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CAPES/FIPSE year one experience report: why begin with math learning objects?

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ABSTRACT

This experience report describes one student's perspective about being a part of the first CAPES/FIPSE exchange session that brought her to study at Universidade Estadual de Campinas (UNICAMP) in Brazil from Utah State University (USU) in the United States. In June and July 2010, this student joined two other university students to present the CAPES/FIPSE project and the related math learning objects at four schools in Campinas. This article provides an overview of the project and offers this student's thoughts about possible reasons for the instructors' immediate responses and future plans with the digital learning objects.

KEYWORDS

CAPES/FIPSE; International student exchange; Digital learning objects; Cultural affordances; Instructor education

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CAPES/FIPSE: um relato de experiência do primeiro ano: por que começar com os objetos de aprendizagem da matemática?

RESUMO

Este relato de experiência descreve a perspectiva de uma estudante sobre ser parte da primeira sessão de intercâmbio CAPES/FIPSE, que a trouxe para estudar na Universidade Estadual de Campinas (UNICAMP) no Brasil, da Utah State University (USU) nos Estados Unidos. Em Junho e Julho de 2010, essa estudante juntou-se a outros dois estudantes universitários para apresentar o projeto CAPES/FIPSE e os objetos de aprendizagem de matemática para quatro escolas em Campinas. Esse artigo fornece uma visão geral do projeto e oferece pensamentos dessa aluna sobre as possíveis razões para as respostas imediatas dos professores e planos futuros com os objetos de aprendizagem digitais.

PALAVRAS-CHAVES

CAPES/FIPSE; Intercâmbio internacional de estudante; Objetos de aprendizagem digital; Saliências culturais; Formação de professores

INTRODUCTION

I appreciate the incredible opportunity I have had to participate in the first year of an exchange program that took me from Utah State University (USU) in the United States (US) to Universidade Estadual de Campinas (UNICAMP) in Brazil. During my time in Brazil, six weeks during June and July of 2010, I was able to attend university classes, collaborate with UNICAMP students, and co-present the project to instructors in public and private middle schools in Campinas. These presentations were conducted as a part of an exchange program sponsored by Coordenacão de Aperfeicoamento de Pessoal de Nível Superior/ Fund for the Improvement of Post-Secondary Education (CAPES/FIPSE). During our presentations at their staff meetings the middle school instructors raised thought-provoking questions about the project goal of supporting instructor exposure to mathematics learning objects (LO). For instance, despite their obvious interest in the project and LOs, the most common question we received was "why did you choose math as a topic?" It was an excellent question about the nature of the project that had not been previously discussed between our presenters.

I will use this question of "why math" as a framework to discuss my experience as an exchange student in the first year of the CAPES/FIPSE project. This article will also address issues of cross-cultural application of digital learning objects with affordances, promoting cultural awareness and language learning for US and Brazilian university students, and the upcoming three years of this project.

CAPES/FIPSE PROJECT

My exchange experience was made possible when professors from four universities were awarded a grant to study, create, and promote digital learning objects for middle and high school instructors in Brazil and the United States. The participating professors and universities from Brazil are Sergio Ferreira do Amaral and Visiting Professor Tel Amiel of UNICAMP and José Aires de Castro-Filho Universidade Federal do Ceará (UFC) of Brazil. The professors and universities from the United States are Professor Richard P. West of USU and Professor Michael Orey of University of Georgia, Athens (UGA). This

four-year grant, cooperatively awarded by the Brazilian Ministry of Education and the US Department of Education, is called CAPES/FIPSE. Through this grant the professors and universities endeavor to support improved technological and cross-cultural knowledge of individuals at the post-secondary education level.

Together, the Brazilian and US professors who wrote and submitted the grant established guidelines to allow students and professors to pursue their individual interests while also meeting the needs of the project. These guidelines include but are not limited to: 1) developing a repository of practices and products to promote creation and use of learning objects with cultural affordances, 2) training educators in Brazil and the US to use culturally appropriate digital learning objects for classroom instruction, and 3) promoting cultural awareness and language learning for university students. The project is designed to allow for equifinality, for the same general goals to be met in different ways as appropriate for separate sessions of the project.

