

## **Coherent Websites and Creative Play: Constructivist Approaches to Information Technology in Teacher Education**

**Isabel Álvarez**  
Autonomous University of Barcelona  
[Isabel.alvarez@uab.es](mailto:Isabel.alvarez@uab.es)

**George Olson**  
Roosevelt University  
[golson@roosevelt.edu](mailto:golson@roosevelt.edu)

**Brent Kilbourn**  
University of Toronto  
[bkilbourn@oise.utoronto.ca](mailto:bkilbourn@oise.utoronto.ca)

### **Summary**

This paper qualitatively compares two different approaches to teaching information technology to pre-service teachers. The approaches (Creative Play and Coherent Websites) have their origins in different cultural settings. Both approaches emerge from constructivist views and aim at engaging students in conversations and collaborations that sensitize them to the sorts of classroom issues they will confront when they are teachers.

**Keywords:** Pre-Service Teachers, constructivism, ICT

### **Introduction**

The problem of teaching information technology to primary and elementary pre-service students are well known to professors of educational technology. How to prepare young adults for teaching (and using technology in the classroom) when they have little or no teaching experience and, not infrequently, are technophobic can be an enormous challenge. This paper describes two different approaches to the problem, approaches that are both based in constructivist principles and that come from a North American (Chicago) context, on the one hand, and a European (Barcelona) context, on the other. Although the different approaches emerge in response to similar problems, they go beyond the idiosyncratic tastes of the professors involved and reveal underlying cultural/educational differences. The Chicago setting emphasizes Creative Play which encourages students to experiment with technologies in a playful but serious way—the assumption is that

stressing a student's creative side will allow them to become comfortable with a technology and to explore its educational potential. The Barcelona setting emphasizes the idea of a Coherent Website which takes educational aims as primary—students are guided through website construction (as one technology) in a way that focuses on educational objectives to insure that they keep clearly in mind that technology is in the service of education, not the object of it. Each of these constructivist approaches has been in response to the inadequacies of a standard transmission/skill approach. The paper will examine the two different approaches with regard to their relative success (according to student feedback and professors' anecdotal accounts) and with regard to the cultural/educational similarities and differences between the two settings. For instance, teaching and learning in Spain (as in many European countries) is predominantly in a transmission mode, whereas North American educational systems have been influenced for decades by Dewey and, more recently, by the constructivist movement. These sorts of forces tend to shape standard approaches, of course, but they also shape the nature of the constructivist approaches in each setting.<sup>1</sup>

### **The Approach to Practice and Inquiry**

The theoretical framework underpinning this qualitative account is constructivism. Constructivism has historical roots in the works of Dewey (1938) and Vygotsky (1962) and more contemporary applications to modern classrooms by Foreman (1983), Darling-Hammond (1993), Brooks (1993) and Fosnot (1996). Teachers who engage in a constructivist approach are continually studying how their students learn and are seeking to create environments and opportunities for them to reflect, probe, and explore their own questions. Teachers face a difficult challenge when they attempt a constructivist path. In contrast to the traditional classroom, where teachers take charge of the packaging of intellectual work in the classroom, the student has much greater charge of that packaging in the constructivist classroom. Amorphous information, ill-defined problems, personal questions—these are the things that students have to put together, using their own idiosyncratic configuration of thought processes in order to arrive at answers. Teachers are the mediators and facilitators of that process.

Our focus is on how technology can be used to help pre-service students experience a constructivist learning environment (Creative Play and Coherent Websites) with a view to being able, in the future, to construct that environment for the students they will teach. We believe that technology can serve as a mechanism by which students can express themselves creatively, develop new knowledge, and use computer tools as a way of expressing their new creations. The evidence from our work suggests that technology can enable pre-service teachers to create environments for students that can encourage, facilitate, and—in a practical sense—allow the kind of questioning and probing that is desired in a constructivist learning environment. As such, this is a promising outcome of introducing technology into classrooms.

