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FEATURED ARTICLES

AMCT'S PROFESSIONAL DEVELOPMENT MODEL: A STRATEGY FOR IMPROVING THE TEACHING AND LEARNING OF MATHEMATICS AND SCIENCE IN ELEMENTARY SCHOOLS OF PUERTO RICO

Elizabeth Quintero, PhD and Oscar Sáenz, PhD

Abstract

The objective of this research was to design and implement a model for teacher professional development. The model was implemented by the Turabo Mathematics and Science Alliance project (AMCT, Spanish acronym), which trains teachers. To test the model, a quasi-experimental design with a comparison group was followed. Pre- and post-tests were administered to both, the participants and the comparison group, through three years of implementation (2008-2011). The participating teachers in the experimental group, elementary school teachers (4^{th} to 6^{th} grade), showed significant improvements in their mastering of content knowledge, providing evidence to support the claim that the AMCT model for professional development is effective for the population of elementary school teachers of Puerto Rico. This model stems from a needs assessment, utilizes the state standards and, at its core, coordinates implementation with the faculty, emphasizing connections to the real world and promoting the assignment of, at least, 50% of each workshop to practice.

Keywords: teacher professional development, learning models, teaching strategies

Resumen

El objetivo de esta investigación fue el diseño e implementación de un modelo para el desarrollo profesional de maestros. El modelo fue implementado por el proyecto Alianza de Matemáticas y Ciencias del Turabo (AMCT), el cual entrena maestros. Para evaluar el modelo, se siguió un diseño cuasi-experimental con grupo de comparación. Pre- y pos-pruebas fueron administradas a ambos, los participantes y el grupo de comparación, a través de tres años de implementación (2008-2011). Los participantes del grupo experimental, maestros de nivel elemental (4^{to} a 6^{to} grado), mostraron mejorías significativas en su dominio de contenido, evidencia que apoya la aseveración de que el modelo de desarrollo profesional de AMCT es efectivo para la población de maestros de nivel elemental de Puerto Rico. Este modelo surge de un estudio de necesidades, utiliza los estándares estatales, y, en su parte medular, coordina la implementación con la facultad, enfatizando conexiones con el mundo real y promoviendo la asignación de, al menos, 50% de cada taller a la práctica.

Palabras claves: desarrollo profesional de maestros, modelos de aprendizaje, estrategias de enseñanza

INTRODUCTION

The Turabo Mathematics and Science Alliance (AMCT, Spanish acronym) is a project administered by the School of Engineering at University of Turabo (UT), a higher education institution in Puerto Rico. The AMCT provides content training in science, mathematics, as well as, research methodologies to elementary (4^{th} to 6^{th} grade) and secondary (7^{th} to 12^{th} grade) school teachers, according to the content standards and expectations of the Department of Education of Puerto Rico (DEPR). The project has been sponsored by federal funds from the Title II-B "No Child Left Behind Act" (NCLB) and the Mathematics and Science Partnership (MSP) Program of the Department of Education. The purpose of this paper was to present a model for professional development developed and tested by the authors by using it to design and deliver professional development workshops to teachers. Initially, the paper presents the theoretical foundations of the model, the teaching-learning strategies and tools that accompany its implementation, and the support activities necessary to implement the model. The final section contains the experimental design and final discussion.

PROFESSIONAL DEVELOPMENT MODEL OF THE AMCT

The NCLB law establishes that students must have the opportunities to attain academic success and that teachers must take the learning process to its highest level. This is a difficult mission to carry out given that in our society the volume of information grows at vertiginous speeds and continuous training is the main strategy for reflection (Montecinos, 2003; Watt et al., 2006).

Knowledge is evolving constantly; from a mathematical standpoint, what is known is supported by axioms and theorems that were proposed centuries ago. Consequently, evolution is seen in terms of the capacity to solve practical problems and establish interdisciplinary relationships with other areas of learning (Ernst, 1998; Godino et al., 2003). In terms of the sciences, educators visualize knowledge as fluctuating and progressive; however, at the basic levels, scientific knowledge is still represented as something done, observed and formed solely on the basis of finalized concepts (Calixto,

2000; Sawyer, 2006). Therefore, it should come as no surprise that, in the United States, as well as, in Puerto Rico, the students' academic achievement in these areas of knowledge was below the considered levels of proficiency or excellence (National Science Board, 2004). The results of the Academic Achievement Puerto Rican Test (PPAA for its Spanish abbreviation) showed that, during the academic year 2009-2010, only 13% of the high school students reached the proficient level in mathematics and only 17% were proficient in science.

In value-added modeling (VAM) tests, a significant relationship has been determined between the students' grades and the teachers' efficiency. It has also been proven that enhancing the teachers' education is an important variable in order to achieve high academic performance among students (Darling-Hammond, 2000; Rowe, 2003; Darling-Hammond and Loewenberg, 2007; Darling-Hammond, 2010; Baker et al., 2010). Furthermore, it has been established that effective teachers are able to inspire their students in a significant way. However, the characteristics that make teachers effective are still under discussion and, therefore, one turns to the domain of measurable variables. Certifications, academic qualifications, and years of experience are also taken into account. Most of these variables are linked to the students' scores, but, as a whole, only account for a fraction of a teacher's caliber (Rivkin et al., 2005). This research presents a model for teacher professional development and shows its positive impact on elementary school teachers. The Professional Development Model of the AMCT (MDP-AMCT, Spanish acronym) has three core components: i) theoretical foundations, ii) teaching-learning strategies and tools, and iii) support activities (Figure 1).

Theoretical Foundations

The selection of topics for each training workshop emerges from a needs assessment, as well as, from topics identified by the DEPR. A needs assessment survey is administered once a year to the participating teachers. Each training workshop must have theoretical foundations and must be aligned with the standards and expectations of the DEPR. With these criteria, the project curriculum specialists design a syllabus for each workshop identifying: i) the standards that will be covered, ii) the topics and subtopics that will be developed, along with their respective suggestions regarding methodology

and application, iii) the suggested distribution of time, iv) a set of assessment items, and v) recommended bibliography.

The syllabus is at the core of the trainings since it embodies the structure and design of the MDP-AMCT and guarantees the fulfillment of the project's requirements. With this syllabus, the faculty develops the workshop. Likewise, the syllabus outlines essential topics and the faculty is urged to address concepts from an interdisciplinary perspective; that is, each workshop searches for possible integrations with other disciplines, such as, connecting physics to mathematics, chemistry, biology, or earth sciences.

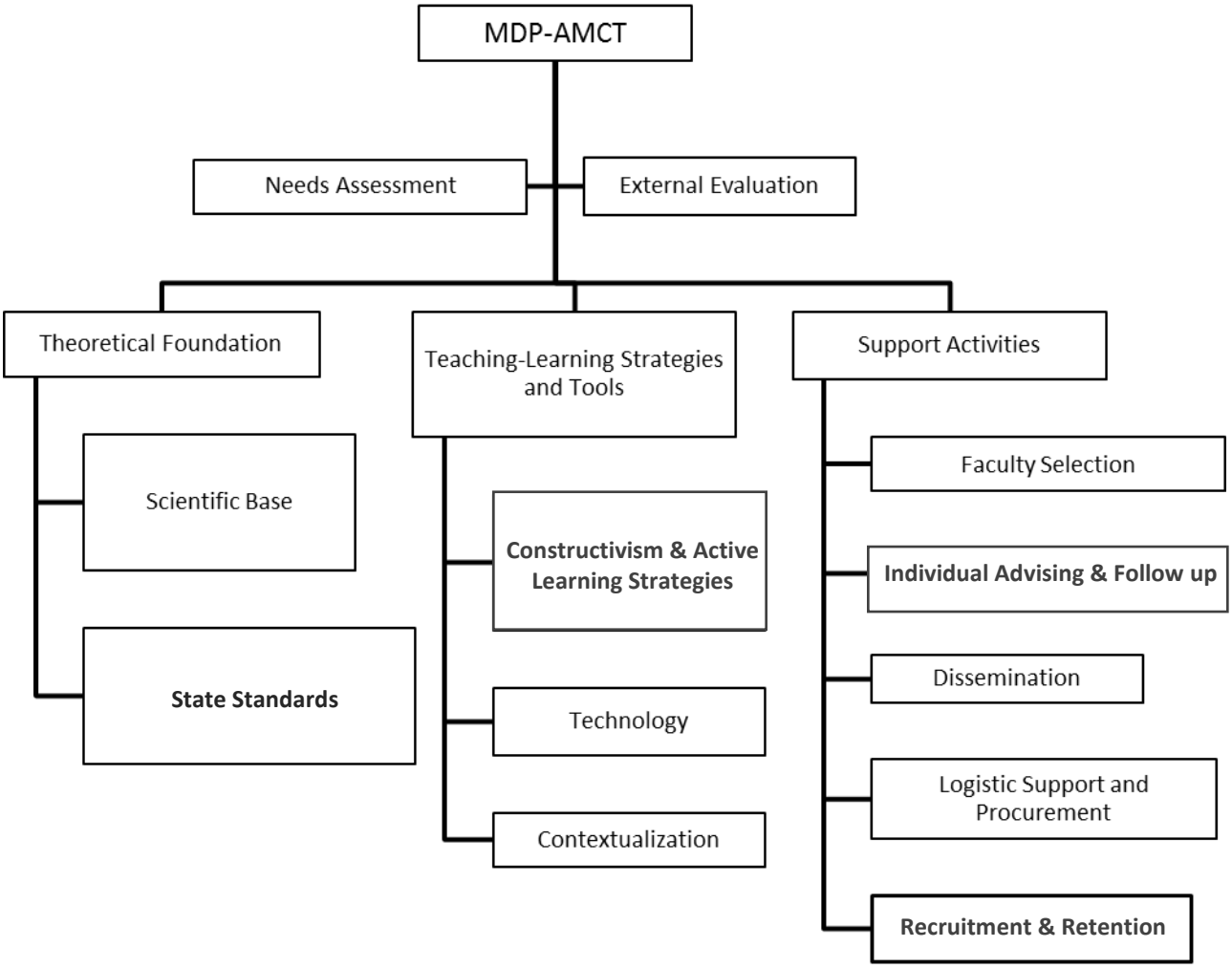

Figure 1. Professional Development Model for the Turabo Mathematics and Science Alliance (MDP-AMCT)

Teaching-Learning Strategies and Tools

The teaching-learning strategies are based on active pedagogical philosophies. The constructivist focus of the workshops promotes the conceptual analysis of mathematics and science by solving problems from other areas of learning and finding applications within everyday situations. Moreover, the use of engineering projects has been a successful strategy for the integration of science and mathematics, making it possible for teachers to acknowledge the interdisciplinary aspect of the courses they teach.