Determination of priorities depends upon both the overall needs of the project and the unique combination of professors and students who collaborate during a particular project session. In essence, three primary yet varying influences on a team's experience are: 1) the interests of students and their sending universities, 2) the opportunities available with university professors at the hosting university, and 3) session of the project, whether first, second, third, or fourth year. The amount of emphasis placed on each of these three components is decided by the unique mix of professor(s), opportunities created through community connections, and US and Brazilian student agreement during their university exchange period. For instance, the priorities of the first year of the project with team members from USU and UNICAMP are unique due to specific factors that will not be present in later sessions. On the other hand, UNICAMP and UFC students who travel to UGA and USU during the second year of the project will have a different experience than if the same students participated during the final year. One purpose of the project is to balance in a flexible manner the overarching project goals with the varying priorities and opportunities of the separate universities during different project sessions.

UNIVERSITY STUDENTS

In each year of the project the CAPES/FIPSE lead professor of each university reviews applications and chooses students for the session year. The professor(s), sometimes with the support of a project assistant, reviews each application and eligible students are invited to interview. After this interview students are asked to participate if they agree to a year-long commitment to the program within which the student will fulfill both the needs of the project and the home university's academic prerequisites. As designated by the CAPES/FIPSE grant, students from Brazil are undergraduate level whereas students from the United States are graduate level.

This interdisciplinary cross-cultural opportunity attracts applicants from a wide range of departments including multicultural human services, education, and instructional design with a technological focus. Prerequisites for my home university include official registration as a graduate student enrolled in an academic department matching the needs of the project and a desire to collaborate across cultures. In addition to meeting the prerequisites of their home university each students agrees to the project requirements: work with the project for at least a year, attend an online multicultural class through UGA, attend classes as a visiting scholar in a country that is not theirs (Brazilian universities host US students; US universities host Brazilian students), and to become proficient in the language of the host country in order to navigate socially and scholastically.

THE EXCHANGE PROCESS

Each student's participation in this project includes work at his or her home university and the completion of the exchange at a university abroad. In this time university students have the opportunity both to live in a country different than their own as a visiting student and to gain experience as a host for visiting student. During the project year students take classes from the other universities in the consortium. This ensures each student takes comparable classes and also offers students access to professors with similar interests who work in universities outside of the student's home university.

During the USU-segment of the first year of the CAPES/FIPSE project both exchange student teams collaborated to create learning objects to demonstrate to instructors who could then use them to teach middle school students in Brazil. USU math professor, Robert Heal, offered digital math learning objects (DMLOs) from the National Virtual Library of Mathematics (NVLM) a website originating on the USU campus. The CAPES/FIPSE students translated and localized six out of 50 learning objects for Brazilian middle school instructors to use in their classrooms thereby adding to the other Chinese, English, French, and Spanish languages already available on the website (see MUFFOLETTO, 2007) for more information about NVLM].

The learning objectives addressed through the digital math learning objects include a range of goals specified in the São Paulo Mathematics Curriculum. To better ensure these DMLOs would be useful to the instructors and students within their classrooms CAPES/FIPSE students teams investigated the goals specified by the official state curriculum and matched them with opportunities available through the DMLOs. For instance, to improve student understanding of using fractions, decimals, and natural numbers instructors can provide students time with the LO called *Diffy*, a shortened word indicating that the purpose of this DMLO is to practice finding the "Difference" between numbers in various forms. With these activities students create and solve math exercises to practice these particular concepts. Using the DMLO offers the benefit of rapid reward or correction to student efforts, different methods to approach math concepts, interaction with colorful and engaging math materials, and increased proficiency with electronic media.

After working together in the US the first year CAPES/FIPSE student teams branched into two groups, one to train educators in Campinas and the other to train educators in Fortaleza. What became clear after arriving in the two different cities is that the university student exchange experiences would diverge widely depending on the scheduling flexibility of the middle school instructors and students. Since my experience is with UNICAMP this experience report will emphasize Brazilian experiences from Campinas.