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<sup>1</sup> This descriptive/interpretive inquiry relied on standard methods of qualitative comparison. Over a period of a year and a half, data from the two settings were collected with respect to course outlines and requirements, examples of students' work, and anecdotal reports of professors. Student projects and feedback were qualitatively analyzed along three dimensions: pedagogical outcomes, technological skills, and adherence to constructivist principles. With each of these dimensions, the focus was on what seemed to be successful, what was not, and why.

## **The Context: Chicago and Barcelona**

In order to understand different approaches to teaching IT in a teacher education program, it is helpful to know a bit of the general context surrounding the two institutions.<sup>2</sup> Urban University in Chicago and Urbano Universidad in Barcelona are both mid-sized, urban universities with teacher education programs. Urban University in Chicago has a program that is predominantly concurrent, whereas Urbano Universidad's program is consecutive. Ironically, both situations described below are attempting to move outside the fetters of transmissive teaching to prepare pre-service teachers to engage with IT in ways that are truly educative—that go beyond stogy clerical functions, on the one hand, and beyond pyrotechnics that impress but do not educate, on the other—but for different reasons. The Spanish historical context is one of rote learning and transmissive modes of teaching, modes with which most Spanish teachers are comfortable but with which there is increasing pressure to break out of the mold. The American historical context involves continued flirtation with Dewey and constructivism, but more recently is driven by a preoccupation with assessment, which, inevitably, involves teaching to the test and transmissive modes of teaching and learning. Let us turn to more specific items of context.

### **Chicago context**

The teacher education programs at the Urban University rely on a course entitled "Technology in the Classroom" to introduce students to the hardware and software applications they will likely use when they enter teaching, including how to use technology to enhance learning. "Technology in the Classroom" serves an ethnically diverse student population with each class containing a mixture of Caucaasian, Latino and African American students. It is the diversity of experience and program, however, that is more significant with respect to creativity and self-expression. The course includes graduate and undergraduate students and students from early childhood (pre K-3), elementary (K-9), and secondary (6-12). These are the grade levels defining their certification programs, and, while a few certified teachers usually pepper the classes, they are overwhelmingly populated with students who have little teaching experience beyond their clinical observations or practice teaching. This is a course, therefore, that attempts to prepare students to utilize technology in intelligent ways in schools and classrooms in which they will teach in the future. The course is aimed at a vicarious experience.

A combination of lecture, demonstration, student presentation, Q and A, small group work, and facilitative instruction are the dominant styles of teaching and learning in "Technology in the Classroom." Students are expected to have Internet access outside of class, and if necessary can utilize the computer facilities at the university which are open days, evenings and weekends. Students are required to purchase Task Stream for the term, a text with a resource website included, and a 128 MB minimum Flash Drive for taking information to and from class. Time is provided before and after class for students who need assistance, and students are encouraged and

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<sup>2</sup> We recognize that two single courses in two different countries do not allow generalizations to be made about teacher education programs in either setting, and that is not our intention. The differences in approach to teaching IT in teacher education are interesting and informative in their own right. The use of "Chicago" and "Barcelona" are merely convenient and memorable ways of referring to the two different situations. However, we do believe that there are cultural/social differences that are provocative and worth thinking about.

expected to help each other. Students are introduced to software packages, but are expected to learn how to use them in greater detail by applying their own ingenuity and creativity which can include tutorials and further individual research. Most importantly, students are encouraged to “play” with the software packages, exploring the various capabilities within a context of what they believe will be their first teaching experience and environment once they are certified and hired for their first teaching position.

In the course, students are introduced to standard IT hardware such as the PC, digital cameras and camcorders, scanners, and LCD projectors. Software applications include the Microsoft Office Suite (less Access), Blackboard (Web based tool for student-teacher communication), IBM's Learning Village (Simple web page design and construction), and Task Stream (a web-based tool for e-portfolio development, lesson and unit planning, and assessment through rubrics). Common assignments are parent newsletter, electronic budget and grade book, power point presentation on assigned reading, web page construction using IBM's learning village, web quest, and design and use of electronic portfolio. A small group research project is a culminating component of the course, including a presentation of research results to class members with the proviso that each group utilize technology in appropriate ways to enhance the presentation and the learning experience for this class. The group project is aimed at engaging pre-service students in processes which they likely will expect of their own future students.

