TRAINING THE TEACHERS OF TOMORROW IN AN ERA OF RAPID TECHNOLOGICAL ADVANCEMENT

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ABSTRACT

This study aims to explore the way teacher educators cope with technological-pedagogical change processes during their teaching and tutoring and adapt the teaching methods to the present age. 86 educators and 186 pre-service teachers filled an online questionnaire which included quantitative as well as qualitative, open questions. In addition, 11 interviews were conducted. The study results indicate that despite the ubiquitous changes that we experience in our environment, methods of teaching and learning have not changed substantially. Students feel that in fact, educators are not making a genuine effort to lead the change that they recognize as so important. While preservice teachers and educators agree that experiencing new technological environments is an important step toward a different educational future, they both feel they do not have enough knowledge about essential pedagogical changes and about the skills they will require in order to cope with the new reality.

Keywords: Technological Changes, Technological-pedagogical Changes, Adapting to Changes, Pre-service Training, Innovative Pedagogy.

INTRODUCTION

Educating pre-service teachers in the 21st century, while the IT revolution is still going strong, requires examination of teacher education programmes and an appropriate preparation of students for a suitable integration of ICT in daily life and in education. Integrating ICT in the digital era is an inseparable part of the necessary knowledge basis and of the skills which education system graduate need.

One of the skills necessary in the 21st century is the ability to cope with swift changes resulting from the accelerated technological transformations which we are undergoing. Most of the teacher-educators were not born into the computerised technological revolution. Teacher education colleges which train the future teachers of the 21st century must get re-organised and adapt the teaching methods to the present age. Their faculty members should implement advanced technology in teaching in an informed way which will benefit the learning; lead an innovative pedagogy; and constitute a role model to the future educators.

1. Theoretical Background

1.1 Change Processes, Objection to Change, and Adjustment to Change

Fuchs (1998) distinguishes between three change types: external changes which oblige individuals to undergo internal changes, personal changes and transitions - natural changes or changes planned in the immediate environment of individuals. This study will mainly focus on external changes which are binding for the individuals. The change frameworks with which people are coping are many and different. There are coerced external changes over which individuals usually have no control. These include changes called "innovations" which present new solutions to technical problems among others. We refer to them as external and, by nature, they necessitate transformations in the behaviour of individuals. These changes usually affect all the staff and their adoption requires personal transformations of thinking, attitudes, and approaches. The degree of objection to changes initiated by external bodies and by the organisation management

has a crucial impact on their implementation (Fuchs, 1998).

It is only natural that those responsible for introducing changes in the education system are the teachers. However, several studies (Englund, Olofsson, & Price, 2017) show that teachers encounter difficulties when implementing change processes. The teaching process is slow and gradual and is characterised to some extent by conservatism and stability which are contradictory to the need to be flexible for generating changes. Walder (2015) mentions various obstacles to pedagogical innovation: lecturers, technical aspects, students, institution, and assessment. On the side of the lecturers, innovation is initially considered risky and they face reduction in student satisfaction as well as students' resistance to change. This lack of change may reflect according to Englund, et al. (2017), academic pressure that senior academics face to gain promotion rather than enhance their pedagogical development. The need for change contradicts the maintenance of stability (Kniep, 1989; Louden, 1991) in the education system. A positive chance for success is a challenging state of opportunity, stimulating teachers to act. Teacher-educators need to learn and develop, professionalise and be currently updated on innovation (Darling-Hammond, 2005).

1.2 From Traditional to Innovative Pedagogy

Teaching in the present era calls for reference to technological transformations as well as attention to definition of school, teachers, learners, and curriculum. In order to generate the anticipated change, Daggett (2005) suggests shifting the emphasis from an educator-focused teaching to learner-focused teaching, whereby educators direct, tutor and accompany the learning process. Moreover, it is essential to develop competences for handling digital and communicational information, including: information literacy, communication media literacy, and IT (Salomon, 1998).