The MDP-AMCT emphasizes the use of technology, both of information and communication technology (ICT), as well as, of the technology available in the laboratories at the UT (e.g., robots, machine-shop, electric circuits, chemistry, biology, and physics labs). In terms of the emphasis on active methodologies, the MDP-AMCT model proposes the use of time in a dynamic way, that is, time is distributed, approximately, 40% for the revision of theory (e.g., concepts, demonstrations) and 60% for practical activities (e.g., problem solving, projects, team work, laboratories).

Support Activities

The logistics of the training workshops begins with the selection of the faculty, taking into account their specialty, experience, and communication skills. In most cases, the faculty is part of the School of Engineering or the School of Science and Technology of the UT, who hold master or doctoral degrees. Following each workshop, the faculty is evaluated by the teachers; subsequently, being the recipient of an excellent evaluation is a criterion which will determine whether or not one can return as a project faculty.

The second group of activities is the Individual Advising and Follow-up, executed with the help of the educational consultant. Each teacher receives a maximum of four visits during the academic year. While the visits focus on topics or activities in which the teacher requires counseling, each visit has specific objectives: i) the first one is the "exploration visit" and helps to identify the topics in which the teachers require support; ii) the second visit is the "mentoring visit", and its purpose is to provide mentorship in the topics previously indicated, as well as, in the search or selection of activities and materials. During this visit, the educational consultant submits the rubric that will be used

to observe the teacher's performance during a sample class; iii) the third visit is the "observation visit" of the teaching exercise; teachers that opt out from being observed, may choose further mentoring, and iv) the fourth and last visit, designated to be the "impact visit", serves to compile data or evidence of content transfer to the classroom.

The third group of activities that provide support is the one related to dissemination. Among these are the production of an information bulletin, leaflets regarding content, the publication of newspaper articles showcasing the project, and the publication of articles in specialized peer-reviewed journals, in which the project shares accomplishments and models. These materials, as well as, those designed by the workshop lecturers, are published on the project's web page: http://www.suagm.edu/turabo/amct_incio.asp. All participating teachers have access to this page, and they are free to use the published materials for the development of their classes, as well as, for student consultations.

The fourth group of activities is the Logistics Support and Procurement. Basically, these consists on the specific support to the AMCT faculty, before and during the trainings, which comprises acquisition of materials, and technical and logistic support, and the purchasing and distribution of teaching materials to the participating teachers. These materials remain at the teachers' schools. The project assigns these materials based on the actual amount of contact hours per training workshops that the participants have attended. The final group of activities is the Recruitment and Retention of participants and control group.

METHODS

The MDP-AMCT is the result of an empirical and research process that underwent multiple revisions and adjustments. The AMCT project evaluation follows a mixed design, including formative and summative evaluation, and consists of qualitative, as well as, quantitative aspects. Without delving into the formative and summative evaluations carried out by the DEPR, composed of quarterly reports, desk monitoring reviews, and final annual performance reports, the AMCT project, as well as, each of the MDP-AMCT components, have been subjected to independent external evaluations, all of which confirm that, throughout the

years herein reported, the objectives of the project have been consistently achieved. This section describes the project's experimental design, along with a description of the participants in the experimental group, as well as, of those in the control group.

Experimental Design

The design implemented was quasi-experimental with comparison group. The project's impact was measured directly by way of the elementary teachers' performance in a pre-test and post-test, designed for each area (i.e., mathematics and science) and, indirectly, by way of the performance of their students in the standardized state test, i.e., "Pruebas Puertorriqueñas de Aprovechamiento Académico" (PPAA, Spanish acronym). The pre- and post-tests were designed by the AMCT project and were subjected to a validation process and reliability measurement. As a result of the process of validation, the tests were modified and some items were eliminated or rewritten. Reliability was measured by the Cronbach's Alpha coefficient, which was higher than 0.65.

Sample Description

A total of 412 teachers have participated in the training workshops during the three years of implementation that were the subject of this analysis. In Puerto Rico, elementary and middle school education is a profession mostly undertaken by women: 91% of the experimental group and 79% of the control group are women. Seventy-one percent (71%) of the experimental group's and 59% of the control group's ages range between 20 and 45 years old. Table 1 summarizes the characteristics of the teachers in the experimental group and the control group that have participated in the AMCT project from 2008 to 2011.

Table 1. Demographic Characteristics of Teachers by Group and Year

Year	Participants (E/C)	Participants' Gender		Age Groups			
		Female (E/C)	Male (E/C)	20-25 (E/C)	26-35 (E/C)	36-45 (E/C)	46-55 (E/C)
2008-2009	141 / 29	125 / 22	16 / 7	22 / 2	37 / 8	40 / 7	35 / 10
2009-2010	133 / 25	123 / 20	10 / 5	25 / 1	35 / 5	34 / 12	34 / 7
2010-2011	138 / 24	128 / 21	10 / 3	26 / 0	38 / 5	33 / 6	35 / 12
Total	**412 / 78**	**376 / 62**	**36 / 16**	**73 / 3**	**110 / 18**	**107 / 25**	**104 / 29**
%	**100 / 100**	**91 / 79**	**9 / 21**	**18 / 4**	**27 / 23**	**26 / 32**	**25 / 37**

E: Participants in the experimental group C: Participants in the control group

The distribution of the participants according to the subjects they teach, mathematics or science, has been similar during the three years analyzed. The distribution of the sample according to grade level indicates that 51% of the AMCT participants were elementary school teachers (Table 2). The distribution of the participants in the experimental and control groups according to the years of work experience dedicated to education is presented in Figure 2. As can be observed, 35% of the participants in the experimental group and 30% of those in the control group reported having six or more years of teaching experience. In Table 3, the sample of teachers was distributed according to the highest academic level completed; 51.2% of the teachers in the experimental group have a bachelor's degree while 61% of the teachers in the control group have a master's degree. During the period from 2010-2011, more than 50% of the participating teachers attended between 61 and 90 hours of professional development training (160 hours per year were offered by the AMCT project). The attendance of the participants can be observed in Figure 3.

Table 2. Distribution of Participants by Group, Subject, Level, and Year

Year	Participants by Subject				Participants' Grade Level
	Science		Mathematics		Elementary*
	E	C	E	C	E
2008-2009	62	13	79	16	70
2009-2010	53	10	80	15	70
2010-2011	56	9	82	15	72
Total	**171**	**32**	**241**	**46**	**212**
%	**42**	**41**	**58**	**59**	**51**

E: Participants in the experimental group C: Participants in the control group
* Elementary level comprises grades 4th through 6th

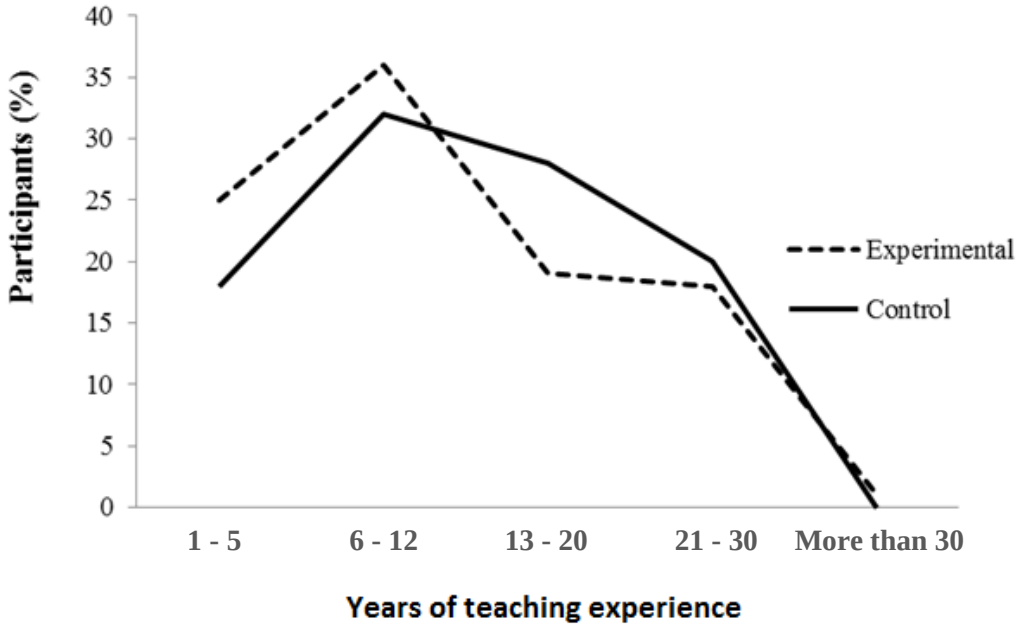

Figure 2. Participants by Group and Years of Teaching Experience

Table 3. Distribution of Academic Degree by Group and Year

Year	Academic Degree			
	PhD (E / C)	**Master (E / C)**	**Bachelor (E / C)**	**Associate (E / C)**
2008-2009	0 / 0	61 / 19	75 / 10	5 / 0
2009-2010	1 / 0	59 / 15	71 / 10	2 / 0
2010-2011	1 / 1	70 / 13	65 / 10	2 / 0
Total	**2 / 1**	**190 / 47**	**211 / 30**	**9 / 0**
%	**0.5 / 1.2**	**46.1/ 61**	**51.2 / 38**	**2.2/ 0**