### **Barcelona context**

To become a primary school teacher in Spain, students must take a three year degree in a teacher education program at a university. Each program consists of approximately 220 credits, varying slightly in different universities. On average the courses in a program consist of 4.5 credits (10 class hours per credit). There are six different specializations: Special Education, Music, Physical Education, Primary teacher, ESL, and Kindergarten. The practicum is normally 32 credits. Some universities distribute the practicum equally among the 3 years, while others reserve an entire trimester for students to work in schools. All courses are taken in the Department of Education of Urbano Universidad, and after the program students are certified to step into a classroom.

An introductory educational technology course is required during the very first year of the pre-service program in Spain. (In this case the course was taught in the Primary Education Department of the university.) This means that the pre-service students in the course tend to be very young—in fact, most are just out of high school and they have little life experience and no experience of thinking about issues of education, other than their own student experiences. Most of the students learning to be primary school teachers in Spain are women and, generally speaking, they tend to be technology shy. (With every passing year more have had at least some experience with computers and, similar to other European youths, they are all comfortable with cell phones.)

Given that the course was a standard educational technology course, the pre-service students were to be introduced to various information technology applications and to learn some of the skills for their use, similar to the situation described with regard to the Chicago context. At the same time, there was an attempt to go beyond traditional skill approaches by getting students to think about technology in ways that might plant the seeds for a deeper conception of technology integration

when they became teachers. This was a difficult task because of students' lack of theoretical and practical experience. For instance, because they were just beginning their program, they did not understand (let alone have experience with) the most elemental concepts concerning unit design, objectives, activities, and evaluation. In spite of these hurdles, there was a genuine curiosity to see how far they could go with the idea of meaningful technology integration.

## **Two Different Approaches to IT in Teacher Education**

The Chicago and Barcelona authors of this paper have taken two unique constructivist approaches to teaching information technology in their teacher education programs, and one can see interesting differences in ways of tackling the information technology problem. The Chicago setting emphasizes Creative Play which encourages students to experiment with technologies in a playful but serious way—the assumption is that stressing a student's creative side will allow them to become comfortable with a technology and to explore its educational potential. The Barcelona setting emphasizes the idea of a Coherent Website which takes educational aims as primary—students are guided through website construction (as one technology) in a way that focuses on educational objectives to insure that they keep clearly in mind that technology is in the service of education, not the object of it. Each of these constructivist approaches has been in response to the inadequacies of a standard transmission/skill approach.

### **Chicago—Creative Play**

A constructivist approach to teaching and learning is the antithesis of transmission, memory, and rote feedback. In a constructivist approach, students as individuals are encouraged to take seriously their personal way of seeing the world, of learning, and of being. They are encouraged to assess what needs to be done in a teaching/learning situation and to look into themselves for ways to construct—to make—whatever they do in response to the situation uniquely their own. Students are encouraged to construct their own meaning of their experiences, and, as future teachers, they are challenged to do the very same thing for the students they will teach in the future. This is a tall order. In a current (American) social environment where the emphasis and context for teaching and learning is to "leave no child un-tested," it is ever more difficult to liberate one's self as a teacher from transmission approaches to curriculum and to participate in the establishment of classrooms and schools where students can and are encouraged to make their own meaning of the world around them. That is one of the biggest challenges faced by those who will teach in American schools.

Information technology is a double edged sword. It promises opportunities for teachers, classrooms and schools, but it also poses challenges. Teachers may comprehend the virtues of information technology in the abstract, but the path to "learning how" can be steep and rocky. The challenge is even greater for the pre-service teacher, who, in the absence of experience, has to envision what it will mean and require to become a teacher. Can the incorporation of technology in pre-service teacher education be used as a tool to help pre-service teachers candidates to plum their own resources to find ability and potential they may not have thought they possessed? It is a question that emerged when students were observed to go beyond the routine mere completion of assignments. It became apparent that some students began to view assignments more as "art

projects” than as traditional, required assignments. For these students, engaging in *creative play* clearly took them “beyond themselves” to a new-found awareness of potential and possibility. Students who entered the course with technophobia and reluctance not only gained confidence in themselves, but they became more aware of what *could* be accomplished through what they themselves *did* accomplish.

