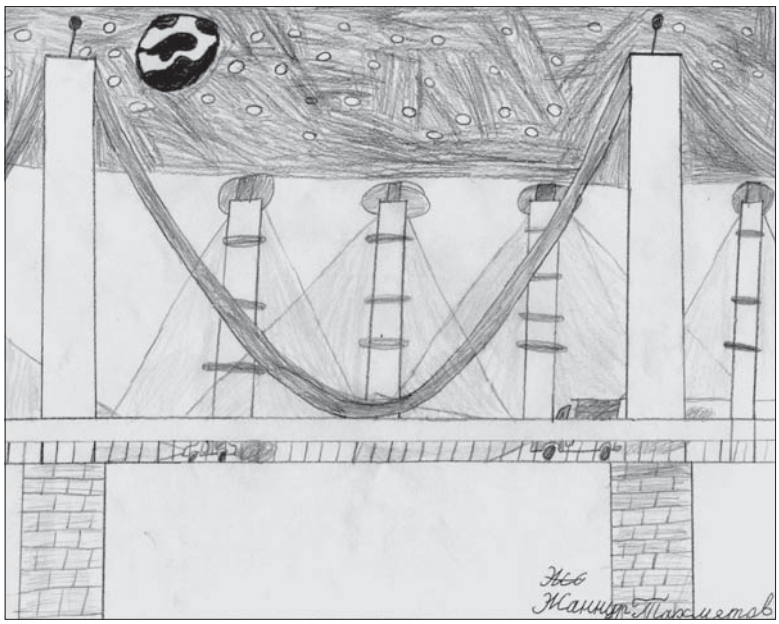


Figure 1: The new bridge at night.

During the 2002–2003 school year, Rysaldy and her students participated in a students-as-ethnographers project that eventually involved about 70 students. The purpose of the project was to use ethnographic research about community life to support school writing. As a result of this effort, the students produced alternative types of writing, different from the usual diet of autobiographical or lecture note writing that goes on in many classrooms. In addition, the students' field research encouraged new relationships with teachers and community members. In this article, we discuss the goals that guided this work. In addition, we explain a vision for school-based ethnographic research and writing and describe some examples of the students' research. Finally, we discuss how student ethnographic inquiry and writing are significant for students and their teachers.

The students involved in the research, representing grades 1, 5, 8, and 11, were enrolled in three schools in two regions of northern Kazakhstan. Their teachers—Sanim Abitova (grade five), Sophia Izmukhanova (grade 11), Zhanbota Musaeva (grade eight), Rysaldy Kalieva (grade one), and David Landis (university faculty member)—worked together to plan a sequence of lessons and activities that guided the students through their research and concluding reports. Sanim, Sophia, Zhanbota, and Rysaldy worked with parents and community members to provide access for students to community sites and events. Each of us maintained journals about the project; planned and

implemented lessons and instructional activities that introduced students to ethnographic fieldwork, data analysis, and report writing; and supervised the students' progress with the project. Teachers of English in our schools, staff members at the Kazakhstan Reading Association, and university students interpreted for us across three languages, Kazakh, Russian, and English.

As we planned lessons and instructional activities for this project, a primary goal was to encourage our students to view writing as a way to organize and preserve useful knowledge relevant to their academic subjects. In the past, we had observed that students often approached writing in school passively and dutifully. For them, the purpose of writing was typically to record notes to be memorized and recited later on tests. We had also observed the changes produced by the introduction of an alternative view of writing that encouraged students to see themselves as writers and to use everyday knowledge and life experiences as resources for school writing. However, students were not always so willing to adopt this vision of writing. Instead, we observed how they undermined this view, speaking of themselves as incompetent writers who had little to say about their life experiences. In these situations, students evidently experienced tension and frustration as they tried to reconcile teacher requests to write about themselves with their belief that there was nothing in their personal lives worth the time and effort to write about. As a result, we believed that many students often wrote solely for the purposes of the teacher and the school as an institution. It seemed to us that students thought it was preferable to reproduce written texts viewed by the school community as authoritative (e.g., encyclopedias, textbooks, dictionaries, and so forth), rather than write about topics that mattered to them (e.g., Curry & Bloome, 1998). We wanted to change this situation, and hoped that students' field research in their communities would encourage their active participation and interest in school writing.

A second goal of our project was to encourage students to view home and community knowledge as a valuable educational resource suitable for classroom instruction. We believed that students would be interested in getting out into their local communities, but we also believed it was important to link the field-based research activities with the school curriculum to fulfill our obligations as teachers. In brief, we sought to understand how field-based research could provide an educationally valuable connection between students' understandings of community knowledge and their academic reading and writing across the school curriculum.

Developing a Vision for Ethnographic Writing

In the past, ethnographic writing described nations and tribal groups, as well as types of societies and cultures (Bromleya & Markova, 1982; Eems, 1991). The principal goal of this type of ethnographic research was to classify people into groups according to geographical area, historical events, languages, and cultural characteristics. In order to investigate groups in historical context, ethnographers examined artifacts collected primarily from archaeological sites, museum collections, and archives.

More recently, ethnographic inquiry has been redirected toward understanding the perspectives of contemporary people on their lives and their societies (Artikbaev, 2001). In part, this shift reflects a view that events, space, and time are relative with respect to multiple observers (e.g., Einstein, 1961 [1916, 1952]), an idea that has influenced literature and the social sciences (e.g., Bakhtin, 1981; Geertz, 1983). In particular, this shift makes it necessary to acknowledge multiple and simultaneous points of view related by different narrators (Chambers, 1985). As a result, contemporary ethnographers study events from the perspectives of members of a cultural group, as well as from the perspectives of those outside the group—describing what was observed, from where, and with what tools and ideas. Ethnographic inquiry seeks to understand the worldviews of other people "in the spaces they inhabit" (Sunstein & Chiseri-Strater, 2002, p. 2). It describes how they organize what is meaningful to them, what systems of meaning they develop

and utilize to express themselves. As a result, ethnography today deals with translating cultural systems, values, and beliefs in order to explore, know about, and take action in contemporary life (Geertz, 1983; Green & Bloome, 1997).

Previous students-as-ethnographers projects tended to proceed in one or more of the following directions: a) research that was utilized to improve academic reading and writing (e.g., Curry & Bloome, 1998); b) inquiries that focused on learning about everyday dialects and language in social interaction (e.g., Thomas & Maybin, 1998); and c) investigations that encouraged students to learn more about their communities in order to change some aspect of everyday life (e.g., Egan-Robertson, 1998). Taken together, these directions show various ways that students and teachers can utilize ethnographic research and writing to (re)consider the social and cultural influences that affect their lives and communities.

In order to encourage our students' field inquiries, we consulted descriptions of ethnographic research strategies in *Fieldworking: Reading and Writing Research* (Sunstein & Chiseri-Strater, 2002), and we reviewed examples of students-as-ethnographers projects described in *Students as Researchers of Culture and Language in Their Own Communities* (Egan-Robertson & Bloome, 1998). Some important field-based research activities identified in these sources are:

a) Observing people and giving attention to what they say and what they do during their everyday activities. Taking photographs of people's activities and uses of objects, and writing about the photos as well as about the observations.

b) Observing the locations where people are engaged in activities and drawing maps and diagrams to represent time/space relations in these locations.

c) Raising ethnographic questions that focus on the perspectives people have on their own activities and events in their local communities (e.g., What do people say about their activities? What do they say about their roles in local events and community groups? What viewpoints do people express about community events?), and engaging in systematic and ongoing cycles of observation and posing questions as a result.

d) Conducting "role-playing experiments" in order to assume the perspectives of other people about their everyday activities.

e) During data analysis, seeking to understand other people's perspectives and views, writing comparisons of researcher views about community activities with the views of the people engaged in the activities, and reflecting upon how the researcher's viewpoints influence the collection and interpretation of the data.

Student Research and Writing

Introducing the project to students and allowing time for them to conduct their research required about four months. In order to provide a sense of the students' research activities and their writing, we discuss several examples of student work in connection with the goals of this project.

Earlier we mentioned our desire to encourage student academic writing through ethnographic research about community life. As students began to conduct their field research, they created various types of diagrams to describe and interpret the views, activities, and artifacts of people in the community. Students drew charts, comparative diagrams, maps, and tables, along with other types of visual aids, in order to visually represent differing perspectives and conclusions. These activities echoed the idea that an ethnographic approach adopts a comparative or contrasting view of the data (Hymes, 1996). For example, students used Venn diagrams to compare their views as researchers with the views of the research participants.

Sophia observed that as her 11th-grade students participated in the field-based research, they also began to adopt a researcher stance toward other school reading and writing. In her journal, for example, she wrote the following entry:

[In literature class] we focused upon particular expressions in an author's writing and attempted to interpret what the expressions meant. When we read an epic called *The Path of Abai*, my students set up a three-column table [to develop a comparative perspective]:

Author's expression	Summary of students' opinions	Synonymous expressions
"All human beings are mortals."	We liked this expression very much, because it was significant for the Kazakh philosopher Abai. But this expression also influenced contradictory views in our group:	
	1) Human beings are born, live, and at last die.	"A human being is a guest in this world."
	2) Even though a human being dies, his name never dies. Abai himself is a good example for this point. He died, but we never forget him.	"If someone dies, we cannot die with him."

Another group of Sophia's students demonstrated in their academic writing that they had begun paying attention to differing attitudes of different people. One student wrote the following observation note and a commentary about the note:

Observation:	Commentary:
"I went to the skating rink with my class. For interest, I observed the skating instructor. He sat without moving. Sometimes, when he spoke to students he did not call them by their names, but said "Eh."	I did not like it… ."

Her students visited various locations, including a library, a shopping district, a park, and a university club (see Figure 2). The students' observational notes included details about the setting, the activities of people in the setting, and what people said. Students included opinions, speculations, guesses, and summaries in their written commentary. Through writing, students were able to compare their own perspectives with those of the people they observed and interviewed.

Figure 2: Everyday activities observed by students.

A group of Zhanbota's eighth-grade students investigated a place they called "the mystery house." They began their research by looking for people and places in the community that seemed interesting, and on one such search they noticed this mystery house. The windows were shut and there was a cross on the roof. The students created a Venn diagram to help organize their preliminary questions and thoughts about the house. They labeled one circle "What we think" and listed their predictions about the building. A second circle, "What we know," displayed a list of information that the students could confirm. The place where the circles overlapped, labeled "Similarities," contained the items that appeared on both lists. As the students generated data, they began to expand their study to include ethnographic questions such as, What is this place? Who lives here? What is the history of this place? How do the people living here see themselves? The students predicted possible answers to these questions, and then asked the same questions of people passing by the house.

As a result of asking these and other questions, the students produced a series of written texts about the house and the people they had met nearby. Students also transcribed a story they had been told about the building. They drew from multiple data sources to convey the perspectives of the passersby about the house and compare these perspectives with those of the researchers (Sunstein & Chiseri-Strater, 2002) (see Figure 3).

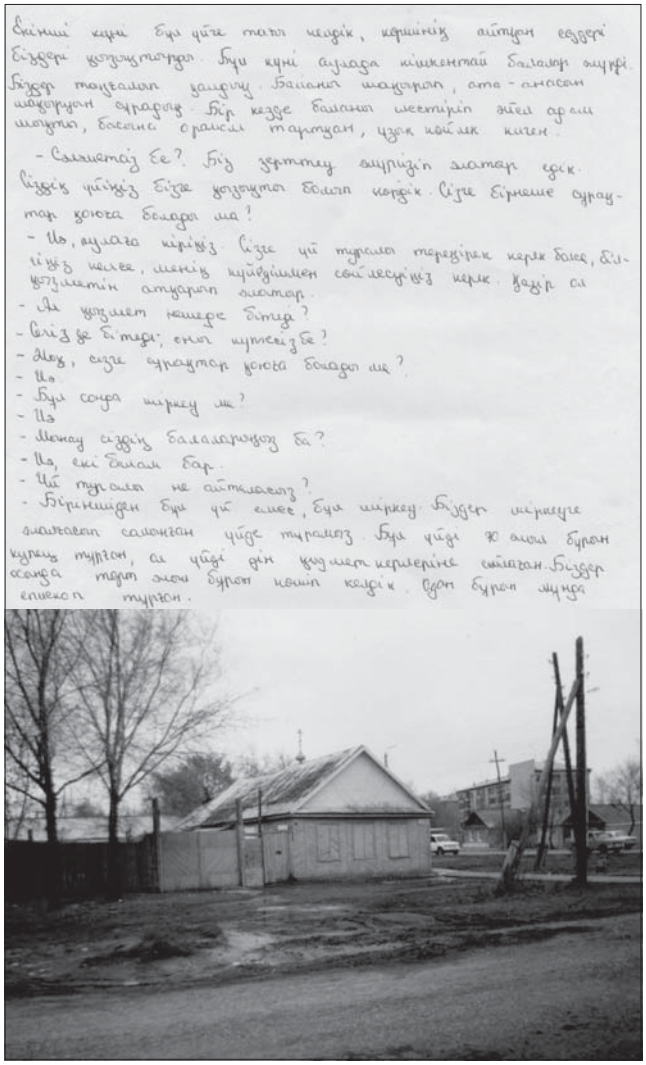


Figure 3: Example of students' notes about interview.

"The next day we came here [to the mysterious house] *again. The neighbor's words had been very interesting for us* [The previous day a neighbor had told them that the house was actually a religious meeting place]. *On this day there were children in the yard. We wondered. We called to one of them and asked him to get his parents. After a few moments, a woman wearing a long dress and shawl followed the child out of the house.*
"Hello. We are researching this house. We are very interested in it. Can we ask you some questions?"
"Yes, you can. Please come inside. If you want to know more about it, you can talk to my husband. He is at work now."
"When will he finish?"
"At 8 o'clock. Can you wait?"
"No, we can't. Can you answer some questions for us?"
"Yes."
"Is this a church?"
"Yes, it is."
"Are these your children?"
"Yes, I have two sons."
"What else can you tell us about this house?"
"Firstly, it isn't a house, it is a church. We live next door. Seventy years ago, a merchant lived here. He gave the building to a religious group as a gift. We moved here four years ago. Before us a church leader lived here."

In this section, we have discussed examples of students' field commentaries as well as excerpts from our journals in order to show a variety of types of academic writing related to this project. Toward the conclusion of the project, several students shared their perspectives about some of the academic writing that resulted from the field research. Some mentioned that writing about the historical contexts of community events and places provided an important means of understanding the perspectives of people in the community. Other students commented on the importance of understanding literary genres, such as legends or folk tales, so they could discuss the extended accounts about events and places told to them by community members. Another related academic benefit was that students applied mathematical and mapmaking skills in order to draw scale diagrams of locations. Students took care to ensure that their diagrams accurately represented the locations they wanted to depict. Students also wrote transcripts of interviews, created questions for surveys, and recorded notes about their observations. They interpreted or "read" their written data and formulated conclusions about them in writing.

In relation to our second project goal, encouraging a view of community knowledge as a valuable educational resource for classroom reading and writing, our students produced a variety of useful data related to their inquiries. Since the concept of a "community" has been a difficult one for anthropologists to define (Curry & Bloome, 1998), we began by defining this notion in geographic terms. We asked students to consider the activities of people in relation to particular locations. Students' photos and maps, for example, helped describe "cultural geography" in relation to physical surroundings (e.g., Collier & Collier, 1986). Students began their research activities by selecting locations, drawing preliminary sketches of people and their activities in that location, and writing possible dialogues of people engaged in the activities. Students then compared their drawings and dialogues with classmates' drawings of similar locations. In this way,

students began to link the social and cultural activities of people with particular places.

Rysaldy explained in her journal how a group of her first-grade students explored knowledge about community memorials by visiting several locations around their town.