E: Participants in the experimental group C: Participants in the control group

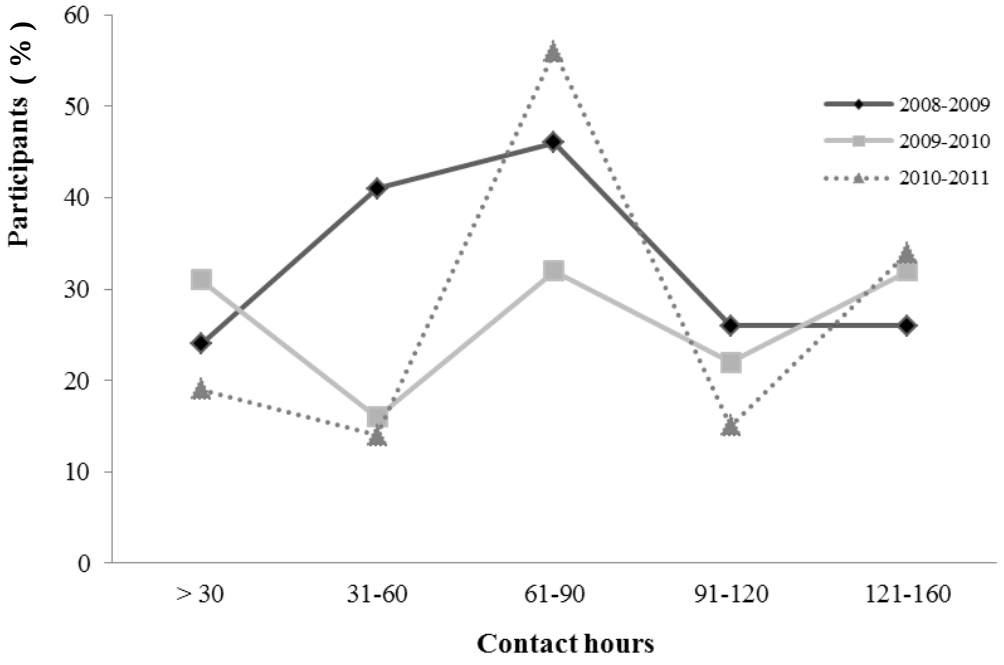

Figure 3. Participating Teachers' Contact Hours by Year

RESULTS

In order to determine the impact of the professional development workshops on elementary school teachers, a test was administered prior to and after the workshops concluded. The results indicated that, in the three years analyzed, the teachers in the experimental group who taught at the elementary level, those who taught science, as well as, those who taught mathematics, improved their performance in the post-tests. The paired t-test shows highly significant *p* values, below 0.017 in the three years analyzed (Table 4). Similar tests were applied to the teachers in the control group showing no statistically significant differences between the pre- and post-tests (Table 5).

Upon comparing the performance in the PPAA of students of teachers in the experimental group with the performance of students of teachers in the control group, the results were: i) in 2008-2009, there were no significant differences between the experimental group and the control group ($t=1.61$, $p=0.055$); ii) in 2009-2010, the control group had a better performance ($t=3.67$, $p<0.01$); iii) in 2010-2011, the experimental group performed better ($t=1.7$, $p=0.04$). These results showed that the results of the PPAA during the years analyzed were erratic. One possible explanation is that the topics covered during an academic year by the AMCT project may or not correspond to the topics evaluated in said test.

Table 4. Participating Teachers Test Results by Elementary Level, Subject, and Year

Year	Experimental Group Results					
	Elementary Science			Elementary Mathematics		
	Pre-test	Post-test	Gain / p-value	Pre-test	Post-test	Gain / p-value
2008-2009	29.36	39.00	9.64 / 0.005	28.9	52.59	23.69 / 0.001
2009-2010	102.8	118.0	5.2 / 0.003	114.8	129.1	14.3 / 0.001
2010-2011	92.4	99.3	6.9 / 0.017	119	135.6	16.6 / 0.0035

Table 5. Control Group Test Results by Elementary Level, Subject, and Year

Year	Control Group Results					
	Elementary Science			Elementary Mathematics		
	Pre-test	Post-test	Gain / p-value	Pre-test	Post-test	Gain / p-value
2008-2009	31.25	29.75	- 2.0 / NA	50.16	51.83	1.67 / 0.29
2009-2010	98.3	106.1	7.8 / 0.083	125.8	120.2	5.6 / 0.18
2010-2011	90.9	84.6	-6.3 / NA	132.7	134.4	1.7 / 0.37

DISCUSSION

In order to verify the effects produced by the AMCT Professional Development Model (MDP-AMCT), the experimental design contemplated the use of two groups, an experimental group and a control group, to which the same pre- and post-test was administered. The pre-test also represented a point of reference in order to discern the teachers' initial knowledge, adjust the content of the professional development program, and schedule the pertinent workshops according to the needs of the majority of the participants. This research provided statistical evidence to support the claim that the experimental group at the elementary level obtained better results than the control group, which can be attributed to the MDP-AMCT professional development program.

Many articles have been written in the United States, as well as, in other parts of the world, with the purpose of determining the characteristics of an efficient professional development program. A great number of researchers agree on that teachers' need to improve their mastering of content knowledge; consequently, these researchers developed their work based on quasi-experimental designs, with the application of tests before and after the intervention of professional development (Weiss et al., 2001, Corcoran and Foley, 2003; Guskey, 2003; Supovitz, 2003; Gerber et al., 2011). The results indicated

that, in all cases, the teachers' scores reflect improved results in the post-tests with *p* values oscillating between 0.035 and 0.042 in science, and between 0.0001 and 0.0008 in mathematics. In regards to this, research conducted by Desimone et al. (2002 and 2003) determined that professional development that focuses on increasing the teachers' content knowledge improved their pedagogical practices. However, these researches were based on self-reporting presented by the teachers and not on the direct observation of the teachers' practices.

Although the teachers' gains in the post-tests can be an indication of the effectiveness of the professional development models, many researchers prefer to observe results based on the gains achieved by the students in standardized tests, such as the Northwest Evaluation Association (NWEA), the Middle Grades Integrated Process Skill Test (MIPT), the Iowa Test of Basic Skills (ITBS), or, as in the case of this study, the PPAA. Similarly to the results obtained in this research, other researchers attempting to link professional development with students' learning achievements have produced mixed results. For example, Yoon et al. (2007) examined nine investigations and found that students whose teachers had received an average of 49 hours of professional development performed better in the standardized tests than those students whose teachers had never attended a professional development program. Another study designed by Garet et al. (2008) determined that the achievements reached by teachers in professional development programs did not necessarily translate into achievements on the part of the students, and many of the abilities developed were managed only for a short term and, as a result, did not have a lasting effect.

Teachers need to know how to teach (pedagogical component), as well as, what to teach (academic component), especially when the "information society" demands an increase in the amount of citizens with high levels of education, who are able to keep up with the current technological developments and to propel to the future innovations in science and technology (Imbernon et al., 1999). Hence, the importance of professional development programs for teachers is evident, as a strategy to face the challenges of modern society (Castells, 2000; Lieberman and Miller, 2001). In response to this demand, the MDP-AMCT designs and offers professional development workshops, providing a more profound study of fundamental topics, with the assistance of selected faculty who,

by sharing their knowledge and strategies, stimulates teachers to improve their teaching practices.

Considering that previous professional development programs that the teachers have received were rarely directed toward putting into practice what was learned (Lüdke, 2006), the core of the MDP-AMCT model consists of the development of workshops in which approximately 60% of the time is dedicated to practical application. This percentage has been determined by empirical experience, as a result of the work between the UT and the teachers, and responds to the amount of new information that the participants are able to process in a session of intense workshops, of no less than 7 hours per day.