Creative Play, therefore, takes on a broader significance than simply thinking about how to use technology in intelligent ways in the classroom. Students need to project themselves into a barely imaginable teaching future. As one might expect, the task is more difficult for the less experienced—undergraduates typically struggle more with this task than their graduate counterparts. However, once students begin the process of projecting, it seems to get easier with each successive attempt.

In the course, students are instructed to carry out a string of 9 different assignments, and the first few are designed to begin this process of projection and reflection. The first is the construction of a parent newsletter, one they will use in their future position. Students must imagine the grade level, the students, and then the parents of these students. They then must ask themselves “what will these parents (my future students’ parents) want to know about my class?” The task is very different for early childhood and secondary candidates, and it is quite common that many have only considered this in the most cursory fashion. They must construct four original articles for parents for the first two pages, and a third may be drawn from material they find on the Internet. In producing the articles, they begin the “play” process in terms of the content of the newsletter. Once formulated, they format the newsletter by going through instructions provided for them on a web quest constructed for this project. In this first project, a few usually get caught up in the process and wind up surprising themselves with what is possible and what they themselves can do. When these first student-produced documents are shared voluntarily among the class, they get to see the different ways other(s) approached this task. Usually, this begins a process of stimulation and challenge and a spirit of “maybe I can do that”. The next event is a student produced power point presentation on a reading from the text produced and presented to the class by pairs of students. With each successive assignment, students are continually challenged to look ahead and to produce something they can use in their future teaching. They are continually encouraged to think in terms of using technology to motivate, to solve learning challenges, and to enhance the teaching and learning environment they will create in the future.

The following figure is an example of one student’s newsletter and was created by a student seeking their certification for the primary grades (K – 3). Students were instructed to use Microsoft Word, to imagine the parents of the students they would teach, and to produce a two page newsletter that would of interest to these parents. This student was not experienced in the use of technology, but who like many in the class, became engaged and enthusiastic in the provision of information to her future parents, but also in making the newsletter engaging and attractive itself.



### FREE LITERACY WORKSHOP

**EVERYONE** is welcomed to join Greene Elementary School in the Fourth Annual Literacy Workshop held Saturday, October 18, 2003 from 10am to noon. Parents are encouraged to bring their children.



The workshop will be presented by Sheila Coffin from Roosevelt University. She is a full-time professor and chairperson of the Early Childhood Program at Roosevelt University, both Chicago and Schaumburg Campuses.



The workshop will consist of different literacy activities that will help you become a better reader and also participate, involve, and expand your and your child's literacy knowledge. Even if you believe that you are not a book lover, after this workshop you may just become that.



The workshop will also have other activities available for your children. Members of Future Teachers Organization will be hosting the different activities.

**NOTE:** There will be **FREE** breakfast and lunch will be served for all participants.

## PRESCHOOL BOOK CORNER

JOIN US...

Every month we will be sending and posting a booklist that YOU can read with your child. This will continue the child on a love for reading path that will be beneficial throughout their entire life.



Many of the booklists will coincide with our monthly theme; others may be on current issues taking place in the classroom. We want to encourage children to read and experience the different adventures through a book. If you have any other book selections **PLEASE** do not hesitate to add to the list. It is always good to have a growing book list.



**IMPORTANT NOTE:**

READ to your child at least 20 minutes a day, whether it is a newspaper or billboard signs while driving, it will help them in them in the end.



# LETTER of the WEEK

The letter of the week is... "**Bb**"!

Bip, Bip Boorah!!! Let's hear it for "**Bb**"!!!

Children will be learning about the different characteristics of the letter "**Bb**". Children will learn the phonetic sound of "**Bb**" and write the letter, as well.

Some Activities will include:

- **B**aking **B**anana **B**read 
- Dancing to **B**opping' Music 
- Reading "**Bb**" **B**ooks 
- "**Bb**" Letter Collage 
- "**Bb**" Letter Hunting 
- **B**ug Observing 

**CHALLENGE:** How many "Bb's" can you find in this newsletter? (Answer in NEXT Edition)

**TASKS:**

- Read Aloud with Children
- Family Style Lunches
- Storytelling
- Field Trip Chaperones



**OCTOBER THEME**

***RIDDLE ME THIS?***

What has eight eyes, eight legs, & is very hairy?