> We went to visit monuments in our town… [including] a monument devoted to the victims of nuclear testing. As we approached it we saw young married couples putting flowers at the base of the monument. We asked several questions: "When was this monument built?" "Why did you come here?" We did not get any exact answers to our first question, so perhaps the date was not so important to people. To the second question, we got the following responses: "We are very happy. Today we wanted to put flowers here, because we were born here and live in this area. This monument is a memorial to those victims and the suffering that took place in our town." We looked at those young, happy spouses and were sincerely glad for them. Not far from the monument we saw a "wishing tree" and asked passer-bys about the pieces of cloth tied in that tree. The people we talked with were of various ages and gave us different answers.
>
> A and C. (joggers in the park): "You are supposed to come here with a piece of cloth and make a wish and tie it in the tree—your wish will come true." [See Figure 4]
>
> G. (a grandfather walking with his grandson): "There is a belief in some Eastern cultures that if you tear a piece of fabric off your clothing and make a wish and tie it to the tree, the wish will come true."
>
> We noticed that the pieces of cloth were different colors, but there were no black pieces. The children thought about this and decided that black is associated with unhappiness, so those wishes wouldn't come true. Wishes that would come true need to be represented by other [lighter] colors. Each of us made a wish, and we decided that our class would come here again.

Figure 4: Students talk with joggers near the nuclear testing monument.

Another group of first graders took a different approach—visiting one location several times—and conducted their field research at a department store near their school. Rysaldy explains how she worked with the students to develop connections between community knowledge and the school curriculum.

> The students visited the department store Aisulu, located behind our school. Their first question was inspired by the sign: "What is a *department* store?" We agreed that this would be their overall research question. I thought that students might put forward an answer after visiting the store. During our visit, I observed that my students showed the most interest in the appliance department. They asked the saleswoman quite a few questions. I observed that the girls' questions were different from those asked by the boys. I wrote their questions in different columns:

Girls' Questions	Boys' Questions
• How many years have you been working here? • How did you became a salesperson, and why? • Do you like your job? • What things do people buy the most?	• Where did these products come from? • Are they good quality? • Why are these things so expensive? • Who determines the prices? • Who is the manager of this department store? • Why are all these things made by the same company? • What is a guarantee?

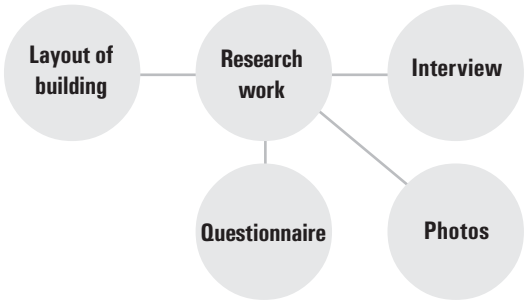
> As we left the store, we paid attention to the many signs for the various departments of the store. We returned to our first question, "What does *department* store mean?" My students couldn't guess. We questioned other people passing by. Even adults had difficulty defining *department store.* Three

people answered, "It is a big store." Six people explained, "It's a store where you can buy anything—a store with departments." When we returned to our classroom we began to write down the information we had generated and the words and phrases we had heard. Students listed a number of words, including *store*, *salesperson*, *signs*, *departments*, *money*, *purchase*, *counters*, *shop-windows*, *cash box*, *bills*. We made a concept web to classify the words in categories and discuss their meaning in relation to the department store. The word *brand* led to a larger question. What company makes this brand? In what country is the company located? It was the next step [in our research]. And after several weeks we went to the department store again, looked at the labels on the packages, and identified the country where the products were manufactured: England. Some boys in the group suggested tracing the delivery route [from the factory] to the department store. Another saleswoman helped us draw a diagram of the route.

The students wondered why the products are delivered from England by airplane. We looked at a map and saw that there was no land route between England and Russia. Thus, children drew upon their knowledge of geography to understand how goods are delivered to the department store. To conclude their interview activities, the students invited a third saleswoman to come to the school, to answer students' further questions and to relate what she knew about the origin of the term *department store*.

Meanwhile, Sanim's fifth-grade students began their field research by planning a systematic approach to their investigations. She described their initial steps in her teacher journal:

My students and I decided to continue research they had begun as fourth graders. During the fourth grade we had investigated the architecture of our old town center, and this year we decided to explore the modern buildings and what activities went on inside them. The students chose a new drama theatre, the skating rink, and a shopping center. We began our work with observation. In their journals, students wrote down the details they noticed. They also asked questions, took photos and wrote captions for them, and drew sketches and maps. During this early phase of their research, we realized that we needed to systematize our work. We made the following classification:



Every student chose the area he/she preferred, and the children began to work with interest and enthusiasm. Of course, we had some difficulties. Practical things [such as arranging for interviews] seemed to cause problems for us. We attracted the attention of parents and other people we knew. With their support we approached the administrators [of various public buildings] and received permission [to visit them]. So we were allowed to move freely throughout the buildings asking questions and taking photos.

These research activities encouraged student writing about community members' understandings, as well as discussions about the concepts and skills mandated by the school curriculum. Students referred to concepts and ideas from the school curriculum (e.g., geography, mathematical scale, literary forms, vocabulary, concepts about history) in order to make sense of their data. They utilized diagrams and other visual representations to understand semantic relations among terms. Students also drew from community members' perspectives and ideas to better understand various concepts in the school curriculum.

Significance of Ethnographic Inquiry and Writing for Students

As we reflect upon the results of these research activities, it seems to us that our students were encouraged in their academic writing. We have presented both anecdotal and observational evidence for these claims. In addition, this research produced other benefits that we had not anticipated.

One important benefit was that the students participated in important social

experiences, thereby learning more about relations between people and interacting with community members they had never met before (e.g., initiating interviews with community members). Through these meetings, students learned that each person they met contributed in some way to the life of the local community. Students realized that they could learn valuable lessons about life from the people they met.

In addition, some students began expressing a desire to further research and write about the communities they had been investigating. Some realized that they needed to read more background information about their community in order to understand their research data. Others decided that they wanted to continue their research activities; while still other groups decided to write brochures about their community for various audiences.

Significance of Student Ethnographic Writing for Teachers

We believe that ethnographic writing is valuable for teachers in at least two ways. First, it can build support and respect for differences in culture and language. Ethnographic writing has the potential to make visible ways of life and views of the world held by people outside the classroom. This type of writing encourages students and teachers to draw from community knowledge as they read and write in school. As a result, they incorporate community knowledge into their classroom lessons and instructional activities.

However, including community knowledge and beliefs in classroom instruction can also highlight important differences among teachers, students, parents, and other community members. One way to respond to these differences is to encourage teacher and student ethnographic inquiry into everyday life in nearby communities as a way to develop further knowledge and understanding about what is different and what is similar.

In addition, ethnographic research and writing support the kinds of activities that encourage critical understanding about the world around us: taking responsibility for learning, forming independent opinions, showing respect for the opinions of others, considering plans of action and their consequences, solving problems, examining circumstances and thinking critically about them, weighing alternative viewpoints, and making informed decisions (Steele, Meredith, & Temple, 1998). Ethnographic inquiry helps research participants understand their ways of life. Reflecting upon one's own life and considering possible responses to life circumstances in light of one's field research represent both a type of problem solving and an illustration of examining circumstances critically. The research process itself presents problem-solving situations, as students make cross-group comparisons and formulate research questions, and consider ways to generate the data needed to answer those questions. In addition, the research process requires thoughtful, informed decision making, so that questions can be resolved and data interpreted to reflect group members' views. In particular, understanding the views of the other group members, as well as self-monitoring of one's views as a researcher, involves weighing alternative opinions.

In addition to fostering critical reading and writing, ethnographic inquiry encourages students to become aware of the social and cultural influences upon their lives. Ethnography has been described as a form of scientific knowledge that supports an ethic of democracy, because it relies upon skills of observation and analysis that people in all walks of life use every day to learn about their communities and make decisions. In brief, ethnographic inquiry can broaden the people's participation in producing knowledge about their own local communities and their society (Hymes, 1981). As a result, ethnographic writing encourages students to raise important questions and develop significant insights about the world around them. Students' ethnographic inquiries can encourage them to reflect on life in their communities and to consider how they might take more active roles in community life.

Final Reflection

We believe that field-based research and writing about home and community life can lead to at least three outcomes. It seems to us that writing about various community settings can serve to broaden teacher and student views about the

school curriculum and provide ways to relate that curriculum to everyday life. In addition, writing about field research encourages students to view reading and writing as activities that can be personally important to them, and provides a renewed sense of optimism about academic literacy activities. Finally, ethnographic writing about community life promotes a view of cultural and linguistic diversity as beneficial educational resources that enhance the school curriculum (Curry & Bloome, 1998). In conclusion, student ethnographic writing about home and community life opens new directions for teachers and students interested in reading and writing in thinking classrooms.

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Chris Breen

Marrow-Bone Thoughts and Lasting Songs?

Making sense of educational change and transformation

God guard me from those thoughts men think
In the mind alone;
He that sings a lasting song
Thinks in a marrow-bone…

W.B. Yeats: "A Prayer for Old Age"

Introduction

In 1990, I was privileged to be included in a group of four "ANC-approved" South African university mathematics educators who travelled to London to participate in the first legitimately attended international conference. At this time the African National Congress' academic boycott, which attempted to further isolate the apartheid regime by blocking contact with the outside world, was still very much in place. The conference was called The Political Dimensions of Mathematics Education. It was an extremely daunting experience in many ways, because all four of us had obviously respected the academic boycott and had not attended any international conferences for almost a decade. However, as the conference progressed, we realized that what we did bring to the discussion was a deeply lived experiential knowledge of the dynamics of change. Living through the struggle against apartheid had meant that for us change was not a theory—it was something that lived in our marrow-bones.

In this article, I have attempted to begin the task of making sense of the 14-year-long journey I have undertaken since then, by trying to match this lived experience of change with my theoretical understanding of the process of educational and personal transformation. I have decided to try to capture the vibrancy of the path and, at the same time, to tease out the theory by focusing on four separate stories. These stories represent a selection of critical moments and attempt to capture major shifts in my teaching approach over the past 20 years.

I have written each story from the first-person perspective of a different participant in the shifting tapestry. I have also given myself a role in each of them (as *Chris*). So while these accounts attempt to capture the essence of a moment, the reader is asked to see them as my own version of a past reality—perhaps as a "realistic fiction." The stories are dated, to give the reader access to the timeline against which they take place.

It seems appropriate that the first story should be the very same one I attempted to tell at that same mathematics education conference in London, where I first became aware of the need to begin the struggle to link theory and practice (see Breen, 1990, 1992).

Chris's Story (1986)

I don't know what to do with this class of preservice secondary mathematics teachers that I am supposed to be teaching this year. There are 55 of them sitting in this large lecture theater, taking my Maths Method course for their secondary teaching diploma. They cover the range of gender and race in an equal balance, and yet it seems that they keep choosing to sit in racially segregated groups. The schools in the townships surrounding us are on fire, with police firing tear gas onto school grounds and arresting school kids (suspected ringleaders) from their homes. Children are fleeing the country to become freedom fighters. I've just employed a fieldworker to work in these underprivileged schools, and he's now

been detained in jail because he's also the chairperson of the left-wing teacher's organization. It's critical that we prepare for a new South Africa and that these students get the skills to be at the forefront of change. I'm committed to this change, and to doing everything I can to promote transformation through my teaching, but I'm growing increasingly disillusioned! I've just given what I think was my most powerful and emotional lecture of the year. I've taken the literature on anti-racist education from the U.K. and argued the case that mathematics education is part of the problem in the way that it maintains an elitist approach to education, and also acts as a filter that keeps the underprivileged from gaining access to a decent education. I've also tried to stress the need for teachers to access the actual human lives led by their students, as failure in mathematics at school can scar pupils for life.

Giovani and Richard spent most of the session reading the newspaper together at the back of the class, though they looked up and shared what seemed to be a sneering look when I spoke of the problems I had encountered when I was teaching in a poor school. Sarah nodded strongly in agreement when I started talking about the political dimensions of math education, and asked questions and participated fully. But I still remember last week's teaching practice lesson, where she behaved like a fascist in the classroom—shouting and berating the pupils for not paying attention to math—in one of the township schools where a police Casper was parked in the school grounds.

What on earth can I do to change this situation and get them to listen? I'm getting nowhere and am burning myself out with my passion for trying to get them to engage with the torment in the country and prepare for a new future in education.

Interlude One

Enactivism is a learning theory that has emerged from the work of people such as Merleau-Ponty (1962) and from the Santiago Theory of Cognition, developed by Humberto Maturana and the late Francisco Varela (Maturana & Varela, 1986) and summarized in Davis (1996) and Capra (1997). One of the basic tenets of this theory is that each of us has a structure (ego), which is formed by our biological constitution as well as our history of interacting with the world. This structure predisposes us to see the world in a certain way and we can only take on board what we are predisposed to understand. Reality is not a given but is dependent on the perceiver. This happens not because the perceiver constructs reality as he or she pleases, but because what counts as a relevant world is inseparable from the structure of the perceiver. We will fail even to notice details or events that lie beyond our structure (for a demonstration of this using a videotape of a music festival, see Breen [2001]).

Clarke (1988) provides a pithy analysis of my predicament with the members of this student class as she reflects on the similar positions of a therapist and a teacher. The other person can only resist if you are pushing. You might be working on the concept of prime numbers (B) and Tony is stuck on factors (A), which is a prerequisite understanding, or indeed on something he saw on TV last night, which really grabbed him. If you try to push Tony from A, where he is, to B where you are, he MUST resist! If, however, you go to A and be there with him and accept his worries or his excitement, he is then free to come to B of his own accord.

Patrick's Story (1989)

I'm getting really frustrated being a student in this Maths Method class taught by Chris. I've been out of the country for several years being trained to fight against the apartheid regime, and now that I'm back home, I want to get qualified to teach math at a college. Before I can do this, I need a teaching diploma. So I joined this class, and in the very first session found myself having to join hands and climb over people to untie the knot we had formed. We've done strange things all year, like circle dancing and trust walks, and we have also played games such as the one last week where we had to tie a balloon onto our ankles and try to pop each other's balloon. I know that something interesting always comes out in the feedback, such as why we are more comfortable with physical rather than verbal aggression, and how a lot of us math people

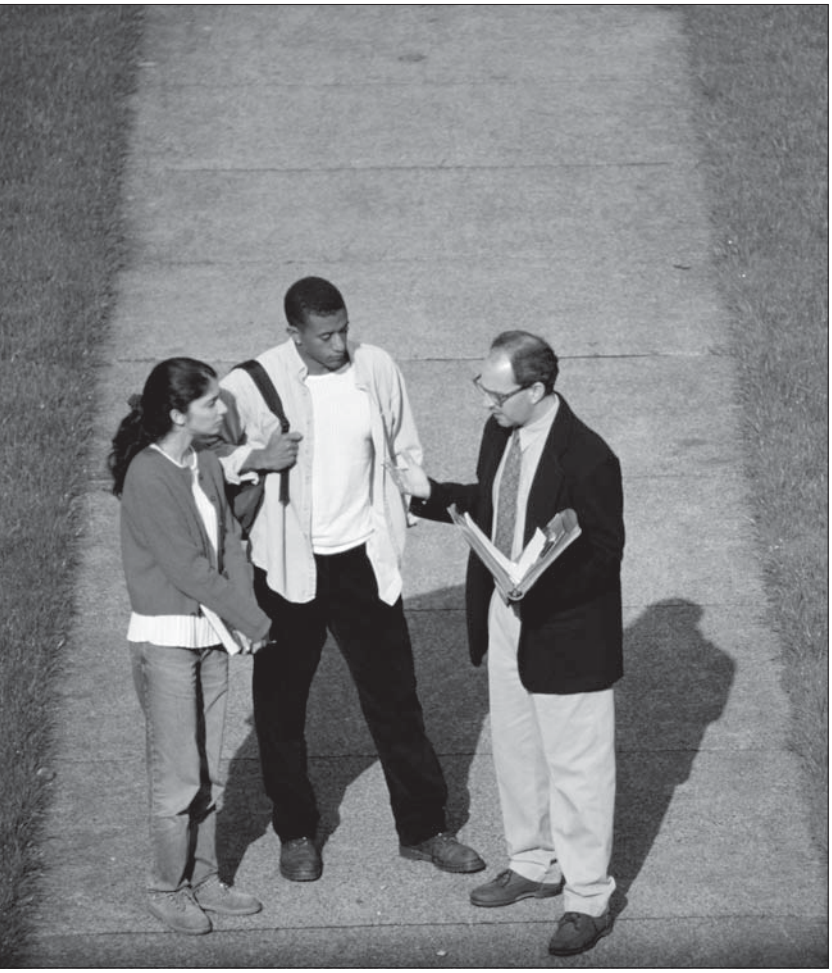

Photo: PhotoDisc, Inc.

aren't comfortable with activities that take us out of our heads. But come on! The struggle is reaching its peak! People are marching in the streets, and here we are, dancing and holding hands. It's strange because Chris is one of the few lecturers that I ever see at struggle meetings and he has a reputation of being one of the proactive faculty members as far as the struggle goes.

