Please cite the source as:

Martínez Vidal, R. D., Montero, Y. H., Pedrosa, M. E., & Martin, E. I. (2006). Teacher-training in Informatics and its Transfer to the Classroom: A Study in the Province of Buenos Aires. *Revista Electrónica de Investigación Educativa*, *8* (2). Retrieved month day, year, from: http://redie.uabc.mx/vol8no2/contents-vidal2.html

Revista Electrónica de Investigación Educativa

Vol. 8, No. 2, 2006

Teacher-training in Informatics and its Transfer to the Classroom: A Study in the Province of Buenos Aires

La capacitación docente en informática y su transferencia al aula: Un estudio en la provincia de Buenos Aires

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(Received: September 8, 2005; accepted for publishing: August 10, 2006)

Abstract

The objective of this study was to investigate some factors that may be related to the degree to which the skills developed by in-service teachers during a computer course, are or are not transferred to the classroom. The course was oriented toward the pedagogical use of the computer, including the design of student-centered activities. The data, collected one academic year after the course ended, revealed different levels of transfer. The study examined the effect on the level of implementation of student-centered activities, with variables such as age, personal assessment of the training, access to a computer at home, attitudes toward computers, experience with computers, and perceived self-efficacy. The results showed that in the classroom, perceived self-efficacy was the most important predictor of the level of implementation for activities supported by the computer.

Key words: In-service teacher training, understanding of computation, teacher's attitude, teacher's behavior.

Resumen

Este estudio tuvo como propósito investigar sobre algunos factores que podrían estar relacionados con el grado en el cual las habilidades desarrolladas por docentes en servicio, durante un curso de computación, son o no transferidas al aula. El curso estuvo orientado al uso pedagógico de la computadora, incluyendo el diseño de actividades centradas en el estudiante. Los datos recogidos un año académico posterior a la finalización del curso revelaron niveles de transferencia muy diferentes. El estudio examinó el efecto sobre el grado de implementación de las actividades centradas en el estudiante, que tienen variables tales como edad, evaluación personal de la capacitación, acceso a computadora en el hogar, actitudes hacia la computadora, experiencia con computadoras y autoeficacia percibida. Los resultados mostraron que la autoeficacia percibida fue el principal predictor del nivel de implementación en el aula de actividades apoyadas en la computadora.

Palabras clave: Formación del profesorado en servicio, comprensión de la computación, actitud del docente, comportamiento del docente.

Introduction

One of the purposes of basic general education (BGE) is to give students an array of relevant knowledge that will permit them to face the challenges of their times (Giroux, 1990; MCyEN, 1995, Sancho, 1996). It is widely recognized that computers, and speaking more generally, computing and communication technologies, are producing significant changes that have an impact, directly or indirectly, on all social sectors and human activities. Nevertheless, the inclusion of these technologies in Argentina's BGE appears to lag rather far behind. In the Municipality of General Pueyrredon, and in the Province of Buenos Aires as a whole, the integration of the computer into public education—with few exceptions—

remains virtually absent—or at best, usually occupies an isolated and marginal space. Probably the main reason for this situation lies in the erratic nature and the discontinuity of the policies followed by the different political and educational authorities. Indeed, the salient characteristic that unifies the various computer-training programs developed in that province is the lack of project continuity, as if they perished after the completion of training (Martinez, Montero and Pedrosa, 2002).

The research reported in this paper was conducted during the school year immediately following the completion of an optional training course, taken by BGE in-service teachers from schools run by the Municipality of General Pueyrredon, Province of Buenos Aires, Argentina. It was dictated by pedagogically high and technically-experienced teachers of the National University of Mar del Plata. The ultimate goal was for teachers to construct customized projects, which voluntarily had be put into practice with their students after the course was completed.

The central theme of this study focuses on analyzing the degree of implementation of such projects, including factors that could have been related to transferring them to the classroom. It is important to emphasize that the schools under study in this project presented quite a homogeneous panorama: they are located on the outskirts of the city, in neighborhoods where various basic needs are unsatisfied and school equipment is quite modest. In saying this we want to emphasize that before and after the training we took a realistic approach to the situation, and therefore, tandem training/implementation was thought of as a first step—modest, certainly—that would point toward incorporating the use of computer into schools.