Another relevant aspect of the MDP-AMCT is the construction of knowledge based on the solution of problems from everyday life. In order to implement this strategy, the teachers' previously held concepts are taken into account. In the workshops, the teachers establish relationships between the information they possessed and the new information available. Moreover, they visualize new relationships between theory and practice. Wenglinski (2000) stated that a good professional development program for teachers should acknowledge the characteristics of the teacher population that is the object of the study. According to the author, knowing the gender, age, years of teaching experience, degree of education, as well as, the population that they teach, are some of the aspects that help to provide a more accurate and contextualized understanding regarding the characteristics and professional development needs of teachers. As was observed in Table 1, women comprise 91% of the population that receives the AMCT professional development workshops. Information from different countries confirms that, except at technical schools and universities, teaching is predominantly a woman's profession. Women represent almost all the preschool teachers, three fourths of the elementary school teachers, and half of the high school teachers (Bonder 1994; Valdivieso 2010). In the same Table 1, it was determined that 71% of the AMCT's participating teachers are between 20 and 45 years old. Similar results have been reported by Bernard (2010). These researchers analyzed demographic variables of the teaching population in Puerto Rico, finding that 60% of the public school teachers are within this age range. This is an important variable to consider in professional development

programs because, since the methodological strategies that a teacher uses are directly related to how he or she was taught (Loucks-Horsley and Stiles, 2001), it is a powerful predictive of the teaching-learning styles of the teachers.

In Figure 2, it was observed that most teachers comprising the MDP-AMCT have less than 12 years teaching experience. Programs like the AMCT have greater acceptance among teachers, especially among those with little work experience. This is consistent with other research where it is mentioned that, while newly graduated teachers have the basic initial training, this does not necessarily enable them to manage themselves sufficiently well in the work force (Darling-Hammond, 2000; Vezub, 2007). Blanco et al. (2008) adds that newly graduated teachers do not feel well prepared. Bullough (2000) maintains that newly graduated teachers' initial contact with their teaching practice will quickly lead them to adopt the abiding school structures and routines. Hence, the need of a professional development program, such as the one designed by the AMCT, where the expertise and knowledge of the most experienced teachers is available, to help reduce the perpetual gap between knowledge and practice. In the aforementioned Figure 2, it can also be surmised that the teaching practice implies a lifelong learning process. Regardless of their years of experience, teachers come to training programs not because they consider it a right, but because they consider it a requisite of the profession; this is so because a distinguishing characteristic of the teaching practice is that it involves a specialized activity in which the problems to be solved are constantly changing. In this sense, the content of the teacher's practice changes with time, as occurs with the objects of study in the sciences (Avalos, 2006). Aligned with this rationale is the needs assessment, where teachers are asked to determine the nature of the topics they wish to be addressed in each academic cycle.

A criterion for being selected as a teacher by the DEPR is having received a formal education in teaching and possessing the corresponding certification in the subject one wishes to teach. Not all teachers fit the expected profile since a percentage of the participating teachers at the AMCT, albeit a small one (2.2%), only possesses an associate degree. In Table 3, it is noted that most of the teachers in the experimental group have completed a bachelor's degree (51.2%) and a high percentage of them possesses a master's degree (46.1%). Given this seemingly solid academic background, it

would seem that the need for professional development is minor. However, it has been detected that, besides content matters, teachers need to improve basic skills in communication, critical thinking, and technological literacy; qualities which they, surely, can improve when they participate in professional development programs (Garet et al., 2001; Hiebert et al., 2002; Miranda, 2003).

During years 2008-2009 and 2010-2011, nearly 50% or more of the teachers attended between 61 to 90 contact hours of training (Figure 3), despite the fact that the training workshops take place during the summer (during the school recess) and on Saturdays (during the academic year). Data provided by Darling-Hammond (1999) indicates that the United States is among the developed countries that provide the least amount of time to their teachers to be dedicated to professional development, since schools and parents expect the teacher to be in his or her classroom at all times. This information contrasts with the data reported for European and Asian countries, where teachers spend between 15 and 20 hours a week in the classroom and dedicate the rest of the time to preparing lessons, talking to parents, advising students, conducting research projects or attending professional development programs.

CONCLUSION

The attainment of quality education is a challenge in which a myriad of variables converge. The AMCT recognizes that one of the essential variables is the teachers, and how they commit to transferring to the classroom the concepts learned in professional development activities. In light of the results produced by the implementation of the MDP-AMCT, there is evidence to support the claim that the AMCT model for professional development is effective and pertinent to the population of elementary school teachers of Puerto Rico. The evidence shows that detailed planning of professional development activities, to the point of suggesting the use of active learning methodologies, allocating time to practice (more than 50% of a workshop), and using a variety of strategies, tools and technology, produce statistically significant results in the teachers' mastering of content knowledge in mathematics and sciences.

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REFERENCES

Ávalos, B. (2006). El nuevo profesionalismo, formación docente inicial y continua, en el oficio del docente. *Vocación, trabajo y profesión del siglo XXI*. Buenos Aires, Siglo XXI. Fundación OSDE.

Baker, E; Barton, P; Darling-Hammond, C; Haertel, E; Ladd, HF et al. (2010). Problems with the use of student test scores to evaluate teachers. Economic Policy Institute Washington, DC.

Bernard, D. (2010). Estado de la profesión magisterial en Puerto Rico. *Ediciones SM*, 1-129.

Blanco, R; Aguerrondo, I; Calvo, G; Cares, G; Cariola, L et al. (2008). Eficacia escolar y factores asociados en América Latina y el Caribe. ONU para educación, la ciencia y la cultura. *Salesianos Impresores S.A.* Santiago, Chile.

Bonder, G. (1994). Mujer y Educación en América Latina: hacia la igualdad de oportunidades. *Revista Iberoamericana de Educación*, (6), 12-26.

Bullough, R. (2000). Convertirse en profesor: la persona y la localización social de la formación del profesorado. En Biddle, Good y Goodson (Coords.). La enseñanza y los profesores, La profesión de enseñar. Barcelona.

Calixto, F. (2000). La imagen deseable de las ciencias naturales. *UPN*, México.

Castells, M. (2000). La era de la información, economía, sociedad y cultural: Fin de milenio. Madrid, Alianza.

Corcoran, T and Foley, E. (2003). The promise and challenge of evaluating systemic reform in an urban district. Research perspectives on school reform: Lessons from the Annenberg Challenge. Providence, RI: Annenberg Institute at Brown University.

Darling-Hammond, L. (1999). Target time toward teachers. *Journal of Staff Development*, 20(2), 31-36.

Darling-Hammond, L. (2000). Teacher quality and student achievement: A review of state policy evidence. *Educational Policy Analysis Archives*, 8(1), 1-67.

Darling-Hammond, L and Loewenberg, D. (2007). Effects of Teachers' Mathematical Knowledge for Teaching on Student Achievement. *Consortium for Policy Research in Education*, 6(2), 10-25.

Darling-Hammond, L. (2010). Evaluating Teacher Effectiveness: How Teacher Performance Assessments Can Measure and Improve Teaching. Center for American Progress. www.americanprogress.org

Desimone, LM; Porter, AC; Garet, MS; Yoon, KS; Birman, BF. (2002). Effects of professional development on teachers' instruction: results from a three-years longitudinal study. *Educational Evaluation and Policy Analysis,* 24(2), 81-112.

Desimone, LM; Garet, MS; Birman, BF; Porter, AC; Yoon, KS. (2003). Improving teachers' in-service professional development in mathematics and science: the role of postsecondary institutions. *Educational Policy*, 17(5), 613-649.

Ernest, P. (1998). Social constructivism as a philosophy of mathematics. Albany, New York: State University of New York Press.

Garet, MA; Desimone, L; Birman, B; Yoon, S. (2001). What makes professional development effective? Results from a national sample of teachers. *American Educational Research Journal,* 38 (4), 915-945.

Garet, MS; Cronen, S; Eaton, M; Kurki, A; Ludwig, M; Jones, W et al. (2008). The impact of two professional development interventions on early reading instruction and achievement *U.S. Department of Education*. Washington, DC.

Gerber, BL; Marek, EA; Martin, EP. (2011). Designing research-based professional development for elementary school science and mathematics. *Education Research International* 1-8. Doi:10.1155/2011/908014.

Godino, J; Batanero, C; Font, V. (2003). Fundamentos de la enseñanza y el aprendizaje de las matemáticas para maestros. *Proyecto Edumat-Maestros*. Universidad de Granada. España.

Guskey, TR. (2003). What makes professional development effective? *Phi Delta Kappan*, 84(10), 748–750.

Hiebert, J; Gallimore, R; Stigler, J. (2002). A knowledge base for the teaching profession: what would it look like and how can we get one? *Educational Researcher*, 31(5), 3-15.

Imbernon, F. (1999). La educación en el siglo XXI. *Los retos del futuro inmediato*. Barcelona. España. Graó.

Lieberman, A; Miller, L. (2001). Teachers caught in the action: professional development that matters. *Teachers College Press*. New York.

Loucks-Horsley, S; Stiles, K. (2001). Professional development designed to change science teaching and learning. J. Rhoton y P. Bowers (Eds.) Issues in science education: Professional development planning and design. Arlington,VA: NSTA Press.

Lüdke, M. (2006). El trabajo y el saber del docente: nuevos y viejos desafíos. Tenti Fanfani Emilio (comp.). El oficio de docente. Vocación, trabajo y profesión en el siglo XXI. Buenos Aires: Siglo XXI.

Miranda, C. (2003). El pensamiento crítico en docentes de educación general básica en Chile: un estudio de impacto. *Estudios Pedagógicos*, (29), 39-54.

Montecinos, C. (2003). Desarrollo profesional docente y aprendizaje colectivo. *Revista de la Escuela de Psicología*, (2), 105-128.

The National Science Board (the Board). 2004. Elementary and Secondary Education. http://www.nsf.gov/statistics/seind04/pdf/c01.pdf

Rowe, K. (2003). The importance of teacher quality as a key determinant of students' experiences and outcomes of schooling background paper to keynote address presented at the ACER, Research Conference 2003.