The other day I told the class about an important march that I thought they should all take part in. We were going to march on Parliament and demand the release of Nelson Mandela. The police had banned the march, so it was important for us to turn up in large numbers. I was really upset because none of my fellow students turned up for the march. I got cross with Chris and told him that this was because he had been encouraging us to play while the country was burning. He listened seriously and I thought I was getting somewhere, but then he asked me if I had made any effort during the year to make contact with my fellow students. Had I drunk coffee with them? Told them about my life? Found out about theirs? I didn't see the point of these questions, because I had obviously been too busy organizing protest meetings during the year. And then he asked me whether I myself would take a chance doing something new on the advice of someone who kept to himself and didn't allow others any opportunities to learn to know him or build some trust…. You know, he may have a point—I definitely would keep away from such a person!

Interlude Two

Because each of us constructs unique narrative knowledge based on our individual continuity of experience, infinite ways of knowing are possible…. Through interaction, meaning is continually reconstructed as new interactions lead to further understanding.

(Olson, 1997, p. 19)

Enactivism is based on Merleau-Ponty's attempt to end the body/mind split. The body is that which engages the person with the world. This means that the focus of enactivism moves away from Descartes's "I think therefore I am," to the enactivist position, "I act therefore I am." Enactivists believe that true learning cannot take place if only the mind is engaged. Activities that engage both mind and body, and allow their interaction, are far more likely to bring about a change in action.

Each of us interacts in and affects the world in a similar way to that in which the world affects us. A learning situation is regarded as a complex adaptive process where multiple feedback loops are established between all participants. It is simplistic to reduce a learning situation into a machine-like, additive process, where each part can be observed in isolation from the whole. The enactivist position is that the lesson is co-created by teacher, learner, and environment (and this environment includes the differing histories of each of the participants).

In this way of thinking, the teacher's role becomes very different. The teacher cannot set outcomes for a lesson, because the teacher cannot control the lesson. All that the teacher can do is try to perturb the thinking and acting of the participants by offering activities that engage more than the mind of the participants. In order to prepare for change the teacher must try to interrupt the usual

habitual beliefs and actions of those present. The teacher then focuses on extending his or her abilities to act as a perturber.

Mike's Story (2001)

I grew up in England and then married a South African lass, so I ended up working here in South Africa since 1995. This means I don't know what it was like living under apartheid. I can't understand all this fuss about racism, because growing up in England I didn't experience race as an issue. Social class, yes—but racism, no. This year I decided it was time to get ahead in the workplace, so I enrolled for the MBA program at the Cape Town Business School. In the first module of the year, our lecturer, Karl, showed us a very powerful film called *The Colour of Fear*, an hour-long film in which a group of American men of different ethnic backgrounds talk about how they experience racism in their daily lives. They get extremely heated and angry with one white American who can't understand them and who keeps positioning them as their own worst enemies for making an issue out of nothing. Once the movie was over there was a lot of agitated and fairly angry talk in the class, with many of the white male majority taking up defensive positions. One guy, Sibiso, got extremely aggressive and said that it was time for all whites in the country to apologize to the blacks for all the hurt and damage they had done during the apartheid era. John jumped in and asked why he should have to apologize for what others had done, and the temperature in the room started rising. Karl quickly ended the lesson as time had run out. However, Karl had invited Chris, an old teacher of his from his math education days, to help teach the course. Chris stopped us from leaving and asked if a group of about 10 of us would like to get together for about three hours one evening, to tell our own stories about how we had experienced racism in our lives.

A group of us from different backgrounds volunteered, and we met one evening soon after the movie. We were all a bit nervous as to what would happen, but Chris set some ground rules based on the work he had already done with us in class. We were not allowed to make generalized statements, and we were there only to tell our own stories. No one could challenge anyone else's story, because it was their own lived experience. We just had to listen as if it had been us telling the story, although we were allowed to ask for additional details if there were pieces that we did not fully understand.

Sibiso told his story that evening, and by the end most of us had shed a tear or two. As a boy, he had worked himself out of poverty by finding work after school, and then had been adopted by a white family. He had lived at their house and worked for them and played with their children. But at meal times he wasn't allowed to come into the house and eat with the family. His food was left on the back doorstep. His life had continued in that vein as he was forced to face large obstacles placed in his way by apartheid.

I told the group about the lack of racism in my life because there weren't really any blacks in my part of England as I grew up. However, that night I woke up suddenly trembling and in a cold sweat. I had suddenly remembered Fred, the prefect who used to bully me during my first year at high school. He was a huge Nigerian and he used to hit me when I did something wrong and humiliate me by making me cry in front of others who then laughed at me. With horror I realized that, in reality, I had developed ways of avoiding black areas back home in England. I was even more shocked the next day when I caught myself crossing the street to avoid a huge black man walking towards me.

Fortunately we had a follow-up evening and I was able to thank Sibiso for trusting us with his story. I told the group how Sibiso's story had triggered this memory for me and how it had shown me how much work I obviously had to do to counter the way in which I must have been engaging with my black colleagues at work.

Interlude Three

> *Thus it is characteristic of every true conversation that each opens himself up to the other person, truly accepts his point of view as worthy of consideration and gets inside the other.*
> (Gadamer, 1975, p. 45)

Since our lived experiences hamper our development, one of the best ways of gaining new insights and possibilities is to engage with the lived experiences of

others. In this way others can provide a way for us to subject our own limited versions of what happens to a different reality check.

Hermeneutic listening (Levin, 1989) provides us with a way of engaging at a deep level with others. In hermeneutic listening we have to set aside our own judgments and listen as if what the other was saying were true. However, we still listen so as to set the other's story up against the template of our own lives. Where we find a dissonance it is essential for us to ask further questions, to clarify what the other person is saying and why they came to that conclusion. We do this not to try to assert our different perspective, but to take advantage of the opportunity that the dissonance of the other's story provides to hold a mirror up to our own lived assumptions. A basic position is that it is highly likely that, if I had been born you, and had lived the same experiences you have lived, I would be saying and believing the same things as you. So talking to you provides me with an amazing learning opportunity if, and only if, both of us are prepared to share in the mutual quest for hermeneutic listening.

Arthur's Story (2003)

I got this e-mail in March from Chris asking me if I would agree to be the external examiner for a module he runs at his university called Re-searching Teaching. I've known Chris for a while and, because I know that he shares an interest in the developing theory of enactivism, I agreed. The assignments arrived in July together with a course outline, and boy, is this a different sort of course! In the first place, the students don't get a full course outline at the beginning. Chris tells them that they will be "laying down the path while walking," so the course will have to be crafted according to where they choose to go. It seems that the students are offered two readings each week, which deal with the topics covered in that day's session. Before the start of the next session students submit a comment on the readings and also a reflection on the lecture. This helps Chris with his planning for the new lecture. Students collect critical incidents from their teaching or lived experiences and then share these with each other in groups according to a prescribed set of procedures. So the theory links in with the practice and all the time the teachers are asked to work with what is happening in their daily lives. They then subject these incidents to a group process, which seeks to uncover the ways in which each person's different history biases their interpretation of the event.

I think that this is a tough task for the group of teachers, but they meet once a week over 12 weeks and it seems as if they are left to make their own sense of the course. I say this because the final assignment was given in a very open way, asking them to respond to the course. They were given a framework for a rubric for marking the assignment, but what was unusual was that students could individually choose their own individual rubric from within a given range.

It was exciting for me to see the many different ways in which the students had responded to the challenge, and, in particular, the way in which they were able to draw on their experiences and re-frame them using the theoretical tools they had been given. One student re-connected with a love of the outdoors, which he had enjoyed as a child. He contrasted this growing-up model of learning with the way in which he constrained his own tertiary teaching. A woman who prided herself on her efficient and professional non-emotional approach to her students, found herself re-connecting during the course with the contribution that two loving grandmothers had individually made to her life. She started drawing on these figures from the past as an inspiration to try to embrace her students and tackle her noted incidents in a different way. Perhaps the most powerful story came from a teacher who worked in a primary school in a very rough area, where he had to deal with issues of violence and rape. The process of collecting critical incidents drew his attention to the way in which he was attempting to do the impossible—remain in control of everything at all times. This need to control the uncontrollable inevitably ended up in his "losing it" from time to time, both at school and at home. His distaste for the person he became in these situations led him to the realization that his desire for control entailed an enormous cost to both himself and those he cared for most.

An additional dimension of the course was that the students started working on ways of interrupting some of their unthinking, habitual responses and changing them in preferred ways.

I'm really pleased I agreed to examine this course. It's so good to find a course where cutting-edge theory is used to engage students in interpreting and understanding their own lives. I wonder what Chris's colleagues make of this. I suspect he stands very much alone in this work.

Interlude Four

Many teaching practices now include the keeping of reflective journals. The trouble is that these reflections can become self-fulfilling and self-justifying reactions to daily events. This is what Varela calls first-person research (Varela, 2000). How can one see outside one's structure? Traditional third-person research, where the researcher attempts the impossible—to become a neutral observer—is of no help, because the researcher's subjectivity (and its influence on the research) is a silent presence that cannot be challenged. Varela introduces the concept of second-person research, where a more experienced other joins the person researching his/her own practice.

However, this concept in itself is not enough, and some agreed-on procedure is necessary to guide the participants, especially when they are working in groups. There are several possibilities available. For example, Schratz and Walker (1995) describe the techniques of Memory Work, developed by German feminists such as Haug (1987). The aim of this work is to challenge the way in which women participate in their own oppression because of their lived realities. Depraz, Varela, and Vermersch (2003) have published a book describing the way in which they have developed a technique that combines insights from Buddhism into a scientific approach on becoming aware.

The Re-searching Teaching course described above (see also Breen, 2000, 2002) uses Mason's Discipline of Noticing (Mason, 2002) as a means of focusing the critical incidents. The challenge is for the participants to write their moments in such a way that their own bias is taken out of the story. Where memory work does this by writing the story in the third person, the Discipline of Noticing asks that the author record a brief but vivid *account-of* a particular moment. The *account-of* differs from an *account-for,* in which the author would include justification, interpretation, etc. The account-of gives a short and neutral description of what happened. In particular it pays attention to the physical sensations that the author was aware of at the time.

Some people struggle to keep emotion and bias out of their accounts, and this in itself can provide them with something to work on. Once a suitable account-of has been written, others can enter into the picture and give their own personal interpretations of the event and how they might have acted given that specific interpretation. Authors of accounts-of are required to listen to these new stories that are being built on the original account, so as to broaden their own potential for interpretation and also to develop different possibilities for future action.

Concluding Thoughts

As I come to the end of the four stories and their accompanying interludes, many other role players and incidents are knocking at the door of my consciousness and wanting to ensure that their voices are also heard. Many of them have nothing to do with teacher education, and everything to do with my own personal challenges and growth during this period. I can see that the changes to my practice have often been accompanied by changes in my life, and much of what I have offered students has been based on what I have been working on at the time.

I have attempted to describe a journey that has taken place over a period of almost 20 years of involvement in teacher education. It is a journey located at the heart of a country battling to engage with a transformation process that has, in many ways, been an inspiration to the world. Yet it is a transformation process that is still in its infancy and still has much to learn. I note how my first attempt at teaching for change involved an outer process, where I took responsibility and tried to argue change by appealing to the intellect. My radical move a few years later to a highly interactive and experiential approach allowed issues to arise for the students

through mutual engagement and play, and I stood back and allowed the students to make out of it what they would.

The last two stories seem to point toward a developing method of balancing the tension between a tightly controlled learning environment of specific tasks and a loosely held invitation to participants to choose what they want to work on. The development of the Santiago Theory of Cognition (Maturana & Varela, 1986) and the ongoing application of these ideas of enactivism to the teaching profession have provided me with a means to challenge and deepen the potential to transform the educational process. The crucial moves have involved acknowledging that all the players (and this includes the environment and each person's history) play a central part in any learning situation, as they all co-create the lesson.

I believe that learning can best happen when we take the necessary time to engage in a deep form of interaction through what has here been called hermeneutic listening. Teacher development can best contribute to this transformation process if ways are found for teachers to work in a structured second-person way in researching their own practice. This process involves careful scrutiny of their actions as a means of accessing their beliefs and historical experiences. The position taken in this paper is that any transformation demands that those involved be prepared to examine their present actions through the lenses of their past. Only by understanding and accepting this past can they move on to addressing aspects of the present that they would like to change. I believe that future transformation depends on this careful attention to both present and past.

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Creating a Climate for Passionate Learning

In Robert's eighth-grade language arts class there was a student who was part of the "cool" crowd. Unfortunately, this middle school crowd placed no value on learning. They believed that the kids who showed an interest in learning and cared about achievement were, in fact, very "uncool." I could almost see the struggle on this student's face when Robert offered her the opportunity to participate in a different kind of learning experience, one that she was able to direct, create, and make authentic to her world.

Sarah's fifth-graders were good learners in a traditional sense. Before they entered her class, they had become fairly proficient at memorizing facts and taking tests. But in the 15 years that Sarah had taught, she had never been traditional, and as a result her students experienced a level of participation in their own learning that was both dynamic and meaningful.

Robert and Sarah recently participated in a research study conducted at Kent State University's Research Center for Educational Technology (Ohio, USA). The study focused on these two teacher professionals because their teaching practices capitalize on the use of student inquiry and multiple technologies as a means to deepen student learning, engagement, and understanding. Though teachers are often exhorted to use inquiry and technology to stimulate thinking and learning, this is more easily said than done, given teacher education models and the pressure on teachers to increase student achievement on standardized tests. Teachers know that in order for students to learn they have to be engaged in the learning process and, preferably, interested in the topic. Fried (2001) takes this a step further, highlighting the need for both teachers and students to become passionate about their learning.

How do some teachers consistently engender passion in their students, year after year? The practices and beliefs of Robert and Sarah provide some insight into this question. Sarah and Robert taught in two separate districts, and both taught regular mainstream classes. Sarah participated in the study during spring 2001; Robert during fall 2001. These individual case studies were developed through observations, interviews, and examination of unit plans. Data were coded and analyzed, using seven standards for authentic and intellectual work (Newmann, Secada, & Wehlage, 1995). In an examination of the teachers' professional practice, clear patterns of student inquiry, rigorous academic expectations, and creative technology integration emerged.

