Abstract— Current teacher training in TEL attempts to develop pedagogical and 21st century skills focusing on the major modes of learning mediated by technology. To identify specific training needs, a learner analysis instrument is being developed based on a 5-dimension model for assessing teachers' readiness to TEL. This was then used to design a survey with statements exploring different aspects of the identified dimensions. After piloting and refinement, this instrument will be used to collect data for course designers and tutors to identify the ICT skills that need to be developed, challenge inapt beliefs, nurture positive attitudes and determine the pedagogical approaches to be used in a particular course.

Keywords- technology-enhanced learning, teacher training, learner analysis

Technology-enhanced learning (TEL) is an integral part of any Educational innovation in a knowledge society. 'ICT in education is no longer a novelty or luxury enjoyed by more affluent nations. Ultimately, the role of ICT in education is to support teaching and learning practices, enhancing the ways that educators can fulfil human development goals,' [1]. Plans for introducing new pedagogical approaches or elaborating existing ones through the appropriate use of digital tools constitutes the essence of 21st century educational endeavors. Are teachers prepared to respond to these evolving demands?

1. THE CHALLENGE OF TEACHING IN A KNOWLEDGE SOCIETY

Over recent years, the focus in education policy for many governments has been on the integration of ICT into educational development plans resulting in increased use of ICT in all aspects of education development, from fostering students’ 21st century skills, to facilitating teachers’ professional development and improving access to knowledge and information literacy through ICT, [2].

The need to prepare teachers, for the knowledge society compels researchers and practitioners to work on initiatives geared to promote comprehensive approaches that merge domain learning with the promotion of 21st century skills. Beyond domain-related knowledge and skills, interdisciplinary and transdisciplinary learning outcomes are increasingly becoming the focus of educational programmes and school curricula. These include competences in the use of digital tools to experience and learn different curricular domains, to extend learning beyond the classroom context and to carry out everyday interactions in any of the personal, social and cultural dimensions. Technology-mediated creativity, innovation and entrepreneurship are skills increasingly demanded by knowledge economies, thus curricula should include core proposals to develop these. Citizens living, learning and working in a knowledge society need to be fluent in oral, written and technology-mediated communication. Other personal management skills include the ability to evaluate information critically, taking responsibility for and being able to manage one’s own learning, developing the habits of effective learning, knowing how to work independently without close supervision, being confident and able to investigate problems and find solutions, and being resilient in the face of difficulties, [3]. These personal skills have to be developed in tandem with a number of socially oriented abilities such as collaboration and team skills, a refined sense of connectedness and networking skills.

Teachers play a key role in integrating learning technologies in the educational process and in promoting these curricular transformations. The Stellenbosch declaration [4] emphasized the special role of teachers in a knowledge society. This role demands new specific competencies to deal with new knowledge and innovative ways for accessing knowledge, to deal with a networked world and with new types of cooperation and collaboration, to deal with a society in which knowledge plays a crucial role, to deal with lifelong learning. They have to work in a more collaborative way locally, regionally, nationally and globally. This implies that the teaching profession needs to evolve strongly and quickly.
The key question is then: Are teachers ready for this challenge? Are they prepared to evolve and make a paradigm shift in their conception of technology and its integration in the teaching-learning process? Is the vision outlined by this declaration actually being translated into effective and efficient transformative technology-enhanced learning experiences?

Pelgrum and Anderson’s [5] study about ICT implementation in schools has found that teachers’ lack of IT knowledge and skills was a major obstacle. Second SITES [6] comparative study of pedagogy and ICT use in schools and educational systems found teachers’ self-perceived technical and pedagogical ICT competence to be positive, significant predictors for teachers’ ICT adoption in their own teaching practice. [7]. In particular, pedagogical ICT competence, which is the teachers’ ability to make appropriate selection and use of ICT tools in different curriculum contexts for different pedagogical purposes, is the most crucial determinant of actual ICT use in instruction, [8].