Rivkin, S; Hanushek, E; Kain, J. (2005). Teachers, schools, and academic achievement. *Econometrica*, 73(2), 417–458.

Sawyer, RK. (2006). Educating for innovation. Thinking Skills and Creativity. 1, 41-48.

Supovitz, J. A. (2003). Evidence of the influence of the National Science Education Standards on the professional development system. In K. S. Hollweg & D. Hill (Eds.), What is the influence of the National Science Standards? (pp. 64–75). Washington, DC: National Academy Press.

Valdivieso, TS. (2010). The usage of information and communication technologies in the Teaching practices of teacher in elementary and secondary education. *Revista Electrónica de Tecnología Educativa* , 33, 1-13.

Vezub, F. (2007). Teacher Training and Professional Development faced to the new challenges posed by the school system. *Revista Currículo y Formación del Profesorado*. 11(1), 1-22.

Watt, H; Eccles, J; Durik A. (2006). The leaky mathematics pipeline for girls: A motivational analysis of high school enrollments in Australia and the USA. Equal Opportunities International. 25, 642-659.

Weiss, IR; Banilower, ER; McMahon, KC; Smith, PS. (2001). Report of the 2000 national survey of science and mathematics education. Chapel Hill, NC: Horizon Research, Inc. Retrieved from http://2000survey.horizonresearch.com/reports /status/complete.pdf

Wenglinski, H. (2000). How teaching matters: bringing the classroom back into discussions of teacher quality. Princeton, NJ: Milken Family Foundation and Educational Testing Services.

Yoon, KS; Duncan, T; Lee, SW; Scarloss, B; Shapley, KL. (2007). Reviewing the evidence on how teacher professional development affects student achievement. Washington, DC: U.S. Retrieved from http://ies.ed.gov/ncee/edlabs

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A STRAIGHTFORWARD QUESTIONNAIRE FOR FAMILY ASSESSMENTS AT SOCIAL SERVICES ORGANIZATIONS

Lizzette Rojas, PhD and Flordeliz Serpa, PhD

Abstract

In order to examine the perception regarding parenting skills, children's social skills, and community involvement of a sample of families receiving services at a non-profit organization in Puerto Rico during 2012, a family assessment questionnaire was developed and administered to a non-probability sample of voluntary subjects. The self-administered questionnaire consisted of 27 closed-ended questions with multiple choice and Likert scales. The Statistical Package for Social Sciences (SPSS) was used for data entry and analysis. The self-administered questionnaires were completed by 97 subjects. Almost 50% of the parents considered their parenting skills as good or excellent. Forty percent of the parents considered their children's social skills as good or excellent. More than 40% of the parents considered as good or excellent their community involvement.

Keywords: parenting skills, social skills, community involvement

Resumen

Para examinar la percepción sobre destrezas de los padres, destrezas sociales de los niños y participación en la comunidad de una muestra de familias recibiendo servicios en una organización sin fines de lucro en Puerto Rico durante el año 2012, un cuestionario de evaluación familiar fue desarrollado y administrado a una muestra no probabilística de sujetos voluntarios. El cuestionario auto-administrado consistió de 27 preguntas cerradas con selección múltiple y escalas Likert. El Paquete Estadístico para las Ciencias Sociales (SPSS, por sus siglas en inglés) fue usado para la entrada y análisis de los datos. El cuestionario auto-administrado fue completado por 97 sujetos. Casi 50% de los padres consideraban que sus destrezas como padres eran buenas o excelentes. Cuarenta por ciento de los padres consideraban que las destrezas sociales de sus hijos eran buenas o excelentes. Más del 40% de los padres consideraban como buena o excelente su participación en la comunidad.

Palabras claves: destrezas de los padres, destrezas sociales, participación en la comunidad

INTRODUCTION

Parenting skills, children's social skills, and community involvement are some of the factors influencing families seeking services at social services organizations. For these organizations, it is crucial to perform an assessment of the families to examine and evaluate, systematically, these factors.[1] An assessment is a process for gathering and organizing information.[2] Through a family assessment, social service workers and case managers will be able to identify family's strengths and critical problems, as well as, to plan effective service interventions.[3] An appropriate family assessment considers support systems and incorporates relationship building as a basis for strengthening families and family functioning. This is why a balanced and effective family assessment goes beyond problems or limitations; it seeks to identify and use strengths, beliefs, values, interests and goals.

Family service representatives must seek to help families build strong relationships and develop empowering skills to identify and access appropriate formal and informal support systems and assist them in building, strengthening and developing a sound state of wellness, security, resilience and self-sufficiency.

Based on the literature, parenting skills are skills that parents need in order to fulfill their duties as parents.[4] Also, parenting skills are defined as child rearing skills used by parents or other primary caregivers.[5] The literature showed that parenting takes a lot of skill and patience and is a constant work.[6] Good parenting skills help children become healthy, productive and successful adults.[7]

Social skills are defined as the set of skills people use to interact and communicate with one another.[8,9] Based on the literature, children's social skills are important for early school success and later adjustment. Also, research showed that children without adequate social skills are at risk for difficulties, including peer rejection, behavior problems, and poor academic achievement.[10]

Community involvement is the process of engaging in dialogue and collaboration with community members.[11] It refers to activities that increase people's knowledge of the community and allow them to give back to the community while experiencing a sense of connection to it.[12]

The purpose of this study was to examine the perception regarding parenting skills, children's social skills, and community involvement of a sample of families receiving services at a non-profit organization in Puerto Rico during 2012. The objective of this study was to determine specific strengths and needs among participating families in order to design services better tailored to their needs using a simple and straightforward questionnaire.

METHODOLOGY

The study was based on a non-experimental, descriptive and cross-sectional design.[13] To collect the data, a self-administered questionnaire was developed in English and Spanish. Well-constructed and validated self-administered questionnaires provide a highly valuable internal view of family life. As a data collection method, they have proven to be reliable and supportive of simple and receptive administration, providing easy scoring and a quantifiable association between the respondent's perceptions (attitudes, beliefs, etc.) and her/his actions. Self-administered questionnaires are the most frequently used data collection method in social research and intervention practice.

The questionnaire consisted of 27 closed-ended questions, including multiple choice and Likert scales. To determine the perception of participating families regarding parenting skills, children's social skills, and community involvement, a scale was developed for each factor. To score parents' perception, the following scale was used: 1=need a lot of improvement, 2=need some improvement, 3=fair, 4=good, and 5=excellent.

The questionnaire included simple instructions to facilitate its administration. Participation was voluntary and the information was anonymous and confidential. The sample selected to complete the self-administered questionnaire was a non-probability sample of voluntary subjects. The data collection instrument was pre-codified to facilitate data entry and data analysis. The Statistical Package for Social Sciences (SPSS) was used for data analysis.[14]

RESULTS

The questionnaire was administered to a non-probability sample of 97 parents. Based on the results, 48% of the parents considered that their parenting skills were good or excellent, while 28% considered that their parenting skills need a lot or some improvement (Figure 1). Regarding the children's social skills, 40% of the parents considered that their children's social skills were good or excellent, while 36% considered that their children's social skills need a lot or some improvement (Figure 2). Concerning the community involvement, 44% of the parents considered that their community involvement was good or excellent, while 34% considered that their community involvement need a lot or some improvement (Figure 3).