Teacher-educators build their professional status and are required to implement continuous changes. They have to be exposed to bodies of knowledge, be familiar with varied teaching strategies, be aware of different pedagogical models and cope with adjusted teaching skills (Shulman,

1986) rather than model their own teaching or that which they have experienced (Shulman, 2005). The innovative pedagogy focuses on the transition from teaching to knowledge building and changes the power foci of teachers and learners, of the learning activity and of the role of technology. According to the model conceived by Shulman (1986), "teachers' knowledge" cannot be defined without the relation between the area of knowledge content and pedagogy. Teachers are expected to acquire the required unique knowledge which will allow them to teach in a unique way various content areas by means of technology. Moreover, they can choose appropriately between learning contents, technological means and pedagogical aspect (TPACK – Technological Pedagogical and Content Knowledge) so that they make an informed pedagogical use of technologies (Koehler & Mishra, 2005). Educators need to think about adapting teaching methods to the changing world, whereby IT activities are currently integrated in teaching. Puentedura (2006) suggests a SAMR framework for charaterizing the level of technology-integrated in teaching. This model consists of four levels: from substituting and replacing older tools to redefining the learning methods.

Salomon (1998) claims that the introduction of technology was not accompanied by a change in the school culture, definition of teachers' role and work methods. Consequently, there was no meaningful pedagogical change which justified the intensive work and massive investment in the equipment. Indeed, although new technologies evoke varied opportunities for innovative, proactive and effective learning, in practice teaching duplicates the traditional teaching and does not exploit the possibilities offered by the technology and lack competences to design learning activities which effectively make use of the technology (Conole & Culver, 2010).

1.3 Technologies Adoption Process in Higher Education Institutions

The required basis for building a change process is awareness of the need for change and the willingness of all those involved in the educational practice to cope with change processes. Consequently, it is necessary to

understand the perceptions and attitudes of IT leaders, lecturers and students at teacher education colleges who are the actual partners to the teaching and learning processes, which constitute the essence of the educational practice. Technological advances open access to innovative learning opportunities. In contrast, It is highly probable that for any technological initiative to result in positive outcomes, teachers need a clear plan that provides support through the transitional stages (Westberry, McNaughton, Billot, & Gaeta, 2015). Therefore, it seems a difficult transition for teachers to be the ones that implement technology and create the opportunity for the students to integrate technology as well as new teaching and learning practice (Mishra & Koehler, 2006; Tondeur, Pareja Roblin, van Braak, Voogt, & Prestridge, 2016). Furthermore, Mastery of the technology can be acquired formally, by attending workshops and instruction sessions, self-experimenting or guidance by colleagues (Morreale, Spitzberg, & Barge, 2001) and shared among peers (de Lima Ferreira & Bertotti, 2016), as well as by modelling using ICT tools in various pedagogical practices (Tondeur, et al., 2016).

Massy & Wilger (1998) stipulate that lecturers adopt technologies in three dimensions: Adopting a technology by the academic staff and the students in order to perform tasks more quickly and efficiently. Enriching a teaching programme by using, for example, Internet sites, movies, presentations – still without changing the teaching method. A change in the teaching paradigm as faculty members re-design the teaching method and affect students' learning ways through maximum application of the technology and definition of new and improved teaching objectives. Moser (2007) conducted a study which investigated information technology adoption processes for the purpose of teaching. Her findings show that since most higher education lecturers are reluctant to adopt the technology, it is suggested applying a strategy which will focus on building lecturers' commitment to invest the necessary time by a reward setup, defined on the institutional level.

Derived from the literature review, the following are the research questions:

1. How do Teacher Educators (TEs) and Pre-service Teachers (PSTs) at a teacher education college cope with technological change processes?

2. How do teacher educators consider their role of preparing pre-service teachers for coping with technological changes?

3. Do pre-service teachers and teacher educators at a teacher education college attribute importance to pre-service teachers' preparation for coping with technological change processes?

4. Do teacher educators and pre-service teachers maintain that the technological changes brought about pedagogical changes?

2. The Aim of the Study

This study aims to explore the way teacher educators cope with technological-pedagogical change processes during their teaching and tutoring. This study examined the extent to which faculty members see their role in educating pre-service teachers for dealing with such changes. In order to obtain a more complete picture, this study investigated the degree of importance which pre-service teachers attribute, during their education, to coping with technological-pedagogical change processes.

3. Methodology

3.1 Research Method, Research Paradigm, and Research Design

This study was conducted at a large state education college. The researcher is a member of the ICT unit. The paradigm of this study is the mixed research model which combines a quantitative and qualitative research methods (Johnson & Onwuegbuzie, 2004; Keeves, 1998). The quantitative findings chapter presents the empirical process which consists of several approximation methods, aiming to check whether the collected data support the theoretical hypotheses presented at the beginning.