The Tiger's will be learning about **SPIDERS** for the whole month of October.

They will study different spiders and different spider webs. The children will learn the many characteristics of spiders and their webs.

Some Activities will include:



Spider Snacks



Spider Art



Preserving a Spider Web



Spider Watch

**ANSWER:**  SPIDERS 



**WHAT:** Spider Exhibit

**WHERE:** Peggy Notebert Museum

**WHEN:** October 15, 2003

**WHO:** The Tiger Room

**WHY:** To Check out & Feel Some Really Cool Spiders.

**NEEDED:**

- Signed permission slip w/ Field Trip money for child.
- Signed chaperone agreement
- Bag Lunch (Disposable)
- **NO LUNCH BOXES**

\*Box Lunch will be provided for those without bag of lunch.

**SCHOOL SPIRIT WEEK**

Monday

October 6, 2003

**BACKWARDS DAY**

(Children will participate in different backward activities)

Tuesday

October 7, 2003

**GREEN & WHITE DAY**

(Children can either wear or bring something in with the school colors)

Wednesday

October 8, 2003

**GREEN & WHITE FOODS DAY**



(Children will eat different green and white foods)

Thursday

October 9, 2003

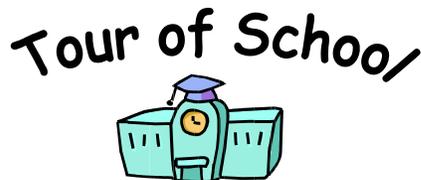


**CRAZY HAT DAY**



(Children will bring in a hat or one will be donated and decorate it)

Friday  
October 10, 2003



(Children will take a tour of school building and classrooms)

### **CHECK THIS OUT...**

Visit these websites with your child and have fun learning!

- [www.virtualpre-k.org](http://www.virtualpre-k.org)  
This Website gives parents different learning activities to do with your child.
- [www.nickjr.com](http://www.nickjr.com)  
This website offers fun Nickelodeon activities to do at home.
- [www.healthybaby.com](http://www.healthybaby.com)  
Learn more about health issues on your child.
- [www.preschooleducation.com](http://www.preschooleducation.com)  
Try some of these wonderful cooking activities with your child.

*Delicious!!!*

Enjoy these wonderful recipes at home with your children. Fun, Easy, & CHEAP!

### **BANANA POPS**

#### **Ingredients:**

- \* 1-1/3 cups toppings such as almonds, sprinkles, coconut, and or graham cracker crumbs.
- \* 4 just ripe bananas (peeled)
- \* 8 wooden popsicles sticks or forks, spoons, etc.
- \* ½ cup of honey or some kind of sticky substance

#### **Procedure:**

- \* Cut bananas in half.
- \* Place toppings on plates.
- \* Place half banana on stick
- \* Place banana on wax paper.
- \* Pour at least 1 tsp. of honey on banana.
- \* Roll honey soaked banana onto toppings.
- \* Let honey dry.
- \* VOULA!! Enjoy your Banana Pop!!

## **SPIDER SNACK**

### **Ingredients:**

- \* 2 round crackers,
- \* 2 tsp. Peanut butter
- \* 8 small stick pretzels
- \* 2 raisins

### **Procedure**

- \*Make a “cracker sandwich” with peanut butter
- \*Stick the pretzel “legs” in the middle of the sandwich.
- \*Stick the raisin “eyes” on top with just a dab of peanut butter.
- \*VOULA!! Enjoy your SPIDERSnack!!

Every class has been a mixed bag in terms of the extent to which students are stimulated to think creatively. But in each class there are a few students who take the “creative” ball and run with it. In some cases it is in the content and in others is the computer application itself. Students are introduced only to the rudiments of Power Point, and they explore and teach themselves the rest. With web-based tools, students are introduced to a few simple HTML tags, and they discover other codes and use them to go far beyond requirements of the assignment, producing some quite remarkable products in the process. As stated earlier, they surprise themselves, doing and accomplishing more than they thought they could. By design, this experience is intended to mirror how they will work with the students they will eventually teach, a point that is emphasized in the course discussions.

