Please cite the source as:

Ramírez, J. L. & Gómez Baldenegro, N. F. (2003). An overview of publications on instructional innovations in media and new information and communication technologies in Northwest Mexico. *Revista Electrónica de Investigación Educativa*, *5* (2). Retrieved month day, year from: http://redie.uabc.mx/vol5no2/contents-ramirez.html

Revista Electrónica de Investigación Educativa

Vol. 5, No. 2, 2003

An Overview of Publications on Instructional Innovations in Media and New Information and Communication Technologies in Northwest Mexico

Panorama de la producción escrita en innovación educativa sobre medios y nuevas tecnologías de la información y la comunicación en el Noroeste de México

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(Received: July 15, 2003; accepted for publishing September 30, 2003)

Abstract

The article describes the methodological design and central findings of a documentary study which has the objective of gathering, selecting, organizing and systematizing of publications generated from 1991 to 2001 in three states of northwestern Mexico, in the field of innovation in media and new information and communication technologies in education. The study was part of the state of knowledge (the systematic analysis of

scientific research and the evaluation of the knowledge produced on a topic during a given period) in Mexico, and was coordinated by the Mexican Council of Educational Research.

Key words: Educational innovation, new information and communication technologies (ICTS), Mexico, educational research, educational technology.

Resumen

Se describe el diseño metodológico y los hallazgos centrales de una investigación documental que tuvo como objetivo recopilar, seleccionar, organizar y sistematizar la producción escrita generada de 1991 a 2001, en tres estados del noroeste de México, en el campo de la innovación sobre medios y nuevas tecnologías de la información y de la comunicación en la educación. Lo anterior como parte del estado del conocimiento en el área, que elabora el Consejo Mexicano de Investigación Educativa.

Palabras clave: Innovación educativa, nuevas tecnologías de la información y de la comunicación (NTIC), México, investigación educativa, tecnología educativa.

Introduction

In 2000, several research teams from the Mexican Council for Educational Research (COMIE, for its initials in Spanish), began the development of states of knowledge[1] for various subject areas. One was education and new technologies.[2] The team responsible for developing the state of knowledge in this area was made up of researchers from several institutions. The team's main objective was to gather, select, organize and systematize the writing produced from 1991 to 2001 in Mexico, in the fields of research and innovation[3] concerning media and new information and communication technologies (ICTS) in education.[4]

This paper describes in general terms the methodology used and the central findings obtained in one of the regions included in the study: Mexico's northwest region, particularly the states of Baja California, Baja California Sur and Sonora, regarding one of the two attention focuses of the state of knowledge, namely, educational innovation using ICTS.[5]

1. Methodology

1.1. Design

Since the central objectives of the project were essentially to collect, select, organize and systematize the writing generated in the field of research and innovation on ICTS, we chose a documentary research design.

1.2. Sample

The production included, in its complete version or in the form of index cards produced by the authors, consisted of publications; theses and papers related to

research projects; projects or experiments of innovation, completed or having a high degree of progress, and presenting results.

The sample includes 45 institutions of higher education in the three states, and the Educational Center of Sonora (coordinator of the normal schools of that state and of the National Pedagogic University's three state branches). The institutions included in the sample represented over 90% of the three states' principal higher education institutions, public and private. Of that sample, approximately 70% of the institutions were successfully contacted.

1.3. Procedures

For the collection, systematization and analysis of data, the procedures described below were followed; the following is a brief summary:[6]

- Sending letters and index cards[7] or making phone calls to officials of the institutions included in the sample, requesting their cooperation in distributing and re-gathering the index cards, and sending them back to us.
- Direct collaboration, and sending cards to: advisors or academic support personnel, or personnel of government agencies; recognized researchers from the various institutions; participants in events related to educational research or educational technology; and members of state educational research networks.
- Visits to institutions and interviews conducted with key individuals, to find documents.
- Review of documents and filling out of index cards: 117 works were reviewed and index cards made for them; these included papers, theses, and/or publications related to the topic, written by academics or students of the institutions sampled.
- Production of databases to contain the information: using the fields included on the index cards, two databases were made to hold the information—one database for research works; the second for works on innovation.
- Development of basic descriptive statistics of information contained in the closed fields of the cards, with the goal of making a first systematization of the information.
- Analysis of the information contained in open fields of index cards.

2. Results

This section will identify and analyze only the results related to educational innovation projects, organized into five sections: general information, data unique to Baja California, data from Baja California Sur, information for the state of Sonora, and comparison of data from states included in the sample.