I. Theoretical framework

For teachers in service, the introduction of technology poses a number of challenges that requiring the mastery of different skills, given that incorporating it alters the normal dynamics of their work (Lumpe and Chambers, 2001). In the municipality in which this work was developed, there are studies reporting that although teachers may have positive attitudes, they clearly encounter serious difficulties when trying to incorporate the computer into their daily activities (Martínez , Astiz, Medina, Montero and Pedrosa, 1998). Their problems have little to do with the lack of convergence between the software available and their needs as users (Bannon, 1990), or with the ways to attach meanings to technology (MacKenzie, 1996); these problems have deeper roots, which largely stem from the school organization itself.

When in due course there are no clear, consistent and continuing government plans that can, even in modest ways, incorporate technology into the school, the actors are trapped in the imperceptible and persistent presence of a school culture still adapted to past situations (Berger and Luckman, 1984, Douglas, 1996). However, there is a dialectical relationship between the institution's culture and the actors' intent, which enables the school to have a space of relative autonomy, even

in cases where there is a marked scarcity of resources and technological support, such as the present one (Díaz Barriga, 1994)

The literature registers a multitude of variables associated with the adoption of technology: the most important being such things as attitudes toward computers, level of experience with technology, beliefs concerning self-efficacy, age 10 and, computer ownership (Lumpe and Chambers, 2001; Ross, Hogaboam-Gray and Hannay, 1999). Gender is another variable of note, and also has received much attention; it has not, however, been included in this study because in the context where the investigation was carried out, all the teachers are women (something very common in the GBE all over Argentina).

Among the factors which have been studied in relation to the incorporation of technology into classroom teaching work, the first set of variables considered was evaluation of *training received*, *age of teacher*, *ease of access to computer*, and *evaluation of the work context* (Fabry and Higgs, 1997; Marcinkiewicz, 1993, Ross *et al*., 1999). Of these factors, the one most studied has been the relationship between age and computer use. It has been shown that there are differences in attitudes toward computers based on the subject's age, although this is influenced by several factors, among which some of the most outstanding are level of *education* and *experience* (Dyck and Smither, 1994). There is evidence that adults need to feel confident in their own abilities in order to learn to use technology and to be open to a broader explanation of the possible uses which might be of interest, as a precondition to the training process (Zhang and Espinoza, 1997). In general, although they perceive working with technology as less comfortable, and feel they have less control over it, there are studies showing that as subjects of all ages gain experience, their attitudes are modifiable (Czaja and Sharit, 1998).

Computer experience, *attitudes* toward the environment, and the *self-efficacy perceived by teachers* are a second set of factors to which greater importance is often attached than to those indicated in the preceding paragraph. The literature records a complex interrelationship between these variables, as well as assigning them a possible predictive value for the transfer of technology to the classroom (Albion, 2001, Delcourt and Kinzie, 1993; Hignite and Echternacht, 1992; Vannatta and Fordham, 2004) room.

Self-efficacy has been associated with attitudes (Zubrow, 1987, Yan and Piper, 2003), related to the decision to sign up for computer courses (Hill and Mann, 1987), and is considered as a predictor for the adoption of the computer (Pajares, 1996, Piper and Austin, 2004, Yi and Im, 2005), and also with the *anxiety* or *fear* of using that medium (Houle, 1996).

Attitudes act as a factor in understanding level of frequency and success in computer use (Karsten and Roth, 1998; Khorrami-Arani, 2001). Attitudes, principally toward *usefulness,* have been pointed out as predictors of the desire to learn; and *self-efficacy*, in turn, has acted as a predictor of readiness to learn complex skills (Zhang and Espinoza, 1997 and 1998).

It has been noted that self-efficacy has been predictive of the subject's commitment to the computer, and that these experiences affect future use insofar as it increases the level of perceived self-efficacy (Kinzie, Delacourte and Powers, 1994).

Attitudes are psychological tendencies expressed in the evaluation of a particular entity as having some degree of favor or disfavor, and where the assessment can be open, covert, cognitive, affective or *behavioral* (Eagly and Chaiken, 1993). Attitudes toward computers have been extensively studied. These attitudes can be partially predictive of the adoption or rejection of this electronic medium in the subject's routine tasks.

One of the instruments most used in educational research for measuring attitudes toward computers (Woodrow, 1991, Gardner, Discenza, and Dukes, 1993) is the Computer Attitude Scale (Loyd and Gressard, 1984; Gressard and Loyd, 1986); since it has demonstrated its validity and reliability in a variety of situations (Dyck and Smither, 1994; Kluever, Lam, Hoffman, Green and Swearingen, 1994; Shashaani, 1994; Busch, 1995; Gabriel and MacDonald, 1996, Jennings and Onwubgeuzie, 2001).