Teacher preparation programs need ways of stimulating students to engage a process of projection and reflection. Incorporating technology into one’s teaching may present a significant catalyst, for this process. The extraordinary extent to which some students are moved to creative thinking (and the time they take to “play” with these new-found tools) is noteworthy—it is one of the reasons for coining the term, creative play, and giving the phenomenon a hard look. Discussions with colleagues who have been attempting to infuse the intelligent incorporation of technology into teacher education have revealed that a comment element whenever students express excitement about information technology in education is the element of “play”. When students were asked what inspired them to accomplish what they did, their response repeatedly used the term “play.” “Playing” had led them on a path to exploration. Perhaps creative play is one strategy for motivating students to go beyond merely completing assignments to discover potentials within themselves and for the integration of information technology in the classroom. IT instructors who encourage creative play—who give permission to be creative—may have a way of motivating their students to see greater worth in their own learning about teaching and learning. There is little question that technology in education is enabling efforts to assess, monitor, track, and organize data traditionally used to measure student achievement over time. However, our experience with creative play suggests that technology can also be used to inspire creativity and serve as an

impetus for teachers and students to reach inside themselves for new and different ways to “achieve.”

## Barcelona—Coherent Websites

The approach to teaching information technology in the Barcelona context was considerably more structured than the creative play situation described above, a feature that was no doubt due, in part, to the more highly structured (and, frequently, transmissive) mode of teaching and learning in a European context. The vehicle for encouraging pre-service students to “think” in more integrative ways was the construction of websites. *Website construction* would be a means for learning about *teaching*—the substance of the website would push them to think about things they would have to deal with when they became teachers: units, objectives, activities, evaluation, and so on. It was anticipated that with a little direction students could learn technological skills and would grow in their confidence with experimenting to learn. The type of website construction we had in mind emphasized collaboration and connection—what we have called *coherent websites*.<sup>3</sup>

Coherent school websites are different from standard websites in that they emphasize the process of website construction rather than the final product. Furthermore, the content of a coherent website is meant to go beyond simply providing information. The overall aim of a coherent website is to contribute to the development of a collaborative learning community that emphasizes the connections among knowledge and skills in a school. A coherent website is not the product of a professional. It is constructed by students and teachers and its primary function is to engage them in learning that stresses connections in a curriculum—it has the potential for fostering the integration of technology and classrooms. If we begin with pre-service education there is the possibility of providing images and ideas to pre-service teachers that might bear fruit later in their teaching.

The general characteristics of a coherent website pertain to process, content, and structure. With regard to *process* the eventual aim is for teachers to work with each other and with their students to construct connected websites which help students collaboratively learn significant concepts. However, in a teacher education context, the immediate aim is to assist pre-service teachers to work with each other—the emphasis is on a collaborative learning process of constructing websites and linking them together. The focus of the process is always on, “what educational goal(s) will this website support?”—the process is to be collaborative and focused on educational goals rather than technology. With regard to *content*, a coherent website should actively engage students in learning significant educational goals—again, in the context of teacher education, pre-service teachers use website construction to learn about curriculum they will one day teach. As with any website, a coherent website contains various kinds of information, but the idea is that the information should go beyond simply listing facts. The content should concern a topic that pre-service students will eventually teach, including the activities and evaluation that would fit that topic. With regard to *structure*, a coherent website consists of several websites that are linked according to meaningful

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<sup>3</sup> The discussion in this section is more fully articulated in Álvarez, I and Kilbourn, B. (2004) “Websites Construction as Learning Tools,” *Teoría de la Educación: Educación y Cultura en la Sociedad de la Información* (Monográfico: “La construcción del conocimiento en la red”) v5, n1. ISSN 1138-9737. [http://www3.usal.es/~teoriaeducacion/rev\\_numero\\_05/n5\\_art\\_alvarez\\_kilbourn.htm](http://www3.usal.es/~teoriaeducacion/rev_numero_05/n5_art_alvarez_kilbourn.htm)

content and are accessed through a “home” site. Visually, a coherent website is a spider-web in which each intersection is a website with the “school” website at the center. As with more sophisticated commercial websites, a coherent website must allow a user to move from one linked website to another within the “web”.