The term *inquiry* encompasses many meanings (Short & Burke, 1996) and can have confusing, and even negative, connotations for teachers. Although commonly associated with science education (Ben-Chaim, Ron, & Zoller, 2000; Pierce, 2001), inquiry can be used with any curricular area. Robert and Sarah voiced common beliefs about student inquiry, but these beliefs translated into unique classroom practices. Both teachers identified several key components. Using almost identical language, they talked about the teacher being a collaborator and co-learner with students. Both expressed the belief that students need to direct their own learning, allowing

learning to be a flexible, individualized process. When asked his definition of student inquiry, Robert reflected, "[Inquiry learning is] having a direction in which to go, but allowing different paths to get there, and then seeing what other kinds of learning happened along the way, and pulling it all together at the end." For both teachers, children's questions seem to be at the heart of inquiry. Sarah stated, "I contend that any question kids have [is valid]…inquiry-based [learning] is about supporting their questions…helping them learn how to find the answers."

Inquiry and Technology in Robert's Classroom

Robert's beliefs in his students' ability to take charge of their own learning provided the underpinnings for student motivation and success. A 28-year veteran of the classroom, he knew his students well and had great respect for them as young adults. Robert's classroom practice provided structure in the classroom and guided, but did not constrain, the pursuit of knowledge. The ebb and flow of his class invited open student dialogue at key points, a critical component of the inquiry classroom (Short & Burke, 1991). At the start of a unit on oral history, the whole group participated in discussions about different forms of history, artifacts from years gone by, and the techniques involved in collecting usable oral histories from their family member of choice. These discussions set the stage for subsequent individual or small-group investigations of topics connected to the learning objectives. Robert circulated among the students, probing with questions designed to help the students examine their own work more critically. Robert noted, "[Technology coupled with inquiry is] going to be the biggest component. I mean that's what [students are] going to do. I'm going to walk around while they're doing all this kind of stuff and just coach them along. I'll try to direct them to try and figure things out and ask questions…."

Robert's questions to his students focused on a variety of issues. He asked why students chose specific primary data for their projects, posed editorial questions that prompted students to look more closely at the quality of their writing, and asked logistics questions that helped students think about project management and time issues. Often, Robert conducted end-of-period whole-group discussions to get student input about their learning experience that day. He could have simply ended the classroom activity and hustled his students out the door to catch their buses, but taking time for whole-class dialogue after everyone had been busy working on individual projects provided Robert with the input he needed to assess his students' needs and progress more thoroughly.

Robert's oral history unit was originally designed to focus on the small community where he and his students live. His belief that his students could broaden their learning through inquiry by using technology is illustrated in an early interview. Robert stated, "I want them to focus on [their home town]. I think they look at [their home town] as this dinky little town that has nothing. If, using technology, they can go other places and see that other places have many of the same things that little [students' home town] has, I think they'll see that there's a lot to be proud of." After the terrorist attacks on New York City and the Pentagon, on September 11, 2001, Robert's students felt a strong need to shift the focus from community to family. They reported that these shocking events had made them think about family and the possible loss of a family member. Since young adolescents in Western society often rebel at this stage of their lives, Robert was gratified to see his students' desire to learn more about their families' histories. He stated, "We were focusing on [our home town] and after all this stuff that happened [September 11th], family became very, very important, so the kids want to go in the direction of the family, the oral history of the family."

Honoring his students' input and following his belief that learning needs to be a flexible process, Robert agreed to this shift in focus. By inviting their personal experiences into the classroom, Robert validated students' lives. Students appreciated having the autonomy to ask their own questions and guide their own learning, so they were eager and highly motivated. The shift of focus from

community to family did not conflict with Robert's objective to follow the district course of study and state content standards. Students would still be honing their writing skills, learning proper interview technique, and learning the use of new technologies.

The oral history project could have been just a simple interview with a grandparent that merely scratched the surface of the tradition of sharing and recording information from generation to generation. But Robert's confidence in his students' abilities resulted in a more rigorous approach to oral history. His carefully scaffolded lessons began with student research designed to explore methods that professional historians use. Robert invited a local historian from Akron's Historical Society to talk with the class about collecting oral histories. This historian was able to explain firsthand the processes Robert wanted his students to learn. At the same time he provided an important link to the real world, showing students how adults use these same skills and how the products benefit the general public.

Following Internet research about oral history making, and the presentation by the local historian, the students conducted interviews with classmates in order to practice the methods they had learned. The practical application of these skills allowed them to refine the interview process in preparation for their oral history documentation of a family member. Practicing their skills with classmates added to the students' confidence and helped them recognize critical design issues of presentations, conduct peer review of their work, and investigate other methods of recording history.

Robert made it clear that the students' success depended upon their own exploration and use of these skills, not on a teacher's lectures. He noted that his initial primary objectives for his students in the oral history project were "How to deal with people, number one. How to listen, and how to go about getting the information they need." Scaffolding their interview skills enabled students to create a stronger final project than would have resulted from a more cursory approach. Robert was sensitive to the fact that his students' prior school experiences had not accustomed them to taking charge of their own learning as much as he was expecting them to. He explained,

> [Students] want to cry first, because they want the answer, but they don't get it (directly). Then [they] go talk to somebody else. There is always a reflecting [component] at the end of class. "What did you learn from this?" "How did you go about doing this?" and "How would you change for the next time?" "What do you have more confidence in doing next time?"

Students' reactions were mixed when they realized that they were expected to take charge. Some welcomed the opportunity to take the reins, while others needed more support, which Robert gladly provided.

Earlier in his years of experience, Robert had taught similar content without the availability of current technologies. But he is now adamant about several points. New technologies enhance student inquiry. Technology has the potential to transform a passive learner into an active learner by supplying tools to research, analyze, and synthesize knowledge. The information that students access via the Internet can provide expert and primary source information necessary for knowledge building. And finally, today's students relate to the multimedia formats that modern hardware and software tools provide.

Nothing about the use of technology in Robert's class was forced. The technology was integrated into the learning process and reflected students' learning objectives. Digital photography, audio, and video were particularly well suited to the investigation of oral history. Students loved capturing a family member's voice and image. They also photographed artifacts, and scanned old pictures and documents to include in their video documentaries or PowerPoint presentations. Students used their newfound knowledge of the oral history process, and their increasing skills in the use of digital technology, to deepen their personal knowledge of family history. Imagine the pride of the students as they eagerly and confidently shared their work with classmates and family members.

Inquiry and Technology in Sarah's Classroom

Sarah's ability to engage and motivate her students was born from her high expectations for them. Sarah gave her fifth graders the "keys to the kingdom" of learning at the start of the school year. The study of immigration is part of the fifth-grade curriculum, and Sarah chose to devote the entire school year to this topic, allowing for integration of all content areas, and also allowing for depth of knowledge. Mindful of the learning outcomes mandated by her school's course of study, she and her students worked together to identify content, decide on the process, and create assessments.

What would an observer see in Sarah's class? At first glance, it might appear that chaos reigned. A longer and more thoughtful look would reveal students' commitment to learning, not merely random activity. Kids worked in collaborative teams to investigate countries of origin of immigrants to the U.S., with each group choosing a different country. Animated and passionate discussions, questions that ignited their motivation to seek answers, and deliberations about assessment were all woven into their daily experience. This deliberative process was as much a part of their learning as was the content area they were investigating. The teacher became a co-learner and a facilitator of the process. Sarah explained her own perspective of her role as follows: "Why should I tell them 'yes' or 'no' [when responding to a student question]?…that's not very fair of me…. To me…inquiry based [learning is] to guide [students] along. I don't want to give them the answers. I don't want to frustrate them either, but we can all work together to find the answers to the questions we have." This perspective reflects current recommendations that a teacher become a co-learner rather than just a "guide on the side" (Carroll, 2000).

The students' behavior reflected their motivation and desire to learn. Sarah had few discipline problems in her class and didn't expect any. She believed in her students' ability to self-monitor both their learning and their behavior, and she developed a classroom culture that fostered open communication among classmates, supported by clear-cut classroom standards created jointly with her students. Lively discussions and even conflict occurred, but, more often than not, these stemmed from the passionate nature of the inquiry and the direction that students' projects were taking them.

Sarah firmly believes that technology supports a constructivist approach to learning. Access to both primary source material and expert knowledge enables students to build on their prior learning. Technology helps them to think about information and choose what is important based on previous learning, and, more importantly, provides an outlet for the natural curiosity that children possess. Sarah reflects, "Can I do this in my classroom without the technology? Yes. It would be very difficult…. Don't try to take them away from me. Don't take my computers."

The immigration study that Sarah and her students designed was much more than a superficial investigation of a foreign country and attempts by its citizens to relocate to the United States. At the beginning of the unit the whole class developed a list of 24 questions that served to orient their study. These questions included: What are some of the countries represented by U.S. immigrants? Why did they come to America? and What cultural heritage do they bring to America? Sarah explained that her class was designed to promote student-driven inquiry, and though she teaches the same unit each year, because it is part of the district course of study, the outcomes are not the same from year to year. She explained how this class had developed during the first part of the school year, prior to the study:

> [At the beginning of the year] we started talking about change…about how we handle change. As they were answering that compelling question, it brought [up] a lot of discussion about war. [Then] we read some literature on survivors of World War II, Nagasaki, and Hiroshima. These kids can tell you so much about that war!… [The question] "What brought on World War II?" …[led to discussions about] the Great Depression. So we did a stock market simulation. They…developed [imaginary towns], [their stock markets] crashed, and they ended up having no money. It very gradually turned into this idea of a dictatorship and how easily people can be led…. Now they're doing individual country

> investigations, [and asking questions] "Why did people leave those particular countries?" and "Why did they immigrate to the United States?"

Their in-depth investigation, constantly guided by the questions they generated at the beginning of the school year, required the students to look at difficult issues from a personal perspective. Sarah provided one such example in which one of her students reflected on the conditions during World War II. She related, "We were talking about Hitler and…about World War II and the [students] were kind of giving their insight on what the war did. [During] the war everybody had jobs, and [they all] were working, and one little girl just looked at me and she said, 'So Mrs. Kelly, that must mean that sometimes out of the bad things come good things.' And I said, 'Yes, sometimes.' You know, I couldn't teach them that." Through their personal inquiry, their collaborative discussions, and Sarah's guidance, the students grew in their understanding of economic issues, patriotism, and human needs. They became increasingly emotionally connected both to their chosen "country of origin" and to the decision by some of its citizens to emigrate and rebuild their lives.

Sarah's class was a reflection of real-life problem solving. Her class worked in collaborative groups representing different countries and made decisions about all aspects of their project. They began to understand the value of choosing the best person for the job so that everyone's talents could add to the overall quality of the work. Students learned the valuable skills of negotiation when differences arose. Sarah provided this example: "The other day…they were having an argument, just almost a brawl over whether [a class project] was [going to be] a documentary or a drama. So we decided to compromise with a docudrama. We're learning about compromise and negotiating." Sarah continually promoted students' growing understanding through gentle questioning of decisions, thus heightening students' awareness of what it means to work together as a group to complete a project.

Sarah pushed her students to see learning as an expression of their own thoughts and ideas. Like Robert, she knew these students were coming from a more traditional background that was much more focused on what the "experts" think, so she had to help them acclimate to a different way of "doing school." She explained, "I can remember when we first started writing in here. You know, 'How long does it have to be?' And I've always told them, 'Don't ask me how long it has to be, because I might tell you 5,000 words. You write what you need to in order to say what you need to say.' [The students] know that that generally takes a good bit of writing because there's not much you can say in one sentence." Her students rose to this challenge, especially exemplified in their final class project, a book answering the 24 questions they had posed at the beginning of the school year.

Technology was used creatively in Sarah's classroom. For instance, to create backdrops for their videos, some students projected an image on the screen that made it appear as though they were standing in a crowd of people from their country of origin. Sarah also used technology to individually assess her students. Using a handheld student assessment program, Sarah was able to input her observations, student–student conversations, and student–teacher conversations on an ongoing basis. This software allowed her to obtain consistent and detailed evidence and examples of student strengths and weaknesses over time, instead of a vague understanding of individual student performance based on remembrances of the classroom activity at day's end. With this intimate knowledge of her students, Sarah was able to provide the support they needed to be successful.

Conclusion

Robert and Sarah share powerful beliefs and practices that promote student engagement, motivation, and success. These teachers enjoy a strong rapport with their students and talk conversationally with them, sharing their knowledge of classroom topics. Rather than dominate a student's understanding of a topic with their own perspective, these teachers challenge student thinking as a matter of course by answering a question with another question. This strategy enables students

to delve more deeply into the topic. Sarah believes it was her students' intellectual immersion in the study of their country and immigration issues that prompted their heightened connection to their investigations of immigration. She repeatedly commented how "awed" she was by her students' questions and insights. Robert knew his students outperformed his expectations because they accepted the challenge to take charge of their learning content and process.

Reflecting on an often-used quote, "All children can learn," perhaps we need to ask ourselves how we can promote instruction so that all students are given the tools, flexibility, and personal connection to their learning to engender passion. How do we promote models of learning that emphasize the new learning goals expected of students, such as critical thinking skills, collaborative problem solving, and the proficiency to work in a world pervaded by technology? Noddings (1997) suggests that in order to motivate students, teachers need to be caring and connected to them as individuals. Teachers express their care for students in many ways. Robert and Sarah chose to show caring by helping students connect their personal thoughts, feelings, and perspectives to what they were learning in school. These two teachers supported student learning this way because they could see their students come alive through the inquiry process.

Robert and Sarah also used technology to enhance learning. They knew from prior experience that technology, coupled with an inquiry approach, could afford their students the opportunity to investigate, construct, and present their unique interpretations of what they had learned, without losing focus on the required course of study. All too often technology in schools is used in a cold and impersonal way, through drill and skill programs that tend to isolate students and require little in the way of deep thinking. Robert and Sarah's experiences show that this does not have to be so.

While many classrooms around the world do not have the various technologies used in Robert's and Sarah's classrooms, availability of technology is increasing worldwide. When scarce resources demand that students share computers and other technologies, skillful teaching strategies can promote positive opportunities for collaborative learning. Regardless of what technology is used, an inquiry approach to learning enhances students' critical understanding of their world, unique representation of knowledge, and innate desire to seek out answers to new questions that emerge as they learn. In this context, technology is used not as the end goal, but as a tool to support the goals of the thinking classroom.

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Mathematics: A Fresh Perspective

A teacher of mathematics has a great opportunity. If he fills his allotted time with drilling his students in routine operations he kills their interest, hampers their intellectual development, and misuses his opportunity. But if he challenges the curiosity of his students by setting them problems proportionate to their knowledge, and helps them to solve their problems with stimulating questions, he may give them a taste for, and some means of, independent thinking.

Polya, 1944, preface to the first printing

Introduction

A common characteristic of high school mathematics instruction is the lack of motivation teachers provide for learning abstract concepts. I often hear students ask, "Why should I learn this concept?" "Where could I use it? Is it applicable in everyday life?"

Humenberger maintains in his article "Applicable Mathematics" that highlighting the usefulness of mathematics should be a general concern of the teaching of mathematics (2000). In a discussion of math teaching today "words such as *applying* and *applicable* become more important than *applied* or *applications*" (Humenberger, 2000, ¶1). Hans Freudenthal (1973) also contends that students should learn how to apply mathematics; it is more important to learn how to apply mathematics than to learn applied mathematics. So, the question I have sought to answer is: How should I teach mathematics so students perceive it as useful?

Another serious drawback of conventional mathematics instruction is that the students do not get the sense that mathematics is a process. The compulsory curriculum and traditional teaching methods used by many teachers fail to illustrate the way mathematicians actually *do* mathematics. Students do not realize that all the results in mathematics are obtained only after many attempts, after long struggles to solve certain fundamental problems. They view mathematics as a given set of rules and laws established many years ago that they are now obliged to use. They can see only the petrified structure, with no trace of the creative process that produced it. This fact raises another question for me: How can I help my students understand the road that mathematicians travel to obtain mathematical solutions?