For analysing the qualitative data, the researchers did an interpretive content analysis while identifying central themes (Creswell, 1998). In addition, they conducted semi-structured interviews with 11 TEs. Four lecturers, two IT subject coordinators and a dean of one of the college faculties were chosen as the interview sample.

3.2 Research Population

The research population consisted of most of the college TEs (650) and most of the PSTs (1677) learning in the School of Education. They all received by e-mail an online questionnaire which was sent twice, about two months apart. At the first time, 73 TEs and 152 PSTs responded to the questionnaire. At the second time, 16 additional TEs and 35 additional PSTs responded. In total, the number of respondents was 86 TEs (13% of the TEs) and 187 PSTs (11% of the entire PST population) from various areas of specialisation in the School of Education.

Out of the 187 research subjects in this study, approximately 73% were female-PSTs and about 27% were male-PSTs. The PSTs' ages ranged between 21-55, the mean being 33 years old. As for the TEs, out of 86 TEs who participated in this study, approximately 76% are female-TEs and about 24% are male-TEs. The TEs' ages ranged between 32-67, the mean being 53.1 years of age. The TEs have a seniority of between 1-40 years with a standard deviation of 10.7. The TEs' use of computers spread over 1 to 36 years, the mean being 15.7 years and the standard deviation being 8.2.

3.3 Research Tools

The PST Questionnaire and the TE Questionnaire used in this study are grounded in the Technology Adoption Questionnaire developed by Birman (2005). The Birman Questionnaire consists of three main parts: the subject's profile, the attitude towards the use of technology, and general attitudes towards seeking help with the technology.

The questionnaire was designed in collaboration with members of the college ICT unit and had two almost identical versions, one for the PSTs and the other for the TEs. The questionnaire comprised five parts. Back-translation was done to eliminate semantic incongruities. The first part gathered information about the subject's profile and included 7 items. The second part, gathered information about the extent to which TEs and PSTs use computerised tools and computerised environments and comprised 18 items. The third and the fourth parts, which were added, were translated and adapted to the college educators and PSTs.

3.4 Validity and Reliability of the Questionnaire

The questionnaire was validated by three ICT unit TEs, processed and adapted to the TEs and to the PSTs. For checking the questionnaire reliability, indices were built by means of a Factor Analysis model. This model distinguishes factors which combine several items according to their extent of factor loading. In this case the researchers used the Principal Axis Factoring, Oblimin Rotation in order to join together various types of activity in a computerised environment. Factors in four different areas measured by the questionnaires were consolidated: extent of using computerised tools and work environments; attitude towards the use of IT technologies; extent of using support services; and attitude technological changes.

In addition, three different factors were approximated for attitude towards technological changes: being open to accept the change; using technical support; and being involved in the change process. The total differentiation accounted for by the three factors is over 50% and their reliability is reasonable- (=.72, =.69, =.66 respectively). The extent of being open to changes, as measured by the three factors, indicated an average level of openness which was similar in the three measurements. There was a significant positive relation between the three factors. Moreover, the researchers built an index of the TEs' perception of their role of educating PSTs for coping with technological changes. The index reliability is =.70, its mean is M=3.84 and its standard deviation is SD=0.81.

4. Findings

The findings are presented for each of the population groups (TEs and PSTs) according to the research questions while integrating the quantitative and qualitative analysis. Several major categories emerged from the open-ended questions and the interviews: 1. Coping with technological changes; 2. Pedagogical changes resulting from technological coping; 3. Ideas for coping with change processes; 4. Critique.

4.1 Research Question No. 1: How do academic TEs and PSTs at a teacher education college cope with technological change processes?

The research findings show that TEs and PSTs are open to technology integrated in learning and to technical support.

When the TEs are not familiar with something, they tend to search it on Google or other Internet sources (M [Mean] =3.8) and so do the PSTs (M=4.0). When TEs learn from someone they know about a new technology, they are usually interested to find out more about it (M=3.4) and the PSTs do so at a greater extent (M=4.0). Furthermore, both TEs (M=3.1) and PSTs (M=3.5) do not hesitate to ask for technical support when they do not understand technical terms. The TEs' attitudes are more or less similar (M=3.4) to those of the PSTs (M=3.2) in the matter of seeking assistance for using technology.