Perceived self-efficacy refers to individuals' personal judgments concerning their capacities for action in a particular type of task, and is closely linked to expectations of success. Moreover, it is related with the concepts of competence and attitude, but unlike overall perceptions that apply to many situations, self-efficacy usually refers to specific judgments on concrete situations (Bandura, 1987, 1992, Pajares, 1996; Pajares and Schunk, 2002).

Efficacy beliefs are developed on the basis of four sources of information (Wang, Ertmer and Newby, 2004):

1) The subject's active experience (which is the most important).

2) Vicarious experience (observed experience).

3) Realistic verbal persuasion.

4) Emotional and psychological states.

These beliefs act on the level of motivation, and are based more on what the subjects believe than on what might be regarded as objectively true.

In other words, self-efficacy refers to feelings of competence rather than to competence itself. It has been verified empirically that the subject's ideas of her* own capabilities have an influence on her motivation, and therefore influence the

* Translator's note: Before the feminist movement arose, in situations including both genders it was customary to use the masculine pronoun. Today, however, pronouns of both genders are used to avoid what is now seen as sexist language. To avert the awkwardness of continually using "s/he", "his/her", we shall, in this paper, sometimes use the feminine pronoun, and sometimes the masculine.

tasks she chooses, the goals she proposes, and the effort she invests in achieving the goals established. Understood as an egocentric construct, perceived self-efficacy is usually measured by questionnaires or similar instruments relating to categories and concrete situations that have to do with the situation under study (Bandura, 1997; Huertas, 1997, Stipek, 1998).

II. Objective

The objective of the research here reported, focused on analyzing a set of factors that could be related, directly or indirectly, to the degree of classroom implementation of the proposals made by the teachers themselves during training. The variables considered were:

a) The teacher's evaluation of the training received, considering two factors: quality of the training, and degree of difficulty;

b) Age of participants;

c) Access to the computer at home;

d) Variations between the context of work expected, and that found after training;

e) Experience in the use of computers;

f) Attitudes toward computers;

g) Perceived self-efficacy relating to the implementation of the above proposals.

In addition to looking at the connection between these factors and the degree to which the training was transferred to the classroom, we sought to make a brief study of the relationship between the last three variables, analyzing them by pairs.

III. Method

3.1. Participants

This research involved 109 teachers of basic general education (BGE) from the schools of the Municipality of General Pueyrredon, Province of Buenos Aires, Argentina. The teachers were part of a cohort of 131 educators who voluntarily attended and successfully passed a training course on the educational use of simple computer resources (in essence, general operation, use of elementary word processing, and Internet searches), given by professors from the Mar del Plata National University.

The course had the following objectives:

a) Teachers should achieve an acceptable mastery of the technological resources mentioned.

b) Teachers should incorporate ways of using the computer to organize activities.

c) According to personal interests and an estimate of the specific conditions of the work environment, upon completion of the training each would develop a proposal so as to implement it with their students.

There were 109 participating teachers, whom we could track during the academic year immediately following the completion of the course. The purpose was to determine to what extent they had implemented the proposals developed during the training. Participants were between 28 and 57 years of age and, with an average age of 41.5 years (deviation 7.6 years).

3.2. Instruments used

For the performance of the study, data were collected in three different stages: 1) at the beginning of training, 2) upon its completion, and 3) a subsequent school year.

1) Beginning of training

At the beginning of the training the following information was collected: age; computer access at home; and personal perception and experience with computers. For the latter, there was generated a small instrument with eight activities, regarding which the teacher had to indicate his proficiency. Based on the possible responses, teachers could be placed in any of the following categories: a) no experience; b) little experience; c) acceptable experience; d) extensive experience; and e) expert experience. It is interesting to note that no teacher fell into the last two categories. Other information collected at the beginning of the course is not relevant to this work.

2) Conclusion of training

The second stage of data collection included a survey that served as an indicator of the conditions under which teachers completed the training. The instruments used were:

- Computer Attitude Scale (CAS). This instrument consists of 40 statements with five-point Likert responses available to the subject. Attitudes toward computers include the following dimensions: 1) anxiety or fear toward the computer, 2) personal confidence in using or learning about the medium, 3) satisfaction or pleasure in working with it, and 4) usefulness assigned to it. Each subscale is measured by 10 statements, including, in their entirety, the 40 sentences above

(Gressard and Loyd, 1986, Loyd and Gressard, 1984). The most negative attitude is a 0 (zero), the most positive is a 4 (four), and 2 (two) is a neutral position.