The actual process of coherent website construction began by putting students into small groups and introducing them to Yahoo Website Maker. After practice sessions to become familiar with the rudiments of the program, they were instructed that the coherent website constructed by each group should contain four “sub-websites” according to (a) Introduction, (b) Topic, (c) Activities, and (d) Evaluation. The topics had to come from the published K-8 curriculum guides, which was important because it meant that they were immediately immersed in educational issues and the technological skills were put into the background. Pre-service students developed topics such as: Body Parts, Colors, Craftsmen, Provinces, Farm Animals, Fruit, Letters, Marine Animals, My City, Numbers, Squares, Work.

Having a single topic as a backbone from which to work was important because it began the process of imagining a topic they would one day teach; it also began the process of thinking about what activities would support the chosen topic, and how those activities could be evaluated. After selecting a topic from the curriculum guides, each group used Yahoo’s website maker to locate the topic as a website. The minimum guideline was that after naming the topic they had to write down the goals they wanted to accomplish. Once they were finished, they worked on the construction of another website that listed possible activities for the topic. Finally, they constructed a third website which gave guidelines for evaluation of the activities. When these four websites were linked, they constituted the group’s coherent website—the site was coherent in the sense that the individual websites were technically and conceptually linked.

At this point in the process there were 12 different coherent websites, each constructed by one of the 12 groups and each containing four sub-websites (Information, Topic, Activities, Evaluation) were then linked into a “coherent school website.” This was done in order for pre-service students to see how the technology potentially could be used to create a school community in which teachers (and students) would be able to see how various concepts were linked and dealt with at each grade level in the school. Obviously, the work of these pre-service teachers was only a beginning on that rather ambitious agenda, but nevertheless it was consistent with the aim of using technology in integrative ways.

The figure below shows the Introduction (the title of the introduction and the names and pictures of the individuals of the group have been edited out to maintain anonymity) of a group’s website on fruit. At the top are the other sites (Topics, Activities, Evaluation) related to this “Introduction” website. Below that is “LINKS a altres pàgines de la nostra escola” (Links to other pages in our school). As can be seen in the figure, each of the other websites is linked according to its Introduction, Topic, Activities, and Evaluation.



### Introduction to Fruit

The group websites were now able to connect with each other. For instance, the group working on the topic “Fruit” could log onto other groups’ topics, activities, and evaluation without having to log off from their own website.

Not surprisingly, given their lack of experience, these pre-service teachers found dealing with issues about curriculum, teaching, and learning to be very difficult. The selection of topics and subsequent articulation of objectives and appropriate activities, let alone evaluation, proved to be a serious stumbling block. Although the use of curriculum guides was helpful and realistic (insofar as that would be what they would have to do as teachers), the guides themselves are very general. Another type of problem emerged when one group decided to add more websites to their own structure, but they had missed the point that the additional websites should be conceptually linked to an educational issue. The group explained that they had taken computer courses when they were in high school and that helped them for this course. They were keen to continue making more sub-websites—they were quicker at the tasks than the other groups and wanted to move beyond where most people had finished. Their addition sites, however, had almost nothing to do with their chosen topic. Left to their own devices this group shifted to a more standard website production and quickly forgot about issues of coherence and connection.

However, on the bright side, these very young students immersed themselves in conversations about teaching and learning that were very much anchored in serious educational questions rather than the bells and whistles of the technology they were using to capture those discussions. Also, unlike the generally abstract theory courses that are common in their (Spanish) pre-service curriculum, their attempt to visualize a virtual school, captured by the idea of a coherent school website, and their use of the curriculum guides got them closer to practical classroom issues earlier in their program than might have otherwise happened. In fact, the very form of the basic coherent website construction reinforced important distinctions that a primary teacher must deal with on a daily basis.