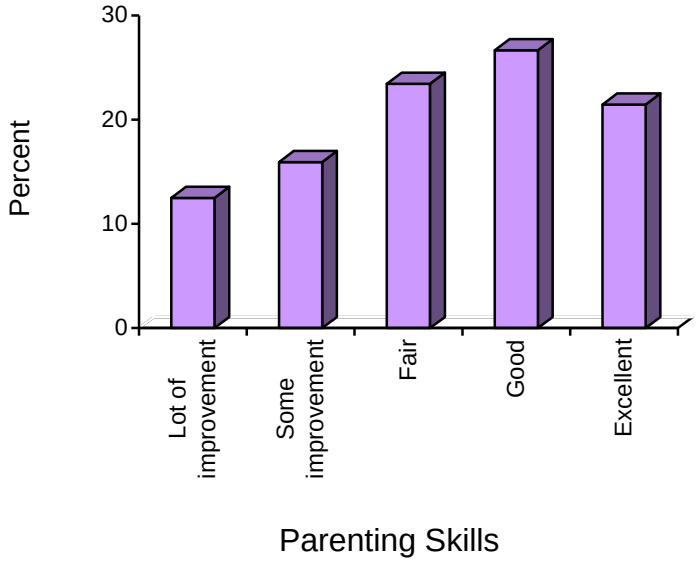

Figure 1. Perception of Parents about their Parenting Skills

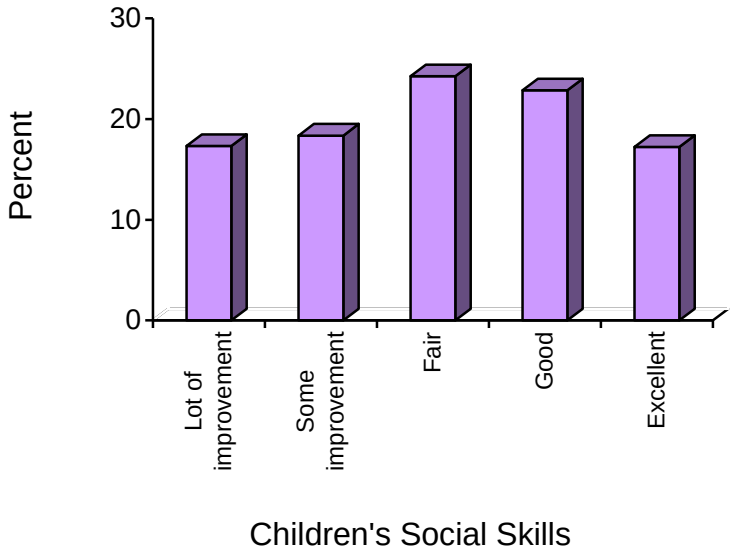

Figure 2. Perception of Parents about their Children's Social Skills

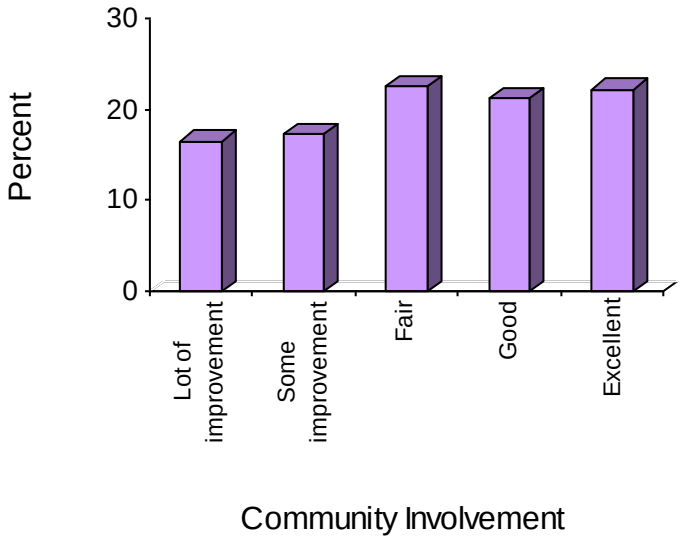

Figure 3. Perception of Parents about their Community Involvement

CONCLUSION

At the time of selecting an assessment instrument, it is critical to make sure that the instrument is reliable and valid, as well as, practical and user friendly for both the respondent and the professional who scores, interprets and uses the results. Through the self-administered questionnaire, a family assessment was performed from an inside perspective, which gave the social service workers and case managers an additional reliable tool to identify family's strengths and critical problems, as well as, to plan effective service interventions in a timely manner.

Based on the results of the family assessment, social service workers and case managers will be able to, not only plan effective service interventions, but also to refer clients to appropriate services quickly, if necessary. Forty percent or more of the parents considered as good or excellent their parenting skills, their children's social skills, and their community involvement. The self-administered questionnaire designed to serve as a self-assessment facilitated the family assessment performed by the social service workers and case managers, contributing to provide a more accurate, complete and timely assessment of family's strengths, critical issues and needs. The administration of the family assessment will also contribute to monitor family's progress over time, to assess overall program performance and effectiveness and to identify service areas in need of improvement.

REFERENCES

1. Johnson, M. A., Stone, S., Lou, C., Vu, C., Ling, J., Mizrahi, P., & Austin, M. J. (2006). Family Assessment in Child Welfare Services: Instrument Comparisons. Retrieved from http://cssr.berkeley.edu/bassc/public/BASSC_FamilyAssessment_FULL_REPORT091406.pdf
2. Free to Grow. Retrieved from http://www.freetogrow.org/pubs_keywords3360/pubs_keywords_list.htm@cat_id=2
3. Family Assessment-Why A Family Assessment? What, Where, and How of Family Assessment, Selection of Assessment Methods. Retrieved from http://family.jrank.org/pages/506/Family-Assessment.html
4. Parenting skills. Retrieved from http://psychology.wikia.com/wiki/Parenting_skills
5. Parenting skills. Retrieved from http://www.education.com/definition/parenting-skills/
6. Parenting skills. Retrieved from http://en.wikipedia.org/wiki/Parenting_skills

7. Parenting skills. Retrieved from http://www.livestrong.com/article/67270-definition-parenting-skills/
8. Social Skills. Retrieved from http://socialskillstraining.org/social_skills.html
9. Social Skills. Retrieved from http://en.wikipedia.org/wiki/Social_skills
10. Social Skills. Retrieved from http://www.education.com/reference/article/social-skills1/
11. US Environmental Protection Agency. Community involvement. Retrieved from http://www.epa.gov/superfund/community/
12. Community involvement. Retrieved from http://www.cnyd.org/definitions/index.php
13. Kumar, R. (1999). *Research Methodology*. Sage Publications Ltd.
14. SPSS, Inc. (2006). SPSS Base for Windows XP [computer software]. Illinois: Chicago.

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ONLINE EDUCATION FOR NATURAL DISASTER PREPAREDNESS

Prof. Aldo T. Marrocco

Abstract

Educational internet resources have been searched that may motivate and facilitate the study of emergency preparedness. The teaching tools available on the web, and presented in this paper, propose basic skills such as those related to a safe evacuation from buildings and a management of living spaces that limits risks and difficulties. The ideas and suggestions presented in this paper consist of text, images, videos, cartoons, games, quizzes and interactive animations, and are all in English. Some documents deal with the possibility of promoting disaster reduction in advance of disasters. This is done by, for example, a careful selection of the sites where buildings can be constructed avoiding unsafe places; some concepts about earthquake resistant buildings are also given. The resources can be used with whichever method is more appropriate, according to the teacher and the group of students.

Keywords: natural disaster, earthquake, landslide, fire

Resumen

Los recursos educativos en el internet que han sido examinados pueden motivar y facilitar el estudio de la preparación para las emergencias. Los instrumentos de enseñanza disponibles en la web, y presentados en este documento, proponen destrezas básicas como las relacionadas a una evacuación segura de los edificios y al manejo de espacios de vivienda que limiten los riesgos y las dificultades. Las ideas y sugerencias presentadas en este artículo consisten de texto, imágenes, videos, caricaturas, juegos, pruebas cortas y animación interactiva, y todos son en inglés. Algunos documentos tratan con la posibilidad de promover la reducción de desastres antes de los desastres. Esto es hecho, por ejemplo, por una selección cuidadosa de los lugares donde pueden ser construidos los edificios evitando los lugares inseguros; algunos conceptos sobre edificios resistentes a terremotos también son ofrecidos. Los recursos pueden ser usados con cualquier método que sea el más apropiado, de acuerdo al maestro y al grupo de estudiantes.

Palabras claves: desastre natural, terremoto, derrumbe, fuego

INTRODUCTION

According to the delegates of the World Conference on Disaster Reduction held in Japan in 2005, we are far from powerless to prepare for and mitigate the impact of disasters.[1] The declaration of this conference encourages the development of a culture of prevention and associated pre-disaster strategies. In order to find stimuli for getting young students interested in the subject "Safety", internet resources have been searched that may motivate and facilitate the study of emergency preparedness. The study can increase awareness on the importance of a safe behavior and, at the same time, stimulate the study of the underlying linguistic knowledge.

The resources available on the internet, presented in this paper, propose basic skills such as those related to a safe evacuation from buildings and a management of living spaces that limits risks and difficulties. Some documents deal with another aspect of prevention, which consists of promoting disaster reduction in advance of disasters. This is done by, for example, a careful selection of the sites where buildings can be constructed avoiding unsafe places. The ideas and suggestions presented in this paper consist of text, images, videos, cartoons, games, quizzes and interactive animations, and are all in English. The resources can be used with whichever method is more appropriate, according to the teacher and the group of students.

The teaching unit, for instance, might cut across English, science and geography. The sources quoted have been the basis of this manuscript, the topics mentioned in the discussion have been selected by the author for the interest that they may have. The subject is very complex and this manuscript, written on the basis of the cited sources, is just an introduction to the study thereof.

DISCUSSION

Earthquakes are phenomena known to be caused by movements of the earth's crust; they can also cause tsunamis, landslides and house fires. Their study as a lesson for a group of students should be part of the curriculum of all grades in all schools. One interesting approach to gain students attention in this topic could be a short video that shows an earthquake drill in a

class and the children take shelter under the desks until the ground stops shaking, then, they evacuate the school.[2]

Another possibility could be a video, overlaid with explanations, partly dedicated to the safe behavior during an earthquake.[3] During an earthquake, a table can serve as a shelter, even for moving within a building; it is important to remember that most people are injured by falling objects or flying broken glass, rather than by ground movement. People who are outside are advised to remain far away from buildings, power lines, trees, bridges or tunnels, if possible.

A great tool to be integrated in a lesson is a document from FEMA that suggests, among other things, how to manage the living spaces in order to limit the possibility that objects can fall hurting people.[4] For instance, it is better to avoid pictures, mirrors and shelves being located above where people sleep or sit. It is also important to remind students that children need to be able to call the emergency numbers. The need to help infants, elderly and people with disabilities needs to be also emphasized. There are resources that work this topic, in fact, there is a document dedicated to emergency management with disabled people.[5] The site also advises some checks to be performed after the earthquake, provided that the stability of the building allows reentering in the house. Among other things, it is important to check for gas leaks, electrical system damage, sewage and water pipe damage.

