Policy recommendations for integrating elearning and education for sustainable development cross-curriculum learning areas into the Maltese state education system

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Policy Recommendations for Integrating
eLearning and Education for Sustainable Development
Cross-Curriculum Learning Areas into the Maltese State Education System

Terry A. Buchanan

A dissertation submitted to the Graduate Faculties of the
UNIVERSITY OF MALTA and JAMES MADISON UNIVERSITY
In
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for the degrees of
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and
Integrated Science and Technology

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Abstract

This research study sought to assess the current status of Technology Enhanced Learning and Education for Sustainable Development in Malta, and to provide practical solutions to the challenges associated with their integration into the Maltese State Education system. Research methods employed during this study utilised a survey involving a cross-selection of Science Education teachers to assess their perceptions and attitudes towards the practical application of Educational Technologies in the classroom, and a subsequent in-depth interview with the Assistant Director and Education Officer responsible for national eLearning decisions in Malta to gain a deeper understanding of the organisation and management of the education system’s infrastructures and the public policy plans that govern them. The literature review section of this dissertation covers a brief history and background account of Educational Technology and Education for Sustainable Development, and links key principles from these subjects to present day Maltese concerns in education.

The entire state education system is currently undergoing significant levels of changes in its efforts to achieve 21st Century education expectations, and as a result, converging interests with shared goals are experiencing some levels of conflict. Several recommendations to address these challenges are provided from the results of the research conducted during this study. A key element to the successful realisation of the proposed list of policy recommendations is regarded to be found through gradual and systematic implementation plans that acknowledge and respect the concerns of all affected parties involved. Recommendations for further topics beyond the scope of this study would include additional research into the environmental
aspects of the present day education system and the development of a detailed implementation plan for the eventual full integration the Education for Sustainable Development subject as cross-curriculum learning area into the Maltese State Education curriculum.
1. Education for Sustainable Development (ESD)

Communities all over the world are coming to a greater understanding that current development trends are no longer sustainable and that high levels of public awareness through education and training is a key element to achieving sustainable development objectives in an increasingly globalized society (UNESCO, 2006).

Education for Sustainable Development (ESD), Education for Sustainability (ES), and Sustainability Education (SE) are terms that have often used synonymously and interchangeably in reference to sustainability learning programmes, however ESD is the terminology used most commonly at the international level and within UN documents (UNESCO, 2006). ESD helps to provide people with the knowledge and skills required to finding practical solutions to environmental problems locally (UNESCO, 2006).

In ESD, diverse international perspectives require that each individual society build their own best practices for dealing with local environmental concerns and how they relate to the bigger global picture. Everyone is a stakeholder in Education for Sustainable Development. We all share in the long-term effects - both the positive and the negative - of environmental decisions (UNESCO, 2006).
1.1 Historical Background

As governments began to realise that the increasingly widespread effects of advancing environmental degradation required international collaboration efforts rather than isolated unilateral approaches to solutions, a series of initiatives were instituted to address these concerns. The landmark 1972 United Nations Conference on Human Environment in Stockholm laid the foundation for a new environmental vision for the United Nations, which in turn led to the eventual establishment of the United Nations Environment Programme (UNEP) and many other subsequent environmental organisations (United Nations, 2012).

Shortly after the Stockholm conference, the international community also began to realize that addressing environmental concerns separately from development plans was not an effective means to managing neither the planet nor the economic welfare of society. Therefore, by the mid-1980s, the United Nations was searching for more effective strategies to meet the needs of both society and the environment together. This effort resulted in the now well-known innovative information report on sustainable development from the Brundtland Commission in 1987, entitled ‘Our Common Future’. This report was endorsed at all levels of government as an overarching foundation for future development policies (UNESCO, 2010).

During this period of development, the United Nations General Assembly concurrently explored the concept of utilising education to promote sustainable development (UNESCO, 2005). The principles of sustainable development continued
to grow worldwide as international committees negotiated the terms of the 40 chapters that eventually became to be known as Agenda 21. Agenda 21 was presented in its completed form to the public initially at the United Nations Conference on Environment and Development (UNCED) in 1992, (also known as the Rio Summit and the Earth Summit) (UNESCO, 2005).

The importance of the relationship between sustainable development objectives and education was first highlighted in Agenda 21’s chapter 36, entitled ‘Promoting Education, Public Awareness, and Training’. Chapter 36 of Agenda 21 outlined an implementation strategy for Education for Sustainable Development and stressed the importance of integrating education into every aspect of Agenda 21 aims. The principles of which were also reaffirmed in each of the successive Earth Summit conventions (UNESCO, 2005). All nine of the United Nations Conferences that convened during the 1990s to address sustainability concerns also correspondingly identified education as a crucial element to achieving long-term success in the implementation of environmental solutions (UNESCO, 2005).

The Fourth International Conference on Environmental Education, (also referred to as the Tbilisi+30), was held at the Centre for Environment Education (CEE) in Ahmedabad, India in 2007 (UNESCO, UNEP & Govt. of India, 2007). Several work group sessions were convened during the conference, along with special sessions for government agencies. The meeting was intended to establish an awareness that environmental education helps to prevent and resolve conflicts, and to
assist in building partnerships and a collaborative knowledgebase for refining the vision of the practical application of sustainability globally. It was also reaffirmed at this time that Environmental Education (EE) supports Education for Sustainable Development (ESD), and encourages a shift from viewing education merely as a delivery system of information to an enduring and holistic approach to life (UNESCO, UNEP & Govt. of India, 2007).

The most recent United Nations Conference on Sustainable Development, (otherwise known as Earth Summit 2012 and the Rio+20 Conference), occurred in 2012, and reaffirmed original Conference commitments to Education for Sustainable Development with the draft resolution ‘The Future We Want’. The conference draft resolution reemphasised the importance of cooperation among nations to achieving global environmental objectives, and strongly encouraged academic institutions to establish sustainable development as an integrated component across core-curriculum disciplines, and included recommendations for improved teacher training programmes and the implementation of Educational Technologies to improve learning outcomes. The draft proposal also recommended more active promotion and integration of Education for Sustainable Development concepts with United Nations Decade of Education for Sustainable Development objectives (United Nations General Assembly, 2012).
1.2 The UN Decade of Education for Sustainable Development (UNDESD)

The Johannesburg World Summit on Sustainable Development (WSSD) convened in 2002 to help strengthen international commitments at all levels to sustainable development goals, and it was at this conference that the UN Decade of Education for Sustainable Development (UNDESD) was initially proposed (United Nations, 2002).

Shortly after the World Summit on Sustainable Development, and based upon recommendations from chapter 36 of Agenda 21, the United Nations declared 2005 to 2014 the Decade of Education for Sustainable Development (DESD). During the decade as declared by the UN, many goals were set forth for teaching strategies intended to affect millions of people from communities all over the world for many years to come (United Nations, 2010). Planned outcomes during the Decade include raising public awareness, updating educational systems, and the integration of ESD into all elements of developmental planning (United Nations, 2010).

The UNESCO World Conference on Education for Sustainable Development was convened in Bonn, Germany in 2009 (UNESCO World Conference on Education for Sustainable Development, 2009b). The ESD Conference started at the beginning of the second half of the UN Decade on Education for Sustainable Development. A primary objective of the conference was to assess the progress made thus far during UN Decade and to develop strategies for the way ahead. Progress made during the Decade as reported by the conference indicated increased global awareness of
environmental issues and the consequences of societal lifestyles that are counterproductive to alleviating these concerns (UNESCO World Conference on Education for Sustainable Development, 2009b).

Strategies developed during the conference highlighted key focus areas for action to encourage further development of ESD during the remaining five years of the Decade. Post-conference strategies included (UNESCO World Conference on Education for Sustainable Development, 2009b):

- Re-orienting education and training curriculum to more effectively address sustainability concerns.

- Extending and strengthening ESD partnerships.

- Building and sharing knowledge, and generating new knowledge through research.

Although much work still remains to be done before ESD fully achieves a fully central role within formal educational institutions, there has been significant improvement since the beginning of the Decade in 2005 (Wals, 2012). A review halfway through the DESD revealed that the need for the incorporation of ESD principles had become well established through various public policy frameworks globally, and that ESD coordinating government agencies have been formed in almost 100 countries across all UN regions (Wals, 2012). Many different professional networks and organisations have also been established globally to encourage and
support ESD in schools, universities, and communities; and in the process, ESD has gained recognition internationally as an important factor in addressing today’s sustainable development challenges (Wals, 2012).

Recent reports also indicate an increasing awareness and understanding that global environmental challenges cannot be solved solely through advances in science & technology and policy frameworks alone (Wals, 2012). In order to achieve sustainable successes, environmental initiatives must be accompanied by changes in local societal attitudes and lifestyles. ESD is being increasingly viewed as a way to develop educational institutions that empower schools and communities to more effectively address challenges associated with sustainable development and the environment (Wals, 2012). As a result, general attitudes towards ESD have shifted from being viewed as merely an add-on to core-curriculum subjects, to an essential part of rethinking teaching and learning methods in formal education systems globally (Wals, 2012).

The challenges to solving sustainability issues require integrative forms of curricula, and consequently, the boundaries between schools and communities are increasingly blurring. The ‘boundary-crossing’ phenomena are resulting in a reconfiguration of formal education institutions and are changing roles and relationships with stakeholders - due in no small part to ICT facilitated network-based education pedagogies.
Earlier in the Decade, the emphasis was on finding a niche among educational institution offerings. However, in the latter part of the UN Decade, ESD is now viewed more as a potential umbrella for all educational institutions concerned with the long-term well-being of the earth and its inhabitants (Wals, 2012).

Despite all the encouraging progress made during the Decade however, there are still challenging issues remaining to be resolved. Local situations vary widely throughout the world, and this often leads to different interpretations and implementations of ESD. As an example, the ‘E’ in ESD is often conceptualized differently among different societies depending upon the availability of opportunities for “participation, self-determination, and independent thinking” within local communities (Wals, 2012).

Transmission-based pedagogies emphasising instruction centred on rote memorisation of knowledge are more likely to be prevalent in environments that are more restrictive. Conversely, in less restrictive communities, ESD is more typically characterized by higher levels of participation, independent thinking, and knowledge co-creation. Higher levels of stakeholder interaction using innovative teaching and learning methods are common benefits from the latter forms of ESD programmes (Wals, 2012).
2. Technology in Education

2.1 Theoretical Educational Approaches

2.1.1 Early Approaches

Behaviourism, Cognitivism, Constructivism have been three of the dominant theoretical learning approaches since the beginning of early Educational Technology publications (Wiburg, 2009). Although these schools of thought are still present in today's literature, they have evolved as psychology theories have advanced.

Behaviourism is a theoretical framework that was originally developed in the early 20th century out of the animal learning experiments of B.F. Skinner, Ivan Pavlov, and several others at the time. The works of psychologist B. F. Skinner’s theories of behaviour were influential to many early academics because the hypotheses could be tested and proven with scientific methods. The work of B.F. Skinner developed into a "programmed instruction" design, wherein the goals of teaching were based on behavioural objectives, with educational materials divided into small, compartmentalised units of knowledge, and rewards given for correct responses early and often (Wiburg, 2009).

Since the advent of the Cognitive Revolution of the 1960s, learning theories have undergone significant changes, and Cognitive Science significantly influenced how educators viewed learning processes. Despite the various changes that occurred however, much of the basic premises from the theoretical framework of Behaviourism were retained in the succeeding Cognitive Science theories (Skinner, 1985).
Cognitivism looks beyond just the superficial elements of behaviours in eLearning environments however. It instead focuses more on the cognitive processes of learning, such as how the brain works and how human memory works to promote learning (Bloom & Krathwohl, 1995-2010).

Constructivism is an early learning theory that education theorists began to examine more closely in the 1990s (Paas, 1992). A central principle of this philosophy reasons that learners construct their own meanings from new information as they interact with others of diverse perspectives.

The practical application of Constructivism theory requires learners to utilize prior knowledge and experiences to develop new, related, and/or adaptive concepts to learning. Under this theoretical framework, teachers take on a role more akin to a facilitator by providing guidance to students so that they may effectively understand and build a knowledge base on their own (Siemon, Virgona, Lasso, Parsons, & Cathcart, 2004).

Social Constructivism is a theory of knowledge that considers how social phenomenon develop in social contexts. Collaborative learning activities, such as discussion forums, blogs, and wikis are commonly employed social-technical resources in education. Techno-Constructivists are teachers who are adept at
integrating technologies into their curricula by means of not only complementing teaching methods, but may also help to redefine them (McKenzie, 2012).

### 2.1.2 Inquiry-Based Learning

Inquiry-based teaching is an active learning methodology. Inquiry-based learning methods were developed during the learning movements of the 1960s. These inquiry-based learning theories were developed primarily as a response to the perceived inefficiencies of traditional forms of teaching at the time, wherein learning processes were confined largely to rote memorization of facts (Bruner, 1961).

