

School technology leadership in a Spanish secondary school: The TEI model

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Abstract

This study analyzes the perception that teachers and management team members in secondary school education have of *technology-based educational innovation* (TEI). Two questionnaires and in-depth interviews permit us to analyze leaders' perspective of planning, development, and evaluation. The school leaders' view diverges from that of the regional/national education policy makers and is closer to the view developed in pedagogy for leading the process of introducing technology in classrooms and influencing innovation in teachers' practice. Based on reflection on the *leadership–technology–innovation* relationship, we derive a top-down model for use by teachers, schools, the community, and education authorities.

Keywords

Educational innovation, educational technology, instructional leadership, secondary school teachers, teacher–administrator relationship, technology integration

Introduction

The literature often analyzes school leadership as the critical component for improving schools, in both implementation of educational reforms and professional development of instructors and improvement of student learning. In addition, education is being transformed by the incorporation of technology in the curriculum, due to the latter's influence on teaching and school organization. But there are few empirical studies of the process of technology leadership in schools and of the perspective that instructors and management teams (MTs) have of such leadership (Richardson, Bathon, Flora, & Lewis, 2012)

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Successful adoption of educational technology in education institutions will not occur without strong leadership in different levels of the organization (Wong, Li, Choi, & Lee, 2008) grounded in collaboration and cooperation between all members. To go beyond mere rhetoric, action strategies are needed that involve adoption of technology-based educational innovations (TEI). We use *technology* here to mean information and communications technologies (ICT) and *TEI* to mean educational innovation through ICT. Furthermore, school leaders play a crucial and complex role in integrating technology (Fisher & Waller, 2013; Lawson & Comber, 1999; Ng, 2008; Razzak, 2015; Shattuck, 2010). Shattuck (2010) argues that this topic involves multiple disciplines, including theories of instructional technology and educational leadership, laws and theories of education policy, theories of organizational change, and theories of the diffusion of innovation.

We focus here on educational innovations in school practices performed using technologies in a specific context at a specific time. These innovations constitute a process that should be planned, organized, developed, and evaluated by the different agents involved, specifically by those responsible for innovation in each school – the teachers and the MT.

Theoretical background

Leadership and the MT

Leading successful changes in schools means helping organizations to *survive* and advance (Fullan, 2001, 2011). Change and innovation should be led based on training and professional development to create significant, successful changes in followers and in the organization (Thomas, Herring, Redmond, & Smaldino, 2013).

A basic definition of the leader is a person who influences an organization's individuals and groups, helps them to establish goals, and guides them to achieve the objectives, thereby enabling them to be effective (Nahavandi, 2009). Being a leader is a social process oriented to the desired goals; it involves becoming the leader or leaders in organizing the organization's interests and those of its members with a vision of the future (Harris, 2008). One learns leadership abilities by experience in demanding, challenging situations (Ross et al., 2011; Siewiorek, Gegenfurtner, Lainema, Saarinen, & Lehtinen, 2013).

According to Nahavandi (2009), leaders should focus on successful results, on achieving goals, internal processes, and capability to adapt to external circumstances. They should be committed to the group in initiating actions, establishing paths for action, and empowering other members. Chang, Chin, and Hsu (2008) and Wong et al. (2008) establish four areas of action for educational leaders: the capabilities to establish shared visions of the future, trust and prepare teachers, support innovations in classroom practice, and support professional development; actions developed through the collegial relationship between school members; a spirit of fighting for progress; and flexibility in permitting adjustments in processes. For Ashbaugh (2013), the leader should see and interpret tendencies in and the need for change in the students. Specifically, the educational leader should show his or her effectiveness in both administrative and pedagogical issues, achieving a personal reputation and open leadership supported by technologies (Li, 2010). Educational leaders' actions and their consequences form a theory of action, creating a vision of shared meanings (Fullan, 2011), and identify expectations for performance to move in that direction (Thomas et al., 2013). In the analysis by Kowch (2013, p. 26), the current idea of leadership is complex in that it assumes ecosystem metaphors; cyclical, recursive imagery; feedback loops/regulation; sufficiency-oriented and growth-minded thinking; and incompressible networks.

Currently, the educational leader does not walk alone but is surrounded by an MT. In Spain, the director is elected by faculty vote, and the director's MT (head of studies and secretary) is chosen

by the director and approved by the School Council and education authorities. It is not viable for the director to act alone (Ng & Ho, 2012). Both leadership and management can be dispersed within an organization, but leadership practices clearly do not fall to a single person (Hsiao & Chang, 2011). Although an extensive literature has analyzed the director's leadership, fewer studies exist of the entire MT, even when they play important roles in contributing to and explaining differences in school effectiveness (Brown, Rutherford, & Boyle, 2000) and instructional leadership (Harris, 2008). Different sources of leadership have been studied by position, but not the leadership practices or the influence these have on the other instructors (Ng & Ho, 2012).