2.1. Overview

As seen in Table I, concerning innovations there were 26 works that met the requirements to be included in the state of knowledge.[8] Of the total, 21 were developed by academics affiliated with public institutions, and the rest with private or non-specified institutions. Eighteen were done in institutions of higher education, three in senior high school, 1 in junior high school, 3 in elementary school, and one in various levels. The most popular element of educational technology was the computer (25 works), with only one work about television. The coverage of the works was essentially institutional (23 works) or state (3 works). Most of the works were published after 1999. With regard to the states, the works were found divided almost equally between Baja California (14 works) and Sonora (12 works). No work was located in Baja California Sur. Finally, as to institutions, two were outstanding: the Autonomous University of Baja California (UABC), with 12 works, and the University of Sonora (UNISON) with 6.

Table I. Programs and projects of innovation technology in Sonora and Baja California

Title	Institution with which the researcher is affiliated	Level	Modality	Technology used	Coverage	Date of publica-tion	State	Institution where performed
Computerized system of examinations	UABC	Upper	Presencial	Computer	Institutional	1995	BC	UABC
Software development projects in telematics	UABC	Upper	Presencial	Networks	Institutional	2000	BC	UABC
Virtual and conscience learning system	UABC	Upper	Distance	Networks	Institutional	2000	BC	UABC
Tool for online teacher training	UABC	Upper	Distance	Networks	Institutional	2000	BC	UABC
Model for evaluation of online course effectiveness	UABC	Upper	Distance	Networks	Institutional	1999	BC	UABC
Security model for distance learning	UABC	Upper	Distance	Networks	Institutional	2000	BC	UABC
Tool for representation of knowledge using semantic networks to support distance learning	UABC	Upper	Distance	Networks	Institutional	2000	BC	UABC
Course-note bank	UABC	Upper	Distance	Networks	Institutional	2000	BC	UABC
UABC modality of IS training	UABC	Upper	IS	Networks/C	Institutional	1999	BC	UABC
Design and evaluation of an online course	UABC	Upper	Distance	Networks	Institutional	2000	BC	UABC
Computerized System for administering the TEA	UABC	Upper	Distance	Networks	Institutional	1998	BC	UABC
System of Web-based learning	UABC-CICESE	Upper	Distance	Networks	Institutional	1998	BC	UABC
SIFM focused on junior high school mathematics	CICESE	Mid	Presencial	Networks	State	2000	BC	NS
Game-based software concept for mathematics	CICESE	Various	IS	Computer	State	2000	BC	NS
Computer and Internet projects for learning	Alerce School	Basic	Presencial	Computer	Institutional	1999	SON	Alerce Sch.
Computer, cell and ecosystems	Alerce School	Basic	Presencial	Computer	Institutional	1999	SON	Alerce Sch.
Designing a Distance Education Model	UNO	Upper	Distance	Networks	Institutional	1999	SON	UNO
Multimedia Development	UNISON-CBTIS	Mid upper	Presencial	Computer	Institutional	1999	SON	CBTIS
Internet college education	UNISON	Upper	Presencial	Networks	Institutional	1999	SON	UNISON
Role of computers for English teachers	UNISON	Upper	Presencial	Computer	Institutional	1999	SON	UNISON
Regional televised capsules for children	UNISON	Basic	Presencial	Television	State	2001	SON	NS
Computer Networks	UNISON	Upper	Presencial	Networks	Institutional	1999	SON	UNISON
Informatics in physics/chemistry practices	UNISON	Upper	Presencial	Computer	Institutional	1999	SON	UNISON
Interactive workshop: Redesign	ITESM	Upper	Presencial	Computer	Institutional	1999	SON	ITESM
Proposal for the application of self-regulation in redesign	ITESM	Mid Upper	Presencial	Computer	Institutional	2000	SON	ITESM
Learning problems and computer aid	NS	Mid Upper	Presencial	Computer	Institutional	1999	SON	NS

Abbreviations: NS= Non-specific; IS = In-service degree module; C = Computer; BC = Baja California; Sch=School; SON = Sonora.
Acronyms: UABC = Autonomous University of Baja California; CICESE = Ensenada Center of Scientific Research and Higher Education; UNO = University of the Northwest; CBTIS = Industrial and Service Technological High School; UNISON = University of Sonora; ITESM = Monterrey Institute of Technology and Higher Education.