Mathematicians know that they owe much to the work of their predecessors. Math teachers know that the mathematics we are teaching now is the result of centuries of mathematics research. We also know that much current mathematical theory has its beginnings in the work of 18th- and 19th-century mathematicians. But what about the students—do they have this historical perspective? Would a course on the history of mathematics help students understand how mathematics has developed?

As I have tried to find answers to these questions, it has become clear to me that mathematics can be richer and more meaningful if it is taught in a historical context, and in connection with other fields.

An Elective Course: The History and Application of Mathematics

My practical response to these questions was to design a new course for students in the ninth form (students about 15 or 16 years old): *The History and*

Application of Mathematics. This elective course introduced a small part of the history of mathematics and outlined the connection between mathematics and other fields, and gave the students the opportunity to rediscover mathematical principles, to *do* mathematics. The content was based on concepts the students had learned in the fifth through eighth forms and on the topics they would be studying during the ninth form. We omitted parts of the history of mathematics dealing with concepts the students had not yet encountered, leaving the door open for further continuation of the course during the 10th–12th forms.

Instructional Framework

In organizing the course, I used a framework for active learning and critical thinking developed by the Reading and Writing for Critical Thinking Program, a model known by the acronym ERR. This model begins with a phase called *evocation*, in which students are encouraged to "consider their assumptions about a topic, raise questions about it, are encouraged to set purposes for learning" (RWCT glossary, n.d.), and generally raise their curiosity about it.

The second phase is called *realization of meaning,* during which students "inquire, examine and construct meaning" (RWCT glossary, n.d.). In the third phase of *reflection,* the students consider what they have learned and compare it with their prior assumptions; "they apply the learning to new situations, they question or debate the ideas, and they begin to reorder their thinking to accommodate what they have learned" (RWCT glossary, n.d.). I usually continue the lesson outside the classroom with a fourth phase, an *extension activity*, to "extend the ideas into further study of real-life applications" (RWCT glossary, n.d.).

The Lesson: The Golden Ratio

One of the students' favorite lessons in the course was "The Golden Ratio." It was one of my favorites, too, because it offered so many possibilities for students to connect mathematics with its history, and also make connections with nature, architecture, music, paintings, etc.

The objectives of the lesson were to enable students to:

- solve, and recognize solutions for, the equation $x^2 - x - 1 = 0$
- reword and solve Proposition 30 from Book VI of Euclid's *Elements*
- reword and solve Proposition 11 from Book II of Euclid's *Elements*
- identify the Egyptian triangle
- prove the main property of the Egyptian triangle
- draw a logarithmic spiral
- identify connections between the equation $x^2 - x - 1 = 0$ and nature
- identify connections between the equation $x^2 - x - 1 = 0$ and architecture.

I launched the *Evocation* stage by showing the students a set of images (on transparencies): the Khufu (Cheops) Pyramid, a statue by Phidias, the Parthenon in Athens, seeds in a flower head. Then I had the students solve the equation $x^2 - x - 1 = 0$. The students started asking questions: "What do the Pyramid, the Parthenon, and the seed head have to do with math?" "Why are you asking us to solve an equation after seeing these transparencies that have no relationship to math?" or "Why are you showing us these pictures?" I had them write all these questions on a flip-chart, and I promised to give them answers at the end of the lesson if they had not found the answers themselves by then.

For the *Realization of Meaning* stage I used a strategy called Jigsaw II (Slavin, 1980). Students are divided into four- or five-member teams. Everyone receives a copy of a text (i.e., book or article), and each team member is assigned a topic (part of the text) on which to become an "expert." Students join their expert counterparts from the other teams and discuss their topics in expert groups, devising strategies for teaching their assigned topic. They then return to their original teams, where they are responsible for teaching their topic to their teammates. Students are highly motivated to listen to their peer teachers, because the only way they have access to the information is through these peers" (Henley, 1997, ¶3). The class follows a cycle of teaching, teamwork, and individual assessment. Teams earn certificates or other forms of recognition based on the degree to which all team members have improved over their past performances.

For our Golden Ratio class we formed five "home" groups. Each team member was assigned a role (e.g., writer, reporter, timekeeper, facilitator). Everyone received a copy of the text for the lesson and read it (see Appendix 2). Putting together the text for this lesson from original source materials was the most difficult part for me as the teacher. But I am convinced that, if carefully chosen, original sources can be accessible and very enriching for both students and teacher. My aim was to provide the students an opportunity to discover information and ideas in a source text, and to transfer mathematical concepts to other fields (e.g., biology, architecture). At the same time, I wanted to give the students a sense of the timeline of mathematical research. For example, I wanted them to understand that the values of Le Corbusier's Modulor exist because of Proposition 30 from Euclid's *Elements*. Almost every mathematical idea is built on ideas developed previously.

The students now rearranged themselves into their so-called "expert" groups, and each group received a different worksheet. Each expert worksheet contained three questions based on a marked section of the text. The questions were as follows:

Expert worksheet #1

1. Reword Proposition 30 from Book VI of Euclid's *Elements*.
2. Prove Proposition 30 from Book VI of Euclid's *Elements*.
3. What is the connection between Proposition 30 and the Golden Ratio?

Expert worksheet #2

1. What is the secret of the harmony of design of the Khufu (Cheops) Pyramid?
2. Identify the ratio between the hypotenuse and the shorter leg of the Egyptian triangle.
3. What is the connection between the Egyptian triangle and the Golden Ratio?

Expert worksheet #3

1. Reword Proposition 11 from Book II of Euclid's *Elements*.
2. Prove Proposition 11 from Book II of Euclid's *Elements*.
3. What is the connection between Proposition 11 and the Golden Ratio?

Expert worksheet #4

1. How is a logarithmic spiral obtained? Draw a logarithmic spiral.
2. Give examples of the logarithmic spiral in the natural world.
3. What is the connection between the logarithmic spiral and the Golden Ratio (Golden Section)?

Expert worksheet #5

1. Is there a connection between geometry and architecture?
2. Explain what *Modulor* means.
3. Find the first 15 values of the Modulor.

The assignment for the expert groups was to answer the questions, create a poster illustrating the answers, and find methods for teaching the topic to the other students. The lesson was planned to allow adequate time for all three portions of the assignment.

The students in expert group #1 were surprised to discover, after carefully researching the text, that Proposition 30 from Book VI of Euclid's *Elements* addresses the aesthetic problem described in the Introduction section of the text. They realized that the idea of finding the point that divides a line segment in extreme and mean ratio was built upon Euclid's Definition 3.

The students in expert group #2 began by identifying the important information, represented it by drawing a pyramid, noted the givens and the goals in "their" part of the text, and listed steps toward a solution. It was wonderful to see them discover that *writing* or *reading with a pencil in hand* helped clarify and develop their thinking.

The students from expert group #3 found it very difficult to reword Proposition 11 from Book II of Euclid's *Elements*. One of them reported, "In reading Euclid's Proposition and trying to prove the theorem we had to interpret the text of the theorem ourselves, and we felt as though we were Euclid. We discussed the questions a lot, and we managed to accomplish our tasks only in small steps."

The students from expert group #4 discovered that there is a close relationship between the Golden Ratio and the logarithmic spiral. Specifically, a logarithmic spiral can be derived from a golden rectangle. "The logarithmic spiral is older than mathematics," the students

wrote. "The spiral has been produced for millions of years in nature: in the arrangement of sunflower seeds on the seed head; in the shape of the nautilus shell."

The students in expert group #5 wrote on their poster: "Geometry is all around us!" They identified many three-dimensional shapes (cube, tetrahedron, cylinder, etc.), as well as the Golden Ratio, in the Parthenon building. They calculated the relation between the values of the Modulor (41.5 + 66.5 = 108; 108 + 66.5 = 174.5…), and thus were able to find the first 15 values of the Modulor.

When they had completed their expert assignments, the students returned to their home groups and presented their mini-topics to their teammates. I chose one of the expert groups at random to present their mini-topic to the whole class. The posters made by the other groups were put on display, and the group reporters summarized each home group's work. I offered feedback both to the groups and to individual group members.

For the *Reflection* stage of the lesson, the students could choose either of two assignments:

- In 10 minutes, write an essay explaining, from your point of view, Johannes Kepler's (1571–1630) statement, "Geometry has two great treasures: One is the Theorem of Pythagoras; the other, the division of a line into extreme and mean ratios, that is, the Golden Mean. The first we may compare to a measure of gold; the second to a precious jewel" (quoted in Calter, 1998, Egyptian Triangle, ¶2); or
- Answer the question (in writing): Are there any advantages to the spiral shape of the clusters of seeds in a flower head?

Sorina wrote one of the essays I liked most. Her idea was that it is the precious jewel that gives a gold ring its beauty. The Pythagorean Theorem is extremely useful, so it is precious like gold; but the Golden Ratio gives us beauty, so it is precious like a jewel. We can find the Golden Ratio everywhere—in postcards, stamps, buildings, human bodies, fashion—so clearly it is visually attractive. The jewel is pleasing to the eye.

Sergiu chose the second alternative, and gave one of the best answers to the question. He wrote that the advantage to the spiral shape lies in the optimal distribution of the seeds—since they are uniformly distributed on the seed head, there are as many as possible in the given space, and they can all be the same size.

At the end of the lesson we returned to the questions we had written after seeing the transparencies. Now the students could answer them all.

For the *Extension stage,* I chose some of the projects described by Dr. Ron Knott on the webpage http://www.mcs.surrey.ac.uk/Personal/R.Knott/Fibonacci/fibInArt.html:

1. Analyze Leonardo da Vinci's paintings *The Annunciation* and *Madonna with Child and Saints*. (You can find these paintings in the Uffizi Gallery's website http://www.uffizi.firenze.it/welcome.html.) Can you identify the Golden Ratio in these two paintings? (Other links specifically related to the Golden Ratio and art include the Web Museum pages on Durer, http://sunsite.doc.ic.ac.uk/wm/paint/auth/durer/, and Famous Painting Virtual Exhibition, http://sunsite.doc.ic.ac.uk/wm/paint/.)
2. Find the Golden Sections in Baginsky's method of constructing violins. You can find information on the website about Baginsky at http://www.violin.odessa.ua/method.html.
3. Find the Golden Ratio in Mozart's music and in Beethoven's Fifth Symphony. You can find related articles in *Mathematics Magazine,* Vol. 68, No. 4, pp. 275–282; in *Mathematics Teaching*, vol. 84 in 1978, pp. 56–57; and online at http://www.americanscientist.org/template/AssetDetail/assetid/24551, and http://www.science-frontiers.com/sf107/sf107p14.htm).

   Editor's note: some of these pages are no longer accessible.

Reflections

I have been teaching this course for five years now. I have changed it a little bit each time, because the students' feedback always gives me some new and interesting ideas. This article describes the most recent form, the form I used this year.

Each year, the result has been that my students have gained a different perception of mathematics, and they have felt a

greater affinity for it. Mathematics has a history, something it shares with the humanities; like history, it is still evolving. Mathematics is strongly related to the real world—it is not merely a useless collection of notions, axioms, theorems, and lemmas, as it might appear to some. It is the result of human beings' attempts to understand the world in which we live.

Another feature that distinguishes this course from most math instruction is that the students are asked to make value judgments. For example, there are two types of geometry: Euclidian and non-Euclidian. Which is "better"? Similarly, various proofs may exist for the same theorem. Which one is most elegant, and why? There are many open problems/conjectures/assertions in mathematics that need to be critically studied. It follows that mathematics involves creativity, that sometimes 2 + 2 does not equal 4. In discovering these dimensions, my students come to realize that mathematics is alive and is still being created.

Here are some of the students' comments from the end of the last school year:

> I discovered mathematics for myself. Working through the source text with a partner and participating in group discussions, when each of us could share his/her understanding of the material, allowed me to understand the text, and all the difficulties I had were resolved.
>
> —Tudor Munteanu

> For me this course was like a breath of fresh air in the context of the mathematics I'm studying in the compulsory curriculum. I've started to like math, and I'm getting better grades in math because I've started to really work on the exercises and problems. They are no longer as difficult for me as they used to be.
>
> —Radu Hozan

> I found the original sources fascinating. At first, they seemed to me like a text in a foreign language I had never studied, even though the words were [in my native language] Romanian. I'm still thinking about Euclid's Proposition concerning the Golden Ratio…. At first I understood nothing. After the discussions with my classmates the hypothesis and the conclusion became clear to me, and I felt like Euclid trying to prove the proposition.
>
> —Vlad Balancan

> This course made me realize that mathematics is not only calculus and theorems; it has some interesting aspects. I didn't know that music and mathematics were related. Rational numbers and music harmony…when I told this to my elder brother he thought that I was joking.
>
> —Sergiu Simionca

> It was nice for me to discover that the subjects we are studying at school are related. History is not just history and mathematics is not just mathematics. Now I would like to learn something about the history of physics, for example.
>
> —Aurelian Ciceo

> I learned some interesting facts. I'll try to find out more about the Arabian mathematicians. It was so strange for me to find out that a mathematician (Omar Khayyam) wrote poems. I thought that mathematicians were boring people.
>
> —Flaviu Craciun

> This course made me understand why all these abstract mathematical concepts appeared. I was surprised to find out that the digit **zero** was introduced a long time after the other natural and rational numbers. I think that it was very difficult for people to conceive of the idea that 'nothing' needs a numerical representation.
>
> —Ioana Jarda

> I'm good in mathematics, but I never thought that I might be able to discover something new in mathematics. During this course, I didn't really discover new theorems, because these theorems were proved a long time ago, but for me it was like a discovery. I thought that the math people need was already known and written in books, but I realized that people are still doing research, and trying to discover and prove new theorems.
>
> —Andrei Cristorian

Conclusions

The intention of this article is to share with other teachers a different approach to mathematics. The teacher's role is to engage students in learning mathematics and to provide experiences that will enable students to construct an understanding of the discipline for themselves. The History and Applications of Mathematics course helped me to carry out this hard task. The students' enthusiasm demonstrated that a humanistic and dynamic vision of mathematics, with mathematical explorations in their own context and with their own motivation, not only engage students in learning mathematics, but also enable them to think critically about the mathematical universe.

Appendix 1 Syllabus

(Note: The syllabus below was previously published in Bernat S.E. & Chis V., 2003).