Technology leadership

The literature review by Richardson et al. (2012) shows that the field of educational leadership at the global level has begun to respond to technology leadership. School leaders have a great responsibility to initiate and execute change in their school through ICT use. Leaders can facilitate the process of initiating and executing integration of technology into learning (Afshari, Abu Bakar, Wong, Abu Samah, & Foo, 2008; Hadjithoma-Garstka, 2011; Raman, Don, & Kasim, 2014; Shattuck, 2010), fostering change in classroom pedagogy (Honey, Culp, & Carrigg, 2000; Sorensen, Shepherd, & Range, 2013; Wong et al., 2008). Now the problem is whether strengthening the abilities of leaders will move at the same pace as the advances in the information society. In particular, leaders need models of ICT competence they can follow to advance, promotion of a culture of innovation and experimentation in their schools, development of clear plans for integrating ICT and their conversion into specific actions, provision of expert ICT coordinators, content knowledge and pedagogy, and establishment of trust between people in the process of integrating ICT (Razzak, 2015).

Van Niekerk and Blignaut (2014) argue that the role of directors, through instructional professional development, is crucial for teachers' effective, sustainable integration of ICT. This role affects three level of equal importance: leadership and management styles, attitude toward ICT integration, and strategic thinking. It is important to recognize that technology leadership does not refer to the MT only. ICT coordinators are also in the position to create the conditions to develop a shared ICT policy (Özdemir, & Kılıç, 2007; Tondeur, Cooper, & Newhouse, 2010), although such work relates more to technical than to educational issues (Rodríguez-Miranda et al., 2014). In Andalusia, Spain, directors recommend naming a teacher ICT coordinator for curriculum matters, making this person the technology leader for proper integration of ICT in the learning program. Sorensen et al. (2013) mention assistants who help teachers to integrate ICT (modeling best practices, providing professional development, and helping teachers to feel comfortable in technology-rich environments for their teaching).

Prior research on technology leadership addresses various topics. First, a significant body of research focuses on leaders. Topics of analysis include the *goals* of technology use – educational and administrative goals (Afshari et al., 2008); development of *collaborative abilities*, creation of an organizational culture, and search for common objectives (Hsiao & Chang, 2011; Sheppard, 2003); importance of directors' knowledge of the integration of educational technology (Shattuck, 2010); *type of leadership* for implementing ICT successfully in education (Hadjithoma-Garstka, 2011; McGarr & Kearney, 2009; Ng, 2008); *level of performance* of the director's technology-related functions (Fisher & Waller, 2013; Yu & Durrington, 2006); *gender differences*, academic level, leaders' experience in supply, technological competence, and use of educational technologies (Alkrdem, 2014; Drake, 2015); directors' *training* in technology use (Raman et al., 2014; Sheppard, 2003); leaders' *beliefs*, perception, and view of ICT and school culture (Chang et al., 2008); *competence* to develop technology leadership behavior (Thomas et al., 2013); capability to

assume the *risks* inherent in adopting technology, and communication with other directors (Alkrdem, 2014); and level in the *chain of command* of leadership in distributing responsibilities (Divaharan & Lim, 2010; Hulpia & Devos, 2010).

A second research group addresses *leaders' influence* on teachers, integration, and performance. We find *technological innovations* proposed by the leader (Van Niekerk & Blignaut, 2014), influence of the director's behavior in integrating ICT in the school (McGarr & Kearney, 2009; Raman et al., 2014), influence of technological leader on *performance* (Anderson & Dexter, 2005), and leaders' influence on degree of technology integration in the classroom (Raman et al., 2014; Tondeur et al., 2010).

A third group seeks to analyze *leadership from the perspective of teachers' needs and perceptions*, including need for organizational support, common shared vision, level of participation in leadership (Divaharan & Lim, 2010), coordination and management and leadership (Tondeur et al., 2010), administrative support and support from the leader (Anderson & Dexter, 2005; McGarr & Kearney, 2009; Ng, 2008), and an ICT coordinator (Lawson & Comber, 1999).

Leadership and technological innovation

According to Hauge (2014), new digital and virtual architectures for management and learning work in combination with – or are integrated into – existing institutional and social structures. It is necessary to develop a design that mixes – and coevolves with – the technical rationality of ICT, and the social and educational development and teaching and learning infrastructure. Innovation requires depth (deep change in classroom practice and alteration of teachers' beliefs, norms of social interaction, and pedagogical principles) and sustainability (maintenance over long period of time) (Coburn, 2003).