- A 10-item instrument in five-point Likert scale, referring to training. It includes the perceived difficulty level plus an estimate regarding the quality of training. Half the items were stated in a positive way, and the rest in a negative manner. The greatest difficulty and lowest quality were graded as 0 (zero); the least difficulty and the highest quality was rated as 4 (four), while 2 (two) indicated an average level of difficulty and quality.

- An instrument designed to measure perceived self-efficacy and to collect the opinion of teachers, based on the specific context of their workplace. Through a brief preliminary study, we examined the specificity and clarity of the instructions, as well as the congruence between these and the concrete actions teachers ought to take in order to implement the proposals developed during the training. Based on these premises there was drafted an instrument of 12 items in five-point Likert scale, and written with half positive and half negative. The lowest self-efficacy was rated as 0 (zero); the most qualified, as 4 (four); and 2 (two) as average.

3) School year

The last phase included data collected at the end of a school year, after training. For this purpose a survey was administered by means of a form containing two types of questions. The first part consisted of five regarding the degree of implementation of the proposal developed during the training. Based on the responses received, these could be put in three categories: *no implementation, partial implementation and full implementation*. The second part was comprised of 10 questions having to do with a comparative assessment of the work context, contrasting what was expected at the beginning of the school year with what was discovered as it developed The responses available were: “worse than expected,” “as expected” and “better than expected “. The first was rated as 0 (zero), the second as 1 (one), and the third as 2 (two).

IV. Results

The first part of the results indicated in this section is focused on the level of implementation of the proposal, and its relationship with different factors considered in this study.

4.1. Degree of implementation

The proposal developed during the training could be implemented in its entirety by only 18 teachers (16.5%); 49 carried out a partial implementation (45%), while the remaining 42 teachers (38.5%) did not ask with the computer in the development of

their classes throughout the entire school year after training. Figure 1 shows this information.

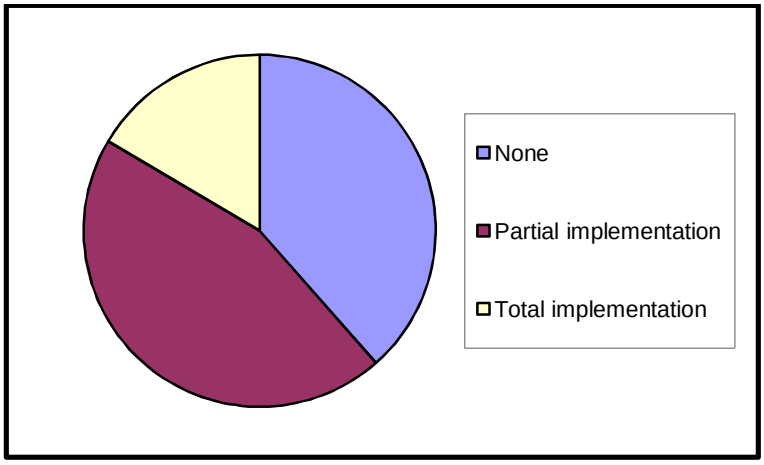

Figure 1. Levels of implementation

4.2. Implementation according to assessment of the training

As noted above, at the end of the training, participants were given an evaluative survey of the training. This included two factors: the perceived difficulty level and an estimate of the quality of the course. As already noted, the greatest difficulty was indicated by the value 0; the lowest by 4; while 2 indicated medium difficulty. Regarding the assessment of the course, the highest value was scored as 4, the lowest as 0; and as in the previous case, an average assessment was indicated by 2. It would be interesting to know whether the perception of the training course had any effect on the degree of the proposal's implementation. The corresponding survey in its entirety, obtained a reliability index of 0.805, as measured by Cronbach's alpha coefficient. Table I indicates the average values of these two evaluations (difficulty and quality) for each level of implementation.

Table I. implementation according to assessment of the training

	None	**Partial**	**Complete**	**Weighted average**
Difficulty	2.29	2.38	2.33	2.33
Quality	3.75	3.67	3.71	3.71

The value of statistic F, according to an analysis of variance, gives the values of 0.424 and 0.595 for difficulty and quality, respectively, which indicates for the corresponding levels of freedom, that the differences lack significance.

4.3. Age of teachers and degree of implementation

Age has traditionally been considered as a factor which can influence the adoption of new technology. Table II shows the average ages for each level of implementation.

Table II. Ages and level of implementation

	None	Partial	Complete	Total
Average age	40.5	41.0	45.0	41.5
Total no. Of subjects	42	49	18	109

Calculating the F statistic gives a value of 2.50 (significance 0.087), indicating that the differences have no important significance.