Moreover, analysis of the data illustrates that PSTs maintain that in the next decade we are going to undergo a wide variety of changes (M=4.0). They attribute importance to the option of choice when implementing the change (M=3.9). They also deem it important to have the means of expressing their feelings regarding the change process (M=3.8) and to be partners to its implementation (M=3.7). The PSTs point out that at some extent they have switched to a new technological work environment over the years (M=3.4). In their daily life they cope easily with changes (M=3.4). In addition, they feel they received technical support while shifting to a new work environment (M=3.3) and that the change of the technological work environment was conveniently executed (M=3.3). As for gender differences, there were no differences found with regard to openness to change of TEs as compared with this of PSTs. While females tend to ask more for technical assistance, female TEs (M=3.6) are more open to receive technical assistance than male (M=3.1) and female TEs' attitudes (M=4.0) are more positive towards technological changes than male TEs (M=3.4).

The findings show that background data, extent of using technological means and attitudes towards technological environments, i.e. openness, are related to technological change processes. In order to investigate this question, multiple regression analyses were performed and three factors which represent attitudes towards change were found: Openness to the change; use of technical support and involvement in the change.

Table 1 shows that the group variable has a negative effect on openness to change (β=-0.15, p<.05), namely PSTs are

Explaining variables	Openness to change β	Use of technical support β	Involvement in the change process β
Group	-.15*	-.40***	-.08
Area of specialisation	.04	-.10	.07
Gender	.08	.13*	.05
Active use of computerised technology	.30***	-.09	.14
Expressing apprehension of using computerised technology	-.12	.24**	.21*
Using distance learning systems and collaborative environment	.09	.06	.03
Using basic tools	.04	.04	-.04
Using Web2 tool	.002	.11	-.004
Openness to learn about computerised technologies	.23***	.33***	.38***
Difficulty and fear of operating in a computerised environment	-.09	.01	.11
Df	10,262	10,262	10,262
F	34.44**	6.92***	6.77***
R^2	.57***	.21***	.24***
N	273	273	273

* p<.05   ** p<.01   *** p<.001

Table 1. Regression Coefficients explaining the Differentiation in the TEs and PSTs' use of Technology and Attitudes towards Implementation of Change

less open to change than TEs. This negative effect of the group applies also to the use of technical support (β=-0.40, p<.001). However, this effect is not significant in the case of involvement in the change process. The stronger apprehension of using technology the respondents express, the greater their use of technical support is (β=-0.24, p<.01). Similarly to the openness to the change model, in both the use of technical support and involvement models, openness to learn about ICT has a positive effect on the use of technical support and involvement (β=-0.38, p<.001 and β=-0.33, p<.001, respectively).

4.1.1 The way TEs are coping with Technological changes

Three levels of TEs' coping with changes emerged in this category:

• Difficult and slow coping

Among the TEs, 26 (30%) attested they encountered difficulties when coping with technological changes. Some of them experienced fear of computers, others found it difficult to comprehend the terms. Most of them

pointed out that they find coping solutions, sometimes with the help of a family member or support at the college. "… It does not come easily to me. As I mentioned, the terms are not always clear and I don't always understand how the technology works. I am still afraid of the technology…"

- Gradual coping through learning and in-service training courses

Seventeen (20%) of the TEs said they were coping gradually, while learning the new environment. This category illustrates that some of them cope independently whereas others acquire the knowledge mainly through in-service training courses and intensive tutoring. Among respondents in this group are innovators and "pioneers" who describe a long learning process with a lot of motivation but also difficulties. 20 who is one of the pioneers of adopting the technology says: "… throughout my years of working many technological changes have transpired. At first I registered to basic courses of educational technology. At any opportunity I attended seminars". 7 adds: "… it was difficult and slow at the beginning but I am starting enjoying it later on…". An expression used by many was: "Slowly but surely…". Some of them pointed out that they had no time to invest in this matter beyond the call of duty, preferring in-service training courses to self-learning.

