

TAKING THE NEXT STEP WITH THE PROJECT RIVED

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Abstract: This is an article on the experience of the establishment and expansion of the process and the production team to support the Project RIVED. The Red Internacional Virtual de Educacion – RIVED was initiated in 2000. It consists of integration of new learning technologies at the secondary level to improve the teaching of science and mathematics. The bulk of these innovations involves production of learning objects. Since its beginning, the production team has evolved continuously, encompassing challenging new issues and exploring innovative applications of educational technology. Currently RIVED is ready to expand its team and speed the development of instructional material to implement in the public schools. To complete this task production teams will be recruited from universities to form true community partnership that lead to better educational products.

The current world and tomorrow's world

Generation of scientific knowledge has been happened very rapidly and it has been growing extraordinarily. Comparing to the last five millenium, the production of technological and scientific information in the last decade it is much bigger. We are able to remember the world of the last 20 years, but the world of tomorrow, the next 20 years, is beyond our imagination. We need to be prepared for dramatic advances and discoveries on all the fields, including cosmology, physics, chemistry, bioengineering, computer science, genetics, and neuroscience.

“The future is about acquiring and acting on knowledge. Knowledge is not simply understanding and information; these are the raw resources of the new economy...The future will depend upon bright people using technology to cultivate their uniquely human skills” (Hodgins, 2000). To participate in a modern world, it is necessary to have a significant understanding about science and technology. This applies to all everyday things such as banks, commercial transactions, health and transport systems, home appliances, gas stations, water and energy supply, communication and data processing. People without the essential abilities and knowledge to live in this modern world will be apart in the society. And consequently, as society members, they will lose the potential to contribute.

Those dramatic changes bring serious issues for education: the challenge facing educators is to evaluate relevant applications for information technologies in the curriculum. Besides, instruction utilizing information technologies must reflect what is known about the effectiveness of student-centered teaching and learning.

The pervasiveness of digital technologies requires a thorough review of technological impacts on curriculum and instruction in science education. Digital technologies are changing the way teachers interact with students in the classroom. Psychological theories based on the importance of language to learning, the ways organizing and relating information facilitates understanding, and the influence of social factors in the classroom are all impacted by digital technologies (Borich & Tombari, 1997).

The changing needs of education are requiring a reconsideration of our traditional approaches to teaching and learning. Information and communication technologies offer powerful opportunities in supporting those changes. However, these technologies are meaningless to enhance learning and teaching unless they are associated to a careful pedagogical plan. Teachers play important roles in implementing technology in schools, making decisions about “if, when, and how” they will use technology in the classroom. Teacher

education courses should emphasize methods for providing students with opportunities to do science, in addition to learning the facts and concepts of science.

The Project RIVED

The Red Internacional Virtual de Educacion (RIVED) (Fig. 1) for the Enhancement of Science and Mathematics Learning proposes to use modern technologies to improve the teaching and learning process related to sciences and mathematics in secondary schools. RIVED's goal is to improve the role of the teacher as a facilitator and leader of the teaching/learning process, and to equally enhance the role of the student as a learner, thinker, investigator and problem-solver.

This pilot initiative aimed the production of technology-rich learning activities to support teaching in participant countries. Such activities should support sound scientific curricular goals and should not be developed merely because technology makes them possible. Over the three years of the project a large collection of interactive material was developed by production teams. During this period the team members developed operational procedures and identified appropriate structure and skills to develop the materials. The next phase, The Virtual Factory, consists in creating new teams to speed up the production of educational material. The plan for the expansion phase is to involve pre-service teachers in the design team. Through this process, the Virtual Factory enables participating institutions of higher education to share their best practices, learning activities, strategies and experiences. This leads to economies of scale in terms of cost, resources, and expertise. A network also will provide a support system for the RIVED core team to help them with the specific problems they may face.

Figure 1: Project RIVED web site.

Our approach

Computing technology and the Internet has evolved to the point that we can leverage and refine the infrastructure to enable authentic learning. Students must learn to manage all the resources. They need to know how to query for relevant knowledge and discriminate what is valid. They need to develop strategies for solving problems. In order to develop critical thinking skills it is crucial to offer the students a safe place, a

laboratory, where they can experiment, test and make mistakes as they learn. People learn in order to solve problems. People solve problems to improve the human condition and they do it because it is intrinsically and/or extrinsically rewarding.