4.4. Implementation according to computer access

It is estimated that access to a computer at home could be an influential factor regarding the teacher's possibilities for implementing students' implementation of the proposal developed during training. Table III shows the crossover frequencies observed for owning or not owning a computer, together with the levels of implementation of the proposal (expected frequencies are shown in parentheses).

Table III. Implementation according to possession of computer

	None	Partial	Complete	Total
Do not have	12 (8.5)	4 (9.9)	6 (3.6)	22
Have	30 (33.5)	45 (39.1)	12 (14.4)	87
Total	42	49	18	109

In this case, Pearson's O^2 coefficient shows a value of 8.161 (bilateral significance 0.017), which indicates differences having some significance. However, in analyzing more closely, it can be seen that these differences do not have a totally precise directionality. Although in the cases of no *implementation* and of *partial implementation*, the situation favors those who have computers at home; in connection with *full implementation*, we observed that those who did not have computers exceeded the expected values, while those did have a computer were lower than expected.

Given the lack of clarity of these results, we redid the calculations, unifying categories of partial and complete implementations. Thus, the subjects were

divided into two groups: those who had carried out no implementation, and those who made a transfer to the classroom. In this case, there was obtained a Pearson's O^2 coefficient of 2.984 (bilateral significance 0.084), which indicates that the differences lack statistical significant.

Another interesting fact derived from Table III is that out of all the research participants, 79.8% (87 of 109) have access to a computer at home, while only 20.2% (22 of 109) do not.

4.5. Implementation according to context expected

As we have already noted, one of the variables that could have influenced the proposal's degree of implementation was the comparative perception of working conditions. That is to say, the comparative evaluation of teachers' work context, contrasting what was expected when the proposal was formulated with what was found during the later development of their scholastic activities. According to the scale constructed, the available responses for each question were: "worse than expected" (scored as 0); "as expected" (scored as 1) and "better than expected" (scored as 2).

For the corresponding survey there was obtained a reliability coefficient of 0.794. Table IV shows the comparative average ratings of the work context, for the three possibilities of implementation of the proposal.

Table IV. implementation according to evaluation of context

	None	**Partial**	**Complete**	**Weighted average**
Evaluation	0.85	0.89	0.95	0.88
Total	42	49	18	109

According to the comparative evaluation of the context, teachers perceived that the real conditions of the work environment were slightly inferior to what was expected (all are inferior to those of the unit). While there is some directionality, in the sense that there is not as much distance between what was expected and what was found in daily practice, when considering the higher implementation level, the differences became significant. In calculating the F statistic in an analysis of variance there was obtained a value of F = 0.445 (significance 0.642), which shows that no statistically significant differences exist.

4.6. Implementation based on experience with computers

As we have already mentioned, at the beginning of training, no teacher or expert had had extensive experience in computer use. Regarding participants of this research, it was possible to distinguish three groups, namely:

- Level 1 (18 teachers). Those who had their first experiences with computers in the training course.
- Level 2 (61 teachers). Those who had little experience before the course.
- Level 3 (30 teachers). Those who, before the course, already had an acceptable amount of experience.

For the analysis of this variable, considered as a factor in the degree of implementation of the proposal, we made a study of the corresponding contingency tables. Table V shows the frequencies observed in each case (the expected frequencies are shown in parentheses).

Table V. Implementation based on computer experience

	None	**Partial**	**Complete**	**Total**
Level 1	8 (6.9)	6 (8.1)	4 (3.0)	18
Level 2	24 (23.5)	25 (27.4)	12 (10.1)	61
Level 3	10 (11.6)	18 (13.5)	2 (5.0)	30
Total	42	49	18	109

Pearson's Chi-square coefficient shows a value of 5.135 (bilateral significance 0.274). This indicates that the differences in the proposal's level of implementation and the level of computer experience exhibited by the teachers are not significant. It is interesting to note that during the development of the research, there was reported the performance of an analogous analysis in reference to the teaching experience; this analysis yielded similar results, which are omitted.

4.7. Implementation according to attitudes toward computers

In measuring attitudes toward computers, carried out in conjunction with the end of the training, confidence levels were measured with the Cronbach alpha coefficient of 0.918 for the general survey, and 0.795, 0.790, 0.783 and 0 top 722 for the four subscales, respectively. Correlations between subscales ranged between 0.490 and 0.684.

In keeping with the purposes of this work, Table VI shows the average values of attitudes toward computers in each dimension and general attitude, corresponding to the proposals three levels of implementation.

