International Journal of Innovation Education and Research

ONLINE ISSN: 2411-2933 PRINT - ISSN: 2411-3123

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Keyword: Knowledge Translation; Continuing Teacher Education; Exact Sciences Teachers

Published Date: 5/31/2019 **Page.12-31** **Vol 7 No 5 2019**

DOI: https://doi.org/10.31686/ijier.Vol7.Iss5.1457

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Introduction

In a scenario full of technological innovations, transformations of the global economy and constant changes in production systems, modern society expects that, in the same measure, the educational system prepares students for these transformations. In this educational landscape, the fundamental role of teachers is highlighted, who must relate the curricular disciplines they teach with the practice of the world of work. Therefore, the exercise of teaching requires improved training, requiring educators to update and progress daily practices in order to increase their pedagogical activities in the teaching units.

In this way, the training of teachers must be continuous in order to offer students effective conditions for responding to the challenges of the professional world and the difficulties in everyday school life. Current teachers are required professional experience, technical training, higher education, teacher training, familiarity with new technologies and professional performance in the area in which they teach [1].

However, there is a gap between the proposal to create the programs for updating and training available to the teachers of educational institutions, and the need for teachers to carry out continuous training and effective updates through these programs. Many educators do not have a conscious attitude about the need to become lifelong learners, ensuring a continuous professional qualification [2].

The importance of scientific knowledge as a tool for the improvement of teaching is highlighted, because these contents provide a professional practice based on evidence. There is an appreciation of the scientific evidence arising from studies in the educational area, since the knowledge is published in these materials contain practical teaching whose research was assessed by means of the scientific method, and there is analysis and judgment of the peers and of the technical-scientific community in respect of the narratives described in the findings of these studies.

The experiential knowledge of teachers needs to be verified by scientific methods and then disseminated and recognized as the professional knowledge of teachers [3]. Thus, teachers demand more solid skills, whose foundation provides consistent responses to the challenges experienced in the profession [4].

Educational research can provide the knowledge that will influence teachers in assertive choices of pedagogical actions [5]. There is a need to create a culture in the public sector that supports and values research, so that teachers obtain professional improvement through research [6].

Scientific methods and the systematic subjects of research allow individuals to contemplate new problems, to design new procedures. This knowledge and understanding makes the teacher's practice more intelligent, more flexible and better adapted to effectively deal with concrete phenomena of practice. Looking more and more at these relationships with scientific discoveries, the teacher sees more possibilities and more opportunities to improve his practice. His ability to judge becomes enriched, with a wider range of alternatives to select in the face of situations-problems experienced in teaching [7].

In order to explore issues related to the continuing training of teachers, improving this process through the translation of knowledge, this article seeks to present the process of Knowledge Translation to the acquisition of knowledge and how professional updates and teacher training can be improved by this process.

In this way, through the investigation of phenomena related to the contextual aspects of this scenario, the objective is to **evaluate whether the process of Knowledge Translation can improve the continuous training of teachers in the Exact Sciences Area.** The extent to which the KT process can improve teacher training and which factors and variables are associated with the use of this process in pedagogical work is examined.

Initially, it is assumed that Knowledge Translation offers a mechanism whose scientific publications can provide reports, experiments and record situations that contribute to the acquisition of knowledge and improvement of pedagogical skills and competences acquired by professionals in the educational area. Furthermore, it is assumed that this improvement provides the professed with discoveries that will allow the integration of these scientific contents to the empirical field of Education.

Literature review

One realizes that the process of training of the teaching staff develops deep and complex, linking not only to the learning of teachers in new techniques, methodologies or technical knowledge, but even to their school experience, career, and social issues of their area. Significant changes are identified in educational environments, highlighting that these spaces today demand innovative practices and technological tools, as well as demanding updating, qualification and permanent teacher training to deal with this reality [8]. Therefore, the process of continuing teacher training should include other teaching-learning strategies that address this imminent vocational training scenario.

The professional development of educators is a complex and uninterrupted process, requiring several factors that corroborate and increase this framework of knowledge. The courses, seminars, workshops, lectures, graduations, new specializations and exchange with peers are some of the examples of initiatives that contribute to the improvement of teachers. However, it can be seen that the improvements and qualifications of teaching can also come from the consultation of articles and scientific publications, this alternative being valid for the acquisition of knowledge that helps the teacher in his/her pedagogical practices.

It is assumed that teachers can extract information from scientific publications in order to improve their practices. Because the researchers of the educational branch publish their studies, from the investigations of phenomena and events that arise from a social demand or even from a problem existing in the educational field. Thus, in order to communicate their findings to the technical-scientific community, researchers and scientists publish their findings and experiments, mainly through articles, in order to contribute to the advancement of science, providing answers to the questions preliminarily raised.

What characterizes the scientific activity is the effort of rationalization, by logical argumentation and by confrontation with empirical reality, thus showing that scientific research can circle the pedagogical actions of teachers, offering deeper comprehensions of the profession [9]. At that, it shall be presumed that such content may provide answers to the questions raised by the teachers, or even propose new methods, techniques and alternative solutions to teachers, in numerous circumstances experienced in their classrooms, thereby increasing the continuing education in the development of teaching.

2.1 Knowledge Translation

The Translation of the Knowledge presents itself as a process to select, translate and synthesize the knowledge available in the articles and scientific publications and in the records of the technical community, facilitating the access of these content to professionals with an option that promotes the enhancement of continued training.

The term translation of knowledge (KT) originated in 2000 at the Canadian Institutes of Health Research (CIHR), being defined as:

> A dynamic and iterative process that includes synthesis, dissemination, exchange and ethically-sound application of knowledge to improve the health of Canadians, provide more effective health services and products and strengthen the health care system [10].