A site of United States Geological Services (USGS) offers a variety of information and interesting activities.[6] Other sources propose, among other things, animations on plate tectonics, earth structure, earthquakes and volcanoes.[7,8] Notoriously, in certain geographic areas, the earthquakes are stronger than in others, but it often happens that even in locations very close to each other, the intensity of ground motion may be very different. This depends on topographic characteristics of the places and type of ground on which the buildings are constructed. A manuscript by Prof. L. A. Raymond is dedicated to the selection of safe sites for the construction of buildings.[9] A site analysis carried out by expert personnel, which considers topographic and lithologic factors, may reduce earthquake risks. The best foundations for structures are provided by solid bedrock, and it is important to avoid, for example, fault zones, unstable slopes, cliffs, narrow ridges and alluvial soils. In some cases, narrow and steeply walled valleys may be

risky for both landslides hazard and the lithology of the soil. In fact, ground shaking on alluvial materials may be increased up to 4.3 times, as compared to what happens in the adjacent bedrock. A short animation that helps to understand this concept would be a great addition for a class lesson.[10]

For older students and adults, there are guides online dealing with the construction of low cost houses, often built in traditional manner with local materials, resources and manpower. These guides suggest some easily understandable design principles that are important for the stability of a house in the event of an earthquake. According to the manual of Prof. G. Minke, the more compact the plans, the better the stability.[11] Hence a circular dwelling is more stable than a square and this latter performs better than a rectangular one. L-shaped plans are less stable. In addition, doors and windows weaken the structure, therefore, they need to be carefully designed and often require reinforcements.

On one of the sources, there were guidelines for earthquake resistant construction of non-engineered masonry in earthquake affected areas which, among other things, included simple drawings dealing with the openings.[12] This source included information about the importance of building stability. It pointed out that, for greater stability of the building, walls, ceiling and floor must be well tied in with each other, doors and windows must not be located in the corners, and the distance between two openings should not be too small. It also mentioned that the use of round stones for building walls must be avoided.

According to the general concepts written in "Guidelines for earthquake resistant non-engineered construction", asymmetry is dangerous, because it leads to torsions during earthquakes.[13] Hence, constructions with a symmetric shape, both in plan and in elevation, are more stable than the asymmetric ones. It would be preferable that doors and windows are symmetrical in both placing and sizing. A long and narrow rectangular building is also more vulnerable to the torsional effects of the earthquake. Ornamentations, unless they are reinforced, may be dangerous during an earthquake. The guides also describe, with drawings, indications relevant to the choice of the safest places in which to build houses. A simple interactive animation provides the opportunity to

observe how a building reacts to earthquakes of various intensities, depending on soil and construction characteristics.[10]

Tsunamis

Tsunamis are usually triggered by earthquakes that affect the bottom of the sea, sometimes they are caused by landslides that involve marine environments. A video produced by USGS entitled "Tsunami Preparedness along the U. S. West Coast" shows the evacuation of a coastal area when a tsunami is forecast in advance because it was provoked by an earthquake occurring far away.[3] The authorities inform the population that, then, has enough time to evacuate calmly following the signs. The video also shows the case where people feel an earthquake or see the sea recede, or hear a loud ocean roar. Even only one of these signals is enough to suggest the urgent need to reach safe areas immediately, without waiting for official notices announcing the tsunami. If it is impossible to reach any heights, a high floor of a building, provided it is a very solid one, is generally considered a safe place. Many other waves, even stronger than the first one, may follow. For this reason, safe areas are not left until the authorities say to do so; the communication may arrive even after several hours. It is necessary that people should never be surprised by the tsunami, being informed, for example, through signs, about what are the dangerous areas, the safe ones, and the best routes to reach the latter.

According to a Food and Agriculture Organization (FAO) document entitled "The role of coastal forests in the mitigation of tsunami impacts", mangroves, beach forests and plantations can provide significant mitigation of tsunamis and storm waves.[14] This would surely be an interesting topic to cut across English, science and geography curricula. The source explains how the flow depth, the velocity of the water and the inundation area are reduced, thus lessening losses of human lives and damage to properties. Where beach forests or mangrove no longer existed, the damages caused by the 2004 tsunami were severe; the villages behind dense mangroves exhibited the least level of damage. Some exceptions and limits to this rule are widely discussed in the same paper. Behavioral differences, in the event of tsunami, among different tree species and diverse types of coastal forests or plantations, are also widely discussed.

According to K. Kathiresan and N. Rajendran (2005), dense coastal mangrove forests, where present, have helped reduce the damage caused by the tsunami that struck South Asia in 2004.[15] Mangroves in the study area, unlike other types of coastal vegetation, showed no visible damage as a consequence of the tsunami. Other positive and negative situations involving coastal vegetation are discussed in the paper. The authors reported that the Governments of Tamil Nadu and Kerala planned to protect the coastline with forests. Still according to the authors, in a situation of continuing degradation and destruction of mangroves, there is an urgent need for their conservation and restoration as protection in the event of a tsunami. A document entitled "Mangroves in the Northern Territory" was published to assist public knowledge of Australian mangrove ecosystems.[16] An important cause of the quick mangrove deforestation is their conversion to aquaculture, especially shrimp farming.[17] A publication provides principles for a more sustainable shrimp farming.[18]

Landslides

Landslides are often caused by heavy rains that make the land heavier and diminish its cohesion. Earthquakes, volcanic activity, wildfire and man-made construction activities on the slope too may trigger landslides sometimes. Freeze-thaw conditions may be responsible for rock falls, as shown in an educational animation.[20] Landslides can occur in seconds, or over the course of weeks and longer. An online guide dealing with landslides can surely be another great assistive material for a lesson because it describes their various types and their causes; it provides a few tips on how to prevent them, and also devotes space to the selection of safe places for constructing new buildings.[21] Sunken or down-dropped roads, tilted trees or poles, or the so-called "trees with knees" shown in the guide, is evidence of landslides that occurred in the past. These observations are important since slopes that in the past have been involved in a landslide, have a high probability of movement in the future. It is also advisable to exclude areas with slopes greater than 10-15 degrees, those near rivers, and those in which forest cover has disappeared due to fire or other causes.

Among warning signs of a landslide there are, for example, cracks in the building, sticking doors and windows, leaks from water or gas pipes. Further study opportunities

can be found on the "Frequently Asked Questions" section of the USGS webpage.[22] The forest cover often reduces the risk of landslides in sloping ground, mainly due to roots that stabilize the soil. This rule, its limitations and exceptions were discussed by F. Berger et al. (2009) and A. Stokes (2006).[23,24] In a manuscript written by A. Stokes et al. (2009), Figure 1 can be used to show schematically the stabilizing action of the roots in the soil.[25]

Fire

Regarding fire, it is important to understand how the fire works and what are the conditions that ignite, sustain, intensify and suppress it.[26] Another document provides tips on how to behave before, during and after a domestic fire while home safety is discussed in different sites.[27,28,29,30,31] It is recommended that the student inspects the house with the aid of an adult to detect possible situations of fire risk, hence making the home more safe, if necessary.[32] Also, it is important to remember that, during the evacuation, is necessary to get low under smoke and go up to the exit.[33]

One of the leading causes of fire is the heating system. Several documents about heating safety can be downloaded from the National Fire Protection Association (NFPA) website, as well as, several educational cartoons, from another webpage, which mostly deals with home fire safety.[34,35] To protect the house, fire sprinklers can be installed in each room; the heat of a fire that is beginning makes the sprinkler spray water, thus, protecting the house.[36]

Sometimes forest fires can also involve the nearby houses. To mitigate this risk, it is necessary that the trees around the houses are spaced out enough and the grass cut, to reduce fire spread.[37] The roof and the area immediately surrounding the house should be free from any combustible material. At least in the vicinity of the houses, it is necessary that the lower branches of large trees and the plants underneath them are removed; this eliminates a vertical "fire ladder" from the ground to the crown of the tree. Compliance with these tips can make the place safer, for the home and for the firefighters. A document provides tips to develop a fire safe landscape, by selecting fire resistant plants and following proper maintenance practices that decrease their flammability and

accessibility to fire.[38] Another document contains a drawing with useful information on how to undertake safe debris burning in the garden.[39]

Flood

Notoriously, fires in natural environments can deprive the soil of grass and tree cover. As a consequence, after heavy rains, the water encountering no resistance from the vegetation that was burned streams down very quickly, thus, creating flood risk.[40] Snowmelt and heavy rains and, in the coast, high tides amplified by storms may cause a flood. Different documents provide information on how to manage the environment to protect people and properties from flooding and proper behavior in case of flood.[41,42,43] The furnace, water heater, and electric panel should be located at a height unreachable by water. When a flood is forecast, all electrical appliances and all the chemicals should be taken to safe places. Before the flood, in order to prevent electrical accidents, it is necessary to shut off electrical power at the main switch of the house, but this is dangerous if the room is already flooded and must not be done. Flood waters can be electrically charged, from underground or from downed power lines. In this case, it is dangerous to approach, and it is necessary to notify the authorities. Walking in 15 cm of fast flowing water can lead to the risk of falling; when moving through flooded areas the use of a stick may prevent tripping hazards.

After a flood, the streets may be damaged and could fail under the weight of a car.[44] Floodwaters may be contaminated with chemicals or sewage. In order to prevent water contamination and health problems, a wise action is to turn off the main water supply of the home and plug all basement sewage connections. Before returning home, it is necessary to wait until authorities say it is safe to do so, and to know whether the community's water supply is safe to drink. Before returning to a house after the flood, there are some hygienic measures to be taken. For example, it is necessary to disinfect the affected areas. A flood could have damaged the building, particularly at the foundations; any damage to sewage systems is a serious health hazard.