LEARNING OBJECTS IN CAMPINAS MIDDLE SCHOOLS

Due to unforeseen events USU students participating in the first year of the CAPES/FIPSE project arrived in Brazil one month later than originally planned. Unfortunately this meant that the Brazilian children would only attend school for three more weeks before beginning a long holiday. The changed schedule reduced the opportunities to implement a two-step plan to work with the instructors and students in the Brazilian middle schools. Rather than meeting with instructors twice we met them once. This meant that we could train them to use the learning objects and suggest ways to connect the new modes of instruction in their classrooms. However, without a second meeting we could not support the instructors using the DMLOs directly with students to meet curriculum components within the classroom environment. The magnitude of impact of receiving one rather than two sessions seemed dependent upon the instructors' previous level of experience with digital learning objects and related educational technology.

Although most instructors were interested and agreed that the digital LOs could be useful, they actively considered how to use them within their own school as appropriate to the levels of access to technology and prior technological training. Some school had more advanced technology (faster internet and newer computers with electronic whiteboards) and/or more experience working with Laboratório de Novas Tecnologias Aplicadas na Educação, or Laboratory of New Technologies Applied to Education (LANTEC). These instructors were able to experience the DMLOs directly, quickly gaining enthusiasm about using them with the students in the following school term.

In contrast, it seemed that instructors at schools with comparatively less technological capacity accessed the DMLOs in different ways and asked more questions about using them with the curriculum. Perhaps instructors with fewer previous opportunities with the technical aspects of the learning objects had more reason to question the purpose of using math as compared to other subjects. It is important to note that the question of "why math" did not seem disapproving. Instructors of math and other subjects asked questions in the context of being attentive while acknowledging their interest in how to use these teaching tools.

The instructors became more enthusiastic when we reminded them that the Brazilian Portuguese math learning objects were free and would continue to be accessible through the internet even when we were not present. In a couple of schools the math instructors provided ideas for additional DMLOs and one instructor offered helpful feedback about a design feature.

Despite our limited time with each school the project inspired positive interest in using digital learning objects in the classroom. Although we presented to instructors in only four schools there seemed to be a common trend: higher levels of technological capacity in the school had more instructors who shared their visions for using the DMLOs in their classroom. Instructors in schools with less technological capacity were willing to consider using the DMLOs but seemed to desire more explicit discussion of the benefits and costs. Working with instructors in schools with different levels of technology clearly showed the need for a presenter to be knowledgeable about different ways to discuss the DMLOs and thoughtful about what types of accommodation could be offered immediately compared to which could be accepted as feedback for later versions.

REPOSITORY OF LEARNING OBJECTS WITH AFFORDANCES

Students and professors from these four universities will continue working together over four years to modify existing and/or create new learning objects that are labeled "open" or free to use and change to meet each instructor's instructional needs. Digital learning objects, when created as "open educational resources" (OER) are different from traditional print materials in that they offer a greater degree of flexibility in how they can be created, used, and reused. The very flexibility that provides exciting potential for transfer across culture necessitates a greater discussion of how to make these learning objects most accessible and respectful for different audiences. For instance, math concepts might be largely universal in terms of addition, subtraction, multiplication, and division, but the manner of teaching and examples used might vary widely between cultures.

When considering the usefulness of a learning object intended for use by individuals in different cultures one question to ask is how much adaptation must be made by the person who designed the LO compared with the person using the LO. For this project these adjustments are called "affordance." Amiel, Squires and Orey (2009) discuss learning objects and how easily each can be used by instructors in various multi-cultural contexts using terms such as Learning Object with Cultural Adaptability (LOCA), , *n-Design*, and Learning Object with Multicultural Affordances (LOMA).

Learning Objects with Cultural Affordances (LOCA), contains an attribute Amiel, Squires and Orey (2009) offer as the most challenging to design but the most useful for users across cultures. Providing an opportunity for the end user to alter the learning object according to his or her own needs within his or her culture creates a learning experience that can be more appropriate to the learner's context. The designer cannot be expected to think of every possible option for how a learning object may be used. Instead it can be helpful to include a manual for altering the learning object, for promoting augmentation of the original.

n-Design emphasizes the design component of a learning object, noting that individuals from a number of different cultures collaborated to create a product that is particularly appropriate for end users who share the same cultures represented on the design team (AMIEL; SQUIRES; OREY, 2009). The number of cultures represented by designers involved should be documented but there is no ideal number so the "n" in *n-Design* merely indicates the culture(s) represented. In practice, there may be a different level of concern about whether the learning object is culturally appropriate since it is intended for use by the end users who share the same n-culture(s) that match the *n-design*(ers). At least in theory the LO will match the needs of the end users without a substantial amount of augmentation in terms of language options and examples used.