In inquiry-based methods of learning, student progress is assessed by how well they develop analytical skills and their practical application of these skills. This is in contrast to the more traditional transmissive methods of teaching, wherein the quantity of knowledge students possess is a primary factor in assessments (Alberta Learning, 2004).

### 2.1.3 Situated Learning

Situated Learning is based on the theories of Situated Cognition and Communities of Practice (Hung, Looi, & Koh, 2004). Situated Cognition asserts that learning is inseparable from doing, and therefore all knowledge is situated in activities that are tied to social and cultural contexts. Knowing exists in-situ, and is therefore
inseparable from individual people and cultures (J. S. Brown, Collins, & Duguid, 1989).

Lave and Wenger (1991) concluded that learning is essentially a social process, and the relationships between learning and the situations in which they occur describe Situated Learning as a variation of 'social co-participation'. The basic argument made by Wenger (1998) was that communities of practice are everywhere, and we are typically involved in a number of them at work, activities at home, school, leisure interests, civic duties, etc. whether we are aware of them or not.

Communities of Practice are comprised of three key components: domains, communities, and practices (Wenger, McDermott, & Snyder, 2002). A domain is defined as an area of shared interests to which individual members are committed and support shared competencies that distinguish them from other individuals. Domains develop a common core of knowledge that inspires its members to lead and assist in learning activities.

A community creates the social context for learning. Within communities that take care of their domains, members participate in joint activities and discussions to share information and support one another (W. Snyder, Wenger, & Briggs, 2004). Practices are the actions around which each community develops, shares, and maintains its knowledge (W. Snyder, Wenger, & Briggs, 2004).
Learners who participate in communities with shared interests benefit from the knowledge of those who are more experienced than they are (Ernst & Clark, 2009). In a phenomenon known as ‘legitimate peripheral participation,’ newcomers to a community of practice gradually become an integral part of a community through active participation in sociocultural learning practices (Lave & Wenger, 1991).

2.2 The Emergence of Technology in Education

Technologies utilised for the purposes of instruction may assume many forms, and are referred to by many terms. These terms include: Technology Enhanced Learning (TEL), Information and Communication Technologies (ICT), and Educational Technology. According to the Association for Educational Communications and Technology (AECT), Educational Technology is defined as “the study and ethical practice of facilitating learning and improving performance by creating, using, and managing appropriate technological processes and resources” (Association for Educational Communications and Technology, 2012).

Educational Technology may theoretically be traced back as early as prehistoric times with the paintings found in ancient cave dwellings reportedly used for training hunters. However, more recent accounts of Educational Technology history begin with the development of educational films in the early 1900s.
The first documented use of Educational Technologies on any large scale began during the WWII era with the use of training films for U.S. soldiers (Leigh, 1998). Some of the earliest documented uses of computers in traditional classroom environments were during the early 1960s to teach math and reading skills to elementary school children in Palo Alto, California (Kulik, 2002).

Network-based approaches to learning are often designed around the concepts of Communities of Practice. Communities of Practice are not necessarily just a recent occurrence, however. They have existed since people first began to learn and share experiences together.

The early history of networked learning can be traced back to the 19th century with the advent of networked infrastructures such as railroads and telegraphs. In more recent times, the roots of modern networked learning began in the 1970s with the use of computer-based networks. The Institute for the Future in Melno Park, California began experimenting with networked learning practices that used the internet for computer conferencing in the 1970s. Hiltz and Turoff began publishing extensive research on the use of internet technologies in education at the New Jersey Institute of Technology at this time also, which eventually became the basis for future collaborative-networked learning technologies (Beller, 1998).
The 1970s saw the emergence of eLearning courses (Ally, 2009). Most of the early eLearning systems were Computer Based Training (CBT) systems that simulated traditional, autocratic methods of teaching that were predominate at the time, wherein computers provided the primary function of transferring rote knowledge to learners (UNCCD Project Management, 2011). Learning methods via this approach are often referred to as eLearning 1.0, and are in stark contrast to the development of later systems such as Computer Supported System Learning systems (CSSL) which are more collaborative in nature and promote a shared concept of learning (Chen & Chiu, 2008).

CSCL systems are often referred to as eLearning 2.0 technologies with the concept of collaborative learning environments. eLearning 2.0 technologies based upon CSCL assume that knowledge is socially constructed through discussions and interaction based upon solution-oriented actions to problems (S. Brown, Adler, & Richard, 2008). More recent examples of eLearning 2.0 technologies include social and collaborative learning methods incorporating the use of networked learning tools such as forums, podcasts, wikis, blogs, and virtual worlds.

2.3 The Application of Technology in Education

2.3.1 Uptake & Extent of Use

The eMerge One-to-One Laptop Learning Project was initiated by the Government of Alberta’s Ministry of Education to examine the effectiveness of
wireless computing for learning and teaching over a period of three years from 2007 to 2010. The project involved 2,502 students, 173 teachers, and 47 administrators within 50 schools throughout the 20 Albertan jurisdictions.

The data collected over the course of the research period determined that the educators participating in the project made significant progress in proficiencies with Educational Technologies use. This in turn resulted in reported increases in their abilities to keep students interested in subjects and increased motivation to learn (Government of Alberta, 2010a; 2010b).

One of the most highly valued services provided as reported through the project was the online Community of Practice. Through participation in this project, teachers and administrators were reported to develop a deeper understanding and appreciation of the principles of the effective teaching skills that they believe will be required of them in the 21st Century (Government of Alberta, 2010a; 2010b).

European Schoolnet is a not-for-profit organisation that provides its services through partnerships with 30 Ministries of Education and the European Commission. The organisation is dedicated to supporting collaboration among schools with networked technologies and the development of technology-enhanced education in schools throughout Europe. In the 15 years since its founding, European Schoolnet has become a leading organisation involved in the transformation of schools in
Europe through the integration of ICT into learning and teaching methodologies (European Schoolnet (EUN), 2011).

Schoolnet offers services to schools that provide teachers with opportunities for active involvement in discovering how ICT can help them to improve teaching and learning experiences. Recent initiatives have focused on raising awareness among teachers on the benefits of collaboration activities for both student learning and professional development for teachers (European Schoolnet (EUN), 2011).

eTwinning is an online community service offered to schools by European Schoolnet that provides online learning tools for teachers to identify potential school partnerships, organize virtual meetings, exchange best practice ideas, and opportunities to participate in community projects. eTwinning projects offer schools from different European countries opportunities to create project plans and carry out them out through the use of Information and Communication Technologies (ICT) (eTwinning CSS, 2011).

The “We Teach Together” eTwinning project was a collaboration effort between schools in the Czech Republic and Portugal. It incorporated the integration of subjects in Chemistry, Biology, and Environmental Education to teach the subject of photosynthesis. The primary objective of the project was to promote a teaching practice in a novel way to help increase the motivation of students to learn what are
generally considered as otherwise less popular subjects among students (eTwinning CSS, 2011).

The reported benefits of participating in this project gave opportunities for teachers to learn from one another on the subject of photosynthesis, established personalised methods to effectively teach collaboratively, and gained significant improvements with the use of a mutually shared second language (i.e. English). This joint-venture was considered to be a remarkable achievement since projects based on science are less common than other subjects in the eTwinning programme due to the fact that science-based curriculums are commonly considered to be less likely to allow teachers the time required to allocate towards project-based assignments (eTwinning CSS, 2011).

The “Climate Change Project” was another notable eTwinning partnership. The project involved 100 students from Iceland, Estonia, and Denmark to collaborating on various Climate Change issues. Overall, the students were reported to have learnt much from it, particularly in regards to climates and their associated environmental issues.

According to one of the lead teachers that was in the project, many teachers are typically reticent to engaging in international projects like this because they assume that the projects require a significant amount of extra work. However, this was
not found to be the case in her own experience (eTwinning CSS, 2011). On the contrary, she considered it a richly rewarding experience where the teachers and students both learnt how to effectively work with the other nations and gained valuable knowledge of how global networks can successfully operate in the process. Communicating and networking is what these projects are all about, and is also what students will be required to do in their future education and employment opportunities (eTwinning CSS, 2011).

The “Water - Source of Life” eTwinning project was a collaboration between schools in Hungary and the Czech Republic, and focused on the subjects of Environmental Education, Physics, and Foreign Language Study. Participation in the eTwinning project was reported to have a positive impact on all the teachers and students involved, as well as on the reputation of the schools participating (eTwinning CSS, 2011).

Through participation in this project, teachers, as well as the students, became more motivated and empowered with the skills of collaboration and teamwork. Which in turn resulted in a better understanding of Europe and its wide range of people and cultures. One of the lead teachers reported that participating in the eTwinning programme helped her to develop more innovative teaching methods, and challenged her to incorporate the use of more technology into her teaching practices than she might have otherwise been comfortable in using on her own without the same levels of support and motivation (eTwinning CSS, 2011).
2.3.2 Advantages, Disadvantages, & Constraints

Although there are many benefits to the use of Educational Technology, it has its disadvantages as well. Some of the disadvantages of EdTech include: the requirement of access to resources that might not always be available, the extra time and expenses required for retraining when appropriate resources are available; and due to the ever-evolving nature of technology, the recurring requirements of regular upgrades and replacement of hardware and software (Hennessy, Ruthven, & Brindley, 2005). Incorporating computer-based learning technologies into lesson plans may also involve the need for extensive resources to produce relevant teaching materials that require more complex computer skills than many teachers are capable of creating themselves or have the time available to develop.

Integrating new technologies into a school system is often a time consuming process and a trying experience for all involved (Ilomäki, 2008; North Central Regional Educational Laboratory (NCREL), 2001). Moreover, once installation and retraining processes have been completed, equipment failures may occur at any time during classroom activities. Thus, teachers utilising these technologies must always be aware of this possibility and be attentive to backup teaching methods in the event of unfortunate technological mishaps.
Since technology is not usually the end goal of education, but rather a means by which it may be accomplished, educators should have a thorough understanding of the technologies employed in the classroom, as well as an appreciation for advantages of their value over traditional instructional methods (Burns, 2010). Otherwise, these technologies may only be viewed as a hindrance and will not benefit overall educational objectives (Burns, 2010).

In addition, since technology directly affects human behaviour, in order to understand and use Educational Technology effectively, an understanding of human behaviour theories is useful. According to Arafeh and Levin (2002), “many schools and teachers have not yet recognized - much less responded to - the new ways students communicate and access information over the Internet. Students report that there is a substantial disconnect between how they use the Internet for school and how they use the Internet during the school day and under teacher direction.”

As an example, data was collected from 14 gender-balanced and racially diverse groups of 136 students across 36 different schools in the U.S. for a study commissioned by the Pew Internet & American Life Project and conducted by the American Institutes for Research (Arafeh & Levin, 2002). This study indicated that the students faced several challenges in attempting to use the Internet at schools, and that the challenges they encountered often prevented them from using the Internet as much or creatively as they would otherwise require to complete their school assignments.
The study also noted that one of greatest barriers to Internet use at school was in the quality of access to the Internet. Many of the schools represented in this study limited use of the Internet to certain times of the day and/or to specific areas on campus (such as in computer labs). In addition, since not every student had access to the Internet outside of school, most students reported that their teachers did not assign homework that required the use of the Internet since the teachers were reported to feel that it was not fair to assign tasks requiring use of the Internet (Arafeh & Levin, 2002).

However, despite all the disadvantages and constraints to the use of Educational Technologies, there are many advantages with its use as well. For example, according to evidence from a research study administered by the Ministry of Education in Canada in 2007, they concluded that despite the drawbacks associated with implementation new Educational Technology systems, technology-based strategies have numerous positive potentialities that well offset any inherent drawbacks (Alberta Education, 2007). This same study went on to report that Educational Technology was proven to have a positive influence on high school completion rates for all students, including those at-risk and with diverse education needs (Alberta Education, 2007).
The resulting AISI report from this study summarised the following benefits of Educational Technology as they related to their own specific needs and requirements (Alberta Education, 2007):

- Strengthens Teacher-to-Student Relationships
- Nurtures Collaborative Learning Community Opportunities
- Motivates and Engages Students in the Learning Process
- Improves Students’ Chances of Achieving Academic Success

Educational Technologies offer new opportunities for individualized instruction or personalized learning plans that encourage students to more active participation in the learning process than those afforded through traditional methods of teaching without the use of such technologies (Skola, 1997; Roblyer, Edwards, & Havriluk, 1997). Students are more motivated to learn because of the instant feedback these technologies can provide to help them understand why some answers were wrong and how to correct them as they learn from past mistakes (Alberta Education, 2010).

Educational Technologies also bring a social-technological element to the learning process. Incorporating technologies such as Web 2.0 tools into lesson plans allow students and teachers to work together in a collaborative manner, and encourages them to learn through interactive discussions and projects (Pacific Policy Research Center, 2010). The use of collaborative tools in the classroom also helps to
prepare students with the social and technological skills that will be required of them in today’s competitive work environments (Pacific Policy Research Center, 2010).