When helping animals during a flood, they can be frightened by the emergency and, therefore, difficult to control. A document entitled "information for pet owners" gives advice in this regard.[45] When returning home after the flood, it is necessary to

remember that, at least in some geographic areas, wild animals, including poisonous snakes, may have found shelter in the house. Masonry and asphalt surfaces are impervious to water and prevent both the infiltration of water in the soil and evapotranspiration. For this reason, after heavy rains in urbanized areas, the water runoff is more intense than in natural environments and this concept is represented by an animation.[46] Notoriously, even from a natural environment, after heavy rain the soil cannot store further water, there may be a huge runoff and floods may ensue. An animation of Melbourne Water Education, allows us to observe the water flow in the town during storms of different intensities.[47,48] The students can learn how houses, streets and parks are affected, what is done to respond to floods and what the consequences of individual actions can be.

Another document deals, among other things, with the risks in underground areas and facilities.[49] Some locations are particularly prone to flash floods, sometimes without such typical warnings as heavy rain; this may happen, for example, in canyons or near streams and canals. According to Prof. L. A. Raymond, if a landslide occurs in a narrow valley, the dam which may be consequently produced, causes flooding upstream and then, if the dam produced by the landslide collapses, flooding may occur also downstream.[9] In several climatic areas, a season of heavy rains is followed by long dry periods. In this case, the problem is not just to cope with the floods, but also to store and save water for drought periods. Two educational tools "Interactive house" and "Rainwater tanks in schools" provide a few suggestions for that purpose.[50,51]

Hurricane and Storms

It is vital to know what to do before, during and after a typhoon or a hurricane, in the event of such emergency.[4,52,53] If ordered to evacuate, it is necessary to do so immediately. In this case, it is necessary to know a safe route to reach the emergency shelter, and to have the evacuation kit ready for any emergency (food, water, medications, documents, money, etc.). During the storm, standing near a window should be avoided because the risk is greater there; to stay in an interior room is safer. Also, being located in easily flooded areas is risky.

It is important to remember that the wind stops when the eye of the storm is passing, then changes direction and regains its strength. The winds are stronger at higher elevations and on coastal areas. It is important that outside the houses there are no objects which can fly as a consequence of strong winds, creating further danger; sometimes, the wind can carry away mobile or manufactured homes.

Other Safety-Related Topics Sites and Sources

A BBC website offers short animations and another document deals with precautions to avoid avalanches in the mountains.[54,55] More safety documents are mentioned, although not specifically concerning to natural disasters. Different sites deals with kitchen safety, the search for hazards in the home and, among other fun and games, a crossword puzzle on safety and an online game about house safety.[56,27,18]

CONCLUSION

Based on the teaching tools presented and the information discussed, teachers can increase awareness on the importance of a safe behavior and emergency preparedness, contributing to develop a culture of prevention among the students.

REFERENCES

1. Retrieved from http://www.unisdr.org/wcdr/intergover/official-doc/L-docs/Hyogo-declaration-english.pdf
2. Retrieved from http://www.archive.org/details/fact_earthquake_psa
3. Retrieved from http://pubs.usgs.gov/gip/105/
4. Retrieved from http://www.fema.gov/plan/index.shtm
5. Retrieved from http://www.fema.gov/library/viewRecord.do?id=1442
6. Retrieved from http://earthquake.usgs.gov/learn/kids/
7. Retrieved from http://www.iris.edu/hq/programs/education_and_outreach/animations
8. Retrieved from http://www.iris.edu/hq/programs/education_and_outreach/resources
9. Retrieved from http://cidbimena.desastres.hn/docum/crid/Diciembre2005/pdf/eng/doc13315/doc13315-contenido.pdf
10. Retrieved from http://earthquake.usgs.gov/learn/topics/?topicID=52
11. Retrieved from http://www2.gtz.de/dokumente/bib/04-5789.pdf
12. Retrieved from http://www.confinedmasonry.org/wp-content/uploads/2009/09/Pakistan_ERRA_Guideline.pdf
13. Retrieved from http://www.nicee.org/IAEE_English.php

14. Retrieved from http://www.fao.org/docrep/010/ai389e/ai389E00.htm
15. Kathiresan, K. & Rajendran, N. (2005). Coastal mangrove forests mitigated tsunami. Estuarine, Coastal and Shelf Science 65, 601-606. Retrieved from http://www.hawaiistateassessment.info/library/Hawaii_Coastal_Hazards/Document_Library/VEGETATION/Mangroves/Kathiresan%20and%20Rajendran%202005%20-%20Coastal%20mangrove%20forests%20mitigated%20tsunaminext%20term.pdf
16. Retrieved from http://www.lrm.nt.gov.au/__data/assets/pdf_file/0010/6778/2003_mangrove_education_pack.pdf
17. Retrieved from http://www.unep.org/pdf/infrontline_06.pdf
18. Retrieved from http://library.enaca.org/shrimp/publications/shrimp-principles-2006.pdf
19. Retrieved from http://www.k12station.com/k12link_library.html?subject=NHS&sub_cat=103526&final=103527
20. Retrieved from http://www.edumedia-sciences.com/en/a622-freeze-thaw-weathering
21. Retrieved from http://www.oregongeology.org/sub/Landslide/homeowners-landslide-guide.pdf
22. Retrieved from http://landslides.usgs.gov/learning/faq/
23. Berger, F. et al. (2009). State of the art on forest and shallow landslide interactions illustrated by two studies in the French Alps. Geographical research abstracts. Vol. 11. Retrieved from http://meetingorganizer.copernicus.org/EGU2009/EGU2009-8877.pdf
24. Stokes, A. (2006). Selecting tree species for use in rockfall-protection forests. For. Snow Landsc. Res. 80, 1:77-86 (2006). Retrieved from http://www.wsl.ch/dienstleistungen/publikationen/pdf/7499.pdf
25. Retrieved from http://www.smokeybear.com/elements-of-fire.asp
26. Stokes, A. et al. (2009). Desirable plant root traits for protecting natural and engineered slopes against landslides Plant Soil. 324:1-30. Retrieved from http://www.springerlink.com/content/t44jv50107346v30/
27. Retrieved from http://www.sparky.org/arcade_riskwatch.html#
28. Retrieved from http://www.fire.ca.gov/communications/downloads/fact_sheets/BeforeDuringAfter.pdf
29. Retrieved from http://www.usfa.dhs.gov/citizens/all_citizens/home_fire_prev/electrical.shtm
30. Retrieved from http://www.nfpa.org/assets/files/PDF/Public%20Education/EscapePlanningTips.pdf
31. Retrieved from http://www.usfa.dhs.gov/kids/flash.shtm
32. Retrieved from http://www.sparky.org/arcade.html#
33. Retrieved from http://www.sparky.org/downloads/SparkyChecklist.pdf
34. Retrieved from http://www.nfpa.org/itemDetail.asp?categoryID=1803&itemID=42601&URL=Safety%20Information/For%20kids
35. Retrieved from http://www.nfpa.org/itemDetail.asp?categoryID=1531&itemID=37034
36. Retrieved from http://www.nfpa.org/itemDetail.asp?categoryID=491&itemID=39669
37. Retrieved from http://www.nfpa.org/assets/files//PDF/Sprinkler%20kit/SprinklerTipsEnglish.pdf

38. Retrieved from http://www.fire.ca.gov/communications/downloads/fact_sheets/DefensibleSpaceFlyer.pdf
39. Retrieved from http://www.cfs.sa.gov.au/site/fire_safety/preparing_your_home/landscaping.jsp
40. Retrieved from http://www.fire.ca.gov/communications/downloads/fact_sheets/DebrisBurning.pdf
41. Retrieved from http://www.flickr.com/photos/7844915@N05/2208748726
42. Retrieved from http://www.countyofsb.org/uploadedfiles/pwd/water/homeownersguide_final.pdf
43. Retrieved from http://www.fema.gov/hazard/flood/index.shtm
44. Retrieved from http://www.pep.bc.ca/floods/preparedness.html
45. Retrieved from http://www.dot.ri.gov/Local_Roads_Fed_Aid_System.asp
46. Retrieved from http://www.ready.gov/sites/default/files/documents/files/PrinterFriendly_Pets.pdf
47. Retrieved from http://techalive.mtu.edu/meec/module01/Landuseimpacts.htm
48. Retrieved from http://education.melbournewater.com.au/content/rivers_and_drainage/our_drainage_system/floods_explorer/floods_explorer.asp
49. Retrieved from http://www.city.sapporo.jp/city/english/disaster.html
50. Retrieved from http://www.sydneywater.com.au/Water4Life/InYourHome/InteractiveHouse/
51. Retrieved from http://www.sydneywater.com.au/Education/rainwatertank.cfm
52. Retrieved from http://webcache.googleusercontent.com/search?q=cache:http://www.gfd.guam.gov/docs/NaturalDisaster_Manmade/TyphoonPreparedness.pdf
53. Retrieved from http://www.weather.gov/os/hurricane/pdfs/hurricane-safety_flyer.pdf
54. Retrieved from http://news.bbc.co.uk/2/hi/science/nature/4183344.stm
55. Retrieved from http://www.slf.ch/dienstleistungen/merkblaetter/Attention_Avalanches_e.pdf
56. Retrieved from http://www.fire.ca.gov/communications/downloads/fact_sheets/Kitchensafety.pdf

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