2.2. Projects, programs and experiments in Baja California

The work done at the Autonomous University of Baja California (UABC) was outstanding, not only because it was the only institution with a center specializing in educational research (Institute of Educational Research and Development [IIDE, for its initials in Spanish]), but also because it had promoted diverse projects related with the use of new technologies, among which the following were most notable:

- The Institute of Educational Research and Development's *Online Journal of Educational Research*, recent winner of the 2001 Award for Excellence in Electronic Publications conferred by the International Consortium for the Advancement of Academic Publication. Unique of its kind at the national level, it has a recognized body of adjudicators and has been published biannually since 1999. It is currently in its fifth volume.
- A system of computerized tests (SICODEX) developed by Backhoff and colleagues, also of the IIDE; this system formed the basis for computerizing the UABC admissions examination. This version of the Basic Skills and Knowledge Examination (EXHCOBA-C) was validated in January, 1995, with approximately 750 UABC applicants. The full report of this experience can be reviewed en Backhoff, Ibarra and Rosas (1995).
- The development and evaluation of distance learning and online materials projects, such as the support tool for online teacher-training developed by Pérez-Fragoso and Rueda (2000), and the model for evaluating the effectiveness of online courses (Pérez-Fragoso, 1999), also from the IIDE; the development and validation of a computerized system for managing assignments, tests and advice (TEA) via *Internet de Organista* (1998), of the IIDE as well; the global security model of a support tool support for distance education (Morán, Velez, Luna, Luna and Zazueta, 2000,); the development of a tool for knowledge representation using semantic networks to support self-directed learning in distance education, by the same authors (Morán, Fletes, Luna and Luna, 2000), of the School of Sciences and the IIDE; the design and evaluation of an online course for undergraduate students (McAnally and Pérez Fragoso, 2000); the course-note bank of the online education system (Meza, Luna, Martínez and Vázquez, 2000); the design for a network learning system using the principles of the dimensions or learning, by Estrada, Tchernykh and Perez (2000), of the UABC and the Ensenada Center for Scientific Research and Higher Education (CICESE, for its initials in Spanish); and the experiment on the implementation of an in-service degree module, UABC School of Humanities, described by Botello and Caceres (1999).
- Located at the UABC as well, was a work on developing an environment to facilitate the implementation of projects in telematics computer projects and related areas (Licea, Escobedo and Sarmiento, 2000); and another, on the development of a virtual learning system as an educational tool to promote environmental awareness (Lozano, Villa, Ojeda and Villa, 2000), at the Engineering Institute.

Besides the UABC, another institution that systematically produces works in the field of education and the new technologies in Baja California, is the Ensenada Center for Scientific Research and Higher Education (CICESE). Two works from this center, both in the same line of mathematics teaching, are that of Vizcarra (2000) on the creation of the Interactive System of Instructors for Fun with Math, focused on teaching high-school mathematics; and that of López-Morteo and López-Mariscal (2000) which endeavors to generate educational computer programs to aid in improving the comprehension of mathematics concepts through an interesting and diverting presentation.

In relation to other traits and characteristics of works on innovation in Baja California included in this report, we found the following: all the academics in charge of the selected innovation projects were working in public higher education institutions; the majority (12 of 14) were affiliated with the Autonomous University of Baja California, and a smaller number (two academics) with the CICESE. There was found one paper done in collaboration by researchers from both institutions, the UABC and the CICESE. The majority (12) of the works which specified the level at which the innovation was implemented, indicated high school, with only one case in junior high school, and another at various levels (see Table I).

As for the modality, eight works were related to distance or virtual education, and three to presencial modality; the remaining three were related to the model of distributed education, which combines the presencial with virtual and distance learning.

The only technology employed was that of networks and computers.

Coverage of most projects (12) was institutional, while the remaining two were of state coverage.

In relation to the theoretical or referential frameworks, six of the projects are not explicit about these; one case (Moran *et al.*, 2000) makes no reference at all to education; it simply uses as a reference the principles of software engineering; in another project there are cited some features of the teaching-learning model used: focused on the principles of supportive self-directed learning, pedagogical dialogue and the social construction of knowledge as well as the philosophy of open education and lifelong learning (Botello and Cázares, 1999.) The remaining works allude to frames of reference associated with psychological evaluation on the computer (Backhoff *et al*., 1995), teaching in manipulation (Lozano *et al.*, 2000), teaching mathematics (Vizcarra, 2000), computer-assisted learning (López-Morteo and López-Mariscal, 2000), constructivism (Organista, 1998; McAnally and Pérez-Fragoso, 2000), and several (Pérez-Fragoso, 1999).