Online communities also have demonstrated the capacity to empower educators to collaborate, share, learn, and solve problems more efficiently and systematically (U.S. Department of Education, 2010). Online Communities of Practice empower educators with knowledge and resources that may not be available locally (Schlager, Farooq, Fusco, Schank, & Dwyer, 2009). They provide knowledge sharing opportunities for educators to learn from one another for the creation of new knowledge and solutions to problems with collaborative tools that bring together like-minded educators with common interests despite living far apart geographically (U.S. Department of Education, 2010; Wang, Yang, & Chou, 2008).

The benefits of Educational Technology are intended to enhance learning experiences over what they would be without the use of such technology. Technology Enhanced Learning is a rapidly growing field (Wolpers & Grohmann, 2002), and it has been doing so for several of reasons. Including the fact that the students of today are learning more and through more diverse means than they ever have before previously (Wagner, 2008).

Therefore, if teachers want to continue to reach their students as effectively as possible, they need to consider the regular use of these technologies as an integral part
of their lesson plans (Landis, 2012). “Like countless other professions, education is increasingly a field in which people must nourish their knowledge and skills or risk seeing them go stale” (U.S. Department of Education, 2011).

2.3.3 Key Questions & Considerations

Although most students today are already engaging successfully within their own personal networking environments, within the parameters of the formal education sector, they still require the assistance of teachers to help guide them to the most appropriate learning materials and how to most appropriately use the information they obtain (U.S. Department of Education, 2011).

We now live in a highly interconnected world where people can communicate with one another in greater numbers than ever before, and therefore, students need supervision from teachers to help guide them in this virtual world to utilise these resources as safely and effectively as possible (U.S. Department of Education, 2011). To be a good teacher, one does not have to be digitally connected. However, if one is already a good teacher but is not digitally connected, could they be even better?

According to a report from the U.S. Department of Education’s Office of Educational Technology (2010), the research available on online Communities of Practice in education is still largely in its early stages, and therefore many questions still remain to be answered.
A list of key questions developed from their report included a list of the following considerations:

- **What types of online content, activities, and interactive features best support learning for educators?**

- **How can face-to-face and online professional learning and collaboration be used together most effectively?**

- **In what ways do online communities positively influence professional practices, and how can these impacts be maximized?**

- **What strategies are effective in increasing the number of educators who participate in online communities and the quality of their interactions?**

- **What drives or motivates people to join and stay involved in an online community of practice?**

Technology’s proven capacity to improve student high school completion rates was the subject of a research report conducted by the Canadian Ministry of Education in 2007. This report also concluded that, in order to realise the full potential of Educational Technologies, it is essential not only to refer to results of findings at the local level, but also to consider the following key points globally for future endeavours as well (Alberta Education, 2007):
– Considering and sharing the lessons learned from other educators and researchers with their own indoctrinations of technology-based strategies.

– Defining what success will look like and how it will be measured, (e.g. engaged students and supportive teachers, authentic tasks, active collaborative learning environments, and sufficient access to required technologies).

– Remaining abreast of current technology trends (i.e. developments and uses of the Internet, and other emerging technologies in education).
3. Research Location: The Republic of Malta (European Union)

Education for the environment on the Maltese Islands has advanced through a gradual evolutionary process. Each successive step has been built upon the preceding one, while concurrently preparing the foundation for future evolutionary phases. Although there have been no clear distinctions between these steps, they can generally be categorised into three basic phases: the Awareness Stage, the Fragmentary Stage, and the Co-ordinated Stage (Pace, 1997).

The Awareness Phase that occurred during the 1960s and 1970s was characterised by random environmental activities, and were primarily aimed at raising public awareness and the need for taking action to help improve the condition of the environment (Pace, 1997). These activities helped to influence public opinion, and provided a rationale for the foundation of an infrastructure for future environmental education initiatives.

The Fragmentary Phase occurred during the 1980s through the 1990s and was characterised by the ‘institutionalisation’ of environmental education. Although several different concerns were involved in environmental education during this phase, they were unable to co-ordinate their various initiatives. And consequently, conflicts were common and little significant progress was achieved during this period.
The Co-ordinated Phase in the 1990s was supported with the introduction of a National Environmental Education Strategy (NEES). This later period was largely characterised by more concerted efforts to draw public attention and to coordinate activities with best practice methods utilising available resources to achieve national environmental objectives in education (Pace, 1997).

3.1 Historical Overview & National Environment Contexts

Until relatively recent history when the Republic of Malta became an independent sovereign state in 1974, the Maltese people have lived under one form of colonial rule or another since the first arrival of the Phoenicians to the islands as early as 1500 B.C. (History of Malta, 2011). As a consequence, the concept of individual ownership of the environment in the Maltese culture has frequently been confined to the limits one’s own home and personal property – wherein everything else beyond these were commonly considered as belonging to whoever happened to be in rule over the region at the time (Pace, 2009). Thus, those in the dominion over the lands of the islands were also assumed to be responsible for out-of-doors environmental concerns as well.

Educational topics related to the environment featured throughout different periods in the Maltese curriculum as early as 1853 (Ventura, 1993). In more recent times, a 1969 primary school syllabus provided one of the first specific sets of guidelines for an interdisciplinary approach to teaching that also included environmental learning areas.
The guidelines developed were intended to combine different subjects together, and included such topics as nature studies, science, geography, and history, and were administered through 'centres of interest' that adopted a student-centred, problem-solving methodology (Pace, 1997; Department of Education, 1969). Unfortunately however, the syllabus proved to ultimately be unsuccessful because it did not consider the main constraint within the primary school system at the time, which was the annual examinations and the environmental topics under the nature study subject area that were not considered examinable at the time (Pace, 1997).

The first step towards an organised national environmental education strategy in the formal education sector was through the "National Training Workshop on Environmental Education in Malta." This workshop was conducted by the Institute of Design for Environmental Action (IDEA) in 1987 (1987), and the results of the sessions provided specific recommendations towards the adoption of an environmental education strategy into the formal education system. (Pace, 1997). Unfortunately however, this strategy never came to fruition, due largely to the fact that the proposals were considered overly optimistic and did not fully take into account the practical constraints of a formal education system that had no plans for any significant curriculum changes at the time (Pace, 1997).

Following the Education Act of 1988, the Ministry of Education published the National Minimum Curriculum (NMC). The NMC declared that one of the principal
objectives of primary education was to promote "Good behaviour and character formation ... in the environmental field, so that they (the children) realise that they should appreciate and safeguard our habitat" (Ministry of Education, 1989).

Additionally, the 1989 NMC also recommend the "Introduction to scientific knowledge to include ... elements of environmental science" (Legal Notice 73, 1989).

In addition to the common-core subjects, the NMC also recommended a curriculum that aimed to equip learners with “a sense of responsibility towards society and the environment consequent on higher knowledge” (Ministry of Education, 1989).

The ensuing Structure Plan was adopted in the early 1990s as part of Malta’s strategy to achieve an equitable balance between the environment and development plans by the year 2010. The plan included key policy objectives to organise educational programmes that would encourage environmentally conscious lifestyles (Ministry of Development of Infrastructure, 1990).

Following-up on this initiative, the MATSEC Board proposed an environmental studies curriculum in 1992 that combined elements of biology, geography, social studies, and history under three main themes: the Natural Environment, the Human Environment, and the Built Environment. The course outline emphasised the need for an integrated approach to teaching and teaching methodologies that promoted active student participation and respect for the importance of the environment (Pace, 1997).
Unfortunately however, significant difficulties were encountered in the attempts to integrate these initiatives into schools. The difficulties were due primarily to three main deficiencies: a lack of proper training to prepare teachers for the additional demands the new subjects would require, limited education resources, and an inflexible scheduling timetable that did not allow teachers to organize teaching efforts (Pace, 1997).

The Education Division, the Environment Secretariat, the Faculty of Education at the University of Malta, and various NGOs jointly organised the Second National Training Workshop on Environmental Education in Malta in 1995 (NEES, 1995). The participants of this workshop generally agreed that a fundamental challenge to introducing environmental education objectives into the school system were due in large part to a generally fragmented approach to teaching.

It was therefore proposed to reorganise efforts around a National Environmental Education Strategy (NEES) that was in alignment with UN Local Agenda 21 guidelines. While the NEES recognised the importance of setting up a legislative framework for the consolidation of all environmental education efforts in Malta, it was also determined that a vital component to ensuring the success of any progress beyond identified constraints required joint co-operation among all concerned parties (NEES, 1995).
As part of the effort to attract more public awareness and support for an all-inclusive and holistic approach to environmental education, Nature Trust (Malta) launched the EkoSkola programme in 2002 with the help of the Foundation for Environmental Education (FEE) (EkoSkola, 2012). The EkoSkola programme provides a well-defined seven-step method to achieving environmental sustainability in schools, and has been introduced in several primary and secondary schools throughout Malta as a means to empowering students - in teams as well as individuals - to care for the environment with an approach that mandates the participation of the entire community as part of its method.

The EkoSkola programme has been considered a great success on the Maltese Islands in achieving its educational objectives with over 70 percent of the students and teachers from over 100 primary and secondary schools in Malta having participated to date. Moreover, at last count, approximately, 20 of these schools have gone on to ultimately earn the internationally respected Green Flag Eco-Label award for their efforts (EkoSkola, 2011).

In early 2012, EkoSkola committee members and students from six Maltese schools in this programme conducted an environmental review at the San Anton Presidential Palace; and in a subsequent follow-up meeting, the results of their analysis were presented directly to His Excellency Dr. George Ablea. His Excellency was so impressed with the high levels professionalism and environmental awareness of the students during their presentations that he graciously offered to serve as a
patron of the national EkoSkola Programme (International Eco-Schools Coordination, Foundation for Environmental Education (FEE), 2012).

The University of Malta founded the Centre for Environmental Education & Research (CEER) in 2004 as part of an attempt to organise the coordination of Environmental Education and Education for Sustainable Development efforts throughout the university and the Faculty of Education’s environmental educator training programme (University of Malta, 2012; Piscopo, 2007). Prior to CEER’s recent launching of a post-graduate programme in Education for Sustainable Development, they initially they offered short-term environmental training courses for teachers, and supervised undergraduate research which included the development of environmental curriculum material and instructional methodologies for environmental learning areas in the formal education sector.

CEER also assumed a role as a national focal point for UNDESD and Local Agenda 21 initiatives. In conjunction with these efforts, they have directly contributed inputs to the National Curriculum Framework draft proposal (University of Malta, 2012; Piscopo, 2007).

3.2 The National Curriculum Framework (NCF) 2011

The Maltese National Curriculum Framework (NCF) 2011 consultation document was developed in conjunction with feedback from stakeholders throughout
Malta, and highlights national policy interests in context with EU practice guidelines and the rationale for a re-evaluation of the national curriculum. The NCF summarises the proposed changes and associated challenges within the envisioned framework, and correspondingly proposes several key elements to support them.

The NCF is fundamentally concerned with preparing young people for successful and productive lives in the 21st century. Correspondingly, the aims of the Maltese education system as set forth in the NCF structure are intended to prepare students of all ages to become lifelong learners with the knowledge, skills, values, and attitudes necessary to sustainably live their lives in the continually changing and evolving world of work and the environment (Ministry of Education, Employment, and the Family, 2011a; 2011b).

Several cross-curricular themes have been identified in the NCF as essential elements to an education plan for all students to achieve the aims of the framework, and Education for Sustainable Development is one of the main cross-curricular themes proposed in this regard. The ESD learning area as proposed by the framework is a system-based approach to an integrated knowledge base that encourages learners to develop a holistic view of their surroundings, and includes the interaction of environmental, technological, scientific, political, and societal perspectives.
In the endeavour to achieving these aims, the eLearning Learning Area is another key cross-curricular theme also specified within the NCF. eLearning technologies integrated into school action plans as per the NCF are reported to help promote a shift to more constructivist-based teaching philosophies such as inquiry-based learning methods. These methods reorient the focus of teaching perspectives from teacher-centred to student-centred learning activities, which in turn helps to generate more student involvement in learning while also maintaining the motivation of teachers as well (European Commission, 2007; Ministry of Education, Employment, and the Family, 2011a; 2011b).

Teachers participating in a recent NCF draft feedback survey generally agreed with the proposed emphasis on new learning methodologies. And they further agreed that the adoption of such inquiry-based methodologies would aid teachers in gaining the increased levels of sustained attention required from students to engage and motivate them in studying compulsory core-curriculum subjects.

However, a common concern expressed in this regard was that in order to encourage more teachers to shift from traditional transmissive teaching models to more interactive and inquiry-based methods, they would require a syllabi that facilitates increased levels of flexibility. And further recommended that this would need to be done in conjunction with a reduction of curriculum content, increased autonomy to implement new proposed teaching approaches in the classroom, and
sufficient time to complete proposed objectives (Maltese Association of Science Educators (MASE), 2011).