In KT initiatives, stakeholders or potential users of knowledge are engaged in the whole process of scientific research. By participating in KT actions, researchers and users work together to shape the process of investigation and research by collaborating to determine scientific issues, deciding on methodology, engaging in data collection and tool development, interpreting results and helping to disseminate research results [10].

There is a systematization of the steps of Knowledge Translation called the Knowledge-To-Action Process, being illustrated by a funnel, which symbolizes the categories of *knowledge creation*, and the *cycle of action*, which represents the activities and processes related to the use of such knowledge [11].

Knowledge creation consists of three phases: *(1) knowledge research, (2) knowledge synthesis* and *(3) knowledge tools/products.*

In the stage of knowledge creation, in the face of a vast number of artifacts and information present in the research process of knowledge, it is necessary to reduce the number of these contents by means of the synthesis of knowledge and, finally, as a product of this process, a smaller number of tools or products is manifested with the purpose of facilitating the implementation of this knowledge. As knowledge becomes more refined, it will presumably become more useful to stakeholders[12].

The action part of the process can be thought of as a cycle that leads to the implementation or application of the created knowledge. In contrast to the funnel of knowledge, the cycle of action represents the activities that may be necessary for the application of knowledge. These phases are dynamic, can influence each other and can be influenced by the phases of knowledge creation [11].

The action cycle is set in seven steps: *(1) identify the knowledge gaps*, that is, what knowledge gaps users demand in their activities. After identifying the gaps and finding scientific contents that can meet these demands, it is necessary *(2) to adapt knowledge to the local context* and *(3) to evaluate the barriers to use this knowledge.* Then, in the face of the possibilities available to enhance training and decrease the knowledge gap among the scientific findings available, it is necessary to *(4) select, adapt and implement the interventions* in practice, but not failing to *(5) monitor the use of this knowledge,* and *(6) evaluate the results* of this intervention proposal, measuring the pros and cons of the intervention carried out, considering the fixes, future enhancements etc. Finally, it is noteworthy that Knowledge Translation is a continuous and dynamic process and one should always carry out the *(7) sustainable use of knowledge,* providing the ongoing implementation of evidence over time and ensuring the continuity and improvement of the actions of the KT in the projects of training of stakeholders[11; 12].

2.2 Knowledge Translation applied to Educational Context

KT Strategies can help define questions and research hypotheses, select appropriate research methods, conduct the research itself, interpret and contextualize research findings and apply findings to solve practical issues and problems [13].

Thus, it is understood that the KT process, in addition to providing an assertive interaction between researchers and users of knowledge, "moves" what has been learned through the scientific artifacts for the professional practice of users. In this process, the users of knowledge offer feedback to researchers about new problems that arise in their areas of activity, requiring new investigations, deepening of phenomena in

their areas and, as a result, new discoveries. This research cycle combined with the use of knowledge and new research is an interesting model of professional qualification.

Hargreaves [14] suggested that teaching could become an evidence-based profession if educational researchers were more accountable to teachers. This could be achieved through a coordinated approach to research, which would charge for research what really matters to teachers. He also asked for more energy to dedicate himself to disseminating research results more effectively to the stakeholders[6].

It is observed that, unlike in the area of health, the publications, involving the themes of teaching, hardly approach the teachers for deep discussion on the issues involving the profession and there seems to be little concern on the part of teachers, with regard to the lack of access to those materials or publications that contemplate the discoveries and studies relevant to the field of education [14]. In addition, the studies of research and evaluation that exist are seldom searched for systematically, retrieved and read, so that they are evaluated critically by the quality, validity and relevance, and neither are they organized and classified by the power of the evidence. The objective of evidence-based education is to ensure that current and future research on education meets the criteria of scientific validity, high quality relevance and practice on educational activities, processes and results [15].

The appreciation for teaching and the consequent professionalization can come from greater scientific support, no longer being based solely on pragmatic actions, whose empirical judgments are not always effective to guarantee quality education. One of the ways to promote professional improvement actions through the translation of knowledge is to disseminate, to the empirical field, potentially useful scientific evidence to the technical updates of these individuals. Evidence is defined as the combination of research, clinical experiences, patient experiences, data and information from the local context. Each type of evidence may have conditions that evaluate the experiments reported in the scientific narratives as of low relevance or high relevance [12].

Knowledge Translation is a process that, fundamentally, attempts to fill the gap between what is known from scientific research and how this knowledge is used by various stakeholders in the delivery of health services [16]. The involvement and interaction of stakeholders that interact within this system is what makes Knowledge Translation a broader process. Knowledge Translation implies the necessary movement to bring to practice what is already known by the results of the research.

Currently, there is a lack of time to read and evaluate, understand and apply the evidence from research, as well as the need for better skills in knowledge management and in the infrastructure to access the evidence of research and parameters to measure the relevance of the information in this process [17]. Despite the considerable resources devoted to research in Health Sciences, a consistent finding of literature is that the transfer of these results from research to professional practice is often a slow and random process [11]. This means that it is denied to patients treatment of proven benefit because the time it takes for research to be incorporated into practice is unacceptably long, thus creating barriers that hinder the use of scientific evidence in the medical treatments.

The establishing of Knowledge Translation as a tool that will help professionals to incorporate the reasoning and experience of scientific findings into their practices [18]. Health professionals need to be able to access the best available, up-to-date and cumulative response in order to ensure the resolution of

problems in the areas of activity[19]. KT is a way to raise awareness among users of knowledge about research results and facilitate the use of findings [20].