Table VI. Implementation and Attitudes (by dimension, and general)

	None	Partial	Complete	Weighted average
Anxiety	3.28	3.23	3.40	3.28
Confidence	2.57	2.66	2.68	2.62
Pleasure	2.92	2.87	3.07	2.92
Usefulness	3.14	3.37	3.46	3.30
General	2.98	3.03	3.15	3.03

Performing successive analyses of variance gives the following values of the F statistic: 0.549, for *general attitude*; 0.427 for the dimension *anxiety*; 0.201 for *confidence*; 0.481 for pleasure; and 3.158 for *usefulness*. The only case that is of some significance is usefulness, since the value found for F is associated with a significance of 0.047. However, in the latter case, post hoc analysis using the Tukey HSD procedure places the three degrees of implementation in a single homogeneous group, although it warns of a certain separation between the group *no implementation* and the other two groups.

4.8. Implementation by self-efficacy

The values of perceived self-efficacy might fall between 0, the lowest self-efficacy; and 4, the highest self-efficacy perceived for carrying out carry out the implementation of the proposal. For the corresponding survey yielded an alpha reliability index of 0.826. Table VII shows the average values of self-efficacy for teachers who achieved the three level possible for implementation of the proposal.

Table VII. Implementation based on self-efficacy

	None	Partial	Complete	Weighted average
Self-efficacy	2.52	2.94	3.00	2.79
Total	42	49	18	109

The calculations reveal significant differences, given that there is obtained an F value equal to 8,717. A *post hoc* analysis using the Tukey HSD procedure shows that there is a clear separation between the group that implemented no part of their training, and those who carried out the total or partial implementation. The degrees of significance among the first group and the remaining two are 0.001 and 0.005, respectively, while the differences between those who made some

implementation (partial or complete) have no statistical significance. The study of homogeneous subsets according to the procedure reported (alpha = 0.05), is shown in Table VIII.

Table VIII. Homogeneous Subset (implementation/self-efficacy)

Tukey HSD	**Subset 1**	**Subset 2**
None	2.524	
Partial		2.939
Complete		3.000
Significance	1.000	0.895

4.9. Attitudes and self-efficacy

In this section we address the relationship between attitudes toward computers and the perception of self-efficacy to implement the proposals. To do this, a study was made of the correlation between those variables. In Table IX shows the corresponding Pearson correlation coefficients, together with the associated levels of significance.

Table IX. Correlations: attitudes vs. perceived self-efficacy

Attitude/Self-efficacy	**Correlation**	**Significance**
Anxiety	0.230	0.016
Confidence	0.460	0.000
Pleasure	0.260	0.005
Usefulness	0.238	0.013
General	0.352	0.000

As we can see, the results indicate positive correlations in all cases. Furthermore, it can be clearly seen that the dimension *confidence* showed the highest degree of correlation, while the other dimensions had a fairly homogeneous behavior.

4.10. Attitudes and experience

Table X shows the overall average values of the attitudes toward computers exhibited by groups who had different experience with this technology.

Table X. Attitudes (general) based on experience

	Level 1	Level 2	Level 3	Weighted average
General attitude	2.43	3.00	3.45	3.03
Total	18	61	30	109

The calculations derived from an analysis of variance showed a value 25.480 for the F-statistic, which indicates a highly significant variation between the different levels of experience. Based on this finding, we did a study of homogeneous sets using the Tukey HSD procedure. Table XI shows the corresponding results.

Table XI. Homogeneous subsets (attitudes/experience)

Tukey HSD	Subset 1	Subset 2	Subset 3
Level 1	2.43		
Level 2		3.00	
Level 3			3.45
Significance	1.000	1.000	1.000

Studies examining each dimension separately yielded similar results, which are omitted.

4.11. Experience and self-efficacy

Finally, we studied the relationship between the variables experience and self-efficacy variables. Table XII shows the perceived self-efficacy values obtained for the three levels of computer experience into which teachers were grouped.

Table XII. Self-efficacy based on experience

	Level 1	Level 2	Level 3	Weighted average
Self-efficacy	2.48	2.71	3.13	2.79
Total	18	61	30	109

Through an analysis of variance, a value F = 10.396 was obtained. This indicates that there are significant differences in the degree of self-efficacy perceived by teachers with different levels of computer experience. By means of a post hoc study, homogeneous subsets were calculated, using the Tukey HSD procedure. Table XIII shows the composition of the homogeneous subsets obtained.