Aims	Types of learning activities
To discover information and ideas within a text	Reading mathematical texts/original writings and writing/re-writing mathematical concepts; Note: Reiter (1998, ¶1) points out that *although most students "learn to read" during their first year of primary school…reading is a skill which continues to develop…as the reading material becomes more sophisticated and as the expectations for the level of understanding increase…. Mathematical reading (and for that matter, mathematical writing) is rarely expected, much less considered to be an important skill, or one which can be increased by practice and training….* *The activities and habits needed to learn from written mathematics are quite different from those involved in learning from a mathematics lecture or from those used in other types of text.* When we discuss an original mathematical text, things become more complicated
To identify important information, to represent the information, and to note givens and goals	The support of student engagement with the text by the analysis of the text, including putting the information into the student's own words/ mathematical symbols, and interpretation of the information
To seek relationships between given and goals, to identify steps to a solution	Tasks that can be carried out through strategies of cooperative learning
To evaluate information and ideas, reflecting on the validity of the text	Reading, writing, and discussing mathematics *Note:* Reiter (1998, Reading Theorems section ¶1) stated that *in almost any advanced mathematics text, theorems, their proofs and motivation for them make up a significant portion of the text. The question then arises, how does one read and understand a theorem properly? What is important to know and remember about a theorem? A few questions to consider are:* • *What kind of theorem is this? (some possibilities are: a classification of some type of object, an equivalence of definitions, an implication between definitions…)* • *What's the content of this theorem?* • *Why are each of the hypotheses needed?* • *How does this theorem relate to other theorems?* • *What's the motivation for this theorem?*
To transfer mathematical acquisitions to other fields (biology, architecture, arts)	Tasks that can be carried out through strategies of cooperative learning
To develop the social skills that support productive mathematical work with peers	Group work with established guidelines
To experiment with mathematical creation	Study of original sources *Note: original sources bring students as close as possible to the experience of mathematical creation. They experience the determination, the false starts and faulty logic, and the successes of mathematical researchers.*

Content:

1. History of mathematics: sources of the history of mathematics
2. Natural numbers and the history of numbering systems
3. The appearance of integers and rational numbers
4. Irrational numbers
5. Numbers in nature
6. Algebra: a brief history, including examples, of solving linear equations with one variable
7. Famous problems: Pythagoras's students, Squaring the circle, Diophantus's Epitaph, Zeno's paradox
8. Pythagoras's Academy—academy, sect, or secret political association
9. The Pythagorean Theorem
10. Perfect and amicable numbers
11. Pythagoras statement: "All is number"
12. The Golden Ratio
13. Fermat's Last Theorem
14. The evolution of Number Theory

Assessment methods and tools:

- Teacher observation
- Personal communication
- Projects + student performances
- Essays
- Self-evaluation
- Peer group assessment:
  - monitoring individual or group presentations (skills in group work, communication, planning, organizing, presenting skills)
  - monitoring project work in teams (complementary roles tend to be adopted)
  - monitoring written assignments (involving students in setting criteria)
- Portfolio: Most of these materials will become a part of the student's portfolio. Portfolios will include a minimum of the following pieces: an essay written by the student on his/her expectations, a self-evaluation sheet, an essay on the development of mathematical ideas, a self-report of learning by the student (which will include answers to the questions: What did you learn? Why do you think that this course is important to your mathematics education? How will you be able to use the knowledge that you have gained in this course?)

Appendix 2 Lesson Text

The Story of the Golden Ratio

Introduction

Let's start with an aesthetic problem. Consider a line segment. How can the segment be cut in two parts, so that the resulting proportions are pleasing to the eye? Some people would say that we should cut the segment in two equal parts; others would say that the two segments should be in the ratio 3:1.

The Greeks found what they thought was the right answer to this problem. Plato believed that if the line segment were divided into two unequal segments so that the smaller segment was related to the larger in the same way that the larger segment was related to whole, the result would be a proportional relationship with special properties (Andi, Mel & Shuj, 2000, Aesthetics section, ¶2).

Illustration: Jill Britton, from http://ccins.camosun.bc.ca/~jbritton/goldslide/gold08.jpg. Used with permission.

In other words,

AB/AC = AC/ CB.

In geometry, we call this the Golden Ratio (or the Golden Mean, the Divine Section, the Golden Cut, the Golden Proportion, or the Divine Proportion). If we rename the segments such that **AB = a, AC = b, and CB = c**, then the proportion takes the form: **a/b = b/c**. The ratio **b/c** between the larger segment **(AC)** and the smaller one **(CB)** is the Golden Ratio, expressed as **Φ**. If we take into account that **a = b + c** and we substitute **(b + c)** for **a** in the equation above we obtain a second equation: **(b + c)/b = b/c.** Dividing the relation by **b** and replacing **b/c** with **Φ** yields a third equation: **1 + 1/Φ = Φ,** which shows us that the Golden Ratio differs from its inverse by one. From the third equation we can obtain the equation **$\Phi^2 - \Phi - 1 = 0$,** which has the solution:

$$\Phi = \frac{1+\sqrt{5}}{2} = 1.6180339887...$$

(Aslaksen, n.d., The Golden Ratio, ¶1).

1. Euclid also discussed this special proportion, although he never gave it any numerical value. This problem is solved in Euclid's Elements, Book VI. At the beginning of Book VI, in Definition 3, Euclid states, "A straight line is said to have been cut in extreme and mean ratio when, as the whole line is to the greater segment, so is the greater to the less." Proposition 30 from the same book is "To cut a given finite straight line in extreme and mean ratio" (Joyce, 1997, ¶1). The proposition leads to the Golden Ratio.

2. Nobody knows who set out the first mathematical statement of the Golden Ratio. It is certain that the Egyptians knew this ratio and used it in building the pyramids. According to Herodotus, the Egyptian priests confided in him that the secret of the harmony in the design of the Khufu (Cheops) Pyramid is that the area of each triangular face is equal to the square of the pyramid's vertical height.

Garry DeLong, from http://garrydelong.com/scenics.html. Used with permission.

If we consider a square pyramid with the height **a**, the slope height **b**, and the length of the side of the square base **2c**, we obtain: $\mathbf{a^2 = bc}$. But, if we take into account that the Egyptian triangle (the triangle formed by the height of the pyramid, the slant height, and half the base) is a right triangle and $\mathbf{a^2 + c^2 = b^2}$, we replace $\mathbf{a^2}$ and we obtain $\mathbf{bc + c^2 = b^2}$ or, dividing by $\mathbf{c^2}$, $\mathbf{(b/c)^2 - b/c - 1 = 0}$, that is the equation that represents the Golden Ratio.

It is likely that Greek mathematicians knew about the Golden Ratio from the Egyptians. In their study of irrational numbers, the Pythagoreans included the Golden Ratio, even if there is no specific mention of it (translation from Câmpan, 1981, p. 49).

3. Some historians believe that Book II of Euclid's *Elements* covers material originally studied by Theodorus of Cyrene, while others attribute the material to Eudox of Caidos. Plato, one of the best-known Greek philosophers, reportedly considered the Golden Ratio the key to the physics of the cosmos. In the *Elements*, Euclid examines this problem a number of times. The first time it appears is in Book II, Proposition 11: "To cut a given straight line so that the rectangle contained by the whole and one of the segments equals the square on the remaining segment." This construction cuts a line into two parts to create a geometrical

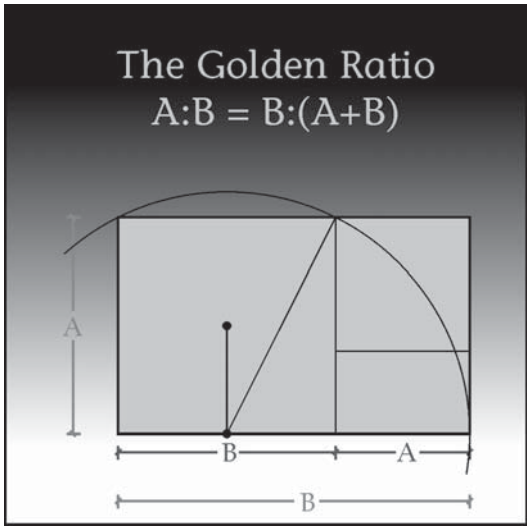


Illustration CopyLeft 2004, John Roland Penner, from http://home.earthlink.net/~johnrpenner/Articles/GoldenLogos.html

representation of the equation $\mathbf{a(a - x) = x^2}$ or $\mathbf{x^2 + ax = a^2}$. Euclid and the Greek mathematicians solved quadratic equations using geometrical (spatial) methods. This construction gives the position of the point on the line segment AB and, after finding it, there is no further mention of it (translation from Câmpan, 1981, pp. 49–50).

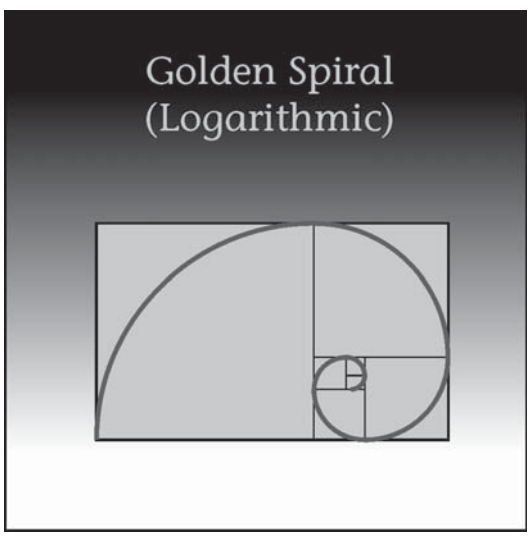
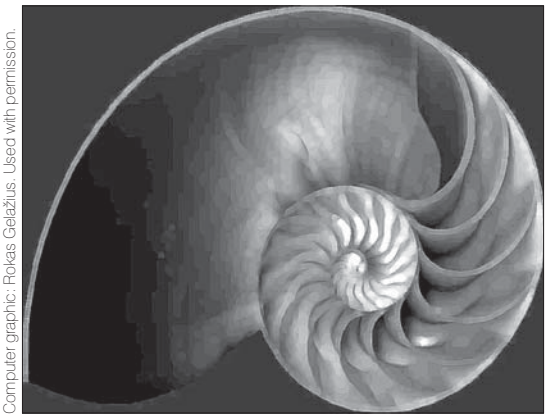


Illustration CopyLeft 2004, John Roland Penner, from http://home.earthlink.net/~johnrpenner/Articles/GoldenLogos.html

4. Consider a rectangle with sides in the ratio $\Phi/1$ or $1/\Phi$ such that when it is partitioned into a square and a new rectangle, the ratio of the sides of the new rectangle is also $\Phi/1$ or $1/\Phi$. This process of subdividing a rectangle into similar squares and rectangles may be continued infinitely. Such rectangles are called golden rectangles. Golden rectangles can be found in many of the proportions of the Parthenon, the famous ancient temple in the Acropolis in Athens, Greece.

The successive points dividing a golden rectangle into squares lie along a curve known as a logarithmic spiral. The spiral is not actually tangent to the sides of the squares.



Computer graphic: Rokas Gelažius. Used with permission.

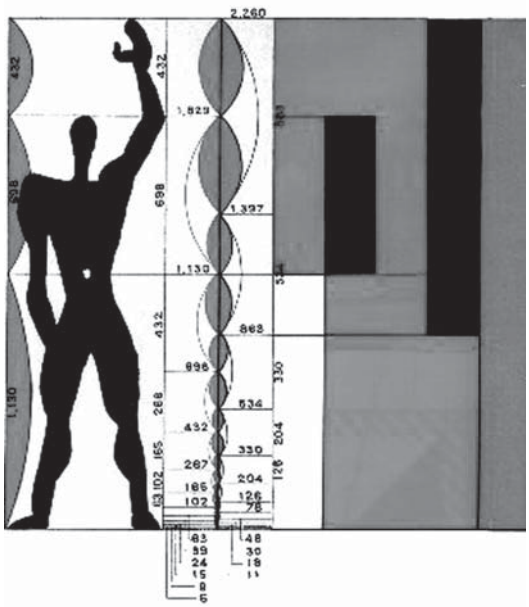
A curve similar to this occurs in many places in nature, for example in the shape of a snail shell or some seashells (nautilus shell). Many such spirals can be traced in the circles radiating from the center of a sunflower seed head or a pinecone. The spiral is also found in astronomy, in the shapes of nebulae and the tails of comets.

The Golden Ratio is sovereign throughout the living world; most animal and plant species have parts in the ratio Φ/1 or 1/ Φ. The navel divides the human body into two parts in the Golden Ratio (i.e., the distance from the top of the head to the navel compared to the distance from the navel to the ground) and these two parts are further subdivided in the same ratio.

Jacques Bernoulli's (1654–1705) tombstone in Basel bears a depiction of the spiral and the phrase "Eadem mutata resurgo" ("I shall arise the same, though changed") (translation from Radian, 1981, pp. 48–50).

5. The Golden Ratio links mathematics with other domains, especially architecture. In his well-known architectural treatise, Vitruviu in the first century B.C. drew attention to the harmony that must exist between the different parts of a building and between the whole building and its environment. This doesn't mean that the artist wanted to constrain his designs to the Golden Ratio.

Modern multistory buildings tend to follow a pattern based on a 1 plus 1 rhythm (ad infinitum); this pattern can only lead to monotony. In Paris in 1950 the famous French architect Le Corbusier (1887–1965) wrote in his book *The modulor: A harmonious measure to the human scale universally applicable to architecture and mechanics*, that architecture in the 20th century could no longer be restricted to the isolated building, the individual house. The city as a whole was architecture. The word *modulor,* which he invented, is formed from the words *modul* (ratio) and *or* (gold), in other words, *the Golden Ratio*. The ancient Golden Ratio offered a new approach for the architects of the 20th century.



Reprinted from Le Corbusier "Arkhitektura XX vekha", Moscow: Progress, 1977. Used with permission.

The Modulor is based on two lines, arrived at via the Golden Ratio and related to the proportions of the human body. The Modulor starts with the division of the height of a man into two sections at the waistline. Le Corbusier started with the length of 216 cm, representing the height of a man with his arm naturally upraised. In this case, the distance between his waist and his fingertips is the same as the distance between his waist and the floor (108 cm). The distance between his head and his waist (66.5 cm) is the proper relation to the distance between his head and his fingertips (41.5 cm). Starting with this system of proportions, Le Corbusier developed a graduated scale of proportional dimensions, which correspond to Fibonacci numbers: 41.5; 66.5; 108; 174.5….

The Modulor, with its proportional scale, allows for an infinite number of variations within a unified system of construction. Le Corbusier said: "the Modulor provides neither talent nor genius…. It offers simply the joy and certainty of using the optimal dimensions" (translation from Câmpan, 1981, pp. 61–63).

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UNESCO's International Bureau of Education, with support from the German Development Corporation (GTZ), has published a CD-ROM entitled *Learning to Live Together: Good Practices in Schools*, highlighting 25 selected projects from RelatED, IBE's database on learning to live together. These practices focus on areas such as human rights, conflict resolution and peace, citizenship, and intercultural understanding that qualify as examples of good practice. The selected projects have undergone evaluation indicating a measure of positive impact on learners or the wider community.

The Reading and Writing for Critical Thinking project, an initiative of the Open Society Institute and the International Reading Association, is one of the 25 featured projects, chosen for their contribution to crisis prevention and peace building. RWCT has been active in 30 countries on four continents around the world, including the Balkans, the Russian Federation, the Caucasus, Central Asia, and Central America.

The CD-ROM includes descriptions of the projects, evaluation reports, teaching and learning materials, and other relevant data. Selected documents on the theory and practice of learning to live together are also included.

The CD-ROM may be obtained free on request from:

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Vida Zuljevic

Puppets—A Great Addition to Everyday Teaching

For centuries, people of diverse cultures have created and used puppets, finding an almost magical power in their capacity for creating open, honest, and trustworthy communication between the puppeteer and the audience. In my work with children in Bosnia, Croatia, Germany, and the USA, I have found out that no matter what culture children belong to or what language they speak, they play with puppets freely, using their hands, thoughts, language, and feelings, and they develop lasting friendships that are beneficial for their further development.

My hope is that by discussing the benefits of puppetry, I might entice other teachers to start thinking about them as a valuable educational tool, both for teaching academic content—English as a Second Language, reading, writing, social studies, science, and math—and for teaching students how to resolve conflicts and deal appropriately with the emotional challenges that are a part of their everyday lives.

Working as a kindergarten teacher in the former Yugoslavia, my country of origin, I used puppets as a teaching tool to introduce works of literature or math concepts, to talk about faraway places or music from different cultures, to introduce the seasons, to deal with conflicts that would occasionally arise, and for countless other purposes.

Through these lessons and activities, I tried to develop children's appreciation for literature, their creative thinking and expressiveness, and a sense for characters, places, and time. I also sought to develop their ability to make connections between different subject areas, and to develop other important skills that young children need in order to succeed in their future schooling and in life in general. Besides developing academic skills, my goal always was to help children become self-confident and develop their social interactive skills, and also to help them express their fears and frustrations in an appropriate manner.