- Easy, challenging and intriguing coping

About half of the TEs said that the connection to technology was challenging. It was easy for them to internalise the changes, as most of them were closely guided by the ICT unit. 23 said: "… usually very easy. I consider it a challenge and am not ashamed to ask…". In this group were also TEs who admitted they liked changes.

4.1.2 The way PSTs are coping with Technological changes

Like the TEs, the PSTs too describe various levels of coping with changes:

- Difficult and slow coping

Nine (10%) of the PSTs admit that they encounter difficulties in coping with frequent technological changes. Some of them define themselves as not being close to the technological world whereas others used the expression "I could not care less". The findings indicate that, although in most of the pathways there are course-supporting sites, some PSTs do not think that this is meaningful for their studies as PSTs. There are indeed PSTs who have begun coping but they are still confused by the frequent changes.

- Gradual coping through learning and in-service training courses

About half of the PSTs tell that they are aware of having to cope with changes, exerting efforts in order to adjust. They acknowledge the need for technology and are usually willing to make an effort. However, some of them need extensive guidance. Another finding illustrates that, side-by-side with PSTs who are apprehensive or who adjust, others have an optimistic view, being aware of the difficulty but also of the advantage of coping with changes.

- Easy, challenging and intriguing coping

About one third of the respondents were at this level of easy coping. Some PSTs said they were computer literate, finding it easy to cope with changes. Conversely, despite of the difficulty, others consider coping as a challenge and overcome the difficulties, sometimes even rather easily. Some PSTs cope by keeping updated, others attribute it to the fact that they belong to a generation born into the computer age. Yet others mention that technological changes have not yet been fully internalised as part of the daily agenda and they are not always willing to invest additional time.

4.2 Research Question 2: How do academic TEs consider their role of preparing PSTs for coping with technological changes?

As for the TEs' use of technology and their attitudes towards changes, the quantitative findings indicate that the TEs maintain that in the next decade we are going to experience many and varied changes (M=4.3). They think it is important to have an option to choose when the change is implemented (M=4.1). They also attribute importance to having the means to express their feelings about the change process (M=3.7) and to being partners to its implementation (M=4.1). The TEs attest that they have changed their work environment throughout the years (M=4.4). In their daily life they find it easy to cope with changes (M=3.7). Furthermore, they feel they received technical support while changing their work environment

(M=3.7) and the change of the technological work environment went smoothly (M=3.9).

Analysis of the interviews and the open-ended questions show that the academic staff members are aware of the difficulty entailed by the implementation of change. Some of them maintain that combining the pedagogical practice training with the ICT course might contribute to the change while others believe in a more active learning in all disciplines. Some of the suggestions focus on the planning of designated in-service training courses. Some TEs said that if the PSTs got acquainted with the role model in the course of their studies, they would use it in their practicum. Others argue that the collaborative and teamwork skills by means of digital tools should be improved.

Some of the TEs think that the college should set up an ICT programme, which will apply to the TEs as well as to heads of the various pathways. Some claim that in order to stimulate TEs to build computerised units for their colleagues and PSTs, they should be rewarded. Some of the TEs' answers indicate dissatisfaction with the way ICT is implemented among the TEs and management team while others point out that a comprehensive debate on this issue should be conducted: "… to conduct a philosophical debate and change the pedagogy and only then to harness technology to the didactics. Otherwise people will work with interactive sheets and presentations but there will be no change, only an 'upgrade' of frontal teaching, of students' passiveness…".

Another finding emerging from the words of many TEs attests that most of those who integrate ICT in their daily practice are satisfied with the technical and pedagogical support provided by the college. The more they sought for advice, the more self-confident they felt with technology.

The findings show that some of the TEs are critical about the technological and pedagogical change processes transpiring in the college but are aware of their importance. They suggest organising a debate about this issue because, according to them, technology is not being used by everybody and it is unclear where things are going. The TEs have many suggestions for improving the ICT integration and the coping with change. For example, integrating inquiry activities in teaching, collaboration,

inquiry and new technological tools. Some of them, however, are not open to change and see no need for changing the teaching methods.

4.3 Research Question 3: Do PSTs and TEs at a teacher education college attribute importance to PSTs' preparation for coping with technological change processes?

The quantitative analysis illustrates that PSTs maintain that TEs' role is to educate them for coping with accelerated change processes (M=3.4). Moreover, the TEs argue that one of their functions is to educate for accelerated change processes (M=4.1).