KT can minimize the problems of users' lack of time by providing relevant scientific evidence [21]. There are some barriers that block the use of evidence in professional practice [22]. Among the highlighted barriers are those linked to the lack of familiarity with KT, the large amount of information available, lack of time for updating and limited access to research resources.

Although, preliminarily, the term KT proposes an interaction of health professionals between the researchers and scientists of these fields of studies, it is understood that the KT process can also be applied in the educational area. That is, in the same way that users of knowledge in the area of health (doctors, nurses, patients, among others) acquire information, knowledge, and concepts arising in the publications of the technical-scientific community, it is assumed that the process of KT, as well as the concepts, structures, procedures and applications of this process can also be leveraged in the field of education, leveraging thus the continued training of teachers (potential users of scientific and technical knowledge) and enhancing their daily practices in the context of teaching.

Teachers can implement, translate, use, adapt and put into practice what they have learned of the scientific basis in their professional activities, since the relationship is that knowledge that makes teaching a profession comes from authorities outside of the profession itself, that is, the theoretical support from other sources [23]. The image of the professional teacher is one that skillfully uses the knowledge base in daily practice. It is important to note here that, from this perspective, teachers are considered knowledgeable of the fact that they have "insights" as well as "knowledge, skills, and dispositions" to explain the phenomena and make judgments about their practices.

In the face of these transformations, it is valid to suggest that, through Knowledge Translation, the traditional models of continuing education (face-to-face or distance) can be improved, having a deeper theoretical background, easier access to the contents of the technical-scientific community, as well as facilitating the acquisition of meaningful knowledge to the interested users. This is due to the fact that the knowledge based on and substantiated in scientific evidence, from reports of publications, study and research of educational phenomena, can result in appropriate practices of teachers, when they base their actions and pedagogical experiences on initiatives based on scientific literature.

Regarding the interaction between researchers and users of knowledge, it is highlighted the need that educators have to develop their professional upgrades, so that they are held fast and flexible, having a solid and scientific foundation, substantiating their training and professional upgrades. Faced with the challenges of accessing, reading and evaluating the numerous scientific contents currently available, strategies for managing this explicit knowledge become valid, as users lack actions that facilitate the translation and contextualization of these discoveries.

1. Methodology

In order to explore issues related to the continued training of teachers, improving such a process by means of Knowledge Translation, has the study and research of this subject, by means of a literature and theoretical review, relating the phenomena that relate to the training activities of teaching, and the

systematization of the process of KT and education based on evidence. In addition to the review of the literature and bibliographic justification described in this article, the following presents the procedures and steps that made possible the proposed intervention carried out with the research volunteers, whose actions evaluate the validation of the study hypothesis.

In order to assess whether the process of translating knowledge can improve the continuing training of teachers, it was proposed to make an intervention with the teachers of the Exact Sciences Areas of the high school and technical-vocational education modalities.

The collection of volunteers for the study took place through posters sent to teachers working in the public school network, whose contact took place through two Brazilian institutions that supervise the teaching of technical schools and coordinate the pedagogical nucleus of mathematics in high school institutions. A call for the voluntary participation of Exact Sciences teachers who had an interest in participating in the study, evaluating the process of Knowledge Translation in their continued training, was displayed on the posters made.

Both institutions of school supervision sent 90 posters to the schools that belonged to their management centers. Sixty posters were made available for one institution and thirty for the other. After receiving the posters in the schools, 28 teachers expressed an interest in participating in the study by registering them on the link made available.

The decision to carry out this intervention with teachers of the exact area was motivated by believing that these professionals experience many difficulties in teaching curriculum components of this area. The challenges go beyond knowledge of the subject, since many teachers know the theories, the concepts and the fundamentals of the discipline, however, lack a more effective preparation regarding the dynamics experienced in the classroom, as well as the didactic related to the teaching of this component. However, the progress of these competences is beyond the initial training obtained in college, formal education or even in the experiences learned in the daily life of the teaching profession. These skills can be increased by continuing training, which is not a one-off development, but developed throughout life.

The cognitive abilities necessary for a Mathematics teacher to be successful in the classroom generally accepted in the literature include three types of skills: 1) knowledge of content of Mathematics; 2) knowledge of pedagogical content related to Mathematics teaching and learning; 3) general pedagogical knowledge related to educational practices and schooling [24]. The professional qualification programs of mathematics teachers, or of teachers of Exact Sciences in general, lack a deeper foundation, because in addition to demanding applications of activities in the classroom that provide more dynamics in teaching, students and society are demanding a more contextualized teaching with more practical meaning.

In the proposed intervention, the researcher sent to the volunteers registered weekly in the e-mail, synopses of scientific articles, whose contents of these publications were summarized in about 500 words. These synopses had their subjects synthesized so that the participants spent no more than five minutes reading them. Volunteers were free to evaluate these synopses, whether or not they contribute to the continuing training of the area in which they operate.

The author elaborated these synopses, through the collection, analysis and synthesis carried out in scientific publications extracted from directories and databases. The criteria for the screening and selection of the articles, whose synthesis was carried out and subsequently sent to the volunteers were:

a) Scientific articles whose contents declare the accounts or experiences concerning the teaching of Mathematics, or activities linked to the Exact Sciences Area, such as: Arithmetic, Algebra, sets, equations, functions, calculations, Geometry, Trigonometry, Statistics, Probability and Financial Mathematics;
b) Publications proposing new methodologies, techniques, tools and/or technologies for the teaching of mathematical concepts whose experiences reported have had positive results in the learning of students or in the professional updates of teachers;
c) Articles whose approach proposes improvement of the pedagogical activities of teachers of the Exact Sciences Area, by means of: methods that improve the didactics of the teaching of mathematical concepts, different or playful practices in the assessment of students, improvements in the planning of tasks and lessons, practices that propose unique assistance to students and other similar studies.