Teacher feedback in the report also indicated that a significant number of teachers identified a likely need for retraining to carry out the newly stipulated responsibilities. Moreover, although most teachers in that survey believed that the new curriculum’s overall vision is a very good one, by the same token, they are also concerned about how it will specifically be implemented (Maltese Association of Science Educators (MASE), 2011).
4. Methodology

The Maltese National Curriculum Framework (NCF) emphasises the importance of involving as many stakeholders as possible in the development of education policies (Ministry of Education, Employment, and the Family, 2011a). As discussed in an earlier chapter, the United Nations has also affirmed the importance of stakeholder involvement on several occasions within declarations concerning the environment and Education for Sustainable Development (UNESCO World Conference on Education for Sustainable Development, 2009a; 2009b; UNESCO, 1997a; 1997b; 1997c).

In this regard, part of the methodology to collect new data for this dissertation enlisted the participation of a diverse group of Science Education teachers working directly with students on the frontlines of education in the classrooms of Malta. A subsequent information interview was also conducted with an Education Officer and Assistant Director in the Curriculum Management and eLearning Department to verify information derived from research activities, and for feedback on interim conclusions and proposed recommendations.

4.1 Background Information on Qualitative Research Methods

A qualitative methodology was determined as the best method for assessing the current situation due to the limited number of available participants during the time of the year that the first part of this study was conducted, (i.e. when
Schoolteachers are typically on their summer holidays). Qualitative information is most commonly derived from a collection of words rather than from numbers as utilised primarily in quantitative studies. Meanings from qualitative data are often provided through descriptions and explanations of events in the context of localised perspectives rather than information derived from numerical frequencies as in quantitative data (Spratt, Walker, & Robinson, 2004). Good quality qualitative data can help to facilitate research results that evolve beyond initial conceptions to new and unplanned for outcomes for new and revised framework concepts (Spratt, Walker, & Robinson, 2004).

Although there are many different research methods and tools available in qualitative analysis studies, surveys and interviews are two of the most commonly used together methodology tools such research work (Harris & Brown, 2010; Coll & Chapman, 2000). While surveys can help to identify patterns within larger population groups, information obtained through qualitative interviews with smaller groups can provide insights of more relative depth. They may also help to provide specific points for further elaboration in subsequent research studies (Harris & Brown, 2010; Kendall, 2008).

4.1.1 Surveys

Survey design formats may include closed or open-ended questions, or any combination of both. Close-ended questions offer the advantage over open-ended questions in being quicker and easier to answer, and therefore more commonly result
in a higher number of respondents participating in and completing surveys (Reja, Manfreda, Hlebec, & Vehovar, 2003). Close-ended questions also facilitate a more convenient and rapid access to accurate interim assessments of the data collection progress, since answers obtained from close-ended questions are more specific and clearly defined (Reja, Manfreda, Hlebec, & Vehovar, 2003).

For all their advantages however, closed-ended questions also have their own unique disadvantages as well. Along with the inherent simplicity of their designs, also comes the disadvantage of a limited scope of responses since respondents may not provide as complete a perspective on what they would otherwise desire to communicate.

Open-ended questions also have their own disadvantages as well. For example, the words used by respondents in responses may be difficult to comprehend and/or compare among all the collected surveys of a study group. Questions with only open-ended sections are also less likely to be answered (Reja, Manfreda, Hlebec, & Vehovar, 2003). Therefore, an effectively balanced combination of both open and closed-ended questions together may offer the most advantageous use of both formats, while also minimizing the associated disadvantages of each within an effectively designed survey.
Web-based online surveys offer many advantages over other media formats. Online surveys are relatively quick and easy to set up, provide a reliable and economical method of obtaining valuable data from large groups of respondents, and are able to do so in a relatively short period of time (Reja, Manfreda, Hlebec, & Vehovar, 2003; Smartline International Ltd, 2012). A variety of reports can also be generated with relative ease from a wide-variety of configurations throughout the data collection process. Online surveys can also accommodate a wide-range of respondents by allowing them to complete surveys when and where they choose, and with an option to save interim progress to complete responses at their convenience.

Despite the many practical advantages online surveys however, there are also a few disadvantages related to the use of such a medium as well. For instance, respondents cannot ask questions if they are unclear on any part of a survey, which may in turn result in skipped questions. There are also the inherent limitations of impersonal inquiries through questions requiring complex answers that would be better facilitated through the use of in-depth interviews (Reja, Manfreda, Hlebec, & Vehovar, 2003).

### 4.1.2 Interviews

In-depth interviewing is a qualitative research method that incorporates the use of open-ended, discovery-based inquiry methods to obtain detailed information from individuals involved in complex situations, such as stakeholders concerns in environmental education problems with no clear solutions. These interviews are most
commonly conducted among small groups of 15 or fewer individuals, and often are based upon queries related to personal perspectives and experiences on issues not otherwise determinable. The results from these interviews may also be useful for refining new objectives of further research efforts (Mack, Woodsong, Macqueen, Guest, & Namey, 2005).

Despite their many advantages however, there are also disadvantages associated with the use of interviews as a data collection process. Interviews can be an extremely time-intensive activity due to the considerable amount time it takes to arrange, organize, and conduct them; and in addition, to transcribe, analyse, and summarise results.

Of all the disadvantages associated with interviews however, perhaps one of the most challenging aspects of their use is in securing available and willing individuals to participate within the allotted timeframes of a given study (Baker & Edwards, 2012; Fox, 2009). Indeed, research interviews are reported among respondents to be one of least popular methods of participating in research studies (Dillman et al., 2009).

### 4.2 The Sample Pool

The sample pool for the survey of this study was selected from a group of teachers through the Maltese Association of Science Educators (MASE). The Maltese
Association of Science Educators was founded in 2006 as a means to providing professional development support for Science Educators, and as a forum for “excellence and innovation in science teaching and learning, curriculum and instruction, and assessment” (Maltese Association of Science Educators (MASE), 2012). This organisation also provides opportunities for Science Educators to network in regularly scheduled meetings, demonstrations of best practices in all areas of science, and informs the general public on national issues and trends in Science Education.

Sixty members of MASE were contacted to participate in the dissertation survey. Given the inherent difficulty of securing survey participants from this profession during the designated research period, (i.e. over their summer holiday), it was most fortunate that 48 individuals kindly agreed to participate and completed survey responses by the end of August 2012. Out of the 48 respondents that participated, 28 also provided additional contact information to obtain copies of the final survey summary report and/or to offer their availability for post-survey interviews.

4.3 Collecting the Research Data

What do teachers know about eLearning systems and how are they currently using online media in their teaching processes? Do teachers have an understanding of what actions in the classroom are helping or hindering their students? What are the
challenges and opportunities in the classroom? How can things be improved in the educational system?

To answer these questions, a series of online survey questions were distributed to a group of Science Educators. The aim of the survey was to assess the current situation regarding the use of Educational Technology in Science Education, and to determine the personal perspectives of respondents regarding these technologies and their effects on students.

4.3.1 The Online Survey

Shortly after this dissertation was approved by the Board of Studies in mid-July 2012, a proposed survey to achieve the aims of this work was correspondingly submitted the Institution Review Board (IRB) for their approval. An electronic consent question was developed in conjunction with subsequent advisements from the IRB in order to conform to new ethics requirements and to ensure confirmation of informed consent for participation in the study. After a series of additionally recommended revisions, the proposed survey was granted approval from the IRB at James Madison University in early August 2012 (see Figure 3).

Upon receiving approval of the proposed survey, the survey’s questions were transferred to an online survey-hosting website provided by Survey Gizmo. Interested survey participants were contacted again immediately thereafter to enlist their
participation, and the survey remained open for these participants during the entire month of August 2012.

Once the survey was closed on the 1st of September 2012, final reports were generated from the tools also provided by the online survey web host. From these reports, a summary and analysis of the surveys was then generated to assess results and to develop a list of interview questions for subsequent follow-ups with interviewees. Once the list of interview questions was finalised, the survey respondents that left their contact details were then contacted to offer copies of these reports and to check for availability in arranging information interviews.

To encourage as many respondents as possible to participate, the surveys were designed to be as brief as possible while still maintaining enough detail in them to make best use of their value. The survey was composed to gather information on the general opinions and attitudes of Science Educators in Malta and to assess and evaluate of the current situation regarding the use of technology in the classrooms. This survey was also the primary means through which respondents were invited to participate in subsequent interviews to elaborate on their responses with additional inputs and insights that were not addressed in the surveys.

The survey was divided primarily into two major sections. The first section collected information on the opinions of teachers about their current use of online
media in the classroom and specific examples of such use. The second section developed a basic overview of respondent demographics, such as age, gender, and years of experience teaching.

The survey’s first section more specifically inquired into teachers’ general experiences in using online media, (e.g. if they are using them, how they are using them, how long they have been using them, etc.). Opportunities for participants to elaborate on specific examples of use were also provided. Further questions sought opinions on related topics, such as what age groups were thought to be most useful for the use of technology in learning, how effectively students use their time on the internet outside of the classroom, etc. An outline of the specific survey questions is provided in Annex B.

During the course of administering this online survey, the identity of all respondents remained completely anonymous.

4.3.2 The Initially Proposed Interviews

The originally proposed in-depth interviews were to be conducted primarily during the month of September 2012, thereby allowing two weeks for completing write-ups and editing before this dissertation was initially due in mid-October 2012. Unfortunately, however, all 28 of the survey respondents that originally provided personal contact information for participation in follow-up interviews were unable to
participate during the time of the last two weeks before this dissertation was due, (which also happened to coincide with the start of the new academic school year for potential teacher-participants). Therefore, omission of the proposed interviews was advised. Such interviews could, however, provide a useful starting point for further study.

The interviews were to be conducted within a semi-structured format to allow as much opportunity for elaboration as possible from participants while also maintaining mindfulness of relevant time constraints. The proposed interview guide was based on the results from survey analysis and literature review research. Opening questions briefly queried on professional backgrounds before moving into more in-depth questions related to career goals and aspirations for the current education system, and perceived constraints to achieving objectives. Additional questions were intended to delve further into opinions on issues as highlighted from the results of the surveys, such as education policy objectives related to Educational Technology and Education for Sustainable Development subjects, and the benefits of inquiry-based teaching methods and online Communities of Practice to achieving these ends. A guide specifically outlining the planned interview questions is provided in Appendix C.
4.3.3 The Curriculum Management and eLearning Department (CMeLD)

Interview

Upon submission of the finalised dissertation in October, due to the unavailability of the originally envisioned participants for interviews, additional alternative research was recommended in lieu of these interviews. A planning meeting with advisors was subsequently conducted as soon as possible in November to discuss revised research strategies, and an informational interview with an Education Officer responsible for national Educational Technology decisions was then recommended.

In the process of contacting the Curriculum Management and eLearning Department office to make arrangements for an interview, an appointment for an interview with an Educational Officer and Assistant Director at the Department was eventually granted in December - which unfortunately after interview transcription and analysis only allowed for less than one week to revise and incorporate interview results and subsequent revisions to the main body of the dissertation work before it was due in mid-January. An interview guide outlining the originally proposed questions for this open-end structured interview is provided in Appendix D.
5. Results

The results of the information collected from the online survey questionnaires will be presented, discussed, and analysed in this chapter, followed by a report on the demographics of the survey respondents. The results from the subsequent informational interview conducted with a representative of the Curriculum Management and eLearning Department will also be reviewed in this chapter.

5.1 Survey Data Analysis

The online survey was comprised of 16 subject questions, plus one electronic consent-form question. Out of the 60 individuals contacted to participate, 48 completed the survey. All of the respondents that completed the survey answered all of the close-ended questions, with a majority of those also answering most of the open-ended questions. Responses for the optional open-ended sections within the closed-ended questions were less frequently completed.

The first question of the survey requested opinions as to the effectiveness of online media for educational use. Most of the respondents that answered this question had positive perspectives in this regard. The majority of respondents (67%) viewed them as a good tool, and a little more than half that amount (31%) considered them as an excellent tool (see Table 1).

<table>
<thead>
<tr>
<th>Survey Response</th>
<th>% Frequency (n = 48)</th>
</tr>
</thead>
</table>

Table 1 - General Attitudes of Survey Respondents to the Effectiveness of Online Media as an Educational Tool
<table>
<thead>
<tr>
<th>An Excellent Tool</th>
<th>31</th>
</tr>
</thead>
<tbody>
<tr>
<td>A Good Tool</td>
<td>67</td>
</tr>
<tr>
<td>Neutral</td>
<td>2</td>
</tr>
<tr>
<td>Not Very Helpful</td>
<td>0</td>
</tr>
<tr>
<td>Totally Unhelpful</td>
<td>0</td>
</tr>
</tbody>
</table>

The second part of this same question also provided an open-ended section for further elaboration, which was answered by 23 of the 48 respondents. Out of the 23 comments provided, 21 were generally positive, and nine of these positive comments also provided further caveats.