Table 2 shows significant differences between the participants (t(271)=6.05, p<.001). TEs' perception of their role in educating PSTs is higher (M=4.23) than that of PSTs (M=3.65).

One of the central questions in the open-ended questionnaire and the interview was: "In your opinion, how should PSTs be educated for coping with change processes?" The answers presented many suggestions, such as: providing experiencing, teaching workshops in class, designing courses, varied means, TEs' modelling, support and backup, choice options.

Many PSTs think that only by modelling they will internalise the importance of technology integrated in lessons. They argue that an important prerequisite for succeeding to cope with change is the support and backup they get during their studies. The PSTs attribute importance to a gradual process, sometimes individual and accompanied by practice.

The PSTs, like the TEs, maintain that TEs' role is to educate for the change and to integrate ICT as part of the teaching. They even suggest ways of assimilating IT: workshop, individual teaching, inquiry work, collaborative learning, and modelling.

4.4 Research Question 4: Do academic staff members

The Group	Mean	Standard Deviation	Df	T
TEs	4.23	0.76	271	6.05***
PSTs	3.65	0.76		

*** p<.001

Table 2. Means, Standard Deviations and t-values of TEs and PSTs' Perception of TEs' Role in Educating PSTs

and PSTs maintain that the technological changes brought about pedagogical changes?

4.4.1 Pedagogical changes following the integration of technology in teaching

Pedagogical changes are defined as collaborative learning, inquiry learning, personally-adapted learning, PBL, individual learning, online learning, whereas technological changes encompass the use of environments and software programmes. The TEs' answers on this issue attested that there is still some confusion between a pedagogical and a technological change. Some TEs estimate that the use of technology or technological integration is always a pedagogical change. TEs consider the computer as added value, enabling them to induce PSTs to study by means of forums and online learning in a more collaborative way.

When discussing changes in their teaching methods, some of the TEs refer mainly to technological advantages. Technology, according to them, promoted a variety of teaching aids. 7 says: "… yes, submitting assignments and receiving them online… using online databases… using blogs… wiki… using movies and inserting them into learning sites…". Seventeen (20%) of the TEs claimed they had changed their teaching method following technological changes. They did not present any examples but rather spoke in general terms. Some of them established a better relation with their colleagues for the purpose of preparing and writing lesson plans, others simply said they had changed but gave no details: "… definitely…", "… the computer is a necessary tool for teaching…".

Most of the technological changes improved the traditional pedagogy of traditional-frontal teachers. Many TEs integrate tools which enhance the lecture and facilitate better access to sources of knowledge. In spite of the TEs' perception, these changes are mainly conservative. Moreover, they do not educate PSTs to become independent learners who are versed in the 21st century competences.

4.4.2 Do PSTs maintain that TEs have changed their pedagogy?

The findings illustrate that some of the PSTs maintain that, as a result of integrating the technology, TEs introduce pedagogical changes which improve the effectiveness of learning. However, it seems that most of the PSTs do not distinguish between pedagogical and technological changes. Conversely, only few PSTs clearly indicate that they feel change whatsoever in the TEs' pedagogy. Moreover, they mention that the TEs adhere to traditional teaching methods although they publicly state that an innovative pedagogy should be implemented. Others even criticised those TEs who indeed integrate presentations but do not know how to use them. Some PSTs complained there is no relation between what they study at the college and the need to implement it in the school system where they are headed. Some PSTs argue that the picture is not black and white. There are TEs who implement changes while others continue with the conventional teaching method. Other PSTs stipulated that the difficulty to cope with changes after many years of routine accounts for that.

Over 50% of the TEs and the PSTs respondents referred to presentations and movies as a pedagogical change and the others view forums, social networks, scanning and presenting photos and digital books as a pedagogical change, even when the lecture is frontal and the audience is in most cases passive. Other PSTs argue that the possibility of submitting assignments through the computer or applying a flipped classroom lesson while attending a conference are a pedagogical change.

4.4.3 The present and the future in the eyes of the PSTs

Part of the findings indicated that the PSTs were dissatisfied with the technology-integrated in teaching, mainly the insufficient preparation for teaching at school as well as the daily life reality they encounter at schools. The PSTs also stipulate that the TEs lack technological knowledge and are incapable of instructing them.