Moyle (2010) lists the *components* to which leaders should attend to manage technological innovations: the school's mission, vision, and strategic plan; classroom practices; school budgets and teachers; the organizational culture and the school's structures; the systems and strategies of leadership and management; the nature and design of classrooms and workspaces for teachers; and risk management strategies. Treatments of technological innovations in schools discuss the *general comprehension* required of teachers and directors of how creativity and innovation processes can be developed in students, how and where these processes can include technologies (Moyle, 2010), and whether the administration encourages such inclusion and how (Moyle, 2014). Leaders are the '*critical hinge*' or point of contact between the school's organizational and human infrastructures for development of innovative technological processes in school teaching and learning. It is thus necessary to adapt leadership for implementation of innovations, in some cases by developing distributed leadership and fostering *teacher-leaders* of technological innovations (Li, 2010; Sheppard, 2003; Weng & Tang, 2014). In a study of leadership in innovative schools, Sheppard (2003) finds a high presence of collaboration, support for innovation, and assumption of risks in teachers and parents or other members of the community.

Due to the innovative character of ICT-based projects, leaders should have *deep knowledge of innovation processes*, identify the corresponding requirements for successful adoption, and, as a result, harmonize plans and actions. For Razzak (2015), lack of a positive attitude among educational leaders will make it very difficult to develop ICT competences and almost impossible for teachers to use innovative pedagogical focuses. Despite these difficulties, Sorensen et al. (2013) argue that directors should dedicate time to systematizing long-term plans so that technology comes to form part of professional development and is evaluated formatively to ensure that teachers are improving their practice, even though this is rarely done in reality (Tuytens & Devos, 2011).

Educational leaders should thus consider a priori the process involved in implementing an educational innovation, thinking about the initial contextual budgets, beliefs of teachers, planning, development, monitoring, evaluation, possible difficulties along the way, ways of overcoming the difficulties, pedagogical change sought, efficacy, and satisfaction of teachers and members of the MT with the educational innovation.

The goals of this study are as follows:

Q1. What is TEI (the process of ICT-based educational innovation) for MTs and teachers in secondary schools?

Q2. How do school leaders perceive TEI?

Methodology

The study was performed in a secondary school (compulsory and postcompulsory education) in Andalusia, Spain. It is a public school created in 1977 and serving a socially disadvantaged population with a high rate of immigration. The students come from 21 countries. Post-compulsory education includes noncompulsory college preparatory education (*Bachillerato*) and Vocational Training (*Ciclos Formativos*).

All members of the official MT – composed of the Director, Assistant Director, Head of Studies, Secretary, and ICT coordinator – and 26 teachers participated. Our study included the ICT coordinator due to his leading role in technology integration (Table 1).

Table 1. Description of sample.

	MT	Teachers
Average years of teaching experience	24	21.20
SD years of experience	5.14	6.86
Gender		
Female	20%	46.94%
Male	80%	53.06%
Years of management experience	4.4	–
SD management experience	1.67	–

MT: management team; SD: standard deviation.

The MT also includes four participants who formerly held another management position (three Heads of Studies and one Assistant Director) for the following number of years: $\bar{x}=2.4$; $\sigma=4.99$. The members' education level is distributed as follows: 20 percent non-university diploma, 60 percent bachelor's degree, and 20 percent graduate degree.

Instruments

We use two questionnaires, as well as in-depth interviews of the Director, Assistant Director, and ICT Coordinator. Reliability and validity of the *Teacher Questionnaire* (TQ) and *Management team Questionnaire* (MTQ) were determined. To complement and nuance the data obtained from the questionnaires TQ and MTQ, we performed semi-structured in-depth interviews with members of the MT (Appendix 1).

Table 2. Sample statistics.

Factors	Group	Mean	SD	SE
Teamwork	Teachers	3.88	0.69	0.13
	MT	4.50	0.51	0.14
Personal competences	Teachers	3.53	0.69	0.14
	MT	4.03	0.81	0.14
External factors	Teachers	3.42	0.87	0.17
	MT	3.77	0.83	0.17

MT: management team; SD: standard deviation; SE: standard error.

Table 3. Contrast of means in groups, teachers, and MT.

	Mann–Whitney		Kolmogorov–Smirnov	
	Z	Asymp. sig.	Z	Asymp.sig.
Teamwork	–1.66	.096	.89	.394
Personal competences	–1.44	.149	.84	.431
External factors	–.770	.441	.39	.476

Table 2 shows a high perception of the factors analyzed in both the group of teachers and the MT.

Analyzing the means enables us to confirm whether there are significant differences between these groups' means. To do so, we performed the different types of analysis described in Table 3.

Results

Descriptors of the TEI relationship for teachers and the MT

According to the data obtained in the Mann–Whitney and Kolmogorov–Smirnov tests, we can accept H0 of equality of means in all of the factors analyzed. Both the group of teachers and the MT use the same descriptors to identify the relationship established between leadership, technology, and innovation. Both groups rank the representational descriptors of this relationship as medium-high in its three facets: teamwork, personal competences, and external factors.

How does the MT perform the TEI process?