To address this list of educational needs we from RIVED believe that the design of problem-based learning is not trivial. Problems must be intriguing, relevant and sufficiently challenging to motivate students to want to participate. Strategies must be employed to help reluctant students overcome their objections and become active participants. For all the reasons stated before, our learning activities must be performance-based, include problem-solving goals, and be contextually relevant and learner-centric. Our educational material must focus on developing competencies and critical thinking.

Learning objects

As an international project RIVED purpose is to assist different participant countries in Latin America. The promise of flexibility and reusability from Learning Objects technology attracted us to better serve our diverse audience. The reusability of learning objects offers an efficient way to facilitate instruction, and it can be readapted to satisfy different types of users (Wiley, 2000). However, objects vary in terms of their potential to be reused, and the context in which they can be reused. There are objects with low probability of reuse because they are created to satisfy specific learning experiences related to contextually specific elements. Figure 2 is an example of RIVED's learning object.

Figure 2: Example of RIVED's learning object.

The success and effectiveness of learning objects application will depend on an effective instructional design plan. This means that we don't think that anyone can select learning objects and combine them anyway he wants. All learning objects have specific characteristics and attributes that influence their potential to combine to other objects. To help teachers in the task of assembling learning objects, all RIVED's objects and activities metadata are catalogued. This procedure allows teachers to find the objects they want by searching.

RIVED development teams

When we started the work we did not know very well how the teams would operate. However, we were sure that a key to the RIVED effectiveness was the involvement of teachers. In Brazil, as the work progressed, we were able to define the team structure and the requiring human resources. In the end the production team consisted of the following professionals: instructional designer (1 person), production manager (1 person), a pedagogical manager (1 person), biology teacher (2 people), mathematics teacher (2 people), chemistry teacher (2 people), physics teacher (2 people), multimedia developer (3 people), programmer (1 person), graphic designer (1 person), Portuguese reviser (1 person), Spanish translator (1 person). We still added to the team an outside consultant a subject matter expert for each content area. The intention was to support and enrich the design of learning materials.

The technical team is composed by programmers, graphic designers, multimedia developers, instructional designer and the production manager. They are responsible to support the teachers and to enable reusability of learning material. The design team is composed by teachers, subject matter experts, instructional designer and the pedagogical manager. The instructional designer is part of both teams since the role of this professional is required in the whole process of production.

The development process

The teams are in charge of developing a sequence of teaching/learning activities that meet instructional objectives of a curricular unit. This body of learning material is assembled in a modular format. Every module brings a suggested sequence of teaching/learning activities and an on-line teacher's guide.

The pedagogical team develops the content and the ways they would like it to be presented for effective learning. They design interactive activities, games, simulations and elaborate the teacher's guide to help teacher to use the material. The purpose of the teacher's guide is to offer the teacher support and to inform about the decisions related to the module implementation. This guide is expected to offer more than a list of procedures related to the activities. It offers detailed instructions to those teachers who need help in the content. When a teacher uses the guide he has a source for knowledge enrichment, job training and skills upgrading.

Figure 3: RIVED development process

The technical team interacts with the pedagogical team to produce the activities and learning objects. We encourage the use of XML – Extensible Markup Language to enable flexibility and reusability. Use of XML technology enables separation between content and presentation and so provide a way to deal with our audience different needs. The technical team shows the pedagogical team the learning object produced. A process of corrections and improvements follows until a satisfactory product is achieved. From this point on, if it is necessary, the pedagogical team update, change, adds examples and illustrations. Figure 3 shows all the steps of the development process.

The Virtual Factory

The Virtual Factory is an expansion of Project RIVED. It is a work in progress for producing multimedia learning objects in higher education institutes. In this project we propose a way to speed up the process of producing learning objects for high school implementation while incrementing the curriculum of science and mathematics pre-service teachers.