However, this may change in the future. Says one of the female-PSTs: "… in a couple of years, the generation growing up with computers will replace the generation that was not familiar with them and then things will change much more rapidly. Next will come the generation growing up with touch screens and it is impossible to tell what will be the change they will generate…".

5. Discussion

The quantitative findings show that TEs cope better with the technological changes whereas the open-ended questions and interviews indicate that the percentage of PSTs who easily cope is higher than that of the TEs. This gap between the quantitative and qualitative findings could be attributed to the assumption that being the survey online, most of the TEs who responded were those who cope more easily with technological changes. These findings are not in line with the findings of Moser (2007) who maintains that most higher education TEs are reluctant to adopt the technology. This, in her opinion, necessitates implementing a strategy which will focus on building TEs' commitment to invest the required time by rewarding them. Yet, it could be that TEs are affected by the changing reality.

Moreover, the qualitative findings show that the percentage of TEs who encounter difficulty with the technology and need wider support is higher than that of the PSTs. Similarly to the close-ended questions, the interviews revealed that the PSTs and TEs who participated in this study were more open to the technology and enjoy learning about it and those who use it feel confident to do so. They are highly interested in implementing technology in their daily life and wish to learn how they can benefit from new technologies.

Some of the PSTs maintained that only by modelling the PSTs would internalise the importance of technology integrated in lessons. Others attributed importance to courses which inculcate pedagogical models for IT integrated in teaching. Conversely, some researchers (Kniep, 1989; Louden, 1991; Sarrason, 1982, 1996; Trubowitz, 2001; Guskey, 2002) argue that teachers encounter difficulties in implementing change processes since the teaching process is characterised to some extent by conservatism and stability which are contrary to the need to be flexible for changes. Perhaps TEs and PSTs are, by nature, conservative people and choose the teaching profession which they perceive as traditional and conservative.

Based on the findings that address technology as well as dealing with changes, we can conclude that both TEs and PSTs are aware of the changes that technology brings. It

seems, however, that on the professional educational level, they did not sufficiently internalize their role as the new generation educators, or their responsibility to educate toward the accelerated process of change.

The research findings presented by Massy & Wilger (1998) indicate that most of the participants are still at an early stage of technology implementation, without changing the pedagogical paradigm. Responses of the TEs and PSTs indicate that they do not really understand the meaning of the concept "innovative pedagogy" and the requirement to adapt themselves to the dynamic and changing reality in which they operate. It could imply, that TEs are more open to change than PSTs (Walder, 2015). It is possible that the lack of openness of students affects faculty in delaying the implementation of change in order to maintain a higher satisfaction level of preservice students by which they are evaluated. This implies that for a pedagogical paradigm shift to happen, there is a need to be aware of the wider context and look for a more systemic solution.

The conclusion based on perusal of the innovative pedagogical features supports the assumption that this concerns rapid, unfamiliar changes which are identified with a digital culture unknown to many teachers and TEs. All these increase the difficulty to cope, presenting the gap between accelerated changes and the need to cope with slow and gradual changes.

These findings indicate that TEs are aware that PSTs should be educated for coping with changes and that we should get re-organised without delay due to the accelerated changes. Moreover, as Salomon (1998) argues, that no meaningful pedagogical change was introduced justifying the great investment. The chances to develop a new educational paradigm which is relevant to the new age as well as adapt the pace of the process depend on the awareness level of educational practitioners for the purpose of exchanging the existing educational paradigm (Aviram, 2010).

The research findings of this study indicate the two ends within which we live and with which we have to cope. Conventional teaching, putting the teacher at the centre, versus technological innovation, obliging TEs and PSTs to cope with accelerated changes, the need to change the

pedagogical paradigm, the ability to cope with change, putting the students at the centre and educate the next generations for coping with changes.

6. Recommendations

This study is grounded in two assumptions. The first assumption is that one of the most important competences of the 21st century is the need to cope with rapid changes, get acquainted with new environments, new occupations and new technologies. The second is that TEs are supposed to prepare the PST generation for coping with change so that they, after their graduation, will prepare the young generation.