It is obvious that teachers need to be trained in making a pedagogical shift from content oriented instruction to the development of process skills exploiting domain contexts. Dede [9] cautions that this involves a major challenge in professional development to help teachers, policymakers, and local communities unlearn the beliefs, values, assumptions, and cultures underlying schools’ standard-operating practices.’ Moving beyond the ‘operational’ curriculum oriented to develop skills in ICT and learning of subjects through ICT, one should prepare teachers for the ‘transformational’ curriculum with its focus on learning processes and interactions that assumes a fundamental change in the organization of teaching and learning experiences. Consequently teacher training in TEL should strive to develop pedagogical insight and know-how rather more than technical ICT-competence.

Law [10] promotes Mishra and Koehler’s [11] technological pedagogical content knowledge (TPCK) framework for preparing teachers in the digital era. This framework builds on Shulman’s [12] notion of pedagogical content knowledge as knowledge about how to teach specific concepts within a curriculum. Teachers not only need technical knowledge, but also knowledge about how technology and content are reciprocally related to each other. Technological pedagogical knowledge includes knowledge of the existence, components, and capabilities of various technologies for use in teaching and learning settings and pedagogical considerations for their selection. TPCK elaborates on this as knowledge of the dynamic, transactional relationship between these three knowledge components to support pedagogical decisions.

Yet for Dede [13] the curricular transformation lies in moving from basic curricular content-oriented approaches and how to promote these through technology, to a curriculum that uses domain content as a context to develop higher order 21st century skills. The shift needed is not to remove the learning of routine cognitive skills (such as basic arithmetic operations) from the curriculum but a fundamental change involving deemphasizing fluency in simple procedures as an end-goal of preparation for work and life and instead using these routine skills as a substrate for mastering complex mental performances valued in the future workplace. In this context, the criteria to assess teachers’ readiness should not only be the degree of integration of technology, pedagogy and curricular subject knowledge, but most important for moving beyond this level and use domain contexts to create learning experience specifically developed to promote 21st century skills.

The instrument being developed is based on this transformative conception of teachers’ competence. The continual need to customize the programme in TEL at the Faculty of Education, UoM, to the ever changing educational needs of (student) teachers, together with the constantly evolving digital environment and culture, creates the need for an analysis tool that can provide insight into the training needs of teachers. Inspired by recommendations from literature about trends in educational technology, an instrument has been designed to obtain empirical data about training needs in different dimensions and processes underlying TEL.

2. REVIEWING LITERATURE ABOUT TEACHERS’ READINESS TO TEL

The study of readiness to TEL has evolved over the past years along different dimensions ranging from institutional readiness, to the availability of technological resources and individual competence development. Before the Web 2.0 era, several instruments have been developed to measure teacher readiness for eLearning. The focus of these instruments was the assessment of hardware and software availability, accessibility to the internet and ICT-related skills. The underlying assumption was that competence in the use of a range of ICT tools and applications (technological knowledge) leads automatically to the effective use of digital tools in teaching and learning. But studies about technology acceptance patterns (E.g. SITES 2006 [14]) and expert recommendations (E.g. Stellenbosch declaration [15]) led to the awareness that using technology effectively involves more than technological competence as many interacting variables come into play.

The seminal work by Hannafin & Land [16] claims that technology-enhanced learning environments are rooted in five foundations: Psychological, pedagogical, technological, cultural and pragmatic. Mirroring the nature of learners’ knowledge and their role in the learning process, these may serve as fundamental dimensions for determining learners’ readiness for the effective use of technology in learning. The technological dimension will identify if the learners have the necessary infrastructure and the knowledge about different applications that can be used in TEL. The psychological dimension will identify if the learners have the appropriate attitudes towards TEL which will help them perform better.
The pedagogical dimension determines if the learners are prepared to go through the change from the traditional teacher-directed methodology to innovative technology-enhanced student-centred modes of learning and knowledge building.