The screening of these materials was preliminarily carried out by reading the summaries of scientific articles of the Exact Sciences Area. Then the researcher read, in full, articles whose summaries had an attractive essay for analysis. Then, for the articles, whose contents have met the selection criteria, we performed the synthesis of the reports collected, disseminating these materials extracted from the scientific research, in the tool Research Electronic Data Capture (REDCap).

REDCap is a platform for the collection, management and dissemination of data from electronic searches. This tool enables the creation and management of electronic search projects and administration of online databases. REDCap provides automated export procedures, facilitating continuous data downloads and other common statistical packages. In addition, the application offers a calendar of integrated projects, a scheduling module, among other reporting tools [25].

Finally, from the various materials analyzed, the articles that fit the proposal of the study, whose contents were characterized as potentially useful to be sent to the volunteers participating in the research. With this, the selection, translation and synthesis of these experiences was carried out through the principles of the translation of knowledge, disseminating them to volunteer participants.

The researcher, in this process of intervention with the teachers, made use of the evaluation questionnaires, as one of the instruments to measure the impact of the process of Knowledge Translation in the training of teachers, according to the answers and evaluations recorded by the volunteers on the platform REDCap. It is noteworthy that the author has adapted this questionnaire based on the model developed by the Information Technology Primary Care Research Group (ITPCRG) of McGill University, whose evaluation questionnaires classify the content provided by the Information Assessment Method (IAM).

IAM was the product of an eight-year research and development program, the addressing of which identified two types of contexts for sharing and evaluating scientific evidence. The *Pull* (information search) and *Push* (information delivery) approach. These two approaches aim to document health

professionals' perspectives on relevance, cognitive impact, potential use of research and health outcomes [26].

The IAM evaluation questionnaire can efficiently evaluate the relevance, cognitive impact, use and benefits of objects whose contents have been recovered and researched by the users themselves or of content delivered through resources or sending tools to the stakeholders [27]. IAM is a popular tool for continuing education and Knowledge Translation in Canada, being an instrument that systematically and comprehensively assesses the value of information from the perspective of the health care professional [28].

Before receiving the synopses, the participants filled out an initial demographic questionnaire, the aim of which was to raise the profile of the respondents and to record their perceptions and statements regarding their professional qualifications before the intervention period.

Throughout the research intervention period, the participants received synopses containing the summary of scientific articles with potentially useful materials for their training and professional improvement. The purpose of the teacher assessments in the synopses received was to measure the participants ' perception of the importance or impact, which they judged regarding the content made available, so that they would inform if the subject contributed in any way or not, to their continuing training. That is, the researcher sought to evaluate whether, in the opinion of the participants, the scientific articles could contribute to their pedagogical practice, through the potentially useful contents that were shared.

After the period of submission of the synopsis, ending the participation of the volunteers in the research and the intervention period, participants received a final questionnaire of the study requesting the record summaries of their perceptions and evaluations of the research, so the researcher could evaluate the feedback of the participants and the results recorded for them with the sending of such content. This questionnaire aimed to evaluate the opinion of the volunteers regarding the intervention carried out and to measure the level of utilization of the information received by the scientific summaries.

After this intervention period, in which the participants answered the questionnaire with the demographic data, assessed the synopses received via electronic mail and, finally, filled out the final questionnaire of the study, recording their perceptions and evaluations of the research, the researcher analyzed the data, charting the demographic profile of the respondents, and considering their evaluations to measure whether the principles of the process of Translation of Knowledge, that is, the abstracts of the scientific articles sent to them over these months, contributed to the professional training and the continued training of volunteer responders, attesting thus, what has been the impact achieved in the continued training of teachers.

Results

The following shows the compilation of the results generated in the period and intervention and their respective interpretations, and discussions arising out of the records analyzed in the (initial and final) demographic forms and of the questionnaires evaluation of the evidence, filled out by the participants of this study.

Initially, 28 teachers from the public education network had applied to participate in the study, but the proposed intervention took place with only 24 teachers, since 4 of them had given up. The intervention period was approximately 5 months (Feb 16, 2018 to Jul 10, 2018), during which 30 synopses of evidence were distributed to the participants, characterizing the analysis and collection of longitudinal data.

The profile of the 30 synopses shared with the volunteers was distributed in 8 different themes, contemplating works whose selected contents proved to be potentially useful for the continuing training of teachers. The synopses sent, contemplated the following subjects:

- 5 articles depicting concepts related to the teaching of Statistics;
- 5 publications presenting tools and/or technologies applied to the teaching of Mathematics;
- 3 studies addressing conceptions of Geometry instruction;
- 3 excerpts learning concepts of Financial Mathematics;
- 2 articles containing topics related to special education;
- 3 studies presenting differentiated methods of students assessment;
- 4 publications discussing topics on the improvement of teaching and professional update;
- 5 articles containing innovative practices in the teaching of Mathematics;

In the intervention period, in addition to the summary evaluations of potentially useful content sent to participants, the individuals recorded information in the initial and final demographic questionnaires, pointing out information concerning the nature of their educational and career activities.