Most of these caveats were mainly related to cautions on the need for proper implementation in order to promote maximum effectiveness of the medium. Some of the specific recommendations included: "the way they are incorporated in the lesson plan is important," "you have to know where your information is coming from," and "it's a good tool, however it has to be combined with the presence of a teacher."

Other cautions focused on concerns related to overuse of such media, including comments such as, "it is A VERY good tool but it is not THE ONLY tool" and "dependency on online media for educational effectiveness may have negative consequences if such tools fail to work."

The second question in the survey inquired as to what respondents’ professional experiences were in using online media resources as part of their own teaching practices. Most of the respondents (96%) reported that they currently use
online media resources, and only two from the group were either not currently using them or had never used them as part of their teaching practices.

The third question was entirely structured in an open-ended format, and queried for specific examples of how online media resources are currently being used in their respective classrooms. From the 48 respondents that completed this survey, 47 answered this question, with one of the 47 answering that s/he did not use any online media resources for teaching.

The remaining 46 provided examples of online media use in the classroom, with videos being the most used resource (35%). Specific examples included the use of information videos to demonstrate processes/concepts, videos to introduce classroom activities, and videos of teaching techniques and methodologies.

The term “Visualisation(s)” was the second most frequently commented reply from this question, with further elaborations citing general examples such as animations, pictures, and simulations. The use of websites was the third most often referred to (13%), with given examples including uses for sources of research materials, teaching methods, and general information gathering.

Several other categories of responses were also reported in this question, although most of these categories of responses were significantly less frequent. Table 2 summarises the responses- grouped together in common categories along with their relative frequencies.
Table 2 - Cited Examples of Online Media Use in Class

<table>
<thead>
<tr>
<th>Comment Responses</th>
<th>% Frequency (n = 111)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Videos</td>
<td>35</td>
</tr>
<tr>
<td>Visualizations</td>
<td>23</td>
</tr>
<tr>
<td>Websites</td>
<td>13</td>
</tr>
<tr>
<td>Research &amp; Information</td>
<td>11</td>
</tr>
<tr>
<td>Communication &amp; Group Dynamics</td>
<td>6</td>
</tr>
<tr>
<td>Interactivity</td>
<td>4</td>
</tr>
<tr>
<td>Inquiry-Based Learning</td>
<td>4</td>
</tr>
<tr>
<td>Experiments</td>
<td>3</td>
</tr>
<tr>
<td>Hand-Outs</td>
<td>2</td>
</tr>
</tbody>
</table>

Some of the specific examples given by teachers from this question included,

“I use a Weblog to communicate my resources to the student”, “video conferencing with foreign schools”, “exchange of projects”, “to help plan activity hands on learning experiences”, “exchange of didactic material with other teachers or candidate teachers”, online simulations for physics experiments which for various reasons cannot be performed in class.”

The fourth question was a closed-end question - without an open-ended comment option, and was structured in a ‘multiple-choice/multiple-selection’ format. The question requested opinions as to which age groups of students were thought to be the most appropriate for utilising online media as an educational resource tool. The frequencies of responses were fairly even throughout all choices, with a slightly higher occurrence of responses in the middle grade levels (see Figure 1).
The fifth question requested opinions as to whether respondents’ students had adequate access to online media in the classroom. This question was configured in a ‘multiple-choice/single-selection’ (i.e. radio-button) format, with an optional open-ended comment section. Although the majority of respondents answered ‘Yes’ to the first part of this question (48%), there was a greater number overall (35% + 17% = 52%) answering ‘No’ or ‘Not Sure’ when calculated together (see Table 3).

Table 3 - Do Students Have Adequate Access to Online Media in the Classroom?

<table>
<thead>
<tr>
<th>Survey Response</th>
<th>% Frequency (n = 48)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>48</td>
</tr>
<tr>
<td>No</td>
<td>35</td>
</tr>
<tr>
<td>Not Sure</td>
<td>17</td>
</tr>
</tbody>
</table>

Thirty-one of the respondents that answered the first part of this question also provided remarks in the optional open-ended comments section. The majority of these open-ended comments were mostly of a negative nature (68%), with the remainder of comments being of both neutral and positive perspectives.
Most of the negative comments were related to poorly performing or no access at all to internet services, and a lack of hardware for student use. Conversely to these opinions, the minority positive comments frequently stated that adequate access to the internet is available in both classrooms and throughout school premises, with Wi-Fi services as well.

The sixth question requested opinions as to whether students were thought to have adequate access to online media resources anywhere outside of school. This question was structured also with a ‘multiple-choice/single-selection’ format in the initial section and an optional open-ended comment section in the later. The majority of respondents answered ‘Yes’ to this question (67%), with most of those that responded to the contrary indicating that they were “Not Sure” (27%), (see Table 4a).

**Table 4a - Do Your Students Have Adequate Access to Online Media Resources Anywhere Outside of School?**

<table>
<thead>
<tr>
<th>Survey Response</th>
<th>% Frequency (n = 48)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>67</td>
</tr>
<tr>
<td>No</td>
<td>6</td>
</tr>
<tr>
<td>Not Sure</td>
<td>27</td>
</tr>
</tbody>
</table>

Thirty of the respondents that answered this question also provided comments in the optional open-ended section. The large majority of answers indicated that respondents believed that all or most all (80%) of their students have adequate access to the internet outside of school, with most of these favourable comments specifically referring to the availability of access in students’ homes.
However, a few comments also expressed concerns regarding the limited availability of internet services at home for low-income families, including specific comments such as “Low-economic families might not have a computer at home” and “Most students have internet access at home, however this is not the case with all students as some come from deprived environments” (see Table 4b).

Table 4b - Do Your Students Have Adequate Access to Online Media Resources Anywhere Outside of School? (Open Comments Section)

<table>
<thead>
<tr>
<th>Comment Responses</th>
<th>% Frequency (n = 30)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Students Have Adequate Access</td>
<td>43</td>
</tr>
<tr>
<td>Most Students Have Adequate Access</td>
<td>37</td>
</tr>
<tr>
<td>Few Students Have Adequate Access</td>
<td>13</td>
</tr>
<tr>
<td>None of the Students Have Adequate Access</td>
<td>7</td>
</tr>
</tbody>
</table>

The seventh survey question inquired as to whether students were thought to make effective use of online media resources on their own personal time. This question was also structured in a ‘multiple-choice/single-selection’ (i.e. radio-button) design for the first section, and an optional open-ended comment section in the later. The responses for this question were fairly evenly split between opinions with ‘Yes’ (35%), ‘No’ (35%), and ‘Not Sure’ (29%) answers.

Thirty–two respondents that answered the first part of this question also answered the optional open-ended part in the second part of this question. One response however was considered as a non-answer. The majority of comments were of dissenting (67%) opinions, with several these comments directly citing the use of
Facebook and other similar media by students rather than studying. Specific comments included, “For most students, the internet is synonymous with Facebook and online games” and “Students are more interested in Facebook and chatting than in using online media resources for their study.”

A few of the comments did not directly answer the question with either positive or negative opinions, but instead, offered practical recommendations to improve effective student use. Such as the importance of positive motivation and direction, and requiring their use as a part of a school project or related research in order to keep students focused on their work. Some of these specific comments included, “Most of them make good use. However, others have to be guided much more intensely because they would otherwise lose a lot of time in irrelevant material” and “once you get the ball rolling in the subject students tend to look for more information and positive resources” (see Table 5).

<table>
<thead>
<tr>
<th>Comment Responses</th>
<th>% Frequency (n = 31)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Negative</td>
<td>48</td>
</tr>
<tr>
<td>Somewhat Negative</td>
<td>19</td>
</tr>
<tr>
<td>Positive</td>
<td>10</td>
</tr>
<tr>
<td>Not Sure</td>
<td>3</td>
</tr>
<tr>
<td>Neutral (Recommendations to Encourage More Effective Use)</td>
<td>19</td>
</tr>
</tbody>
</table>

The next question was structured in an exclusively open-ended format, and requested three advantages of incorporating the use of online media education tools as
a regular part of teaching practices. The ability to draw student attention and motivate them to learn was the most cited potential advantage (27%).

The visualisation aspects of the medium were the second most frequent responses (13%). One notable comment elaborated in this regard, “I remember that I was 'amazed' when I saw an Amoeba for the first time and thought to myself - it really looks like that!” Accessibility of up-to-date lesson materials (7% + 6%) and time efficiency in lesson planning (8%) were respectively the third and fifth most frequent responses to this question.

Also additionally noteworthy of the results from this question was in the relatively low number of comments related to advantages from environmental sustainability perspectives, which were only commented by three respondents. Specific examples from this small group included, “Reduces the need to use valuable resources such as paper”, “Faster, and more environmentally friendly way of passing on information to students. Instead of having many sheets of paper, a link sent via email can allow the students to access all the information required”; and “more interactive therefore more interesting embedded learning for computer skills related to scientific and environmental knowledge encourages team work.”

Table 6 summarises the main themes that emerged from the responses to this question - all of which fell under four broad categories: benefits especially for
students, benefits especially for teachers, benefits applicable to both teachers and students, and environmental advantages.

Table 6 - Advantages of Online Media Use in Education (Comment Themes & Percentage Frequency Response) 
(n = 142)

<table>
<thead>
<tr>
<th>Comments of Benefits to Students</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Attraction and Motivation to Learn</td>
<td>27%</td>
</tr>
<tr>
<td>Ease of Use and Adaptable to Different Levels of Learners</td>
<td>11%</td>
</tr>
<tr>
<td>Interactivity (Active Learning)</td>
<td>5%</td>
</tr>
<tr>
<td>Variety of Lessons and Activities</td>
<td>4%</td>
</tr>
<tr>
<td>Realistic Links to Life Outside the Classroom</td>
<td>4%</td>
</tr>
<tr>
<td>Communication</td>
<td>2%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Comments of Benefits to Teachers</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Time Efficiency - (Lesson Preparations &amp; Conveying Points)</td>
<td>8%</td>
</tr>
<tr>
<td>Availability of a Wide Variety of Resources</td>
<td>7%</td>
</tr>
<tr>
<td>Timely (Up-To-Date)</td>
<td>6%</td>
</tr>
<tr>
<td>Communities of Practice</td>
<td>6%</td>
</tr>
<tr>
<td>Miscellaneous Teaching Methodologies</td>
<td>5%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Comments Beneficial to both Students and Teachers</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Visualisation Capabilities</td>
<td>13%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Comments of Benefits to the Planet</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Environmental Sustainability</td>
<td>2%</td>
</tr>
</tbody>
</table>

The next question was another open-ended question, and requested opinions as to the three most significant disadvantages of incorporating the use of online media education tools as a regular part of teaching practices. The most frequently cited responses were related to ineffective teaching and learning issues (36.9 %), and
included specific examples of the difficulties associated with preventing students from getting side tracked and to keeping them focused on their work. On this same subject, a few respondents also indicated that some students get bored with the medium easily and/or may not like it all.

Interestingly, despite responses to the contrary in the previous question, time-consuming factors were a close second theme in the overall responses (36.9%). Specific elaborations in this regard included examples of both teaching in the classroom, as well as lesson preparation time outside of class. The third most frequently cited disadvantage was related to dependencies on resources that may not always be available (22.5 %), (see Table 7).

Table 7- Disadvantages of Online Media Use in Education (Comment Themes & Percentage Frequency Response) 
(n = 111)

<table>
<thead>
<tr>
<th>Ineffective Teaching and Learning Issues (40.5%)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difficult to Keep Students Focused on Work</td>
<td>12.6%</td>
</tr>
<tr>
<td>Overdependence on the Medium</td>
<td>8.1%</td>
</tr>
<tr>
<td>Student Boredom</td>
<td>4.5%</td>
</tr>
<tr>
<td>Materials don’t Integrate Well with Lesson Plans</td>
<td>6.3%</td>
</tr>
<tr>
<td>Student Dislike of the Medium</td>
<td>3.6%</td>
</tr>
<tr>
<td>Not All Students Learn This Way</td>
<td>2.7%</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>2.7%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Time Consuming (36.9%)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lesson Preparation Time Prior to Class</td>
<td>16.2%</td>
</tr>
<tr>
<td>Locating Appropriate Resources</td>
<td>8.1%</td>
</tr>
<tr>
<td>In the Classroom</td>
<td>8.1%</td>
</tr>
<tr>
<td>Retraining Required</td>
<td>4.5%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Dependency on Unavailable Resources (22.5%)</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Limited Internet Access</td>
<td>6.3%</td>
</tr>
</tbody>
</table>
The next question requested opinions as to the three most significant external factors - not directly associated with the media resources themselves - that would affect the overall effectiveness of online media education tools in classrooms. Only 40 of the 48 respondents that completed the survey answered this question, with three of those responses indicating that they did not understand the question.