Chapnick [17] organizes the wide variety of factors related to e-learning readiness into eight categories allowing practitioners to use the same process to assess the vastly different stakeholders in the system. Psychological readiness considers the individual's state of mind as it impacts the outcome of the e-learning initiative. Sociological readiness considers the interpersonal aspects of the environment in which the program will be implemented. Environmental readiness deals with the large-scale forces operating on the stakeholders both inside and outside the organization. Human resource readiness considers the availability and design of the human-support system. Financial readiness deals with the budget size and allocation process. Technological readiness considers observable and measurable technical competencies. Equipment readiness considers the question of the proper equipment possession. Content readiness considers the subject matter and goals of the instruction.

On a similar vein, the study about eLearning Readiness in Malaysia [18] employs a survey methodology using four instruments, one for each of the identified target groups, namely, policy makers, eLearning providers, eLearning enablers and receivers. Each instrument contains a section for demographic variables and a section containing items asking for perceptions of readiness in eight areas: learner, management, personnel, content, technical, environmental, cultural and financial.

Watkins, Leigh & Triner [19] give a list of self-test instruments used to assess online distance learning. Based on an analysis of these instruments they developed a survey to assess readiness for e-learning based on five dimensions: technology access, online skills and relationships, motivation, online audio/video, internet discussions and factors determining success in on-line learning.

The Second Information Technology in Education Study [20] was an international assessment of teaching and learning practices and of how ICT support these in secondary schools around the world. ICT-enhanced teaching and learning was assessed at four levels. The National Context Questionnaire consists of four sub-topics comprising the educational system structure and responsibility, teacher preparation, change during a 5-year period and system wide ICT policies. The Principal Questionnaire asked for information from schools about education and policy matters related to pedagogical practices and computers. The Technical Questionnaire asked for information about the ICT facilities and about practices regarding their use in the school. The Teachers' Questionnaire requested information about the target class, curriculum goals, teacher practice, student practice, learning resources and technology infrastructure, impact of ICT use, information about teacher and the school, and specific pedagogical practice that uses ICT.

Moving beyond the eLearning and ICT skill development paradigms, the UCISA survey [21], builds on previous surveys (2001, 2003, 2005 and 2008) but shifts the focus away from e-learning to TEL. This survey explored institutional factors that determine TEL comprising drivers for TEL in the institution, institutional strategies that inform the development of TEL, internal or external strategies that influence the implementation of the various tools in TEL, the type of support in an institution for TEL, barriers in an institution to promote TEL, and future challenges.

BECTA [22] guide for teachers integrates institutional factors as part of the environmental dimension of TEL. The guide provides a checklist that categorizes the readiness of teachers in TEL along 5 dimensions. The ‘About You’ dimension considers what a teacher can do towards developing the range of professional teaching skills with technology. The ‘About your Learners’ dimension considers how a teacher can expose learners to a range of technologies and develops their skills to use them within their everyday learning. The ‘About Learning Beyond School’ dimension considers how a teacher and the school can use technology to build dialogue and engagement with parents, families and the community. The last aspect is ‘About Your Role in Your School’ taking into account the school plan and approaches to ICT as a whole school issue.

3. DEVELOPING THE INSTRUMENT

Synthesizing the different dimensions proposed by these various instruments, a 5-dimension model was developed to assess teacher readiness to TEL, dedicating a section for each dimension. Each section comprises a number of statements to be scored mostly on a 5-point Likert scale to explore different aspects of these five dimensions. The overall Culture determines the Pedagogical approach which in turn determines the educational Environment of the institution and surrounding community. This will demand a range of ICT skills (Technological dimension) that will determine a teacher’s interaction with the environment considering his/her Psychological frame-of-mind.

The Cultural dimension. A teacher’s frame-of-mind and practice are strongly influenced by the surrounding general and institutional cultures. Ultimately the culture determines the policies, curriculum and design of learning systems by reflecting social mores and values concerning the nature and role of education and the use of technology according to this role. National policy goals and visions for the future of education serve as catalysts to stimulate cultural change. UNESCO [23] ICT-CST policy document proposes three educational approaches – Technological literacy, Knowledge Deepening and Knowledge Creation - corresponding to alternative educational frameworks determined by the prevalent culture. Through these approaches, a country’s
students and ultimately its citizens and workforce acquire increasingly sophisticated skills needed to support economic, social, cultural, and environmental development, as well as an improved standard of living. These are the fundamental elements of the culture in a knowledge society.