The demographic questionnaires, as well as submitting the personal data of the participants such as gender, age, academic training, cities where they work, areas of expertise, and time devoted to the exercise of teaching, were seeking to raise also important information related to the continued training of teachers, the difficulties of the profession and the needs of increments in their pedagogical activities, and professional upgrades. The relevance of the two questionnaires (initial and final) must be stressed, because it is possible to verify the impact that the intervention developed over the proposed time period, reflected in the continued training of teachers, by means of the potentially useful scientific content shared with the participants. When comparing the records of both questionnaires, evaluating the previous and subsequent participation of the respondents, to the intervention period, it was possible to analyze the phenomena concerning the increase of the update and vocational training of the educators.

With regard to the demographic profile of the participants, it was noticed a balance in the genders of the participants who were interested in participating in the research, once that, from the 24 participants, 12 were male and 12 female. The age group of participants revealed that the vast majority of users (21 teachers) were 40 years of age or older, with only three teachers between 25 and 39 years. In addition, it was found that the teaching career of 12 participants was longer than 15 years and the remaining 12 teachers had less than 10 years of teaching experience.

The curricular components of Math and Calculus related to Statistics and Finance were the most noted subjects by teachers in the demographic questionnaires when questioned about the materials that they taught in terms of education, revealing the direct action of the participating teachers in the Exact Sciences.

In the initial questionnaire the teachers flagged that their greatest difficulties in professional qualification concern lack of time, lack of financial resources to invest in their qualifications and difficulties in reconciling their work routines with continuing training actions.

When comparing the level of knowledge and understanding of the teaching area, knowledge of the curriculum and the assessment practices of the students it was found that, initially, the vast majority of members reported having *little* or *moderate need* of qualification in these three themes. In the initial demographic questionnaire (IDQ), 20 teachers pointed out these two options on issues related to understanding the area of education and knowledge of the curriculum, and 18 teachers pointed out that they had little or moderate need for knowledge in evaluation practices. However, after the intervention period, the number of subjects who reported having received "*great use*" or "*moderate increment*" in their practices was very significant. In the final demographic questionnaire (FQD) 24 teachers state these two options regarding the improvement of knowledge in the field of education and 23 participants pointed out that there was a large or moderate use in the subjects related to knowledge of the curriculum and evaluation of students.

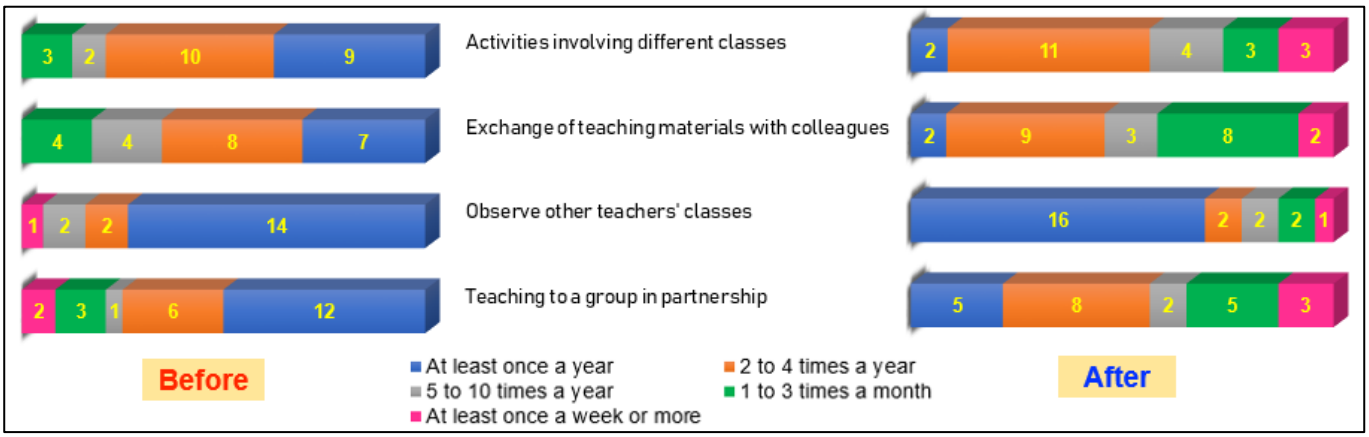
Demands related to ICT skills have been investigated for teaching and teaching students with special needs. On the IDQ 16 teachers indicated that they had "*great need*" for training in ICTs and 11 in the teaching of students with special needs, pointing to training difficulties in this area. After participating in the study, 18 teachers marked in the (FDQ) the option "*great use*", referring to the skills in ICTs and 11 of them regarding the teaching of students with special needs, showing a significant increase.

Regarding the behavior of the student and the management of the room, the data point to low relevance for the teacher's training, due to a preliminarily large number of respondents, 20 teachers, to indicate these subjects in the IQ as of "*little*" or "*moderate need*" for their updates. Even against a low expectation of training, after receiving the scientific evidence, 21 teachers evaluated in the FDQ, "*moderate*" and "*great use*" of the content received via electronic mail.

When questioned on the extent to which individuals believed they needed content that addressed relevant themes to the teaching of cross-curricular pedagogical skills and competences to teach in the area of education, 17 and 20 teachers, respectively, in the initial phase of the research, expressed that these two issues were not mandatory for your training, as noted in the IDQ that these statements were "*little*" or "*moderate need*" for the development of its professional upgrades. However, the results of the post-intervention period showed a significant contingent of educators who valued the potentially useful shared contents, qualifying them as "*great use*" in the FDQ, for 19 teachers rated improvement in cross-curricular skills and 17 of them in the pedagogical competences.

Another section of the analysis of the results was the comparison of both demographic questionnaires verifying how often teachers began to develop some differentiated activities or practices in their teaching units as a result after the intervention period. The following discusses the periodicity that teachers performed these actions and the progress of this regularity as a result of the intervention process.