To contextualize analysis of how the TEI process occurs in the school, we contrasted the tools used in the school and by the MT. All MT members used email, desktop tools, the school's webpage, and official programs. The teachers, in contrast, used a wider variety of tools, although in smaller percentages. Next, we show the perspective of the members of the MT based on the in-depth interviews.

Way and timing of planning educational innovation. In recent years, planning of ICT innovation had been developed using various specific benchmarks (participation in the education administration's program ICT School named Plan TIC 2.0, appearance of digital blackboards, mobile apps) and an attempt to use the tools provided by the administration '*before they were obsolete*'. ICT innovation

is achieved through the school's Education Plan, with the director informing of new elements and providing his or her help in using the tools, making the MT the basis for innovation. Recently, pedagogical leadership of the process has been delegated to a new department, called the Department of Innovation. Planning was done annually at the beginning of each academic year, but it is the MT that 'has the four- or five-year view of the project' relative to their time in this position. As to who does the planning, the questionnaire indicates that the '*MT has fostered experiences and supported them, both teacher training and the use of resources*'.

The MT marks the guidelines for what, how, and who monitors and evaluates the innovation. It indicates the importance of planning: '*management teams are crucial in promoting the launching of innovation, especially with ICT*'. Training is a key issue for being able to propose an innovation with technology and being involved in the project: '*. . . you also have to believe in it, you have to believe that this is going to work*'. Once it has '*committed itself to this*' the MT '*does not close the doors on anyone*', nor does it force their participation in this plan. It must, however, '*make it easy, ease the way*' for the teachers, facilitating participation, help, and advice from the MT so that teachers feel drawn into the innovation process.

Development of educational innovation with ICT in the school. Development occurs in two facets, administrative and pedagogical, developed over time. The MT shows that the teachers are gradually joining the plan, even if some difficulties arise. '*ICT sell really well, but then you have to use them in the day to day, and that's the big problem we have*'. Development from the beginning has been very favorable, but always '*little by little*'. Each year, more teachers have been incorporating innovation through ICT – depending on prior training. Currently, approximately 50 percent of the teachers innovate with ICT, 10 percent resist change, and 40 percent are trying innovations with ICT. Innovation has been gradual and beneficial for student learning in fostering good use among students. Implementation varies depending on the type of study (broader in postcompulsory vocational training). It has been carried out in several phases:

First is teachers' familiarization with the new tools (Guadalinux, educational platform Helvia, Virtual classrooms, Moodle, Google Apps, PDI, etc.). For example, '*at first, it was complicated for the teachers to consult email, but now it's the opposite, the teachers are the ones who ask you to send things by email*'. There are currently teachers who ask the MT for tools to innovate in their subject, for example, a three-dimensional (3D) printer. The second phase is training at the school for some of these tools, workshops on how to use them, advising and fostering their use by the ICT coordination team, and collaborative training among teachers. The third stage is the evaluation of level of use and acceptance of ICT. Sometimes, '*things happen*' and innovation starts to disappear, but the MT must listen to teachers and propose solutions.

Way of monitoring educational innovation with ICT. The innovations have not been monitored well ('*trivial evaluation*', '*without going into depth*'). The school uses only a self-evaluation memorandum, an evaluation survey, and the network access counter. One member of the MT states, however, that '*Little by little, we have to persuade people that ICT are an aid*'. Monitoring is done annually in June, at the end of the school year, and daily monitoring exists to enable adaptation to the diversity of and relationship to the community. There is also quarterly monitoring of the goals proposed to ensure that the right decisions are made. None of these forms of monitoring is official.

Way of evaluating educational innovation with ICT. Evaluation and monitoring occur in parallel, with the same methods: self-evaluation through surveys at the school and analysis of number of users, frequency, and means used. Evaluation also occurs by measuring access to blogs, platforms,

twitter, YouTube, and Google apps. Evaluation and monitoring are performed annually by the teachers and analyzed by the Technical and Management Teams, faculty as a whole at the faculty meeting, and the School Council.

Difficulties of educational innovation with ICT. Both teachers and students encounter difficulties. The MT stresses that the main difficulty is connectivity to the network. It also mentions teachers' beliefs about teachers' adaptation to technologies, need for motivation, unfavorable attitudes, lack of involvement, hesitation to use ICT, conflicts with students over use of ICT, and inappropriate use. Furthermore, the MT lists problems with equipment: projector, blackboard, students do not bring laptops or laptops do not work, and teachers' resources are not updated. Finally, there is the need for ongoing training since *'it is hard to keep up with all the new things'*.

The difficulties are found primarily in the implementation in *Bachillerato*, perhaps due to the Spanish education system's excessive emphasis on subject content in this phase of education, which is oriented to passing an external university entrance exam. Vocational Training, which is more closely related to the professional world, perceives greater need for training in the area of technology.