In this culture, emerging technologies require new teacher roles, new pedagogies, and new approaches to teacher training. The successful integration of ICT into the classroom will depend on the ability of teachers to structure the learning environment in non-traditional ways, to merge new technology with new pedagogy, to develop socially active classrooms, encouraging cooperative interaction, collaborative learning, and group work. This requires a different frame-of-mind and set of classroom management skills that reflects national policies, the philosophy of the institution including school board, administration, teachers and parents. Thus the cultural dimension of the survey includes statements reflecting prevailing beliefs of the school and community about education and technology, the roles of teacher in school and community, the values underlying curriculum together with the philosophy of the school.

The environmental dimension takes into consideration the situational constraints, mainly the policies adopted that will determine (innovative) approaches promoting ICT integration in the curriculum and the process of educational transformation. Besides promoting learning processes through technology in school, this dimension also considers how technology is used to build dialogue and engagement with parents and the community.

UNESCO [24, 25] conceptualizes four environmental scenarios depending on the school’s specific stage of development characterized by specific philosophies and policies. A preliminary ‘emerging approach’ provides ICT courses to students, taught by individual teachers who have the technical competence. At a later stage, the ‘applying approach’ is based on a curriculum focusing on providing opportunities for students to apply their ICT skills in some specified learning contexts. The school advances to an ‘infusing approach’ when all teachers share the vision of bringing about new learning opportunities to students through ICT integration. This demands from teachers technical and pedagogical ICT skills in the relevant subject areas as well as on collaborative, cross-curricular uses of ICT. A school reaches the most advanced stage, the ‘transforming approach’, when it is ready for and committed to making use of ICT to realize visions for the school of tomorrow. Here, the curriculum provides differentiated and individualized learning opportunities for students where learners have to take responsibility for their own learning and contributing to solving real-world problems. In this scenario the teacher has to be a lifelong learner integrating theory and research with practice, showing leadership both in innovation and in to leading the school to become a learning community. Thus professional development at this stage is a self-managed, continuous and a critically reflective process.

Consequently the proposed instrument assesses the environmental dimension through statements about a teacher’s contribution to the school’s vision for TEL, development of TEL within the school’s Continuous Professional Development plan, communication with parents, sharing of school vision with students, promoting autonomous learning, sharing of practice in ICT with colleagues and contribution to a research community.

The Pedagogical dimension explores the type of learning processes mediated by technology resulting from the stage of technological integration, the type of learning resources used and the teaching-learning practices promoted within or outside the classroom. UNESCO framework [26] identifies 3 levels of technological integration each with its pedagogical focus: technology literacy approach focuses on increasing the technological uptake of students by incorporating technology skills in the curriculum; the knowledge-deepening approach focuses on developing the ability of students to solve complex, real-world problems by applying the knowledge they have learned through constructivist and situative approaches; and the knowledge-creation approach aims at developing students that can innovate, produce, and benefit from new knowledge.

The proposed instrument operationalise these three pedagogical foci through five learning processes: ‘learning through instruction’, ‘learning through exploration’ (inquiry-based learning, digital games and simulations), ‘learning through collaboration’, ‘learning by reflection’ and ‘learning by designing’. The survey enquires about the frequency these learning processes are manifested through activities within or outside the class and if ICT is used during their execution. Another section under this dimension enquires about assessment methods relevant to these learning processes and whether ICT was used in the process.

The Technological dimension considers what a teacher can do to develop a range of professional teaching skills with technology demanded by these different institutional scenarios and pedagogical approaches. It also considers those competences that enable use of technology to improve students’ learning effectiveness and how to use ICT in different classroom settings, in different curricular areas and how to make use of ICT in assessment.