Figure 1. Frequency activities comparison



There is a significant increase in the frequency of activities involving different classes and age groups, in the exchange of teaching materials with other colleagues and in the initiatives of teaching to a class in partnership with other colleagues. This increase shows that the shared synopses provided the participants in this study with tools and materials that support the drive of these three practices.

The scientific objects provided certain alternatives to the knowledge of educators, in the activities performed along with other profession colleagues. This can be seen by the increase in periodicity that these practices began to be developed after the intervention stage.

While there were positive aspects to the frequency of the three previous topics, there were no significant changes in the activities of observing the lessons of other colleagues in order to provide feedback.

After presenting the results of the frequency of the activities of teachers after the closure of the survey, was analyzed according to the responses of the participants, how many hours the individuals have engaged in activities to upgrade, continuing education and/or professional improvement after having participated in the intervention proposal. The survey showed that 29% of teachers claimed to devote more than 10 hours per month, 37.5% from 6 to 9 hours per month, another 29% dispensed from 2 to 5 hours per month, and only one teacher (5%) reported that he devoted less than 1 hour monthly to these activities. These figures show the stimulus resulting from the proposed intervention to the continued training of volunteers, since they have spent more time on activities aimed at their qualifications.

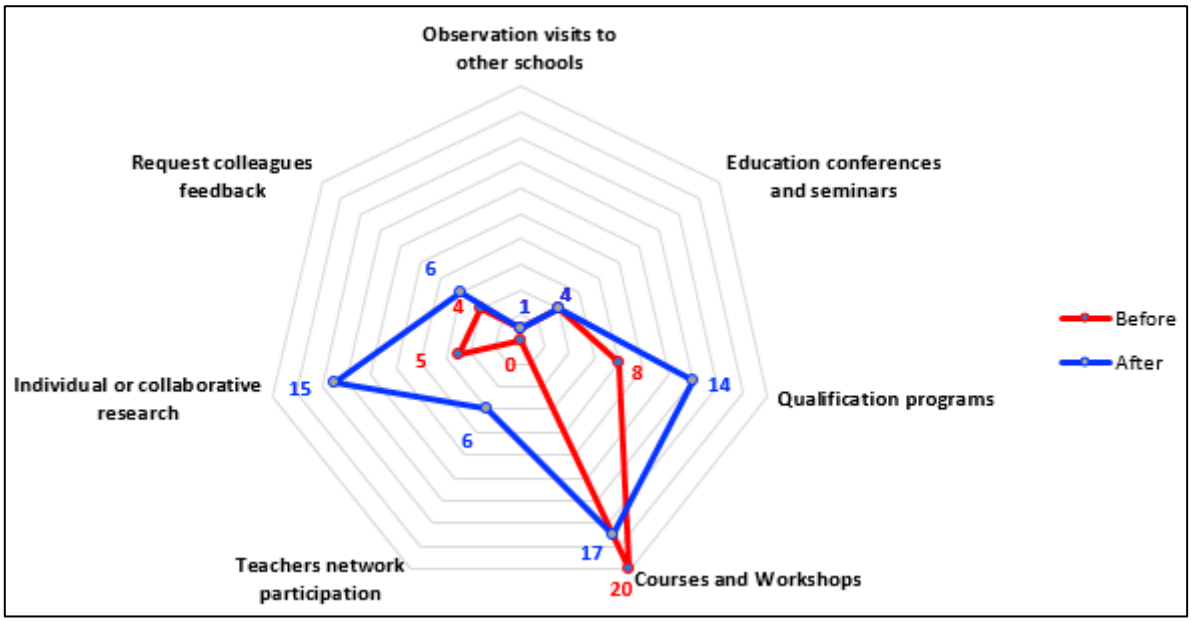
In addition, around 21% of the participants were motivated to read all the articles in full after reading the synopses sent. Another 75% said they had read *some* of the original articles.

Following the questioning for the time dedicated to continuous training activities, it was found alongside the teachers what practices they developed in their careers after participating in this study, revealing the extent to which the intervention is carried out, influenced the participants, the application and/or development of actions directed to the professional development of these individuals. Based on the comparison of the initial and final demographic questionnaires, it has been found that in the previous scenario to the survey, 85% of participants had performed at least one or more update tasks, or ongoing training, in the last 12 months, and the rest of them have declared that they had not participated in or carried out any action of this nature. On the other hand, in the records of the final demographic questionnaire, all

the participants pointed out the alternatives that indicated the involvement in tasks and projects related to the update and/or continuing education after the intervention period, in addition to including increase the frequency of these activities, as seen initially in the previous paragraphs.

There were seven options available to educators to point out about the involvement they had and started to have in their ongoing training activities, Professional Update and/or actions to improve pedagogical practices. Through the comparison of the answers in the two questionnaires (initial x final), we observed the scenario of professional improvement before and after the proposed intervention, evidencing whether the teachers started to develop or not some of the practices listed in the forms, after participating in this study. It is stated in Figure 2 that out of the seven tasks listed, two enterprises had no change in the conduct of the educators, being the proposals of observation visits to other schools and conferences and seminars on education.

Figure 2. Activities comparison: Professional improvement (before x after)



In addition to the same graph, it should be noted that A has had twice as many sign-ups in qualification programs. This result can be considered surprising since, in the description of this item, the qualification programs involved some degree or postgraduate course offering some certificate or diploma. In the initial demographic questionnaire, the teachers were asked about the level of their academic training, but this question was not included in the final demographic questionnaire, as it was not predicted that the teachers would be motivated to start some degree or postgraduate during the intervention period.