The following results were reported: the study confirmed the preference of students for the computerized version of the UABC admissions examination (Backhoff *et al.*, 1995). The development of projects in the courses of telematics, computer networks or similar systems was facilitated (Licea *et al.*, 2000). Learning

experience was increased through the association of the senses involved with the messages contained in the environment (Lozano *et al*., 2000). The current version of the Global Security Subsystem (GSS) shows a 90% advance, and successful tests of portability have been performed on various platforms (Morán, Vélez *et al.,* 2000a). The students have internalized the philosophy and spirit of the distance mode, taking responsibility for their own learning, and the university authorities seem to have been sensitized about the indispensable character of didactic materials for distance education (Botello and Cázares, 1999). There was developed the Interactive System of Instructors for Fun with Math (SIFM), consisting of 14 interacting instructors of different types (Vizcarra, 2000). A model of the collaborative learning environment for mathematics education (López-Morteo and López-Mariscal, 2000) was designed; the results obtained in online courses, or supported on the Internet, are similar to those achieved in presencial courses (McAnally and Pérez-Fragoso, 2000; and Organista, 1998).

2.3. Projects, programs and experiences in Baja California Sur

Unfortunately, in this state we were unable to locate any document that met the requirements for inclusion in this study, despite personal visits to several institutions of the area, and repeated communications sent to the institutions thought to have works on the topic.

2.4. Projects, programs and experiences in Sonora

In this state there were located 12 papers on innovation that met the minimum requirements for inclusion in the states of knowledge.

Table I shows that just as in Baja California, in Sonora one institution is outstanding for the number of reported studies on educational innovation: the University of Sonora (UNISON), with half of the projects found in the state (six). The rest are divided among four institutions: the Monterrey Institute of Technology and Higher Education, North Sonora Campus (two papers), the Alerce School (two papers), and the University of the Northwest (one paper).[9]

In the UNISON there were found six papers. The first (Pérez Soltero, 1999) came from the Department of Industrial and Systems Engineering, and is about education with Internet support. For this project, web pages with the syllabus and contents of some subjects of the study program were created. Teachers were asked to use the Internet as an additional support in teaching their courses, students carried out various activities using the Internet, and finally, the impact of this experience on the teachers and students involved was evaluated. Another work located in the UNISON, in the Department of Foreign Languages, was that of Ramírez, Anguamea and Gutiérrez (1999) about an experience in the use of computers for training future teachers of English. A third work done in collaboration by a teacher of the Department of Physics, the UNISON and two teachers of the CBTIS 26 (Miranda, Paz and Domínguez, 1999), advocates the development of multimedia courses for high school, through a multimedia designer

club comprised of students from that campus, created and coordinated by the authors of the project. In the Mathematics Department there was found another other work on computer networks; it explores the potential of this environment in the upper-level calculus course (Villalba and Hernández, 1999). The Chemistry-Biology Department identified a proposal for the use of computers in the practice of physics-chemistry (Mares and Dorado, 1999); it aims to develop faster laboratory practices and results in the same lab session by using computers in experiments. A recent work located in the UNISON's Department of Psychology and Communication is a master's thesis (Retano, 2001) on the preparation of regional-content television capsules for children; it aims to provide teaching support for the work of teachers in third grade.

At the North Sonora Institute of Technology and Higher Education, Monterrey Campus (ITESM) there were located two works: the first (Cota and Tapia, 1999) on the topic of a guide for designing courses using technology. Highlighted among its objectives is providing the teacher with the experience of taking a redesigned course on the same technology platform and educational paradigm students take. The other work (Espinosa, 2000) is a master's thesis that proposes the implementation of self-regulation in the redesigning of a program for the academic improvement of high school students.

In the Alerce School, a private elementary and junior high school, there were two works found: one by Mancinas (1999), whose objective was to lay the groundwork for the development of a model using new information technologies in that school; these would serve to support the project of comprehensive child development in the cognitive, affective and social aspects. The other was done by Márquez, Montiel, Morales and Cota (1999), and is about the computer, the cell and ecosystems, and intended to develop the method of cooperative learning in the classroom, coupled with the use of computer and telecommunications networks in order to facilitate the creation of strategies and skills.

At the University of the Northwest there was found only a work of educational innovation for university students, about the design of a model for distance education via the Internet; it was by Flores (1999), whose objectives were to design, test and validate a model for Internet learning.

Finally, there was found a study by Contreras (1999), on a proposal using the computer to solve certain epistemological problems of maximum and minimum learning; the institution with which the author is affiliated is unknown.

As related to some features and characteristics of works on innovation for the state of Sonora, included in this report, the following was found: the number of projects on innovation by academics from public institutions (seven projects) was greater than that from private institutions (five projects). The educational levels where the projects were implemented were various, with the university level predominant (six works), followed by the high school level with three projects, and elementary education with three others. As to the modality, the majority of the projects (11)

were related to the presencial level, and only one to distance learning (see Table I).

Regarding technology, most of the studies (11) used computers, while only one used television. Coverage in most cases (11) was institutional; only one had state coverage. All the studies were reported as completed, and the majority (10) were done in 1999 (see Table I).