The UNESCO [27] document ‘ICT Competency Standards Modules for Teachers’ elaborates on the skills that need to be developed according to the pedagogical orientation adopted by a school or institution. The basic literacy level involves the use of various technologies, tools, and e-content as part of whole class, group, and individual student activities. Changes in teacher practice involve knowing where and when (as well as when not) to use the technology for classroom activities and presentations, for management tasks, and to acquire additional
subject matter and pedagogical knowledge in support of the teachers’ own professional development. The technologies involved may include the use of computers along with productivity software; drill and practice, tutorial, and web content; and the use of networks for management purposes.

The knowledge deepening approach demands from teachers the ability to manage information, structure problem tasks, and integrate open-ended software tools and subject-specific applications with student-centred teaching methods and collaborative projects in support of students’ deep understanding of key concepts and their application to solve complex, real-world problems. To support their collaborative projects, teachers need to be competent in the use of network resources to help students collaborate, access information, and communicate with external experts to analyze and solve their selected problems. Teachers should also be able to use ICT to create and monitor individual and group student project plans, collaborate with other teachers making use of networks to access information and supporting their own professional development.

In the knowledge creation approach teachers will need to design ICT-based learning resources and environments; use ICT to support the development of knowledge creation and critical thinking skills of students; support students’ continuous, reflective learning; and create knowledge communities for students and colleagues. They will also need leadership skills to train colleagues and to develop and implement a vision for their school as a community based on innovation and continuous TEL.

Thus the proposed instrument enquires about the level of commitment shown by a teacher to develop his/her professional teaching skills together with statements probing about teacher’s use of ICT in their practice. It also asks teachers to indicate which applications and tools (representing the 5 identified modes of learning) are used and for what purpose (i.e., use in class, for students’ activities at home, or for regular personal use).

The Psychological dimension determines one’s interactions with technology considering how individuals acquire, organize and deploy knowledge and skills. On a social level, it considers the beliefs about how technology affects one’s interactions with others. Efficient and effective TEL is possible if a learner accepts technology and be comfortable in using it. William [28] discusses eight theory models that were identified to investigate technology acceptance. The Technology Acceptance Model (TAM) [29] identifies external variables, which may affect beliefs, in turn beliefs influence attitudes that lead to intentions and therefore generate typical behaviours in the use of technologies for learning. Engagement with technology arises from positive or negative affective evaluation determined by perceived use and perceived control of technology in (learning) tasks. Perceived Control is the extent to which a person believes that using a technology will be free of effort. Also, it refers to the confidentiality that the learner has in being able to solve problems that will be encountered when using the technology. The higher the confidence the learners have in their technical abilities, the better the attitudes towards TEL are. The learners’ motivation and their success in a TEL environment are advanced. Perceived Use is described as how much the learner believes that technology will help in the learning process. It depends on the Perceived Control that learners have over technology. Learners make use of a digital tool if they believe that it will improve their performance in their learning.

The Behaviour of learners’ towards technology is dependent on Perceive Control and Perceive Use. The behaviour will vary according to how much the learner view the technology as being important which will be influenced from self or other experiences. Learners who do not have faith in their technology skills will face behaviour towards technology with more difficulties. On the other hand, people which are more self-efficient in technology will have a positive behaviour.

Thus the section in the proposed instrument about the psychological dimension includes statements about perceived use, perceived control, affective component and behaviours about teacher’s engagement with technology for personal use and in relation to classroom practice.

4. CONCLUSION

Once the final version of this instrument is developed it will be piloted with a representative sample of Maltese teachers using paper and on-line version. A detailed item analysis will be performed controlling for item validity and reliability. The final instrument will be used as a learner analysis tool to collect data about specific teachers cohorts, for example those enrolling for a graduate and post-graduate training course or others taking in-service training. This will enable course designers and tutors to identify the ICT skills that need to be developed and the pedagogical approaches to be adopted in a particular course. It will also provide detailed information about the strategies that need to be adopted in order to challenge established beliefs and attitudes while nurturing positive ones. Data from the environmental dimension will be used to evaluate existing policies and propose workable courses of action.

Most important, the instrument provides an integrative model and approach emphasizing the network of interrelated variables that operate in educational and training contexts based on TEL. Designing courses and learning experiences that involves use of technology should be based on a SWOT
References:


[2] Ibid. [1]