Another approach, LOMA, indicates that the learning object is not easy to change but can be used by the instructor to teach both the subject material and about the culture from which the designer originates. We followed the correct protocol of consulting our cultural liaisons, the Brazilian university students who were on our team. They shared their experiences of using *Material Dourado* when they was in school and could provide the

Brazilian Portuguese correct name – it was not a direct translation from English title "Base Blocks." What we learned through presenting the math learning objects was that one of the objects is not typically used in math instruction. The Base Blocks, or *Material Dourado*, was used in the past and can be seen on storage shelves in many of the schools, but instructors told us they use different materials now. This was a good example of a case for which we thought we were being culturally sensitive by using the proper names for the object, but because the materials were out of date we were still not entirely culturally appropriate.

TRAINING EDUCATORS TO USE CULTURALLY APPROPRIATE DIGITAL LEARNING OBJECTS

During our time in Campinas we were invited to present the math learning objects during staff meetings at local middle schools. The instructors shared time in their staff meeting agenda where we learned about their concerns and hopes for teaching and managing students. We could then better understand the classroom, computer lab, and school environments where instructors would use the technology. This practice of listening to the instructors before presenting allowed us to account for the "human and social factors that are critical for learning" rather than promoting the math learning objects regardless of their school context (SALOMON, 2002, p. 73).

One way we tried to predict a possible concern of the instructors was to connect the learning objects to the state government mandated São Paulo math curriculum. To do this we followed the USU Instructional Design department's lead in using a backwards design approach to connect the math learning objects with the curriculum. A useful overview can be found in the *Understanding by Design Professional Development Workbook* offered by the Association for Supervision and Curriculum Development (2004). Each learning object we created included steps to model for instructors how they might use it in the classroom. With a second visit with each school we might have been able to collaborate with instructors to create a systematic way to meet curriculum goals while using the learning objects.

We visited four schools and in each school instructors were interested in learning more about the CAPES/FIPSE project and the math learning objects. The instructors were all very welcoming and we learned through these different experiences about the prime

conditions for us to present given our tools. By providing training from university students and access to technological teaching tools CAPES/FIPSE aims to minimize potential difficulties of introducing technology without providing training or awareness preparation. Mark Warschauer discusses these difficulties in his 2002 article, "Reconceptualizing the digital divide." He posits that while lack of access to technology is part of the problem, another part of the problem is actually rooted in the thought patterns and expectations of instructors and students who are not accustomed to incorporating technology into their teaching and learning processes. This was made clear during our school tours when we learned that official knowledge of campus computer labs was allocated to one or two staff members. Each school had a computer lab but access to the equipment was commonly dependent on the presence of a single staff member who was trained to help students and other instructors. If this expert staff member was not available then students and staff could not access the computers.

We learned from the instructors that many of them were interested in using the digital learning objects but they had important questions about what to do if they planned a lesson using the LOs but then the equipment was not functioning or was not available. We saw this happen in our own presentation at one school where on the day of our presentation the internet in the staffroom was disconnected and the Java applet required for access to the NVLM was not installed on the computer provided. Since visiting the computer lab was not an option we needed to be creative in presenting our concepts without the internet-dependent examples we had used in other schools. We accepted this as an important example of the need to view digital learning objects as a tool to use within a larger lesson plan. There are times when digital learning objects will be used by instructors as a resource of information and activities rather than used directly by students. Planning for different scenarios will help support instructors in innovative instruction rather than limiting the usefulness of the learning object to when the physical technology is working properly. Storage of the equipment was also an issue, with one school reporting that the computers could not be used for a portion of the school year due to overheating in a poorly insulated room.