In relation to the theoretical or reference frameworks, it was found that the constructivist theory was one of the most used, since three projects explicitly state that they are based on it (Cota and Tapia, 1999, Espinosa 2000, Contreras 1999). The other works considered various theories or approaches, such as educational technology (Flores, 1999); the competencies model (Miranda *et al,* 1999); Piagetian theory (Villalba and Hernández, 1999); learning through projects (Mancino, 1999); cooperative learning (Johnson *et al*., 1999); and the theory of technological assimilation and application of computers in education (Ramérez *et al*., 1999). In the other three projects the frame of reference was not clearly spelled out (Perez Soltero, 1999; Retana, 2001; Mares and Dorado, 1999).

The following results were reported: a positive reaction from teachers and students was observed regarding the introduction of ICTS in school (Mancino, 1999). Four projects related to with the cell and ecosystems, for which there was necessary a preparation process of the knowledge and use of various educational computer programs, of the work model by projects, and in some cases, basic computing practices which converted this knowledge into a daily work strategy; since it not only focused on the computer program, but each teacher had to apply it to his or her own subject (Márquez *et al*., 1999). There was created a multimedia club with 50 students who worked on several projects and produced multimedia support material using *Power Point*, with advice from teachers, for the common-core subjects (Miranda *et al.*, 1999). The teachers could make better use of class time and improve the presentation of their notes in class. The review of assignments and tests was electronic, while students felt better prepared to use new technologies, their self-esteem was increased, and their ability to access information was improved (Pérez Soltero, 1999). Furthermore, the vision turned toward computers; the role they could play as a motivational tool was understood, the fear of working with them was lost, the attitude toward school was improved, and the motivation to do the assigned tasks was increased (Ramírez *et al,* 1999). Students showed a greater ability to remember and understand the messages and contents transmitted in the classroom through televised capsules (Retana, 2001). The quantity and quality of the questions asked by students was increased, and higher levels of concreteness and abstraction were achieved (Villalba and Hernández, 1999). The most common methods of data processing were applied only in a lab session, and the measurement error was minimized (Mares and Dorado: 1999). The experimental group outperformed the control group in learning the subject of maximums and minimums in calculus (Contreras, 1999).

With respect to the context providing the framework for the projects of innovation in education and new technologies, it is important to note that just as in the case of general educational research, what was done in the area of ICTs appears to obey the interests of the researchers more than the clear guidelines and policies of the state or institutions of higher education. As it would relate to the addition of new equipment in schools, there seems to be little or no account taken of the research done so far.

3. Data comparison between Baja California and Sonora

Comparing the data from both states, we found the following:

1) In spite of their being neighboring states, there are differences between them, especially in relation to:

a) The type of institution of affiliation of researchers: in Baja California there is a much stronger presence in the public sector (100%) than in Sonora (58%).
b) Educational level considered: works from Baja California are more likely to deal with the upper education level (86% of projects); in Sonora all three levels appear to be considered, although the attention to the upper level (50% of projects) predominates.
c) Modality: Sonora projects emphasize the presencial (92% of projects), while those of Baja California give more weight to distance education projects and distributed learning (79% of the work has to do with these modalities, and only 21% with the presencial).
d) Theoretical frameworks: while 75% of the works from Sonora specify the theoretical framework used, only 58% of those from Baja California do that.

2) The only thing in which the works are relatively similar in both states is the coverage of projects: in Sonora 92% of the projects are for institutional coverage, while 86% in Baja California pertains to that type of coverage.

3) In Baja California, in general, the field of educational innovation seems to receive attention mostly from academics in the public sector, with projects on the level of higher education, interested in combined or distance modalities and the use of networks; unlike Sonora, where although academics of the public sector also predominate, and 50% of the work has been performed at the level of higher education, there is a major academic presence of private sector projects in different educational levels, and there is a greater tendency toward the presencial. That is, there seems to be a greater diversity in terms of projects and subjects in Sonora, but a higher level of investigation in Baja California, perhaps explainable by the existence of more defined institutional policies in the establishment that carries out such projects in the state, that is, the UABC.

4) Concerning results from the application of ICTs to education, projects in both states reported positive results in all the areas in which these were implemented, and highlighted users' positive feedback about the incorporation of such technologies. Especially in Baja California the findings are striking in relation to the role of distance education in school performance as compared with the presencial, where, as one of the authors argued (McAnally and Pérez Fragoso, 2000) "in the worst of the cases" it is equal to the presencial; this opens interesting possibilities for the use of such technology in the region's educational institutions, which use has so far been insufficiently explored and exploited.