Out of the 94 individual comments provided, approximately 25% of those were considered as non-answers and were not related to the aim of the question, with these comments generally relating to either the quality of the media itself or the advantages/disadvantages of its use. The remaining 71 comments most often referred to factors relating to the availability of resources (47.9%) and time constraint issues (25.4%). The predispositions and limitations of both students and teachers towards the use of online media were respectively observed third and fourth most frequently (see Table 8):

Table 8 - External Constraints to Use of Online Media in Education
(Comment Themes & Percentage Frequency of Responses)

<table>
<thead>
<tr>
<th>External Constraints to Effective Use</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resource Availability Factors</td>
<td>47.9%</td>
</tr>
<tr>
<td>Time Availability Factors</td>
<td>25.4%</td>
</tr>
<tr>
<td>Students' Predispositions &amp; Limitations</td>
<td>16.9%</td>
</tr>
<tr>
<td>Teachers' Predispositions &amp; Limitations</td>
<td>5.6%</td>
</tr>
</tbody>
</table>
The final question in this section of the survey invited respondents to share any additional comments. Out of the 48 respondents that completed this survey, only 11 of them answered this question.

One half of the comments were related to teaching methodology issues (50%), with specific examples including concerns about whether some teachers were using the medium too often in class at the expense of other equally essential tools and methods. One comment that well encapsulated this view stated: “I love opening the window of technology, and the enormous wealth it brings in my class and the boost it brings to my teaching. Being in charge of other teachers though, I see many cases where online resources are the heart of many lessons and this should not be the case. It is one of the tools within the arsenal of teachers.” Another respondent stated: “Unfortunately not all teachers are computer literate and thus need constant/ongoing IT support in class in order to make proper and better use of online media resources.”

The other equally frequently cited theme of this question (50%), was related to requests for additional resources. With these being generally requested to increase the usage of online media tools in the classroom.
5.1.1 Survey Demographics

Two-thirds of the 48 survey participants were female. The majority of respondents were between the ages of 25 and 55 (94 %), with the 35 to 55 age-range (53%) slightly higher in number than the 25 to 34 range (42 %), (see Table 9).

Table 9 - Survey Respondents' Years of Age

<table>
<thead>
<tr>
<th>Survey Response</th>
<th>% Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-24 Yrs.</td>
<td>6</td>
</tr>
<tr>
<td>25-34 Yrs.</td>
<td>42</td>
</tr>
<tr>
<td>35-55 Yrs.</td>
<td>53</td>
</tr>
<tr>
<td>55+ Yrs.</td>
<td>0</td>
</tr>
</tbody>
</table>

All 48 of the survey participants have had at least some experience teaching children or young people. The majority were currently teaching (85 %), and the remaining number, although not currently teaching, had taught in the past.

Although teachers from all grade-levels were well represented in the survey, the majority of respondents were teaching in the Late Secondary forms (33 %), and the Early Secondary forms were the second most common (21 %), as per the information collected via a ‘multiple-choice/multiple-selection’ structured question (see Table 10).

Table 10 - Survey Respondents’ Representative Grade Levels

<table>
<thead>
<tr>
<th>Survey Response</th>
<th>% Frequency (n = 85)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kindergarten</td>
<td>5</td>
</tr>
<tr>
<td>Early Primary (Years 1-3)</td>
<td>11</td>
</tr>
</tbody>
</table>
The teachers participating in this survey possessed a wide-range of professional career experience in the field of education (see Figure 2).

![Bar Chart](image)

**Figure 2 - Survey Participants’ Professional Education Career Experience**

5.2 In-Depth Information Interview

Results from the in-depth interview provided substantial information on the current status and intricate complexities associated with the organisational structure of the Maltese State Education system from the perspective of the Curriculum Management and eLearning Department. As an entity under the authority of the Ministry of Education, the Curriculum Management and e-Learning Department
(CMeLD) is charged with the responsibility of overseeing curriculum and associated eLearning activities in government primary and secondary schools.

Given the significant amount of new technologies recently introduced into the school system, the department is currently focused primarily on the training pillar of the eLearning strategy at this stage of development (Zammit, 2012). The status of the Maltese education system has been evaluated by the CMeLD to be operating currently in the second, or “developmental,” stage of eLearning technology implementation plans. This is why most of the training currently administered is more of a technical nature than the pedagogical training that is planned in the future.

The criteria used to assess development status originated from a framework designed by the CMeLD with supporting input from outside international organisations, such as the British Educational Communications and Technology Agency (BECTA) and Microsoft Partners in Learning. These assessments assist in identifying where schools and teachers can be supported to achieving national education development aims and objectives.

The CMeLD works on behalf of the Directorate for Quality and Standards in Education to review the curriculum of all subjects in the state school system to determine how Educational Technology can be most effectively applied to enhance learning in the curriculum. Another task of the department is to monitor how investments made in public education system IT infrastructure are effective in enhancing learning.
The data used to evaluate effectiveness status is derived directly from support teachers working with classroom teachers in the field. The results of findings are reported weekly to the Director General for progress review. Information analysed during these reviews includes the number of classroom teachers contacted per week, knowledge gaps discovered among teachers contacted, and what efforts have been utilised to address revealed deficiencies.

The information from this interview was received directly from Mr. Emmanuel Zammit. Mr. Zammit holds the positions of both Assistant Director and Educational Officer for the eLearning Department under the Directorate for Quality and Standards in Education. As part of his responsibilities, he reviews the curriculum of all the subjects in the state school system, and more specifically, looks at how technology can be applied to improve the teaching and learning of subjects in the curriculum. Mr. Zammit also mentors and “trains the trainers” to help teachers in the classroom, and manages the eLearning centre that is used for these training purposes. He is also charged with the responsibility of developing strategies for building up the availability of educational materials on the system’s infrastructure.

One of Mr. Zammit’s primary roles is to observe how investments in the IT infrastructures for the entire school system are used to enhance learning and teaching practises. As part of this effort, he monitors all technology issued to classrooms for returns gained from expended funds and discusses his findings in weekly meetings with the Director General to assess the state of the Maltese educational system in reference to curriculum management and eLearning objectives.
Monitoring criteria is received through departmental support teachers’ working logs, which include the amount of teachers contacted each week, knowledge gaps discovered, and what efforts have been utilised to fill-in gaps. As an example, to discuss issues as to whether teachers are using the Interactive Whiteboards with the best new teaching methods available, or if they are continuing to teach students with older transmissive methods of teaching.

Discussions during the semi-structured interview for this dissertation’s research focused on several interrelated elements related to the coordination of integrating the eLearning and Education for Sustainable Development cross-curriculum learning areas into the Maltese State Education system. Topics discussed included details on national education policies, Educational Technology distribution strategies, training programme schedules, the benefits of holistic policy perspectives, the necessity for shifts in teaching methodologies to achieve planned objectives, and associated challenges and constraints of these subjects.

5.2.1 National eLearning Policies

The integration of modern Educational Technologies into the Maltese State Education system is guided by three main policies: the National Curriculum Framework, and the Smart Learning and Smart Island strategies. Many of the same individuals - including the interviewee - were directly involved in the drafting of all three strategies.
The Smart Island policy is primarily oriented towards the integration of ICT into education. This policy is comprised of seven key strands, one of which is associated with eLearning objectives. The Smart Learning policy was based upon foundations of the Smart Island policy, and is primarily concerned with the development of the national eLearning strategy.

The national eLearning strategy is comprised of three fundamental pillars to achieving these objectives (Ministry for Investment, Industry and Information Technology & Ministry of Education, Youth and Employment, 2008):

1. Infrastructure
2. Training
3. Content

5.2.2 Infrastructure Development

Interactive Whiteboards (IWB) are the most predominate Educational Technologies currently being installed throughout all state primary and secondary school classrooms. Other technologies, such as robotics, digital cameras, and video cameras are also concurrently being distributed in limited quantities. Most all schoolteachers have also been issued personal laptop computers.

A ‘Fronter’ Virtual Learning Environment (VLE) is also in the process being rolled out, with deployment scheduled in four phases split among primary and
secondary schools. All installations of the Fronter VLE are scheduled to be completed by the end of the 2012-2013 academic year.

5.2.3 Training Development

Although instruction promoting alternative teaching pedagogies is also delivered during all mandatory training sessions, most of the training currently requested by teachers is primarily of a technical nature to familiarise themselves with recently introduced technologies. The only training delivered so far on the VLE system has been a single 12-hour session presented as part of the required annual in-service training periods. Although the training was relatively brief, it has helped to build a foundation for further training and assimilation of the system in the near future (Zammit, 2012).

Additional supplemental training has been offered on a voluntary basis on the VLE system as well. However, thus far, only fourteen out five thousand possible people had attended the first training offered, none attended the second training, and only seven attended the most recent training, which was offered in November 2012. An increase in interest is anticipated however once the system begins population with educational content that teachers can immediately utilise for their daily lesson plans (Zammit, 2012).

As part of the effort to support the implementation of national educational policies, the Malta Union of Teachers (MUT) has an agreement with the Maltese government for the training of classroom teachers. Professional development training
sessions focused on eLearning are required to be delivered a minimum of one, to a maximum of three, times per year. These professional development sessions are administered by CMeLD support staff to all state primary and secondary schoolteachers, with sessions being typically of two hours in duration. In addition to professional development training, there is also an agreement with MUT for an in-service training session, which occurs once per year and is 12 hours in duration.

In addition to mandatory training, opportunities for teachers to receive additional training are provided several times per year by CMeLD. Unfortunately, however, any additional training offered over agreed-upon minimums, must be administered on a strictly voluntary basis, and therefore only an estimated 200 to 300 classroom teachers per year - out of a possible 5000 - commonly attend these courses. Recent policy changes, however, have further strengthened support teachers’ positions in assisting classroom teachers to improve their skills on state Educational Technologies with mandatory supplemental training sessions when deficiencies are identified (Zammit, 2012).

5.2.4 Content Development

As reflected in data received from the online survey responses, the Directorate affirms that those classroom teachers that wish to use online resources for lesson plans are currently relegated to merely making due with whatever content they can randomly find. This in turn has been reported to be a time-consuming process that frequently does not completely address their needs.
To address this situation, a tender call has been recently issued by the Directorate for professionally developed content adapted specifically for Maltese needs. It is anticipated that content should begin to start filling the existing VLE systems soon after the tender has been filled (Zammit, 2012).

5.2.5 Holistic Learning Development

National education policies support holistic teaching approaches for learning. For example, classroom teachers facilitating student-centred work on interdisciplinary projects comprising of cross-discipline learning areas such as eLearning, Education for Sustainable Development, and Science Education all on one lesson assignment.

Educational Technologies help to support these types of learning approaches, and the CMelD affirms that much of the recent developments to the IT infrastructure are oriented in large part to support policy prescribed alternative teaching methodologies. However, despite public policy recommendations and infrastructure development support, CMelD feedback reports confirm the dissertation’s survey data suggesting that many teachers are still just layering the same old teaching methods over new Educational Technologies.

Indeed, some teachers are reporting that they are more comfortable with the status quo, and are therefore reticent to participating in significant changes to
classroom procedures (Zammit, 2012). This concern is noteworthy since it only requires a small group of teachers - perhaps even just one - to submit a complaint to the Malta Union of Teachers that in turn will result in an immediate halt of any activities associated with the introduction of changes involving teachers without a memorandum of understanding agreement between the Union and the Government.

As an example, when the Fronter VLE was first distributed in classrooms, it was required to be presented to teachers solely as a voluntary resource. Consequently, after introductory training for teachers on the system during an annual compulsory training period, it remained unused for an entire year after the training because some teachers protested to the Union its usage before a formal agreement was authorised.

Part of the reluctance of some teachers to participate in these education system advancements is that, although these approaches are advocated by public education policies, they are not yet mandated as requirements. Moreover, strategies as to how these new methodologies will specifically be implemented into each school individually have not been determined. Even with national policies in place that stipulate changes to the educational system, School Development Plans must be designed and authorised for each college in the state education system before any involvement of their respective teachers can be mandated.
In the process of developing each school’s development plan, Education Officers work with the Senior Management Teams of each college to address the specific needs of their schools, and an estimated three years are regularly required to monitor, evaluate, adapt, and eventually achieve each school’s development plan objectives. However, once a School Development Plan has been initially finalised and authorised for a school, it is anticipated that the schools and teachers will be requesting the additional training they will need themselves as soon as possible to acquire the skills necessary to execute new requirements in classrooms (Zammit, 2012).

Unfortunately however, before any School Development plans can be pursued in this regard, there are reported to be concerns among some of the Education Officers that were not involved in the initial policy making processes advocating these changes, which correspondingly must be addressed first (Zammit, 2012). This reluctance is due in part to the conviction of some Education Officers that the integrity of their subjects may be compromised if they were to be integrated with other subjects.