Forced by war to flee from our country, my family and I lived in refugee camps in several different places, and I dealt with the wounds—both emotional and physical—inflicted by war on children, including my own. I continued to make puppets and produce puppet plays involving children, thus helping them to concentrate on something productive, helping them to release their traumas and to overcome the stress caused by war. The puppets proved to be powerful tools.

Even though I was an adult, much stronger and much more aware of the situation, I knew that my involvement with puppetry—which focused my attention on making puppets, finding appropriate literature for performance purposes, and then performing the puppet shows with children—helped me release my own war traumas.

Eventually I moved to the United States, and I discovered a new field where puppets worked perfectly. Upon arriving in Addison, Texas (a Dallas suburb), my family and I were immediately put into the situation of having to learn yet another language for survival purposes. After we had been in Texas for a month, I had to find a job to provide for my family. My own children had studied English in school in Europe, and they

were able to teach me a few sentences so I could ask about job openings.

So one morning I inquired at the nearby preschool academy, and the very next afternoon I received a call from their director. My daughter helped me understand that I was being offered a position as a preschool teacher. I was terrified. Almost in a panic, I reached for puppets to help me in the new situation. That evening, I made a puppet and named her "Ana." Neither Ana nor I knew English, but Ana was my shield to protect me from embarrassment and my ambassador to the children's hearts and minds. Ana helped me by singing children's songs in Serbo-Croatian, my native tongue. She was just borrowing the voice from me. The two- and three-year-old toddlers with whom I worked would gather around me, and even though they could not understand a word Ana was saying, they listened patiently, clapped their little hands, touched Ana, and very soon asked me if they could hold Ana on their own. I helped them by demonstrating how they should hold their fingers in order to hold the puppet. In those interactions, I heard "The ABC Song," "Rain, Rain, Go Away," "B-I-N-G-O," "Mary Had a Little Lamb," and other popular children's songs for the first time, and I started learning English very fast. Ana was a bridge between the children and me, and we soon built an unbreakable bond with each child. After six months, I had learned enough English that I could perform a puppet show called "Are You My Mother?" for all the children enrolled at Brilliance Preschool Academy (in Addison, TX) and their parents. I also prepared a display of the puppets I had made and used in my work during this period.

After moving to Richland, Washington (USA) in November of 1996, I continued to work as a preschool teacher, and I also started studying at Washington State University to obtain a state teaching certificate. I received my certificate in December 2000, and in January 2001 I was hired as a Russian bilingual and ESL teacher at Robert Frost Elementary School in Pasco, Washington. Since that time I have held several different positions at the school.

The students at Robert Frost are very diverse, in both language and economic background. My first position at the school involved two jobs: For the first half of the day I co-taught a Russian bilingual first- and second-grade class; and during the other half of the day my assignment was to help newly enrolled (most migrant) Spanish-speaking children feel welcome, and to teach them English as a second language. I had absolutely no knowledge of Spanish.

My previous personal experience—using puppets to help me communicate with children despite my extremely limited English skills at that time—inspired me to think about these students in the same way and try to provide them with this same tool. I wanted first to open their hearts and minds to the puppets so that this emotional, affective connection could help them focus more on the cognitive domain—the learning of a new language—later on.

My puppet, Ana, was there to help my students, just as she had helped me when I began learning English. Simple introductory sentences such as "Hello, my name is Ana. What is your name?" worked well with all the children. Using her (my) warmest voice, she looked straight into my students' eyes, pointing with her little hand toward herself when saying her own name and toward the student when asking his or her name. Ana thus gained the students' trust and became an indispensable member of our small group. My personal experience and my six months of work with these Spanish-speaking students taught me a new and exciting thing about puppets: They are the best language teaching tool I could ever wish for. In the group I worked with from January through June of 2001, I had several students who spoke not one word of English when they started and who were able to perform a puppet show in English for their classmates by the end of the school year.

Since September 2001, my position at Robert Frost Elementary has involved teaching Russian/English bilingual kindergarten and K–5 art, and I am still very involved with puppetry both in my school and in the nearby region. I have given presentations about the benefits of using puppets in teaching reading to ESL students at three Washington Organization for Reading Development (WORD) conferences (in 2001, 2002, and 2003) and at the 2003 International Reading Association (IRA) conference as well.

During the 2001–2002 school year I prepared a puppet show with one of my

art classes, a third- and fourth-grade Spanish bilingual class, with great help from their home-base teacher Mrs. Sanner.

When I talked to Mrs. Sanner about using puppets to teach bilingual students, telling her that together we could make it work in her classroom, she was excited. She knew that her students needed more English-language experiences and would benefit particularly if these experiences came in the form of a fun activity such as puppetry.

We made an eight-week plan to prepare and perform a play written by Bill Dickey (a retired teacher, a volunteer in Mrs. Sanner's classroom, and a published author). I used my art classes to make the stick puppets, introducing art concepts along with this work. Mrs. Sanner taught related vocabulary in advance, so when I arrived each week to work on the puppets and the art concept, the students were always "ready to go." Everybody was engaged. Our puppet-play script was about life under the ocean. Mrs. Sanner provided the students with encyclopedias, dictionaries, magazines, and Internet sites to investigate various ocean species and their habitats. Even the most skeptical and shyest students opened their hearts to these activities. In the beginning, the Spanish-speaking students hesitated, but with Mrs. Sanner's encouragement, interpretation of difficult terms, and support, they always tried. A few of the monolingual students asked Mrs. Sanner if they could say their lines in Spanish. "Yes," we agreed. "Let us have the fishermen speak Spanish. Why not…?" This kind of ice-breaking moment assured Mrs. Sanner's students that we were there to support them and help them to become better English-language speakers, better readers, and confident performers—but all of this only when they felt they were ready.

Once the puppets were ready, we started practicing the play. First we read the script just as readers' theater—paying attention to fluency, intonation, and vocal expression. Then, I started bringing the stage (a very practical pipe stage purchased on the Internet from http://www.puppetgallery.com/gallery/stage.html) to Mrs. Sanner's classroom so we could practice our play with the puppets, stage, and stage decorations that the students had made in their art classes. Mrs. Sanner's eagerness to explore and share her ideas made her an incredible resource and a source of motivation for me.

These third- and fourth-grade students performed their puppet play for the entire school and their parents. The process of preparing and performing this play with Mrs. Sanner's students was a highlight of my work with puppets in America. The students' performance was an incredible success. They were truly engaged in the production, and through it they were engaged in an unconventional language-learning activity, one that was fun and appealing to them.

Photo: Vida Zuljevic

Russian bilingual kindergartners explore puppets on their first day of school.

It was clear to me, and their teachers confirmed my impression, that the students' reading skills and vocabulary improved as a result of this experience. Their self-confidence, responsibility, and communication skills were enhanced as well.

That same school year the students in my Russian bilingual kindergarten made stick puppets and prepared and performed the puppet show "Goldilocks and the Three Bears" in English at the end of the school year. These kindergartners were taught in Russian at first, with a gradual introduction of the English language (15 to 30 minutes per day). I frequently used puppets for their English language instruction, which made that short period the most enjoyable time of the day both for the students and for me, and facilitated the students' acquisition of English. The Goldilocks production amazed everybody who saw it. When I started, I had in mind Caroline Feller Bauer's great advice in her book *Leading Kids to Books Through Puppets: "*Think Simple. Think Lively. Think Fun. Think… Books*"* (2000, p. 5). In my opinion, this is crucial advice for those who wish to use puppets in everyday teaching.

For the kindergarten puppet show I started by reading the folk tale "Goldilocks and the Three Bears" several times over a period of ten days so my students would became familiar with the text. I also had three copies of this book in the classroom, so that students could look through them during their free choice time. Then, I organized a book discussion involving the whole class. I asked questions and recorded the students' answers on chart paper. Some questions involved literary elements and sequencing, such as "Who are the characters?" "Where does the story take place?" "What happened first, next, last?" while other questions, such as, "What size were the bears? the bowls? chairs? beds?" involved math and vocabulary. Next to their answers, I also drew pictures of what they said. For example, when they answered that the characters were Goldilocks and the three bears, I wrote the answer in English and drew these characters with their names under each one. This way my students, who had not yet learned written English, could relate the picture and the spoken word to the written form of it.

When I told them we were going to prepare our first puppet show, the children were very excited. "But we don't have puppets," one of my boys exclaimed. "You are going to make them," I replied. "You only need to think of what you just said about the setting, the house, the main characters, the bowls, and other things from the story. You may also go to the chart and check what you will need for your puppet show. Now tell me what character you would like to play," I continued.

Assignment of characters was not difficult in this case, since there were only 11 children in my class. The bravest chose the main characters. I asked the ones who did not volunteer for a character role at first to take care of the setting and props for the story. They were happy with that opportunity. After the roles were assigned, the children worked on making stick puppets for the characters they had chosen. The only direction I gave at that point was that they should draw, color, and cut out the character or the prop they wanted to make, and I would be ready to help them staple their puppets onto the sticks (wooden sticks commonly used to mix paint).

During this "art time," they talked, gave suggestions to each other, and helped each other. When all the puppets and props were done, the excitement grew even greater. I took the role of the narrator, my teaching assistant was the cameraperson, and we were ready to perform.

The performance was a tremendous success and a great testament to the value of puppets for enhancing and developing oral language abilities, social communication skills, appreciation of literature, and many other aptitudes.

I also led an after-school enrichment program, the Puppet-Making Club, in two six-week-long sessions. The students who were involved in this club created puppets that could compete with the finest artwork. They also performed a puppet show for their peers, inventing their own dialogue for the characters they had made.

Several of my puppeteers took part in the celebration of Dr. Seuss's birthday, performing the puppet show *Green Eggs and Ham*.

After that show, one of the participants came to me and asked, "Mrs. Zuljevic, if I write a puppet play and practice with puppets, could I perform for parents and kids here at our school?"

"Yes, of course," I said, and his face lit up with pride and determination.

"Yes, yes," I thought. "This is the outcome I (and I'm sure every other teacher) really want to have: creativity, self-confidence, high goals…."

Last year, with immense support from my principal, Denny Delafield, who is also a puppetry lover, and from my colleagues, we officially established the Robert Frost Elementary School's Puppet Theatre, which meets twice a week. The puppeteers are mostly bilingual third, fourth, and fifth graders. The puppeteers' first production for their schoolmates was a show I wrote (in English!), inspired by the new self-discipline program we were implementing at our school. The performance was very successful, and received only positive feedback. Subsequently the puppeteers performed three additional puppet shows for our school's students and participated in the Dr. Seuss reading celebration event at our school. They then took their show on the road and performed for students at an elementary school in a neighboring city, for the elderly tenants of the Beverly Health Care Center, and at a Kiwanis Club luncheon. They also performed at our local Barnes and Noble bookstore on three different occasions: as part of a Dr. Seuss Birthday Celebration, during Poetry Celebration Month, and during a regularly scheduled reading time.

The Barnes and Noble performances were especially successful and rewarding for me. Not only were my students excited and well prepared for this activity,

but we had children and parents waiting in the store for our next performance because it was something they did not want to miss. The store's community-relations person reported that parents frequently asked her if she planned to schedule another event with the Robert Frost Puppeteers, as their kids had simply loved the previous one. At our first performance, we had 40 people in attendance, at the second we counted 58, and by the third there was a record audience of around 80 children and parents. This outreach activity, promoting oral language development, reading, and performing, gave my students lasting stature as true advocates for reading in their school, family, and community.

At the end of the school year I conducted a short survey on how these children perceived their involvement in puppetry and to what extent (if any) it had helped them master certain skills. I also asked them what their favorite aspect of the program was, and what they would want to change for the next year. Their response speaks for itself. The following are direct (and uncorrected) quotes from their survey papers (the names are omitted to protect the students' privacy).

> *I think that in puppet theater I learn how to read, to expressing, and how to learn English…to express more beter and communicate and talk beter.* (fourth grader, Spanish bilingual).
>
> *It is a very grate place to be. It helps me with better Inglish….* Favorite part—*to perform puppet shows* (fourth grader, Russian bilingual).
>
> *I felt happy to join because I liked to perform to kids. I also liked all the puppets. And I should come each day or I would let my teacher and friends down…. Yes, I acquire more skills. I learned how to read and more and speak the language more better…. I like to stay in and practice to get better and more better and I like to prevorm to kids or adult* (fourth grader, SET English [a transitional program to support intermediate ESL students]).
>
> *It is part of my life because Mrs. Zuljevic really helped me understand how to not be afraid of proform on stage. She is one of my best friends. It helped me have an expressive voise.* Favorite part—*proform, because I want to entertain people* (third grader, mainstream English).

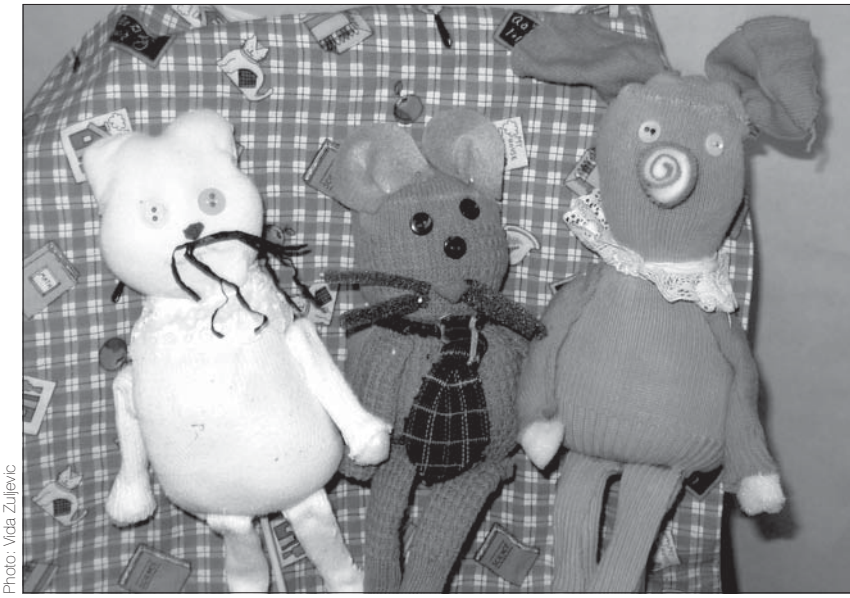

Photo: Vida Zuljevic

Puppets made by 4th and 5th grade Russian bilingual students: a cat, a mouse, and a pig.

Several other teachers at my school have now started using puppets in their teaching. They report an increase in their students' involvement in and motivation for this activity, and they also note development in the children's reading, oral language, and general communication skills. One of my colleagues, Caroline Yeryomenko, wrote,

> In the spring of 2003 my students performed two puppet plays for their families and friends. Not one student was late or absent from the performance. Afterward they talked about that evening for months. The puppet plays were the highlights of my students' year and an important part of their education.
>
> During the 2002–2003 school year, I was a second-grade Spanish bilingual teacher in a school with many low-income families. I adapted the two puppet plays from Joe Hayes' bilingual stories set in the Southwest of the United States. My Hispanic students connected to his storytelling style, which reflected their culture and traditions. One of my best performers was "Crista," a little girl who arrived in the fall with almost no letters or sounds recognition. She shook her monster puppet with such expressiveness and lowered her voice to growl out the words. The audience laughed so hard at Crista's monster that the show paused for a long while to quiet down. Performing with puppets greatly assisted Crista in her reading and fluency development. And most especially, it brought out her talents despite her tardiness in learning to read.
>
> My students and I had never used puppets before that year. Vida Zuljevic was our art teacher, and we had one hour of class time

Theoretical support for the use of puppets

The improvement of various skills as a result of using puppetry in the classroom is supported by research. Vygotsky, for example, underlines the importance of play for a child's development and points to the connection between play and learning. Playing with puppets is well suited to take that connecting role in the classroom.