Table XIII. Homogeneous subsets–self-efficacy/experience

Tukey HSD	**Subset 1**	**Subset 2**
Level 1	2.481	
Level 2	2.710	
Level 3		3.133
Significance	0.226	1.000

V. Analysis

In the present case, and as usual, according to the legal-bureaucratic framework of education in the provincial and municipal environments, teachers have no obligation, no incentive or support to carry out in their daily work those changes that are supposedly the primary objective of the training being reported. Figure 1 shows that in a significant percentage there was no transfer of what was proposed in the training. This occurred even though the reporting period came immediately after the conclusion of the course in which teachers were very much aware of what they had learned, and in general, of a certain enthusiasm. However, even under such unfavorable conditions, some teachers were able to implement their proposals, either wholly or in part, while others were not. What factors may be linked to this disparity? Below is a brief review of the results obtained, which can approach some tentative answers.

The first point to consider was whether teachers who implemented different degrees of the proposal (null, partial, complete) had assessed the training differently. Table I and the attached data show that this did not happen. The difficulty of the course was considered as slightly above average, while the quality of the course was rated as very good.

Two factors which the literature registers as possible influences for the incorporation of the computer into education are the age of the teacher and her access to the computer at home. The calculations corresponding to Table II indicate that there are no significant differences in the average age of the teachers who effected different levels of implementation. Moreover, the highest average age was found in the group who implemented the proposal in its entirety.

As to the impact of computer access at home, the crossing of data is shown in Table III. The accompanying calculations exhibit some directionality, in the sense that the differences in the frequency expected and those observed, as concerning the degree of implementation of the proposals, are favorable to those with computer access. However, neither clear trends nor important significance are seen in those differences. This would indicate to us that although the presence of the computer at home can be a positive factor, but it is by no means decisive.

Another variable we took into account is the work context in which the teacher finds himself. When during the training, teachers produced the proposals that would be implemented with their students, they adjusted these proposals according to their expectations regarding the conditions they might find in their work context. The relationship between the context they found vs. the one they expected is shown in Table IV, for the three levels of implementation. Calculations indicate that the context found was slightly worse than expected (values less than the unit) and there is some directionality in these differences; that is, the smaller the gap between what is expected and what was actually found, the higher the level of implementation. However, as indicated by the corresponding calculations, these differences lack statistical significance. Therefore, one cannot infer that unexpected deterioration or improvement of work contexts has been influential in the different degrees of transferring training to the classroom.

Important factors associated with teachers' degree of willingness to incorporate technology into their classroom work, are: experience in using computers, attitudes and self-efficacy. We analyzed the results obtained, considering each of these variables.

The data in Table V and their accompanying calculations indicate no significant differences concerning the implementation of the proposal, between groups with varying degrees of computer experience. A study of attitudes allowed us to corroborate clear positive correlations between the four subscales.

As for their relationship with the degree of implementation: the overall results and those differentiated by size are condensed in Table VI. In that table it is possible to observe some directionality in the sense of increasing positive attitudes, according to the proposal's degree of implementation. However, the calculations show that these differences have no statistical significance. In general terms the table shows positive attitudes in all cases (over 2, neutral value); these probably can be explained by the fact that the training course was optional, and if so, it is not unreasonable to assume that, at least, teachers' attitudes toward computers were not negative.

On the scale used, *usefulness* is the only dimension in which calculations approach a certain differentiation (associated significance 0.047). There, it can be observed that teachers who effected some sort of implementation (partial or complete) had a tendency toward a more positive assessment of the computer's usefulness than those who did not implement anything.

Finally, we consider the self-efficacy perceived by teachers for the implementation of the proposal in their classroom activities. The values obtained and condensed in Table VII, as well as the corresponding calculations reveal that there are significant differences between the self-efficacy perceived by those who effected no implementation, and that perceived by the ones who managed to implement something (partially or completely) in favor of the latter. This situation is clarified with the analysis of the homogeneous subsets shown in Table VIII. In that table

there is a well-defined separation between the two subsets and the close proximity of the values of perceived self-efficacy among those who carried out partial implementations and those who performed them in their entirety.

It is interesting to note that this separation, between those who implemented the proposal (wholly or in part) and those who did not, is the same as that suggested in the dimension *usefulness* of the attitude scale. This allows us to conjecture that the gap between total and partial implementations might have its origin in several factors that have escaped this study, or that have not been deep enough.

As indicated in the theoretical framework, experience with the computer, attitudes toward the environment, and teachers' perception of self-efficacy are often assigned a predictive value for the transfer of technology into the classroom. However, to give a brief summary of the results, it appears that the only factor which showed a direct influence on the implementation of the proposal was teachers' perception of self-efficacy.