However, the Director General, all Assistant Directors, and the Education Officers directly involved in advising on policy restructuring are all on board with proposed holistic framework objectives. And therefore, it is anticipated to be just a matter of time before the remaining reticent Education Officers will eventually grant their final approvals for subject integrations (Zammit, 2012).
6. Discussion

In consideration of all comments received from the open-ended sections of the online survey together overall, most were primarily related to two or three main areas, with a few additional noteworthy minor themes also emerging from the survey owing to an absence of incidences. One of the main comment themes was related to events associated with the use of Educational Technology tools in the classroom, and the other was related to the constraints of using these tools due to the limited availability of these resources.

A third less common theme was related to comments from teachers about their students’ general predispositions towards online media, and their belief that most students growing up during the modern technological age have been raised around these resources their entire lives. And therefore, any teaching methodologies that incorporate the use of such media are often more attractive and engaging for students than traditional learning materials. This is a point that was also reiterated by the Curriculum Management and eLearning Department during this dissertation’s information interview session (Zammit, 2012), as well as in numerous published documents, such as a research report by the American Institutes for Research and a journal article by Marc Prensky (Arafeh & Levin, 2002; Prensky, 2001).

The question remains, however, as to whether students effectively make use of such technology for learning activities on their personal time or not. The opinions of teachers in the survey on this question were closely divided between all three possible
responses - ‘yes’, ‘no’, and ‘not sure.’ Many of those teachers with more supportive perspectives on this issue also provided additional comments with suggestions for what they use themselves to help prepare their students for more effective use of their time online outside the classroom. Suggestions were given that, with proper guidance and encouragement from teachers, students would make the most effective use of their time.

However, data from the dissertation survey suggests that not all teachers are fully prepared to provide this assistance to their students. This issue is also confirmed by the Curriculum Management and eLearning Department as a concern, and is one in which they are currently trying to address (Zammit, 2012).

These instances may serve as examples as to how community resources for educators, such as the online Communities of Practice referred to by Wenger (1991; 1998; 2002; 2004), may help to support teachers challenged by issues with technology and its integration into increasingly required cross-curricular subjects such as eLearning and Education for Sustainable Development. This is an issue currently being addressed by the CMeLD through the availability of a selection of technologies that may be able to provide such resources through the Fronter VLE, the eTwinning programme, and Microsoft Partners in Learning (Zammit, 2012).
The large majority of comments throughout the survey were related mainly to teaching and education issues associated with the use of technology tools during the course of classroom activities. Although a large proportion of these comments noted the positive advantages of online media because of their inherent qualities to draw student attention in the classroom - at least initially, concerns about inadequate teaching and education issues came up 42 times - more than any other single issue.

Specific examples given associated to this issue were most commonly related to difficulties in keeping students focused on their assignments and problems with student boredom, and/or students’ general aversions to computers. Indeed, lack of student motivation is regarded by many in the field of education as a major source of concern, and a key element to declining levels of student performance and new enrolments in higher education for many fields across Europe (European Commission, 2007).

However, if used appropriately, technology has been proven to enhance the learning process to prevent such indifference among students (Ministry for Investment, Industry and Information Technology & Ministry of Education, Youth and Employment, 2008; Zammit, 2012). European Schoolnet (2007) published a review of studies on the impact of ICT in European schools, and reported that Interactive Whiteboards were demonstrated to have positive impacts on literacy, mathematics, and science tests. Wider positive benefits were also found to increase student motivation, concentration, cognitive-processing, independent learning, critical
thinking and teamwork (Ministry for Investment, Industry and Information Technology & Ministry of Education, Youth and Employment, 2008).

So what is the real issue then? Perhaps it may be related to the fact that most of the training delivered so far on Interactive Whiteboards systems has been technically related and without significant emphasis on pedagogies yet. The benefits available from this, or any Educational Technology for that matter, are only as accessible as the educators that use them are proficient in the skills required for their use.

Comments from some survey respondents related to this issue expressed concerns that some of their colleagues may have an over-dependency on technology use in the classroom, with one comment specifically suggesting that some teachers use online media simply as a “babysitter” for their students. Other survey comments frequently expressed concern that some teachers had difficulties in locating and effectively integrating materials obtained online into designated lesson plans.

Perhaps issues such as the later may explain why some teachers have required a ‘digital babysitter’ while they located materials to teach assigned lessons. And perhaps this would not be as much of an issue of concern if more content materials were designed and distributed with local Maltese requirements in mind as recommended by national learning policies (Ministry for Investment, Industry and
Information Technology & Ministry of Education, Youth and Employment, 2008; Ministry of Education, Employment, and the Family, 2011a). This is also another issue currently being addressed by the CMeLD with a public tender call for new content development (Zammit, 2012).

The most common theme among comments from the survey question that requested opinions on the most significant external constraining factors towards the effectiveness of digital media in education were related to inadequate teaching and education issues, which were cited three times more often than any other specified factors from this question. However, as some teachers participating in the survey seemed to generally be doing much better overall than others were, they did not seem to have the many of the same reported challenging issues. In fact, the more accomplished teachers were not only able to pull their students’ attention, (as most all of the teachers in the survey reported they were able to do with Educational Technologies), but they also reported that they were able to maintain their students’ attention throughout the majority of designated class periods.

Perhaps part of the reason for these differences in abilities may be explained by the varying age groups of the teachers participating in the survey, and correspondingly, when they were trained to be teachers. However, given the apparent inconsistency of availability to resources as reported amongst survey participants, the issue may not be one entirely of possessing sufficient teaching skills, but also one of having adequate access to relevant media.
Another important indicator on this issue may lie in the fact that a remarkably few number of comments throughout the entire survey ever referred to inquiry-based learning technique concepts. As cited earlier, inquiry-based learning strategies are a proven effective method to move beyond teaching methods that merely attracts students’ initial attention, to one that engages them and motivates them to learn (Zammit, 2012; Ministry of Education, Employment, and the Family, 2011a; Eurobarometer, 2005). As also discussed earlier, inquiry-based methods also promote awareness among students as to how actions taken individually and locally can - for better or worse - directly affect the environment globally (Ministry of Education, Employment, and the Family, 2011a).

Conversely, generally positive comments related to the use of Educational Technology in classrooms were one of the most cited. Many of these comments specifically referred to the use of videos to elaborate upon theories being discussed in the classroom. However, from the data gathered thus far it would be difficult to specially determine from these comments as to whether or not the outdated transmissive methods of teaching are still occurring in classrooms despite the utilisation of modern Educational Technology resources for these purposes.

The use of websites was stated by respondents several times in the survey, yet remarkably few of these comments offered any specific mention as to how these resources could be used to include elements of interactive learning approaches for
students. In fact, inquiry-based learning themes were only cited few times throughout the entire survey, and the precise phrase never came up specifically anywhere in the survey. However, the PhET and Webquest websites were specifically cited three times, and both of these companies do refer to themselves as inquiry-based learning resources on their websites (PhET, 2011; Webquest, 2008).

As referenced earlier however, inquiry-based methodologies are reported to require more time to implement (Directorate for Quality and Standards in Education, 2012), and since ‘time constraints’ were the second most frequent response from the survey question requesting opinions on the most negative external factors affecting Educational Technology effectiveness. This may be at least one reason why these methodologies are apparently less commonly employed in classrooms.

‘Time consuming’ was also the second most frequently cited disadvantage in another survey question. Specific examples referred to the extra time required for lesson planning most often. Cited about half as often were in-classroom challenges related to managing students, and the necessity of retraining was the third most common comment response theme.

Teachers in this survey, as well as in others, have indicated that regardless of specified teaching methods or Educational Technologies, they are concerned about timetabling schedules and the volume of curriculum content they are responsible for
delivering within allocated timeframes (Directorate for Quality and Standards in Education, 2012; Maltese Association of Science Educators (MASE), 2007; 2011). This problem has also been acknowledged and identified by the Directorate as an issue of concern that will be addressed once the NCF is has been signed (Zammit, 2012). Once the NCF has been officially approved, all Education Officers will review proposed timetabling changes in conjunction with what NCF and National Minimum Curriculum stipulate, at that point, work will then begin on redesigning the syllabi (Zammit, 2012).

Conversely, however, in the “Advantages of Use” question of the survey, a significant number of respondents positively responded to the use of Educational Technology in the classroom as being more time efficient, with specific examples in a few these comments citing faster lesson preparation time, and a few other examples promoted the functionality of enabling students to pick up concepts quicker in lectures. Perhaps with an increased availability of more educational materials specifically designed for local Maltese requirements as advocated in national policies (Ministry for Investment, Industry and Information Technology & Ministry of Education, Youth and Employment, 2008), positive opinions on time effectiveness of these media may be higher in future studies.

Additionally, with a move to more student-centred teaching approaches, a greater amount of the curriculum could conceivably be covered in less time, and therefore, time constraint concerns would be less of a prominent issue (Zammit,
As an example, with the use of project-based learning methods the consequences of time wasted due to the repetition that is often inherent in traditional module-by-module educational materials could be minimised since a background of foundational skills is built upon as students progress through concepts to complete projects from start to finish. Therefore, holistic approaches to learning are an important factor to consider in the drafting of any new syllabi for the curriculum.

Surprisingly, despite all the various comments from the survey supporting the numerous benefits associated with the use digital media in education, a remarkably few number of comments recognised the capacity of these technologies to share and learn from other colleagues and more experienced teachers. Among the hundreds of separate comments collected during the survey, the potential benefits of virtual learning communities for teachers were only cited a total of 8 times, with most of those comments being exceedingly general in nature and without any specific mention of Communities of Practice.

As referenced in earlier chapters, the benefits of Communities of Practice are multi-fold to both teachers as well as students (Zammit, 2012; U.S. Department of Education, 2011; Wang, Yang, & Chou, 2008; European Commission, 2007; W. Snyder, Wenger, & Briggs, 2004), the Fronter VLE system currently under deployment throughout the state school system may provide a possible starting point for developing such a system-wide Community of Practice. Similar opportunities may
also be possible through the Microsoft Partners in Learning community and the eTwinning National Support Service.

As an example of the potential benefits the use of these services might offer: if a predetermined specific amount of time is required to complete one PowerPoint presentation for a lesson plan, the return on time invested by each additional teacher participating in a community group would be multiplied in direct proportion to the total number of teachers also contributing content materials to a shared content resource pool.

Despite their distinct advantages and availability however, since these resources are presently required to be offered on a strictly voluntary-basis, the number of educators currently participating is relatively small. And until the use of any such resources becomes a compulsory part of the state school curriculum, the numbers of participants are anticipated to remain minimal (Zammit, 2012).

Limited access to resources was the second most cited issue from survey participants regarding constraints associated with the use of digital media in education. As referenced at the beginning of this chapter, this issue was also the second most frequently commented throughout the entire survey overall. However, given the numerous other concerns also raised during the survey, particularly of those pertaining to whether the medium is being implemented as effectively as it could be,
the question arises as to whether implementing the latest technology resources that these teachers are requesting (i.e. one-to-one internet access and computers for students), would be the most efficient use of resources at the present moment in time.

It is evident that some participants in the survey were not as well prepared as others were in making the most effective use of the resources that are currently available. Moreover, the evidence gathered during this study tends to suggest that simply investing in new infrastructure developments alone will not yield any significant improvements to the state education system. Therefore, rather than focusing all efforts solely on upgrading infrastructure resources as some teachers would recommend, incremental development steps implemented concurrently with teacher training and materials content acquisition, along with timetable restructuring and syllabi revisions, would perhaps be a more effective alternative in preparing schools for the coming challenges of the 21st Century over the long-term.

We are already well into the 21st century, yet the schools of Malta are still behind many other nations in achieving the levels of learning practise and performance expected of schools in this century (Maltese Association of Science Educators (MASE), 2011; Zammit, 2012; Malta Information Technology Agency, 2011a). This is a paramount concern of the eSkills Alliance - a joint government agency charged with the responsibility for ensuring that Maltese students are adequately prepared for employment upon graduation (Malta Information Technology Agency, 2011a; Zammit, 2012). This is also one of the challenges that national
policies are designed to address as well (Malta Information Technology Agency, 2007; Ministry for Investment, Industry, and Information Technology & Ministry of Education, Youth and Employment, 2008).

As referenced earlier, most students in today’s classrooms are already intimately acquainted with technology, often equally to - if not more so in many cases - than their teachers. Since most students already possess adequate technology skills, the challenge then is to translate their technical skills into formalised learning environments. The long-term plan for teachers working in technology-based education environments should then include a revision of roles from merely transmitters of knowledge to facilitators for learning via inquiry-based learning methods.

Conversely, a common concern among classroom teachers in a rapidly changing learning environment is the issue of “reform fatigue” (Zammit, 2012). Therefore, a balance is required between development for the overall good of the country and its students, and minimising the fatigue teachers may face if too many changes are introduced at one time.

Another noteworthy theme that arose from the results of this and other surveys of Maltese teachers (Directorate for Quality and Standards in Education, 2012; Maltese Association of Science Educators (MASE), 2011), was in the remarkably few
number of comments related to any of the potential positive benefits to the environment with the use of digital media in classrooms. Among the hundreds of different comments collected in total from this survey, only four comments even vaguely referred to concepts of sustainability; and only one of those was more specific, which referred to the potential benefits of reducing paper use.