The participation in courses and workshops has been an activity that had a result opposite to that expected, for instead of increasing the number of statements of teachers who went on to develop operations in this essence, there was a 15% reduction in markup linked to this type of work of ongoing formation. However, in the other activities there was a significant increase in the training of professionals.

There was an intense growth in participation in a network of teachers trained specifically for the professional development of teachers. Previously, this activity was not developed by any member of the

project, but 25% of the participants (6 teachers) mentioned this topic in the final questionnaire as a result of the intervention undertaken.

The individual research or in collaboration on a topic of interest of the teachers was the most expressive result after the intervention carried out, because the number of marks that flagged this type of undertaking was tripled. This result is justified by the very characteristic of the KT process because, as previously seen, the shared scientific synopses provided a stimulus to teachers to read the educational phenomena of which they were interested.

In the actions directed to the guidance and/or observation made by a colleague and supervision, formally organized by the school, in the period after the project, there is a 50% growth in the markings of these contexts.

Discussion

After reviewing the notes made by the participants in the evaluation of the synopsis shared, and to compare the records of the initial and final demographic questionnaires, it is verified that the phenomena concerning Knowledge Translation has facilitated the increment of the update and training of the educators.

It can be observed that, by means of Knowledge Translation, the contents synthesized and shared via electronic mail, not only have initiatives that are relevant to the continuous training and professional updating of the stakeholders, as also suggested improvement with low cost and concomitant to other activities, providing conciliation with the work routines of teachers. The participants reported that their greatest difficulties in professional qualification concern lack of time and lack of financial resources to invest in their qualifications, so it is assumed that the obstacles declared by the respondents can find alternative solutions through the KT Strategies proposed throughout this article.

With regard to the level of knowledge and understanding in the area of education, knowledge of the curriculum and the assessment practices of the students, we note significant increase in the use of these themes in the qualification of teachers after the intervention period. These three areas are the decisive areas in modern pedagogy [29].

The participants highlighted demands related to the qualification in ICTs and themes associated with the teaching of students with special needs. The lack of training on these themes demonstrates the need for training of teachers in these subjects, as there are difficulties in adapting practices and methodologies fronts to the numerous demands of the current educational landscape, especially in matters linked to ICTs. The demand for digital empowerment and technological tools becomes mandatory in the current generation, as educators need to go beyond the blackboard to provide contextualized and meaningful teaching to their students in the current era. The technological training item is one of the most latent needs of teachers today [4]. This lack of training is already evident in the basic training of teachers because in many degree courses “knowledge related to technologies in education is practically absent” [30].

The appreciation realized after the period of intervention in the themes relevant to the teaching of cross-curricular skills and pedagogical skills to teach in the area of education can be leveraged by continuous training and by teaching qualification programs [31]. KT is an interdisciplinary process,

including multiple activities of updating, communication and articulation of knowledge and sources of knowledge that will result in significant impacts on professional activity [12].

The intervention also led to significant increase in the frequency of activities involving different classes and age groups, in the exchange of teaching materials with other colleagues and in the initiatives of teaching to a class in partnership with other colleagues. This increase highlights that KT actions provide potentially useful contents to educators' knowledge and in activities concomitant to other colleagues in the profession. The intervention proposal with the 24 volunteers is already a collaborative learning model that can even propose discussions and conferences in teams in order to disseminate the best practices learned among peers.

Despite the positive aspects of the three previous topics, there was no evolution in the regularity of activities involving the observation of the classes of other colleagues in order to present a feedback. It is assumed that the volunteers did not feel comfortable reproducing these actions, in a way this would cause an increase in the frequency of this topic in those training practices in which they were used. This discomfort of educators to get feedback from colleagues is common, but it is suggested that this resistance is broken, in order that the teachers reap the benefits of this sharing with peers, enhancing their educational activities by means of criticism and suggestions of professional colleagues [32].

Another positive aspect of KT actions was that the teachers showed interest in reading the original articles, whose synopses were based on. The commitment to reading the original articles and the dedication of more time in the activities aimed at updating and professional qualification reveal benefits from KT Strategies in the continuous training of teachers.

Regarding the involvement that the teachers had, and started to have in their activities in continuous education, professional updating and/or enhancement of pedagogical practices, the results indicate that there were no changes in the conduct of the educators in the case of the proposals of visits of observation to other schools and conferences and seminars on education. It is assumed that there have not been changes in these dynamics, since they are activities that are not part of the routine of most teachers, whether for reasons linked to the displacement to observe other teaching units or by lack of resources or awareness of timelines of events that include seminars or conferences in the area of education.

To analyze the intensive growth in the participation in a network of teachers declared by participants and the increase in the activities of individual or collaborative research, the prominence of the shares of KT in the training of teachers is reinforced, since over the course of this work, the merit involved in the collaborative networks of professionals was pointed out, when the latter distribute their knowledge along with other colleagues, overpassing then the learning acquired through this shared practice.

KT provided an increase in the actions aimed at the orientation and/or observation made by a colleague and supervision, formally organized by the school, in the period after the intervention. This growth may be associated with the comments that participants made to their peers or managers regarding their participation in the research. By giving or requesting feedback of their pedagogical practices to or from other colleagues, individuals can increase their training by means of the appreciation, specialized or not, of these professional partners.

In addition, we do not know the extent to which volunteers have encouraged their units to formally promote these activities in their schools, but it is predicted that the direct or indirect participation of the participants in these practices have resulted in benefits to their formations, as the results of the questionnaires analyzed.