4. Conclusions

Compared with what we know is being done in the region concerning innovation using ICTs in education, there is little that is documented and disseminated in written form. However, since 1999 the situation seems to have begun to change in the states of Baja California and Sonora, with the gradual escalation of writing on the subject. This is not true of Baja California Sur, where the lack of such production is still worrisome. One possible reason is that in the first two states there were organized two events that could have served as triggers, providing space where local researchers could make their work known. The events were the National Forum on Education and New Technologies, and the First Regional Congress of Open and Distance Education.[10]

The great majority of papers discovered were theses or papers presented at conferences. We found few works published in national or international journals or in book form. Given the above situation, it is necessary, on the one hand, to analyze the causes of the shortage of literature; and second, to encourage production of publications by those involved in innovation, in order to socialize their ideas and give a boost to the field.

In the quality of the studies reviewed, the ample diversity hinted at problems such as:

- A high number of jobs that did not make clear their theoretical or referential frameworks, a fact which weakens their theoretical soundness.
- Lack of designs sufficiently complex to substantiate that the results reported were caused by innovation rather than by other causes, since most rely exclusively on user feedback. In most cases there are still needed more rigorous evaluations which would go beyond the level of the subjects' opinions, so as to achieve a reliable assessment of the actual impact and potential of the innovations.
- The scant number of investigations that go beyond the institutional framework. It is necessary to extend the scope of the investigations beyond the institutions, and make regional and inter-agency efforts that would allow those involved to take advantage of resources and infrastructure.

Proposals for innovation seem to be designed and implemented primarily by academics from public institutions of higher education, on issues related to that educational level. There is a need to produce and to implement proposals in the other educational levels, extend the range to include topics related to areas of knowledge in which little or no research was found, such as social science and the humanities, or on "neglected" or "marginal" subjects such as the access and use of ICTs by students of marginalized and indigenous areas, and those with limitations or disabilities; or topics that would help to reduce the generation or gender gap in relation to ICTs.

Equally and urgently needed are:

- The design and validation, in specific subject areas, of computer programs that would respectfully address the cultural and linguistic diversity of our region and of our country.
- The development of innovative proposals based on diagnoses that would meet the most pressing social needs in education, and that could be implemented in the region's schools, thus making possible further and better access to ICTs by traditionally-marginalized groups—in sum, proposals that would help to provide our students with an education of greater dignity and excellence.

References

Amador, R. (Coord). (In press). *Tecnologías de información y comunicación en la educación en México y América Latina durante la década 1992-2002*. Mexico: Consejo Mexicano de Investigación Educativa.

Amador, R. (2002). *Plan de trabajo 2001 del estado de conocimiento 1991-2001 sobre medios y nuevas tecnologías en la educación* (Internal communication). Mexico: Consejo Mexicano de Investigación Educativa.

Backhoff, E., Ibarra, M. Á., & Rosas, M. (1995). Sistema computarizado de exámenes (SICODEX). *Revista Mexicana de Psicología*, *12* (1), 55-62.

Botello, R. & Cázares, S. (1999). La modalidad de estudios semiescolarizados de la Facultad de Ciencias Humanas de la UABC: una experiencia pedagógica en construcción. In F. González & J. Armenta (Comps.), *Educación y Nuevas Tecnologías: Memorias del Foro* (pp. 247-255). Hermosillo: Universidad de Sonora.

Contreras, S. (1999). Problemas epistemológicos hallados en el aprendizaje de máximos y mínimos y una propuesta de solución con ayuda de la computadora. In J. Arreguín (Ed.), *Memorias del 2º Encuentro Estatal de Investigación Educativa* (pp. 62-68), Hermosillo: Universidad Pedagógica Nacional-Secretaría de Educación y Cultura.

Cota, R. & Tapia, N. (1999). Taller interactivo de rediseño: una guía para el diseño de cursos utilizando la tecnología. In F. González & J. Armenta (Comps.), *Educación y Nuevas Tecnologías: Memorias del Foro* (pp. 137-144). Hermosillo: Universidad de Sonora.

Espinosa, G. (2000). *Una propuesta de aplicación de la autorregulación en el rediseño de un programa de mejoramiento académico para alumnos de preparatoria*. Unpublished master's thesis, Instituto Tecnológico y de Estudios Superiores de Monterrey, Hermosillo, Sonora, Mexico.

Estrada, I., Tchernykh, A., & Pérez, M. (2000). Usando los principios de las dimensiones del aprendizaje para el diseño de un sistema de enseñanza a través del Web. In *Primer Congreso de Educación Abierta y Distance*, *CEAD 2000* [CD-ROM]. Ensenada, B.C.: UABC, CICESE, ANUIES.