UPON REFLECTION

Another layer of this project addresses an essential question: how does one learn to clarify the difference between using materials that are culturally sensitive compared to those that are culturally appropriate. We offered blue digital *Material Dourado* to the instructors for use in their classrooms or computer labs. This was after following the protocol of consulting our cultural liaison who assured the team that the color blue was not culturally offensive for use with students. When we shared the LO with a Brazilian university professor he suggested that a more culturally appropriate color would have been based on the actual items used in the classroom: natural wood or a comparable light yellow. Hoping to better understand the effect of the color of the learning object we checked with the school instructors who assured us they were not concerned about the color of the *Material Dourado*. Upon reflection we realized that the level of learning about math may be the same if the students use blue blocks rather than the natural wood color with which they are familiar. However, the students and instructors may need to take an additional mental step to accept blocks that are not truly representative of the learning objects they would use in real life. This mental step may be associated with the knowledge, conscious or unconscious, that when learning objects are not in a representative color they have been transplanted from another culture rather than originating in Brazil. This is not inherently a problem but should be considered when designing objects for use in multiple cultures. Moving beyond direct translation we consulted the Brazilian team members and incorporate cultural nuances that would make the end user experience more authentic and feel less like it was transplanted from another culture. This takes more time and effort on behalf of the design team.

The National Virtual Library of Mathematics (NVLM) was a logical choice to use in the first year of the CAPES/FIPSE project. The USU FIPSE professor had access because the servers are located on the USU campus and the UFC professor was interested in using the NVLM within the context of the Brazilian Ministry of Education database, Banco Internacional de Objectos Educacionais. Each university student had previous experience of learning math concepts as school children in our respective countries. We saw this as a unique opportunity to promote localization by offering culturally appropriate versions if the DMLOs in Brazilian Portuguese.

The NVLM professor trained two students from UFC to update the code, making it their responsibility to add culturally relevant data created by the CAPES/FIPSE project. The technical expertise of these two students made it possible to create a Brazilian Portuguese version of a small portion of the learning objects available on the NVLM website. Lacking technical expertise, the other university students did not have the ability to alter the DMLOs. This effectively placed all responsibility for updating code on two of eight university students. It also indicated the future limitations for localizing the other NVLM LOs.

Although the virtual math library is a helpful site that is free to use, it is not open source. In other words, it can be used only in the way the LO designer intended unless the user has specific permissions and training to change the code. Offering this service for free was a step in the right direction but did not fully meet the goals of the CAPES/FIPSE project. We were unable to make changes to the learning objects despite some good advice from instructors about how to make some of the lessons more useful to students in their cultural context. Instructors themselves cannot alter the learning objects, either. That said, the math learning objects met an important goal for the first year: providing a good beginning from which to reflect and improve the LO development and training process.

PROMOTING CULTURAL AWARENESS AND LANGUAGE LEARNING FOR UNIVERSITY STUDENTS

Given that one goal of the CAPES/FIPSE project is to promote language learning of English and Brazilian Portuguese, using math as a subject provided a finite system of concepts to practice in another language. In addition, many of the concepts have similar words for Portuguese, Spanish, and English which made it easier to understand the curriculum requirements and the direction for using the learning objects. However, the needs of the university students may be different from the Brazilian instructors. In this case, the very similarities of math-related terms may be part of the reason Brazilian instructors questioned the decision to focus on math rather than an alternative with more concepts considered to be more difficult to localize, to accurately convey across cultures.

Strengths of this CAPES/FIPSE project include its flexibility within an organized framework and its emphasis on multicultural, educational, and linguistic diversity. By encouraging university students of different cultural and educational backgrounds to work together each student could be expected to share and learn, and to have a chance to be expert and novice in culture and language. This provided practice for thinking about our roles as collaborators and presenters in schools where the instructors were experts in some areas and we were experts in others.

CAPES/FIPSE: THE NEXT THREE YEARS

The first year of the CAPES/FIPSE project was guided by the goals of the project, the availability of the NVLM, and the transferability of math across cultures. Although we did not discuss as a group the reason we agreed to work with math, when questioned by the Brazilian instructors it was agreed that this subject was a natural fit to begin testing learning objects and affordances.

Reflection upon the first year helps illustrate some important points about localizing digital learning objects regardless of the topic. For future groups I would recommend a clearer understanding of the following: the level of technological experience and technology available to instructors, the physical learning objects instructors already use, and making sure to have time with both instructors and students in the classroom. The group of students in the second year of the exchange project will use different subject domains to meet the guidelines of this project. These include philosophy and sociology, two areas that will influence the nature of the project in a different manner than using math as the primary subject domain.

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