The Virtual Factory is based on RIVED previous experience on creating learning modules with learning objects. The decision to structure the multimedia resources as learning objects was based mainly on a fundamental requirement of RIVED: to enable delivery and re-use of resources within several modules in different Latin American countries. A repository of learning objects will enable teachers to select and sequence learning resources according to their student's needs. Based on RIVED guidelines, multidisciplinary teams in each science and mathematics subject will be selected in higher education institutes. The teams will be composed of pedagogical and technical members. All participants will attend an on-line course on developing learning objects on RIVED standards before starting the module production. The Virtual Factory teams will be supported and monitored by the RIVED core team. This includes access to templates and learning material produced by the core team.

On top of supporting the Virtual Factory teams through the creation of the modules, a major responsibility of the RIVED team is to enable reusability of learning objects produced. For this new phase, we expect the participants of the Virtual Factory to follow the steps of RIVED development model. These steps are: 1) to elaborate a general design of the learning module, 2) to elaborate storyboards of computer activities, 3) to produce learning objects and assemble a module, 4) to elaborate a teacher guide for each activity and learning object.

Preparing tomorrow's teachers

The primary goal of The Virtual factory is to replicate the prior experience of RIVED's production team by creating and training new production teams from higher education institutions. Such initiative will speed the production of educational modules and speed their implementation in Brazilian's schools. Another important intention of this expansion is to provide pre-service teachers the opportunity to improve their preparation to teach science and mathematics.

Appropriate educational technologies have the potential to make scientific concepts more accessible through visualization, modeling, and multiple representations. It is very important for secondary teachers to have experiences with technologies in order to provide representation of concepts that are difficult to represent in every day experience. Studies (Williamson and Abraham, 1995) found that simulations increased conceptual understanding of chemical reactions by helping students form their mental models.

Success in any profession requires collaboration, professional behavior, critical thinking skills, and a desire for life-long learning. The Virtual Factory expects to create a collaborative community of learners and helps to develop these behaviors and attitudes in the future teachers. The Virtual Factory will challenge the pre-service teachers to learn how to work in groups with dissimilar colleagues. They will have the opportunity to learn the importance of sharing information with each other and they will have a place to do that beyond the classroom.

Conclusion

This paper has described some of the principal issues in building the RIVED production team and the production process. In addition, it has outlined the main principles that underpin the decisions we made along the work. A key element is related to the use of the learning object approach to allow reuse and more flexibility.

The project's next step consists of creating new production teams in higher education institutes. This is expected to multiply the quantity of learning material produced and at the same time, contributes to improve pre-service teachers experience in educational technology.

This project is on-going, but the initial experiences provide a firm foundation for further work in expanding the production process and the repository of learning objects.

References

- Baxter, G. P. (1995). Using computer simulations to assess hands-on science learning. *Journal of Science Education and Technology*, 4, 21-27.
- Borich, B.D., & Tombari, M.L. (1997). *Educational Psychology: A contemporary approach*. New York: Longman.
- Boyle, T. (2002). Towards a theoretical base for educational multimedia design. *Journal of interactive media in education*, 2.
- Hodgins, Wayne. (2000). Into the Future: A Vision Paper. Commission on Technology and Adult learning. Retrieved December, 2003, <http://www.learnativity.com/download/MP7.PDF>
- Kirchner, P. A. (2000). The inevitable duality of education. Retrieved December, 2003
<http://www.mmi.unimaas.nl/presentations/kirchner/The%20inevitable%20duality%20of%20education%20-%20Final%20for%20web.pdf>.
- Nascimento, A. & Morgado, E. (2003). A Cross-Country Collaborative Project in Latin American Countries. *Proceedings of Ed-Media 2003, World conference on Educational Multimedia, Hypermedia & Telecommunications, Honolulu Hawaii; June 23 – 27, 2003*.
- RIVED Project. <http://rived.proinfo.mec.gov.br>
- Wiley, D. A. (2000). Connecting learning objects to instructional design theory: A definition, a metaphor, and a taxonomy. In D. A. Wiley (Ed.), *The instructional use of learning objects* (pp. 1-35). Retrieved February 14, 2002, <http://www.reusability.org/read/chapters/wiley.doc>.
- Williamson, V., & Abraham, M. (1995). The effects of computer animation on the particulate mental models of college chemistry students. *Journal of Research in Science Teaching*, 32, 521-534.