Flores, V. (1999). La experiencia del diseño de un modelo de educación Distance a través de Internet para estudiantes universitarios. In F. González & J. Armenta (Comps.), *Educación y Nuevas Tecnologías: Memorias del Foro* (pp. 109-118). Hermosillo: Universidad de Sonora.

Licea, G., Escobedo, L., & Sarmienta, R. (May, 2000). *Un ambiente de desarrollo para facilitar la realización de proyectos de software en telemática y áreas afines*. Trabajo presentado en la XXVIII Conferencia Nacional de Ingeniería, Guadalajara, Jalisco, Mexico.

Litwin, E. (2000). *Tecnología educativa: política, historias, propuestas*. Buenos Aires: Paidós.

López Morteo & López Mariscal, G. (2000). Una concepción lúdica del software educativo para las matemáticas. In *Primer Congreso de Educación Abierta y Distance, CEAD 2000* [CD-ROM]. Ensenada, B. C.: UABC, CICESE, ANUIES.

Lozano, G., Villa, R., Ojeda, S. & Villa, C. (June, 2000). *Sistema de aprendizaje virtual un medio educativo para promover conciencia ambiental*. Paper presented at 1er. Simposium Nacional de Medio Ambiente. Mexicali, Mexico.

Mancinas, A. (1999). El método de aprendizaje por proyectos, apoyado en el uso de la Computer e Internet: un modelo y una experiencia de introducción de las NTI en la escuela primaria. In F. González & J. Armenta (Comps.), *Educación y Nuevas Tecnologías: Memorias del Foro* (pp. 119-124). Hermosillo: Universidad de Sonora.

Mares, J. & Dorado, J. (1999). El uso de la informática en prácticas de físico-química. In F. González & J. Armenta (Comps.), *Educación y Nuevas Tecnologías: Memorias del Foro* (pp. 179-183). Hermosillo: Universidad de Sonora.

Márquez, M., Montiel, L., Morales, M., & Cota, A. (1999). La computadora, la célula y los ecosistemas. In F. González & J. Armenta (Comps.), *Educación y Nuevas Tecnologías: Memorias del Foro* (pp. 163-175). Hermosillo: Universidad de Sonora.

McAnally, L. & Pérez Fragoso, C. (2000). Diseño y evaluación de un curso en línea para estudiantes de licenciatura. *Revista Electrónica de Investigación Educativa*, *2* (1). Retrieved April 20, 2001, from: http://redie.ens.uabc.mx/vol2no1/contenido-mcanally.html

Meza, V., Luna, J., Martínez, V., & Vázquez, C. (2000). Banco de notas de cursos (BNC): módulo del sistema de enseñanza en línea. In *Primer Congreso de Educación Abierta y Distance, CEAD 2000* [CD-ROM]. Ensenada, B.C.: UABC, CICESE, ANUIES.

Miranda, R., Paz, R., & Domínguez, L. (1999). Desarrollo de multimedia en el proceso educativo. In F. González & J. Armenta (Comps.), *Educación y Nuevas Tecnologías: Memorias del Foro* (pp. 301-305). Hermosillo: Universidad de Sonora.

Morán, A., Fletes, U., Luna, J., & Luna, E. (2000). Desarrollo de una herramienta de representación de conocimiento usando Networks semánticas para apoyar el autoaprendizaje en educación Distance. In *Primer Congreso de Educación Abierta y Distance, CEAD 2000* [CD-ROM]. Ensenada, B. C.: UABC, CICESE, ANUIES.

Morán, A., Vélez, G., Luna, J., Luna, E., & Zazueta, M. (2000). Modelo global de seguridad para una herramienta de apoyo a la educación Distance. *In Primer Congreso de Educación Abierta y Distance, CEAD 2000* [CD-ROM]. Ensenada, B.C.: UABC, CICESE, ANUIES.

Organista, J. (1998). *Desarrollo y validación de un sistema computarizado para administrar tareas, exámenes y asesorías vía Internet*. Unpublished master's thesis, Universidad Autónoma de Baja California, Ensenada, B. C., Mexico.

Pérez Fragoso, C. (1999). Modelo para evaluar la efectividad de cursos en línea. In F. González & J. Armenta (Comps.), *Educación y Nuevas Tecnologías: Memorias del Foro* (pp. 213-219). Hermosillo: Universidad de Sonora.

Pérez Fragoso, C. & Rueda, M. (2000). Herramienta de apoyo para la formación del docente en línea. In *Primer Congreso de Educación Abierta y Distance, CEAD 2000* [CD-ROM]. Ensenada, B.C.: UABC, CICESE, ANUIES.