In his book *The Triune Brain and Evolution* (1990), McLean, a neurologist and a senior researcher from Maryland, states that play has a primary role in the evolution of mammals, and therefore may constitute a fundamental part of human socialization.

Wilson (1998), in his book *The Hand: How Its Use Shapes the Brain, Language, and Human Culture,* examines the role of human hands in human development in light of the new research in psychology, anthropology, linguistics, and neuroscience. His conclusion is that the use of human hands has a direct connection with human learning, and that humans use their hands to leave a personal mark on the world in which they live. Wilson's research includes experiences of puppeteers as well as musicians, surgeons, mechanics, etc.

In their book *Literature Based Instruction With English Language Learners,* Hadaway, Vardell, and Young (2002) give a detailed explanation of Krashen's five-hypothesis theory of second-language acquisition. In his affective filter hypothesis, Krashen underlines the importance of the affective dimension of second-language acquisition. He argues that if the classroom atmosphere is tense, the affective filter is high, and children are anxious; thus, language acquisition is less likely to occur. If the classroom atmosphere is relaxed, there is a low affective filter, children are more receptive to input, and thus greater language acquisition occurs. This is where the use of puppets could come into play, because they help children to relax and take the focus off themselves, thereby lowering the affective filter and making acquisition of a second language much easier.

with her per week. One day, as I struggled with the idea of props in the two plays, Vida and I stopped to chat. As soon as she heard about the puppet plays, she suggested that the children learn how to use puppets and the puppet stage during art. In two or three art periods, Vida had taught my students many important skills. They learned how to enter and exit the puppet stage and how to use expressive voices and gestures such as crying, singing, and dancing. They practiced moving the puppets' mouths and bodies properly, to sit, walk, or talk.

Vida let us use her beautiful puppets, some of them bought and some homemade. Whether or not the puppet moved its mouth or other parts, Vida could make it come alive while acting. The children loved watching her act with puppets. They were waiting every week for art class to arrive. Vida became a true friend to our class and an important mentor to me.

In my reading and writing programs, I noticed significant improvements in the children's interest and abilities related to puppetry. I had tried many techniques for teaching fluency, and puppetry was most successful. In their reading, students began to attend to dialogue and punctuation. They changed their voices for expression and characterization. The students were excited about reading aloud to their friends and families. If the text did not sound right while they were reading, they would stop to reread for fluency.

Perhaps the most dramatic improvement was in the writing of Eduardo, a shy and quiet little boy. I decided that Eduardo, instead of talking, spent his time looking around at the world and making poetry about what he saw. His stories were full of images like "a bird floating overhead in the blue windy sky…" However, none of Eduardo's stories had any organization. I worked with him to occasionally write a story with plot sequence, but he was not transferring any of our work to his independent writing, until after the puppet show. Suddenly, some of Eduardo's stories had structure that worked nicely. And then it occurred to me where his ideas had come from—the elements of plot were suspiciously similar to the sequence of the two puppet plays. Eduardo found meaning in the use of plot because of his experiences with puppetry.

At the end of the 2002–2003 school year, we had an all-school award assembly, and my puppeteers presented a puppet variety show including poetry, songs, jokes, and two plays. When it came

time for the awards for achievement in reading, all but one of my puppeteers received certificates. I felt that part of this achievement surely was a product of their involvement in puppetry.

To start using puppets in teaching, teachers should have in mind the previously mentioned advice given by C.F. Bauer: "Think Simple. Think Lively. Think Fun. Think…Books."

Simple means really simple, just as it does when using a textbook or an overhead projector or any other teaching tool. The teacher can have a classroom mascot, usually a hand or stick puppet, that is always there to introduce a new concept, read a book, report the morning news, play a new game, announce new rules, or talk about conflict-solving strategies—just about anything the teacher might do.

If the teacher feels more comfortable setting up a puppetry "corner" or "station," it should not be big and fancy, because students need to feel comfortable using it without being afraid of ruining it and upsetting the teacher. A big cardboard box (such as a refrigerator carton) would work perfectly because it is inexpensive, foldable, and big enough to serve the purpose. Just a little work—cutting out a hole for the main performing window; decorating it with markers, crayons, or paints; installing a curtain, etc.—can transform it into a delightful puppet stage. The puppet corner can contain a box with some hand puppets, or material such as construction paper, scissors, fabric pieces, beads, feathers, glue, paper bags, and wooden sticks for students to make their own puppets. As the students create their own characters, the teacher can assess the students' understanding of story elements, concepts, rules, or other lesson objectives. Also, in observing free-time play with the puppets, the teacher can gain insight into a child's feelings, possible traumas, conflicts, or understanding of a just-introduced concept, and can respond with a plan for appropriate intervention.

For more ideas on how to incorporate puppetry into the classroom, C.F. Bauer's book is the perfect reference. For anyone interested in becoming more proficient in puppet performance, the wonderful book *Making Puppets Come Alive* (1973) by Larry Engler, creator and director of Poko Puppets, and Carol Fijan, director of the National Theatre of Arts, is a must-have reference to begin this training. Teachers can also find puppetry resources on the Internet. Numerous websites (listed in the "Useful Links" section of this article) offer ideas for scripts and opportunities to order puppets, stages, accessories, etc.

Before starting puppetry in the classroom, teachers should consider the goals they want to accomplish by using the puppets. As a kindergarten teacher I use puppets primarily as a curriculum-teaching tool, to enhance content-area instruction. That means I don't pay much attention to what the puppets look like, how they move, or what voice my students are using for a particular character. I pay attention instead to what the puppets say: how it reflects and connects to what I have taught and to my objectives for students' learning. For example, if my students perform a puppet show about the parts of a plant, I would focus on what the "root," "stem," and "leaves" say about their color, the role they play as part of the plant, and where they are located, rather than on the artistic representation of the leaf, root, or stem, or what voice the children give to their plant-part characters.

On the other hand, when I teach puppetry to my puppet theater group, I teach them specific skills of puppet performance, focusing on movement, vocal expression, gestures, etc. With the same puppet play—about the parts of a plant—I encourage these children to imagine and produce different voices for the different parts: a stuttering voice, a squeaky voice, a deep voice, or some other voice that might define their puppet character. Then, I would teach them how to add some distinct personality to each of the stick puppets they make (e.g., to make a "leaf" with charming eyelashes, "roots" with tiny shoes on each branch, a "stem" with a necktie or lots of buttons…just whatever the students come up with). Next I would teach them the basic movement skills involved in entering the stage from the sides, and the correct puppet walking movement, up and down rather than a linear, sliding motion. Next we would work on dialogue and communication between two puppets on the stage. A little exaggeration in expression of a character's feelings is

desirable, just to keep the attention of the audience, but overacting may be overwhelming. The puppeteers have to learn how to recognize this fine line and be aware of it every time they perform.

These are just a few suggestions on how puppetry can be used in teaching. Teachers may well need to modify all these suggestions to suit their own classrooms and make the ideas workable for their students.

Puppets offer great potential for developing language and reading skills in children, as well as other social and communicative skills, particularly in children whose native language is not English. Teachers should not hesitate to use puppets as much as they wish, for puppets are open, honest, and trustworthy friends, wonderful additions to the classroom and a great help in our everyday work.

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Useful Links

http://family.go.com/crafts/buildmodel/specialfeature/puppets_crafts_sf/ This site has a great variety of ideas that any teacher, whether a beginner or experienced, could find very useful.

http://www.puppetools.com/v3/workshop/frame.html A wonderful guide to making puppets and using them in your work, including ideas for use in the curriculum, special education, and special projects.

www.puppeteers.org - The Puppeteers of America website

www.unima-usa.org - UNIMA-USA - The American chapter of Union Internationale de la Marionette

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Literacy Conference in Tbilisi, Georgia

New Edge of Literacy in Georgia, a two-day conference, was held September 25–26 in Tbilisi by the School-Family-Society Association together with the International Reading Association. Conference participants, from Georgia, the USA, Ireland, and the UK, shared their views on various key issues: What factors contribute to improving reading performance? What is the current status of each of these factors in Georgian schools? How can policymakers, school administrators, and teachers implement different strategies to achieve higher literacy standards? How should the educational system be structured so as to support literacy instruction? What skills and knowledge do we want students and teachers to have?

The conference attracted wide public interest and coverage in the Georgian media. As a result of the conference, a proposal has been developed for improving literacy education in Georgia. It calls for establishing or strengthening parent organizations, community libraries, programs of education research, and teacher education. The project will be implemented by the International Reading Association and the School-Family-Society Association, in partnership the Georgian National Ministry of Education and several "clusters" containing universities, schools, PTAs and libraries.

[source: School-Family-Society Association]

"It's the first book I ever read all the way through" Helping Students Find Entry Points to Literacy

William G. Brozo

Not long ago I was looking through a wonderful source that had just been loaned to me by a colleague, a book entitled *Once Upon a Heroine: 450 Books for Girls to Love* by Cooper-Mullin and Coye (1998). Interspersed among the titles and annotations were sections of boxed text in which more than 20 highly successful American women recounted their earliest memories of critical experiences with books. For example, Ruth Bader Ginsburg, a U.S. Supreme Court justice, wrote that *The Secret Garden* [by Frances Hodgson Burnett] was one of the first books she could read, and she treasures it to this day; Ruby Bridges, a prominent civil rights activist, remembered *Green Eggs and Ham* and *The Cat in the Hat* [by Dr. Seuss] as the first books that drew her into the literacy club; and Dr. Ellen Baker, a NASA astronaut, became an avid reader as a child after discovering the Madeline books [by Ludwig Bemelmans].

When I finished these personal recollections of important childhood reading experiences, I was struck by the sense that while each of our literate journeys is private and idiomatic, one common characteristic binds all of us who are active readers and writers in adulthood. Like the successful women in Cooper-Mullin and Coye's book, we each began modestly down our own path to literacy. Yet, if from those first stirrings of excitement we experienced as children and teens we continue down the path of lifelong reading, eventually we realize the life-altering and consciousness-expanding power of literacy. Why some of us stay the course of reading and others do not, I am prepared to argue, has to do with whether we are offered (or discover for ourselves) an entry point to literacy in our youth.

Youth who become disaffected readers have one of two stories to tell: (Worthy, 1998): Reading was once exciting and pleasurable but now is boring, tedious, and decidedly not fun; or reading has always been a chore and will never compete with the other things they like to do. But those who (re)discover the joy and excitement of reading can tell us different stories (Brozo, 2002), from which lessons can be extracted and turned into useful teaching strategies.

Match Students With Reading Material Based on Outside-of-School Interests

Claude was a teenager with a genuine passion for hockey, but none of his teachers seemed to take notice. One day, however, his science teacher found him standing outside the classroom talking animatedly with his mates about a picture in the daily tabloid of a referee who had been hit by a puck. The teacher had played hockey in his youth, and passed on to Claude *The Leafs vs. the Canadiens* (Duplacy, 1996). Claude, who had never before "bathed in the energies of a book" (Birkerts, 1994, p. 84), now experienced for the first time the unique pleasures of reading, and there was no turning back from there. "It's the first book I ever read all the way through," he told his teacher, and asked for other similar titles. For Claude, books about hockey served as the pathway to reading.

Teachers do not have to rely on chance encounters to discover students' outside-of-school interests. Using a strategy such as "My Bag" teachers can learn a great deal about individual student's hobbies, dreams, and experiences. The strategy involves collecting items that symbolize different aspects of one's life and then sharing the bag of items with the class. For example, Delfino's bag included a photograph of himself and some friends on the beach with their sailboards. I asked him about his hobby, and learned that in spite of his intense interest in windsurfing, he was not reading any books or magazines about it. He became very enthusiastic when I introduced him to Tim Winton's (1991) *Lockie Leonard, Human Torpedo*, and Lockie became Delfino's entry point to literacy. He confided, "I still don't like to read much…but after Lockie Leonard, I like it more than I used to" (Brozo, 2002).

Through a My Bag activity, Sergei, a science teacher, found out that Alexei, one of his weakest readers, was fascinated with his country's space program. Even though his school had only a limited number of books, Sergei found numerous interesting and easy-to-read articles about rock-

etry on the Internet, and made them available in an electronic folder for Alexei. The young man discovered for perhaps the first time that he could enjoy reading in school about a topic that interested him outside of school.

Personal Introductions to Books and Other Texts

Once teachers are aware of students' interests, they can highlight related reading material through *book talks*. A book talk offers a short, exciting glimpse of a book, including expressive reading of excerpts, with a conclusion that keeps listeners guessing (Brozo & Simpson, 2003). An exciting book talk can be delivered in as few as three to five minutes, so a teacher can give them frequently.

The more books and articles students are introduced to, the greater the likelihood their curiosity will be aroused by a particular title. That's precisely what happened for Jusef. He had become an indifferent reader, but became intrigued by a book talk on *If Rock and Roll Were a Machine* (Davis, 1994). As his teacher described the story, about a teenager who, like Jusef, loved motorcycles, she seemed to be speaking directly to him. Immediately after class he asked to borrow it, and he was not disappointed.

Create Time in School for Self-Selected, Recreational Reading

Putting the right books and other print material in students' hands will not guarantee they will read. Teachers can take an important additional step to encourage active reading by creating the time and space during the school day for students to enjoy texts of interest. The easier their access to interesting print materials, the more frequently adolescents read (McQuillan & Au, 2001).

When Lela's mother died unexpectedly, her counselor gave her a book called *Coming Home* (Brooke, 2000), which related to her recent experience of deep personal loss. Lela admitted that she probably wouldn't have read the book if it hadn't been for the 20 minutes of free reading time built into the school day. She was a slow reader and worked after school, so she rarely had time for reading, but the daily opportunity to read in the classroom meant she was able to complete the book within a few weeks. She often stopped in to talk with the counselor about the story and how Amy, the main character, is forced to deal with the tragic death of her own mother. Even before she finished it, she was asking for other recommended titles.

A Final Word About Entry Points

Because we simply don't know where a young person's first exciting print experiences will take him or her, we need to discover students' personal interests, expose them to a great variety of books and articles that relate to those interests, and give them time and space to read and enjoy those texts. Finding an entry point to literacy should be our highest goal when working with struggling and disaffected readers. Once young people have been engaged by text, regardless of the particular material that initially captures their imagination, we can be optimistic about their chances of becoming lifelong readers.

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Writing for **Thinking Classroom**

Thinking Classroom (also published in Russian as *Peremena*) serves as an international forum of exchange among teachers, teacher educators, and others interested in democratic teaching practices. It seeks to encourage professional development, research, and reflection. Authors are invited to submit articles that focus on active inquiry, student-centered learning, alternative assessment, and other aspects of educational change. Due to the international nature of the journal, articles should address issues that appeal to a wide audience, and terms or examples that are specific to a particular country or region should be explained in the text.

Thinking Classroom strives to maintain a balance of practical and theoretical information. The writing should take the form of a narrative, rather than a formal research report. Examples from classroom experience, quotations from colleagues or students, or examples of students' work can help communicate ideas to journal readers.

In addition to original submissions, *Thinking Classroom* will consider for publication articles that have appeared previously in national journals with limited circulation, to present these works to a wider international audience.

Format for Submissions

- Submissions are accepted in English or Russian.
- Articles should not exceed 4,000 words in length.
- Articles should be submitted electronically, preferably in .rtf format as an attachment to e-mail, to **bmichaels@reading.org.**
- The full name(s) of the author(s) should be included on a cover sheet, but this information should not appear in the body of the manuscript, as submissions are reviewed anonymously. The cover sheet should also include complete author contact information (**postal address and e-mail address**).
- References to articles or books cited must be complete. For journal articles include author, date of publication, title of article, title of journal, volume number, and page numbers (where article appeared). For books include author, year of publication, title, location and name of publisher. Additional details and examples can be found online at http://owl.english.purdue.edu/handouts/research/r_apa.html
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