With regard to the technology per se—the actual construction of websites—all of the groups were able to construct coherent websites with no more difficulty than might be expected of someone

learning a program for the first time. As group conversations were overheard, we came to the conclusion that, because most of their experience with technology was limited to entertainment (VCR's, cell phones, computer games, etc.), it came as a bit of a shock that they would have to use technology to do work—it seemed to be an idea they had never really considered before. However, a number of students commented on how exciting it was that they had started out computer illiterate and petrified of touching a keyboard and they had ended up having constructed an actual website. It became clear that most of them (not all) understood the difference between a coherent website and a standard school website. As one student remarked, “most school websites are propaganda for parents, [whereas] coherent websites are for students to do work.”

## **Conclusion**

The documentation and analysis of alternative approaches to teaching information technology grew out of our common interest in constructivist teaching and learning and shared sense of the difficult task of working with pre-service teachers who have little or no classroom experience. Even though we are coming from different educational settings (North American and European), informal discussions (at past AERA conferences) suggested that each situation had something to teach the other and that the commonalities and differences in the two settings merited a more systematic analysis, one which would be of interest to local and globalized audiences.

In spite of differences in countries and cultures, we teachers (professors) of the students enrolled in IT courses in the two teacher education programs share many of the same goals, and we are working toward those goals via different paths. The goals stem both from the common commitment to constructivism as a conceptual framework and from the practical need to provide pre-service teachers with the knowledge and skills necessary to incorporate technology in intelligent and useful ways when they become teachers, regardless of the culture or country. The examples of student work that stem from Creative Play (Chicago) and from Coherent Websites (Barcelona) present interesting alternatives to disconnected, transmissive modes of teaching and learning information technology. In an increasingly globalized world, it seems fitting to begin a more general conversation about teaching information technology—a conversation in which we learn from each other. What did we learn?

The problems encountered in these two different settings are quite similar and reflect the educational tensions engendered by lack of experience and technophobia in pre-service situations. In these two settings, the ways of responding to those tensions were very different and, in turn, reflect cultural/educational differences. However, in spite of those difference, each setting clearly has something to teach the other, and it is this feature that will be highlighted in the paper. From recent analyses and comparisons, the following conclusions can be sketched.

With regard to the particular settings:

- In the Barcelona setting, the case-studies developed for engaging pre-service teachers to create Coherent Websites and the act of creating the websites themselves clearly involved students in discussions about pedagogy and curriculum that they would have unlikely had with a transmission/skills approach. Students frequently remarked about pedagogical issues that they “would never have thought of” before this activity.

- Again, in the Barcelona setting, at the start students had difficulty with the constructivist approach (these are students who have experienced only transmission teaching/learning) and complained about how consuming it was in time and energy even though they grew to understand and enjoy the approach.
- In the Chicago setting, students were given a variety of assignments relating to classrooms and were asked to “play” with technology software and explore their interests and particular talents, but to create nothing that they thought could not be used in future classrooms. By imagining their future student population, students tapped into their experiences and training to produce something useful and personal. Most students responded positively to this challenge and developed strong ownership and satisfaction in their creations.
- Again, in the Chicago setting, moving from a transmission to a constructivist mode was a difficult transition for a number of students. Some seemed better adapted to risk and pushing limits. Students found their peers to be an important resource. Through sharing their work, they stimulated each other, effectively raising the bar of expectations. Initial discouragement was replaced by motivation.

More generally, with regard to both settings:

- Technology, intelligently applied, may hold significant potential for creating learning environments in which pre-service teachers can break through traditional boundaries and explore their individual and group capacities for thinking and creating.
- This inquiry suggests that more creative and engaging ways of teaching information technology in pre-service teacher education can help pre-service students think about what classroom life will be like for them when they become teachers. Although our data do not allow us to come to any conclusions about how these students will actually use technology in the classroom, their feedback and conversations (in both settings) lead us to believe that, if resources allow, they will likely move in constructivist directions.
- There are clear cultural differences in the two settings and these differences did in fact shape the nature of a constructivist approach, but in spite of the differences, students in both settings were able to engage the use of information technology in ways that went far beyond a standard transmission/skill approach.

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