The MT highlights bureaucratic tasks as the main impediment to carrying out the innovations due to the loss of time involved. Although the MT would like to be more involved in innovations through ICT, administrative workload makes this impossible. Bureaucracy also causes another kind of difficulty: *'Some years ago, professional innovation networks were organized, but when the administration got involved and took a hand in determining who was a member, the people who were really interested left'*. Furthermore, the administration *'doesn't know what is really going on in the schools'* and *'lives in a different universe'* obsessed with performance and making teachers accountable. The administration does not give either economic or professional recognition to the professionals who perform or lead educational innovation with ICT. Legislation determines the hours of teaching personnel, preventing the MT from deciding what amount of time it can give teachers to perform these innovations. Furthermore, the administration looks for *novelty* in its applications: *'They [the administration] launch a program, and then it is practice which, over the years, gradually modifies it'*.

Respondents of the MT perceive Spain's economic situation as the problem causing lack of financing. The administration approves new innovation projects but with no budget (*'at 0 cost'*), making it impossible to maintain this rhythm over time. It is the MT who decides whether to postpone projects under these conditions until the following year, modify the school's budget, or propose that the projects cannot be carried out: *'We are in a very difficult situation'* on the level of personnel and resources.

We observe considerable differences in the role of families in educational innovations through ICT: Some families are very involved (especially in the lower grades of compulsory secondary education), but participation decreases in the higher grades.

Way of overcoming difficulties of educational innovation with ICT. The MT identifies that collaboration is the key to overcoming difficulties. They also argue that the problems of connectivity can be reduced (if not solved) through greater use of the virtual classroom and on-site programs, optimizing software and hardware resources.

It is important for teachers who have performed an innovation to disseminate their results and tell their colleagues *'what it was useful for'*, promoting their colleagues' participation at the start of the next school year to achieve a *snowball effect*. To overcome problems in teachers' attitude, the MT promotes the inclusion of all teachers (*'we make them see that it is a solution, not a problem'*,

‘we try not to make anyone invisible’, ‘we go into classes and ask them to leave the door open for other teachers to see’).

At other times, the students themselves demand that the teacher use technology (*‘the students are internalizing that computers are not only to play’*). This means that *‘teachers look for technologies, methodologies, innovations in their way of teaching’*. This approach works often in Vocational Training because the teachers know the repercussions for the future. *‘Vocational training teachers are more aware because our students go to companies in which they have to know how technologies work’*. What they cannot experience in the school they get to know in company internships.

For training, the MT mentions courses, alternative programs, and qualified personnel who help them solve problems.

The MT tries to achieve investment in technology within the low budgets supporting the school. If the school were well off economically, *‘we wouldn’t need much more, we have enthusiasm and innovative ideas from the head of innovation and the management team’*.

In general, schedules are important. *‘We would have to redesign the education system . . . one hour is very little time to work with ICT’*. Some teachers stay at school after their classes to collaborate with other teachers, showing interest and willingness. The high bureaucratic workload

could be performed more easily . . . , for example, the new teacher’s card makes some work easier . . . and there are technologies that the administration doesn’t provide, but that doesn’t stop us, we keep trying (now a teacher has brought his computer to school, we use it, and then he takes it home). We are surviving. No one lacks motivation – what we lack is means.

Connection of leadership with student-centered learning through innovation with ICT. The MT fosters teachers’ participation in discussing and planning educational innovation with ICT from various perspectives: *‘Technology encourages contact, closeness, and clarity and . . . this is my view of management’*. The technologies per se are not ‘new’ – they are a relative innovation – but their use in the classroom is changing the way of teaching. Students have changed; they want new technologies, and teachers should teach them with what is new (*‘They say, “Why are we using this device is no one uses it anymore? It’s obsolete”.’* Teachers also point out that *‘by becoming familiar with digital languages, we will be closer to achieving our goals; that’s why we are trying to push for this’*.) But there are difficulties with some teachers, and one cannot implement innovations without the support of the MT. The school’s community is making an effort, fostered by the MT, to encourage increasingly intense and effective use of ICT.

The MT thinks that some teachers view school dropouts and improving performance as the priority, *‘without taking into account that ICT can be significant to this improvement’*.

Efficacy and satisfaction with educational innovation through ICT. The MT perceives innovation as very satisfactory on the personal and professional level, especially in the Vocational Training Cycles: *‘it changes very fast, but we have to teach it so we don’t fall behind because it is increasingly present in all areas of society’*.

The MT trusts its team completely – *‘We are the teachers who want to innovate with technology’* – and trusts in its effectiveness as long as there are means, places, resources, and good functioning and use of this technology.

It expresses satisfaction with one innovation that is not part of a formally written plan: the virtual environment that has gradually been acquiring form and content: *‘we have managed to foster this innovation in the school, and now it works perfectly, with the collaboration of parents and teachers’*. The MT is also satisfied with the openness this environment provides to schools abroad, teachers from foreign schools, and exchange visits with schools through the Erasmus Charter,

‘although there is a huge amount of bureaucracy’. Finally, the MT is also satisfied with the speed, efficacy, and economy: *‘I like it because the information goes quickly, reaches everyone, and you can contact everyone. It also lets us reuse materials’*. But this is not recognized by the education authorities: *‘International visits to the webpage are satisfying, but they would probably be more satisfying if the administration recognized this’*.