Pérez Soltero, A. (1999). La educación universitaria con apoyo de Internet. In F. González & J. Armenta (Comps.), *Educación y Nuevas Tecnologías: Memorias del Foro* (pp. 145-153). Hermosillo: Universidad de Sonora.

Ramírez, J. L. (In press). La investigación en Baja California Norte, Baja California Sur y Sonora. In R. Amador (Coord.), *Tecnologías de información y comunicación*

en la educación en México y América Latina durante la década 1992-2002. Mexico: Consejo Mexicano de Investigación Educativa.

Ramírez, J. L. (2002). Las investigaciones sobre las nuevas tecnologías de la información y de la comunicación en el campo educativo en la región Noroeste. In E. A. Carlos (Comp.), *Investigaciones educativas en Sonora* (Vol. 4, pp. 149-179). Hermosillo: Red de Investigación Educativa en Sonora-Secretaría de Educación Pública.

Ramírez, J., Anguamea, G., & Gutiérrez, M. (1999). Papel de las Computadoras en la formación de futuros profesores de inglés: una experiencia. In F. González & J. Armenta (Comps.), *Educación y Nuevas Tecnologías: Memorias del Foro* (pp. 187-196). Hermosillo: Universidad de Sonora.

Retano, D. (2001). *Los colores de Sonora: cápsulas televisivas de contenido regional para niños*. Unpublished manuscript, Universidad de Sonora.

Villalba, M. & Hernández, V. (1999). Networks de cómputo: una exploración de este ambiente en los cursos de cálculo de nivel superior. In F. González & J. Armenta (Comps.), *Educación y Nuevas Tecnologías: Memorias del Foro* (pp. 155-162). Hermosillo: Universidad de Sonora.

Vizcarra L. (2000). *Sistema de instructores interactivos de diversiones matemáticas*. Unpublished master's thesis, Centro de Investigación Científica y de Educación Superior de Ensenada, Ensenada, B. C., Mexico.

Zabalza, M. (2000). Innovación en la enseñanza como mejora de los procesos y resultados de los aprendizajes: condiciones y dilemas. In A. Estebaranz (Ed.), *Construyendo el cambio: perspectivas y propuestas de innovación educativa* (pp.10 -40). Sevilla: Servicio de Publicaciones de la Universidad de Sevilla.

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[1] By *state of knowledge* we mean here the systematic analysis of scientific research and the evaluation of the knowledge produced on a topic during a given period.

[2] The media and new technologies in education were conceptualized as the "set of information and communication technologies: audiovisual (radio, film, television and video), informatics (computer and networks), telecommunications (satellite) and telematics used for the creation, production, storage, distribution and consumption of information and knowledge, in the context of different individual, group, institutional and social educational practices" (Amador, 2002, p. 3).

[3] By *educational innovation*, we will understand, following Zabalza (2000) and Litwin (2000), the introduction of justified changes in order to improve the quality of the educational system, scholastic reality, or educational practices.

[4] Considered as investigative works were those whose main objective was to explain, understand or generate knowledge through a process of inquiry; while considered works of innovation were those which had as their central objective to describe the implementation of a proposal for educational innovation, and which showed the methodology followed and the results obtained.

[5] The findings related with the other focus of attention (that concerning studies on new information and communication technologies in the states mentioned) can be consulted in Ramirez (in press). To consult the complete national report, as related to research, see Amador (in press).

[6] A more detailed version of the methodology used can be consulted in Ramírez (2002).

[7] These index cards had as their primary purpose to allow the digitalization of the central data of written documents related to the theme of education and new technologies produced by academic personnel of the various institutions. Each card explored 16 fields, namely: name of project, author(s), institution of affiliation of the project leader, institution(s) where the work was done, type of institution(s) in which it took place, year(s) in which the project was carried out, funding source, complete reference regarding the source where it was reported or published, type of document in which the project was reported or published, level and educational type in which it was implemented, subject benefited and contexts where it was carried out, technology which was the object of the project, theoretical and methodological perspective, and content of the project (objectives, frame of reference, activities and results).

[8] To facilitate the work of counting, when the same experience or project was presented in two or more publications, we decided to include the central publication, giving preference to the thesis.

[9] The institution with which one of the authors is affiliated is unknown.

[10] By matching the dates of organization of events and the number of studies, we found only two papers that were eligible for inclusion in the state of knowledge. Both were prepared, presented or published between 1995 and 1998, while in 1999 (when the National Forum on Education and Information Technologies was held in Hermosillo) 12 papers were found, and in 2000, during the First Regional Congress of Open and Distance Education, CEAD 2000, in Ensenada, 11 works were found.