On the other hand, the literature also registers complex interrelationships among the three variables mentioned. In the present case, positive correlations have been confirmed among all the dimensions of the attitudes among themselves, and between attitudes and self-efficacy, as shown in Table IX. There it can be observed that the major correlation was found in the dimension *confidence*, which tends to differ from the three remaining subscales. This is consistent with the fact that this dimension is the one closest to the perception of self-efficacy.

The relationship between attitudes and computer experiences is reflected in Tables X and XI. In these tables, and in the calculations that accompany them, there are clearly defined the positive attitudes that increase as the level of experience grows, leaving well-differentiated the three levels of this latter.

The relationship between experience in informatics and self-efficacy are shown in Tables XII and XIII, and in the results associated with such tabulations. These data show that self-efficacy increases with an increasing degree of experience, revealing significant differences between subjects with *acceptable experience*, and those of *little or no experience*. The latter are not statistically differentiated, unlike what happened between these two levels in regard to attitudes.

These results confirm the complex interrelationships among the variables considered in this section, and the directionality provided by the theory: positive correlations between attitude and self-efficacy, and the increase in self-efficacy and positive attitudes as computer experience increases. However, we have and found no predictive value on implementation of the proposal as regarding attitude and experience—unlike what happened with self-efficacy.

Finally, it is important to remember that teachers were under no obligation to implement the proposal. There was for them no support, no incentive nor condemnation, and ultimately it was subject to their own decision. In other words,

it was devoid of extrinsic motivations; the implementation of the proposal depended heavily on the intrinsic motivations that the educator might have.

Conclusions

The results obtained in this study allow us to draw some conclusions—at least provisional ones—and consider possible courses of action or research to extend or deepen knowledge on the impact of certain factors in the complex cycle of transferring teacher-training to the classroom. In this regard, we point out would the following conclusions:

It is absolutely necessary that teacher-training plans for the incorporation of technology into schools, be understood as processes that would include, and, at least the stage immediately after training, the one in which should occur the transition of the results of the latter to the everyday classroom.

It is necessary that there be incorporated into the latter part of the process: a) monitoring and support to serve as scaffolding for the teacher, and b) weighted analysis, with its corresponding records, which would enable upcoming training campaigns to take advantage of the experience accumulated, rather than having each one run as if it were the first.

It has been verified that remove despite the low impact and very precarious conditions, the school still has some spaces with a certain autonomy, small, but important; these permit evolution and positive change in actors in the teaching-learning process.

The teacher's age seems to have no effect on the degree of transfer to the classroom. This circumstance permits a certain vision of optimism concerning this variable, for working on the incorporation of information and communication technology into the scholastic environment.

Having a computer at home seems to have no impact on the amount of transference to the classroom—there was neither more nor less—although it evidences a certain directionality. For that reason, we understand that it would be worthwhile to investigate in detail, what those teachers who have a computer at home do with it. Probably such studies resume would shed light on the impact of this factor.

Although there have been found no differences of significant implementation between those teachers with different levels of computer experience, we need to remember that there were no subjects who fell into the categories *extensive experience* or *expert experience*. Therefore, the results obtained were confined to those who had, at best, acceptable experience. Moreover, this information confirms that, adjusting the training activities to educators whose experience with these does not exceed the range studied, it would cover virtually the entire educational spectrum.

Results have shown that the detention *usefulness*, of the attitude scale, and perceived self-efficacy, significantly discriminated between two subsets: a) teachers who did not perform any implementation, and b) those who did so in whole or in part. This situation would merit further investigation as to what factors might have an influence on the fact that in the same apparent subset, there might be different degrees of implementation of the proposals.

Although the only factors that have shown a direct effect on implementation have been *self-efficacy*, and to a lesser extent, the dimension *usefulness* of the scale of attitudes, the results confirm the complex, positive interrelationships between experience, attitude and self-efficacy. Therefore, it is sustainable to say that acting on any of these factors positively affects the others, and transitively, the degree of transfer to the classroom. If this reasoning is correct, then we can have a practical, concrete, well-founded dimension. Indeed, offering teachers courses, workshops and action-research projects suited to the thematic object of their work in the classroom should have consequences affecting the following factors, listed but not limited to: a) evaluation of the tool's usefulness, with positive impact on the rest of the attitudes; b) increased confidence in using the medium, with an impact on their perception of self-efficacy; c) increased experience, with its positive impact on attitude and self-efficacy. While this brief agenda has solid theoretical foundations, its corroboration must be grounded on solid research accompanying the above proposals.

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Translator: Lessie Evona York-Weatherman

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