TEs' perception of their professional role in the 21st century has a great weight in coping with changes and leading them. The assumption is that TEs who are aware of the need to educate PSTs in coping with pedagogical-technological changes and who are ready to cope with change processes will assimilate changes and innovations more successfully and effectively than TEs who are unaware of the importance of change and on the researchers' pedagogical experience.

This study indicates the need for orienting the TEs' training to cope with technological and pedagogical changes from the level of college TEs, through the level of PSTs - the teachers of tomorrow - and up to the level of pupils in class. The following recommendations for coping with changes are based on the research conclusions.

6.1 Establishing an in-service Training Courses Setup

Every in-service training course should comprise two parts of technology and pedagogy. The parts will be studied both separately and together. Moreover, the in-service training course will consist of theoretical and applied sections:

- Technology – to include exposure to up-to-date environments, technological-pedagogical models, approaches and methods of training and learning experience. This is aimed to provide TEs with meaningful experiences of using ICT and enable them being creative in adapting various tools for activities they were not initially designed for. A response to the 21st century needs in the field of technology.

- Innovative pedagogy – these findings can elucidate the importance of the design of teacher education programs that integrate innovative technologies and engage TEs and PSTs in activities that will lead to new experiences. This may increase their willing to further implement them in their practice and give the opportunity for the PSTs to gain a more innovative training so they develop the ability to transposition the theory into practice, making the needed adjustments according to age group, subject matter, and learning goals. Every TE should be familiar with effective pedagogical approaches and their added values. TEs should be familiar with the TPACK (Koehler & Mishra, 2005) and SAMR (Puentedura, 2006) models. This experience can lead the paradigm shift needed so PSTs can gain experience with varied teaching strategies, be aware of pedagogical models and best practices (Shulman, 1986) and cope with adjusted teaching skills while implementing technology.

6.2 Setting up Planning Teams according to Pathways/Specialisations/Faculties

Teamwork for building new teaching programmes in the different faculties while acknowledging the existing models. It is essential to teach TEs to introduce into the equation of teaching, planning considerations the adoption of innovative environments and pedagogies. This should be done while examining the feasibility and contribution to teaching, accompanying the technology adoption and empirical examination of its applicability to the various educational contexts as well as accumulating best practices regarding a maximum integration in teaching. These teams can leverage ICT integration among their peers and lead an innovative pedagogy in their teaching methods.

6.3 Setting up Teams for providing Feedback on the Programmes

At the stage of implementing technology in teaching, we have to characterize the assimilation addressees, identify the stage of each addressee and accompany the assimilation processes by individual adjustment to each TE. Thus, at the end of the process, the TEs would be the driving force in leading the innovative pedagogy. A commitment to invest time, assistance, support and tutoring throughout

the assimilation process are prerequisites for a successful process.

6.4 Top-down and Bottom-up Management Involvement

It is noteworthy that no change or programme can succeed without the support of the institutional system (Walder, 2015) since without assimilating everything will remain the same (Aviram, 2010). On the systemic level, the important factors to increase effectiveness are the college management statement about the importance of integrating technological innovation in the process of PST education; a systemic approach of the institution regarding the teaching method expected; and the necessary skills of those newly admitted to the institution, including tutoring of new TEs absorbed in the educational institution during the implementation of innovative teaching methods (Englund, et al., 2017). In some instances, the need of the institution to cut expenses, leads to an increase in large scale online learning courses which enforces the mastery of innovative pedagogy. In other instances, the design of innovative learning spaces may promote, encourage and inspire creative teaching approaches.

Conclusion

Technology brings with it changes, threatening to change procedures. Hence, it is not surprising that TEs adhere to non-threatening technological environments which are well assimilated in their teaching methods without committing to a significant change in the teaching paradigm. Paying attention to the various barriers, TEs should be guided in a way which does not threaten them, but rather evokes a sense of confidence towards the enhancement of learning and teaching with innovative technologies so to evoke participants' awareness of innovative technologies and the importance of their implementation in learning and teaching. Additionally, efforts need to be made to improve PSTs' ways of coping with technological changes. Consequently, importance is attributed to the choice of work environments since they offer efficiency and productivity and can constitute a working role model for the PSTs. In light of the various digital age developments, we should consider the changing world and the fact that in a world where everything is changing the teaching paradigm must be changed so that education is relevant to the skills which are required for the best functioning in the changing society.

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