Conclusion

There was a significant stimulus to the continuous training of research participants, by means of the intervention carried out, because the teachers said they devoted longer hours to their professional qualifications, in addition to motivate to read all or part of the original articles, revealing that the strategy of Translation of the Knowledge adopted motivates the teachers to investigate the phenomena, events and problems existing in the educational field, in order to find answers in the scientific evidence or even deepen the investigation of the pedagogical context.

It was found that after the reading of the potentially useful contents, the volunteers had earned not only on the intellectual assets that are tied to their professional qualifications, but also declared the possibility of increasing their activities of teaching, with content extracted from scientific excerpts. It is understood that the teacher may have an additional measure to evaluate the impact of his actions when they are based on evidence. KT gives the opportunity of a professional practice based on evidence and a feasibility of a structure of exchange of experiences and knowledge between researchers and users.

Thus, it is concluded that the sending of potentially useful content to teachers impacts and contributes to their continuous training. In addition to the positive results derived from the intervention undertaken with the volunteers, the literature attests that Knowledge Translation co-operates for the acquisition of knowledge from scientific research and contributes to decrease the gap of the use of that knowledge in practice.

Teachers, through KT, can implement, translate, use, adapt and put into practice what they have learned from scientific knowledge in their professional activities. Teachers are knowledgeable about scientific artifacts, and become able to extract insights, knowledge, skills and dispositions to explain phenomena in the educational area and make judgments about their practices [23].

KT can guide teachers in their professional practices in a more profound and assertive way, basing their pedagogical and didactic choices on scientific evidence [33]. However, evidence-based practice is not telling teachers what to do, but it is about empowering teachers and making them more critical and prepared in the face of current training requirements [34].

Professionals will not change their practice as a result of new information delivered by e-mail or obtained in a database containing several scientific articles in the area [35]. Practical change is complex, influenced by multiple factors and not by the unique result of the information and reflection of these materials. Thus, it is understood that the scientific evidence should be used by teachers to support their pedagogical activities, and not to dictate which methodology, tool or technology is more assertive in a particular situation.

Therefore, the proposal of this article was to demonstrate that the teacher's continuous training can be improved by the process of Knowledge Translation, but improvement is not a guarantee of success, but rather a deeper and more comprehensive foundation on the educational context.

Evidence-based education, such as evidence-based health care, is not a panacea, a quick fix, a recipe book practice or the provision of ready-made solutions to the demands of modern education. It is rather a set of principles and practices that can change the way people think about education, how they deal with policy and educational practice and the basis on which they make professional judgements and apply their knowledge [15].

The argument that KT has provided significant results by leveraging the training of teachers in the intervention held with the Exact Sciences teachers is a positive sign that the good practices observed in the health area – whose scenario presents a few professions that are based on evidence – justify the fact that it is also possible to get the favorable effects which support the continued training of educators.

But it is important to point out that the educational context and the teaching and learning process are complex. Individuals should understand scientific evidence not as a material that provides rules for action, but only hypotheses for the intelligent solution of problems, providing instrumental or technical knowledge. This means that research and scientific research can only show teachers what is or has been possible. That is, the surveys, in short, point to what worked, but do not necessarily guarantee what will actually work in the future [36].

Faced with these statements, it is evident the suggestion that the KT, through scientific research, directs a teaching profession based on evidence, but does not dictate procedural rules to teachers about what works or not in the school context. However, this information will support the judgments on which methodologies can be adopted in the classroom or not. Teachers should read the scientific articles in some way as they try to read good literature, that is, not everything will be able to performed in a classroom, but will certainly contribute to the process of professional training of the teaching career [5].

An interesting test in order to assess whether a scientific evidence will in fact result in the same effects stated in the research that was appreciated by the reader. That is, for those teachers who intend to reproduce in their classroom, a practice or idea obtained through scientific research, assessing whether the result of that evidence will provide the same results in the context he works, it's just perform two interventions and check which one works best. That is, a group of students is, schools or people is simply set apart, dividing them into two groups at random. An intervention is performed with one group, and the other intervention declared by the analyzed scientific evidence is performed with the other group. Then we measure the results obtained in each group, to see if one intervention achieved its supposed result better than the other [34].

This example illustrates how to critically evaluate the scientific content and understand that not necessarily the result declared by a scientific evidence will be reproducible in any context. However, even the opposite result to that which it was obtained initially by the scientific evidence demonstrates the positive points for the professional practice of the educator, since it complements the didactic experience of it, understanding even more the complexity of the pedagogical context in which it is inserted.

Knowledge Translation offers a mechanism whose scientific publications can provide reports, experiments and record situations that contribute to the acquisition of knowledge and improvement of

pedagogical skills and competences acquired by these professionals in the modalities of secondary and technical education. In addition, this improvement provides to the teachers the opportunity of discoveries discoveries that will allow the integration of these scientific contents into the empirical field of Education.

KT should be a proposal that contributes to the formation of teachers, so that they get more critical with the information available, facilitating the discussion with peers, leveraging the ability to develop new strategies and increasing the ability of educators in the educational processes by means of the insights obtained from scientific materials.

It is therefore important to understand the role of KT in the continuous training of teachers and the contribution of this strategy to vocational qualification programs. Perhaps it is important to point out that scientific evidence does not work miracles in changing teachers' behavior, as a result of students' learning or as a result of the quality of teaching. However, KT can at least provide to teachers a series of ideas, technical knowledge, methodologies, tools and proposals of technologies drawn from the scientific evidence, whose contents will provide not only training and qualification of the teaching career, but a deep and full understanding of social issues and education.

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