Suggestions to improve educational innovation through ICT. Based on the problems detected for educational innovation through ICT, the MT proposes a series of improvements – (a) connectivity: providing fiber optics, bandwidth and so on; (b) training: continuous training and professional development for ICT use with emphasis on pedagogy; (c) resources: better equipment, digital blackboard in each classroom; (d) the administration’s monetary recognition or recognition of time invested; (e) recognition by citizens, thanks to greater diffusion of results; (f) maintain and extend professional networks on the regional, national, and international levels; (g) increase coordination between similar schools to share resources and successful educational practices; (h) give greater relevance to digital competence in different subjects; (i) regulate technologies available to students – for homework – to make better use of them.

Conclusion

Our study has two research goals: to analyze the perception that the group of teachers and MT have of educational innovation through ICT and to develop deeper understanding of what TEI is like (planning, development, and evaluation) from the perspective of the MT. The results generate a leadership–technology–innovation model.

The teachers’ evaluations of the MT are very high, although their perception specifically of the MT’s work on technology is somewhat lower. We can conclude that there is strong leadership enabling successful adoption of educational technology (Hadjithoma-Garstka, 2011; Nahavandi, 2009; Wong et al., 2008). The group of teachers and the MT use varied technology tools adapted to their needs (and use is more and more frequent). The perception that both the teachers and the MT have of leadership are similar concerning teamwork, personal competences, and external factors that describe the leadership–technology–innovation relationship.

Planning of TEI

In planning for the case analyzed, we observe some characteristics mentioned in the prior literature that are crucial for leadership in innovation with technology. Numerous studies (Anderson & Dexter, 2005; Hulpia & Devos, 2010; Sheppard, 2003; Sorensen et al., 2013; Weng & Tang, 2014) state that these characteristics are willingness, commitment, and belief in the possibility of improving the community and student learning through technology, long-term vision, and decision-making for the future (Harris, 2008). Innovation must be oriented to the desired goals but sufficiently flexible to adapt to the characteristics of the context (Moyle, 2014; Nahavandi, 2009) and instructors’ needs, establishing paths for action (Figure 1).

Development of TEI

Development is characterized by solid leadership and involves communication among professionals in the school, combined with action strategies. Leadership in development of TEI is seen as distributed, based on productive collaboration and assessment of experts, whether or not they

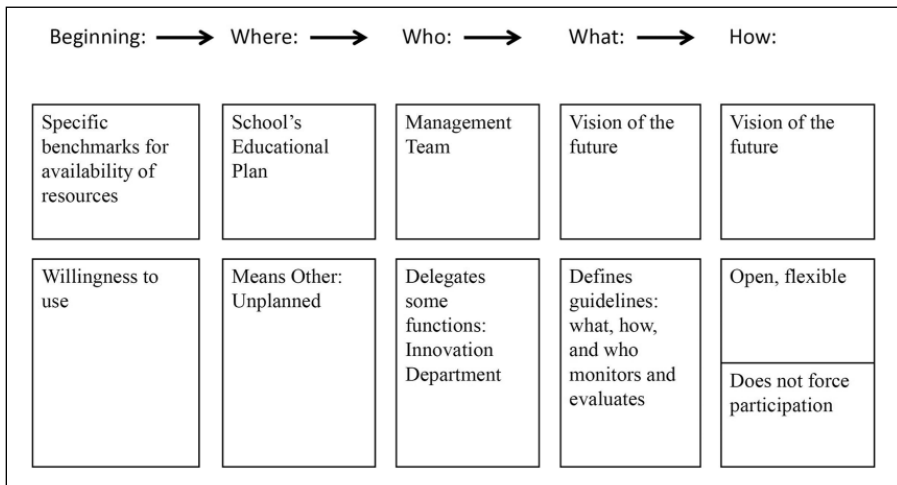


Figure 1. Structure of TEI planning.

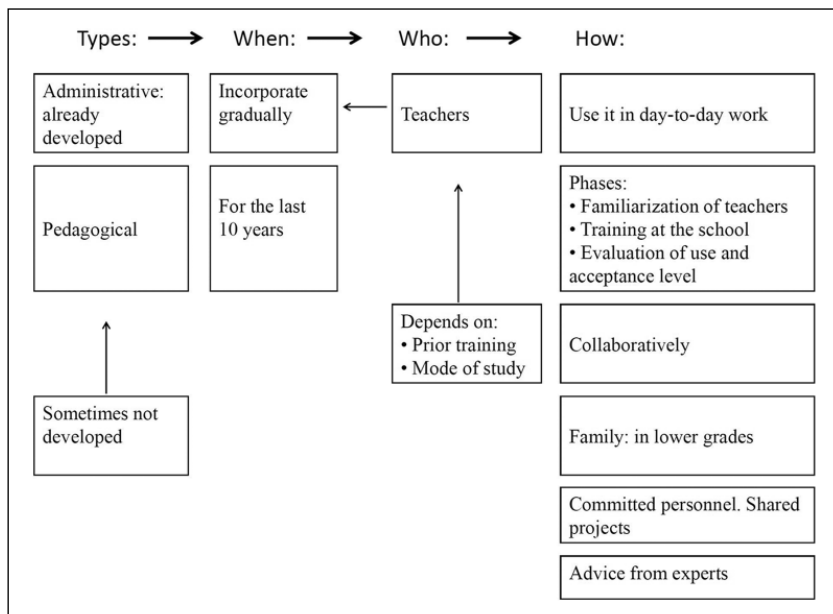


Figure 2. Structure of the development of TEI.

belong to the school staff (Harris, 2008; Harris, Jones, & Baba, 2013; Hulpia & Devos, 2010; Ng & Ho, 2012).

We perceive indexes of openness and capability to respond to social, cultural, and economic changes. The MT supports implementation of technological innovations and technical support, as well as teacher training (Ashbaugh, 2013; Weng & Tang, 2014). And the MT develops its work in demanding, challenging situations to establish action paths and a vision of shared meanings (Fullan, 2011) (Figure 2).

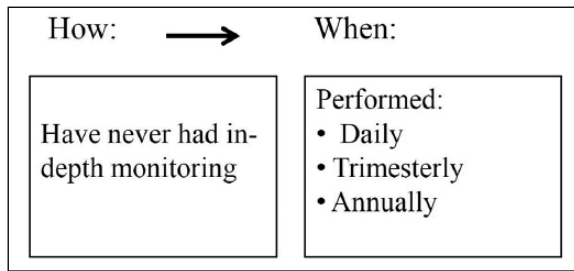


Figure 3. Structure of TEI monitoring.

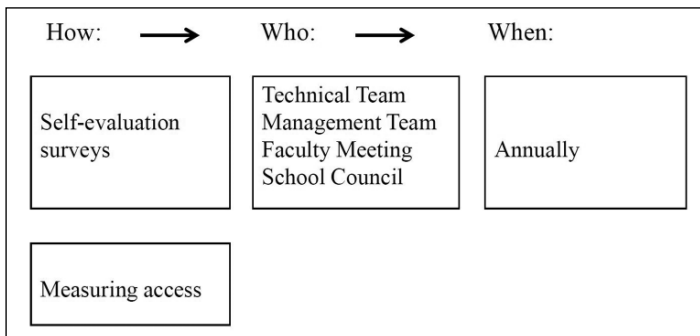


Figure 4. Structure of evaluation of TEI.

Monitoring of TEI

Creating shared meanings (Chang et al., 2008; Fullan, 2011) in developing requires continued participation and collaboration in monitoring, as well as everyday identification of expectations for performance to move in the same direction (Anderson & Dexter, 2005; Kahai, Jestire, & Huang, 2013). In the case analyzed here, however, we observe that the monitoring was not done systematically and continuously (Figure 3).

Evaluation of TEI

One function of the MT is to guide individuals toward achieving the school's objectives, toward successful results to help to make innovation more effective (Nahavandi, 2009). To achieve this goal, the school leaders must acquire tools that make it possible to perform innovations systematically and gain feedback for the strategic plan in the long term (Moyle, 2010). Involving the faculty and School Council in evaluation means that these actions are evaluated collegially, which enables the necessary adjustments in the cyclical development processes (Kowch, 2013) (Figure 4).

Difficulties and ways of overcoming them

The MT faces continuous challenges as management of technological innovation is a complex function (Drake, 2015; Kowch, 2013) that requires continuous analysis of the difficulties. The MT is conscious of the school's problem in implementing technology-related educational innovations

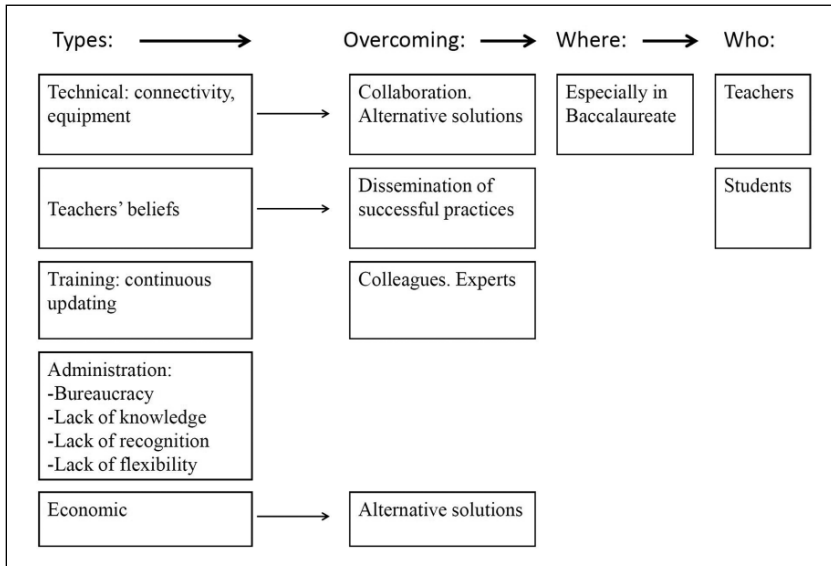


Figure 5. Structure of difficulties with TEI.

that affect students and teachers (Ünal, Uzun, & Karataş, 2015) and responds to and interprets the needs that produce changes (Ashbaugh, 2013). It is aware, however, of the systemic and economic limitations in education in Spain (Rodríguez-Miranda et al., 2014) (Figure 5).

The key element for overcoming the difficulties described is based on collaboration between teachers, with the help of external experts. Technology encourages closeness, democratization, and distributed leadership. Although some problems are hard to solve, such as connectivity, the MT seeks alternatives to decrease these negative consequences. As to the teachers' beliefs, dissemination and participation in the school's future planning are key to continuing to advance in this respect, as is making students aware of technology's utility as a learning tool.

Connection of student-centered leadership

The MT's vision relates technology to increase in leaders' closeness to students and teachers. Technology also creates closeness between students and teachers, who establish two-way relationships oriented to agreeing on content, resources, and innovative technology-based methodologies. The MT perceives that post-compulsory education students are demanding and believes it is a priority to attend to this demand (Figure 6).

Efficacy and satisfaction

Efficacy and satisfaction seem linked on both the personal and professional levels, especially in Vocational Training (Training Cycles). The perception is enthusiastic, based on the reality experienced, rooted in the practice of the teachers participating (Petko, Egger, Cantieni, & Wespi, 2015) rather than the administration and educational authorities, who are at a remove from the perceived needs. Although the school leaders did not receive economic recognition or improvement of working conditions, the leaders perceive personal and professional satisfaction (Kurland &

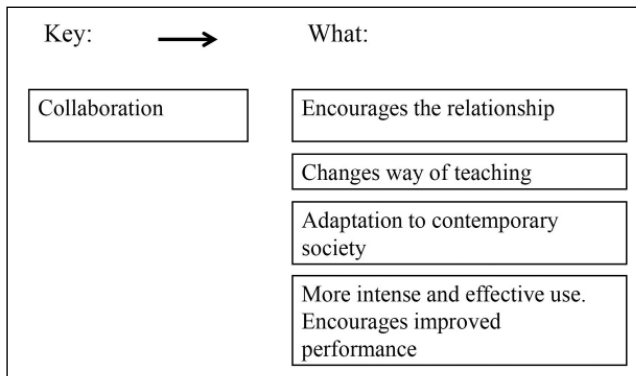


Figure 6. Structure of leadership–student connection.

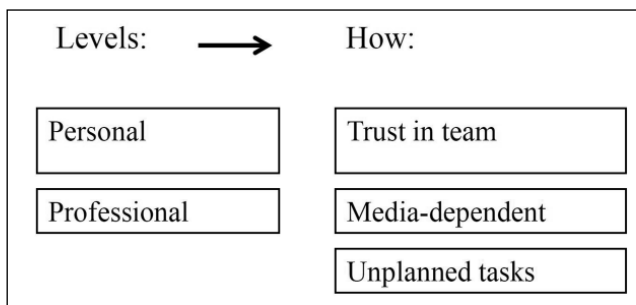


Figure 7. Efficacy and satisfaction with TEI.

Hasson-Gilad, 2015) in being able to count on teachers who innovate with technology and in having the collaboration of the ICT coordinator and MT to do so (Figure 7).

Finally, we recognize the small number of teachers who participated in the study as a limitation. This number was limited by the requirement that they have in-depth knowledge of the MT's perspective on technology integration. Future studies require different methods and contexts to analyze school technology leadership.

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Appendix I

1. What technology tools predominate and/or are used in educational innovation with information and communications technologies (ICT)?
Desktop tools
Internet tools
2. How and when was educational innovation with ICT *planned* in your school?
3. How was educational innovation with ICT *developed* in your school?
4. How did your school *monitor* educational innovation with ICT?
5. How did your school *evaluate* educational innovation with ICT?
6. What difficulties arose in educational innovation through ICT?
7. If you had difficulties with educational innovation through ICT, how were they overcome?
8. In your school, is leadership with student-centered learning linked to innovation through ICT? Why?
9. Has educational innovation through ICT been effective and satisfactory?
10. Add any comments and suggestions you have for improving educational innovation through ICT.