This issue is symptomatic of a general lack of environmental awareness, and is one in which the most recent Maltese National Curriculum Framework proposal seeks to redress with the Education for Sustainable Development cross-curricular learning area (Ministry of Education, Employment, and the Family, 2011a). Promoting higher levels of public awareness in this regard could perhaps be achieved through additional policy measures similar to those of the eLearning cross-curriculum learning area via the Smart Island and Smart Learning strategies. The subject of such initiatives could be a worthwhile starting point for further study.

Another means of generating increased awareness on the importance of Education for Sustainable Development in schools could be promoted through national competition and showcasing events similar to the EMBED programme for ICT-based accomplishments in schools. The EMBED programme is an annual event that showcases the outstanding work teachers have accomplished over the school year with their students using ICT tools in education. The weeklong event and includes a schedule of workshops and demonstrations, and culminates in a series of incentive awards for outstanding achievements that demonstrate the high levels of excellence
the Maltese education system is capable of attaining in 21st century learning environments.

Recipients of awards from EMBED events may also have the opportunity to represent Malta in the European Innovative Teachers’ Forum and the Microsoft Partners in Learning Global Forum events (Malta Star, 2012; Zammit, 2012). The EkoSkola programme referred to earlier may have the most potential to organise such an event, and perhaps the subject of such an initiative could be an advantageous starting point for further study.
7. Conclusions and Recommendations

This research study sought to assess the current state of technology-enhanced learning and environmental sustainably principles in education, and to offer practical solutions to challenges associated with their integration into the Maltese State Education system. In this regard, a cross-section of 48 Maltese Science Education teachers were recruited to complete online survey questionnaires, and based upon the results of data collected during the survey period, a subsequent interview with the Assistant Director and Education Officer responsible for national eLearning policy decisions in Malta was conducted. Several key insights emerged from the results of this study, (as discussed in preceding chapters). This concluding chapter summarises these insights and correspondingly offers policy plan recommendations to address relevant issues.

Recent research indicates a disconcerting trend among students of declining interests in learning throughout Europe (European Commission, 2007; Eurobarometer, 2005; OECD, 2006; 2005). The results of the survey data collected for this study reiterates this concern locally. Maltese policy reports also confirm that a lack of student initiative is a significant challenge to the national education system, and therefore, correspondingly recommends Educational Technology based teaching methods as a proven approach to assist in resolving these issues (Malta Information Technology Agency, 2007; Ministry for Investment, Industry and Information Technology & Ministry of Education, Youth and Employment, 2008).
However, as the results of the survey data collected for this study also indicate, introducing additional enhancements to the technology infrastructure alone will not bring about significant improvements in this regard by themselves. As an example, survey results revealed that, although teachers are able to commonly attract students’ attention in the classroom initially with new Educational Technologies, compelling evidence suggests that many of these same teachers are unable to sustain this attention, and therefore their students’ motivation to learn.

The European Commission reviewed a cross-section of proposed initiatives to address issues associated with declining interests in learning, and determined that these declines were largely due to the methods by which subjects are being taught in classrooms (European Commission, 2007). Another similar report by the OECD (2006), more specifically suggests that paradigm shifts to more student-centred, inquiry-based teaching methods offer significant potential to increase sustained student interest and motivation in the classroom. The Maltese Curriculum Management and eLearning Department (CMeLD) also concurs that student boredom is an issue of concern nationally, and reaffirms that the integration of Educational Technologies in conjunction with student-centred, inquiry-based teaching methods will significantly aid in helping to motivate students to become more active participants in their own educational development (Zammit, 2012). Educational Technology and inquiry-based pedagogies are not only a proven aid in increasing student interest and motivation to learn, but they also help to stimulate the motivation of teachers as well (European Commission, 2007; Kubicek, 2005).
However, despite documented evidence of the positive benefits that these resources offer, the results of the survey data from this and other national studies suggest that the practical application of these in Maltese classrooms is limited (Directorate for Quality and Standards in Education, 2012). As discussed in earlier chapters, a factor in many Maltese teachers’ reluctance to incorporate more elements of modern methods into lesson plans is because they are often perceived as time-consuming processes that interfere with the requirements of teaching under a content-heavy syllabi within constrictive timeframes (Directorate for Quality and Standards in Education, 2012).

A reduction of syllabi requirements in conjunction with timetable revisions that permit a greater degree of flexibility and autonomy for teachers will help to encourage adjustments in common teaching practices for more effective utilisation of Educational Technology resources in the classroom. It is therefore recommended that options for reducing syllabi content and increasing timetable flexibility be analysed, assessed, and applied during the next planned curriculum revision sessions.

In conjunction with syllabi content reduction and timetable restructuring initiatives, a condition for introducing new scheduling requirements stipulating an additional two hours per week minimum from teachers for training purposes to promote the most effective use of available resources and proposed flexibility adjustments is further recommended. These proposed training sessions should be conducted on a regular and consistent once-a-week basis at minimum.
The additional potential benefits of these recommended training sessions may also result in the development of new educational materials designed by teachers with specific knowledge of the requirements of their classrooms locally. More specially, these materials may be utilised in supplying content for the online libraries of the Virtual Learning Environment (VLE) systems discussed in earlier chapters. As also discussed in earlier chapters, the results of the survey for this study revealed that Maltese teachers often have difficulties in locating instructional materials online to supplement daily lesson plans, and consequently, significant additional time is required to prepare for classroom activities. Moreover, the materials that they do find often do not blend well with syllabi requirements, and rarely specifically address issues relevant to Maltese culture and society (Ministry for Investment, Industry and Information Technology & Ministry of Education, Youth and Employment, 2008). Hence, the supplementary benefits of these proposed additional training sessions may also help to support in meeting this need.

Further incentives for active teacher participation in content creation initiatives could include the promotion of a specific category of awards exclusively for projects created during these proposed training sessions. Which in turn, could be presented during annual EMBED or other similar events. Criteria for award decisions could be based in part by how well they are rated by fellow colleagues via an electronic voting system, developed as an optional software function of the aforementioned VLE content servers.
Another source of reluctance by some teachers to incorporate more elements of proposed methods into their classroom practices may be due in part to the general attitudes of leadership teams over some schools (Zammit, 2012). If new technologies are adopted under circumstances where support from management is lacking and outmoded processes remain unchanged, then new Educational Technologies and associated pedagogies may be perceived as unnecessary impediments to teaching in the classrooms (EC ICT cluster, 2010).

Although national strategy plans direct changes to the Maltese education system, it is the School Development Plans for each school that authorises specific changes for actual implementation. The process of revising School Development Plans requires the mutual participation of Senior Management Teams from the colleges and Education Officers from the Directorate to develop implementation plans that address the specific needs of each school individually. Hence, in essence, if the leadership teams of schools do not support the benefits of advocated resources, then there is the distinct likelihood that a significant number of teachers working under them will also not support them either. Therefore, building awareness and promoting the proven advantages and benefits of these resources to school leadership teams is highly recommended.

The Maltese Ministry of Education recently signed a five-year contract with Microsoft’s Partners in Learning to procure their professional technical services
(Malta Information Technology Agency, 2011b; Zammit, 2012). It is therefore recommended that school leadership teams and Education Officers avail themselves to the resources available through this organisation in the drafting of new School Development Plans based upon input from their proven experiences from abroad.

It is further recommend that advisements on measures for monitoring and evaluating resulting development plans, and the hardware and software required to implement them, are included for consideration. Additionally, inputs from these resources towards the drafting of a systematic plan to incorporate Education for Sustainable Development (ESD) as a cross-curriculum learning area into the Maltese national curriculum is also recommended.

One of the most challenging aspects associated with implementing the proposed education policy strategies lies not only in the intended paradigm shifts from teacher-centred to student-centred pedagogies. But as discussed in earlier chapters, to accomplish these changes through a holistic curriculum framework - wherein all school subjects will eventually be required to interconnect with one another. Initially incorporating the Education for Sustainable Development learning area then as an isolated stand-alone subject is therefore recommended.

After an initial pre-determined period of time has elapsed to allow for a thorough review and analysis of the progress of ESD curriculum development, an interim step would then be subsequently recommended to identify specific points within the associated syllabi where direct links to other subjects could be authorised for future cross-curriculum development plans.
To organise and manage the most effective means of integrating the Education for Sustainable Development subject as a cross-curriculum learning area into the Maltese State Education system, the establishment of a national Education Officer position, responsible for the overall administration of this subject, is recommended. To further facilitate this transition, and to represent the specific needs of each Senior Management Team and their respective classroom teachers during the development of individualised School Development Plans, the establishment of ESD Curriculum Coordinators positions - assigned one to each college - is additionally recommended.

As resulting finalised ESD implementation plans successfully progress and evolve, the establishment of additional Assistant ESD Curriculum Coordinators positions – assigned one to each school - is further recommended.

In addition to assisting with the administration aspects of ESD syllabi integration, proposed Assistant Coordinators would also be advantageously positioned to facilitate the full integration of ESD principles and policies throughout the entirety of each participating school - leadership teams and all other staff included as recommend by the UN Decade of Education for Sustainable Development and other organisations referred to in earlier chapters.

Given that the majority of the research conducted thus far for this study has largely been oriented towards Educational Technology and associated pedagogies, additional research in the area of integrating environmental principles in the classroom is recommended for further study, and specifically advise the EkoSkola
programme as an ideal starting point for syllabi and school development planning inputs.

If additional time were available to further develop the research elements of this study, supplementary research in the form additional in-depth interviews with Education for Sustainable Development professionals familiar with the challenges associated with instituting new education policy framework changes in this regard would be recommended.

Instituting new Educational Technologies alone will not immediately change - much less improve - the status of the Maltese national education system. However, the integration of these new technologies in the infrastructure currently in progress is a necessary preliminary step for the gradual transition to realising proposed national education policy objectives.

The foundation is being set for the implementation of the succeeding steps required to familiarise teachers and leadership teams with the benefits of modern Educational Technologies, to inform teachers as how to teach with these resources using appropriate pedagogies, and how to integrate them with proposed cross-curriculum learning area subjects, (e.g. ESD), into holistic learning environments in alignment with the global expectations of formal education systems for the 21st century.
References


Directorate for Quality and Standards in Education. (2012). *Analysis of feedback to the consultation process on the draft national curriculum framework.* Floriana: Directorate for Quality and Standards in Education.


Zammit, E. (2012). In Buchanan T. (Ed.), *Personal communication*. Maltese

Directorate for Quality and Standards in Education: Curriculum Management and e-Learning Department.
Appendix A: IRB Proposal and Approval

James Madison University
Human Research Review Request

For IRB use only:

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Exempt: ☒
Expedit: ☐
Full Board: ☐

Responsible Researcher(s): Terry A. Buchanan
E-mail address: buchata@dukes.jmu.edu
Telephone: +356 9957 2329
Department: ISAT-SERM
Address (MSC): University of Malta

Please select: ☐ Faculty  ☐ Undergraduate Student
☐ Administrator/Staff Member  ☐ Graduate Student

(if Applicable):
Research Advisor: Dr. Jonathan Miles
E-mail address: Milesji@jmu.edu
Telephone: (540) 568-3044
Department: ISAT
Address (MSC): 4102

Project Title: An Analysis on the Convergence of Technologies Enhanced Learning and Education for Sustainable Development

Project Dates (Cannot exceed 1 year minus one day):
From: 07/26/12
To: 07/25/13

Minimum Number of Participants: 15
Maximum Number of Participants: 50

External Funding:
Yes: ☐ No: ☒
If yes, Sponsor: _____

Investigator: Please respond to the questions below. The IRB will utilize your responses to evaluate your protocol submission.

1. ☒ YES ☐ NO Does the James Madison University Institutional Review Board define the project as research?

   The James Madison University IRB defines "research" as a "systematic investigation designed to develop or contribute to generalizable knowledge." All research involving human participants conducted by James Madison University faculty, staff, and students is subject to IRB review.

2. ☒ YES ☐ NO Are the human participants in your study living individuals?

   Individuals whose physiologic or behavioral characteristics and responses are the object of study in a research project. Under the federal regulations, human subjects are defined as: living individual(s) about whom an investigator conducting research obtains: (1) data through intervention or interaction with the individual; or (2) identifiable private information.

3. ☒ YES ☐ NO Will you obtain data through intervention or interaction with these individuals?

   "Intervention" includes both physical procedures by which data are gathered (e.g., measurement of heart rate or venipuncture) and manipulations of the participant or the participant's environment that are performed for research purposes. "Interaction" includes communication or interpersonal contact between the investigator and participant (e.g., surveying or interviewing).
4. ☐ YES ☒ NO Will you obtain identifiable private information about these individuals?

"Private information" includes information about behavior that occurs in a context in which an individual can reasonably expect that no observation or recording is taking place, or information provided for specific purposes which the individual can reasonably expect will not be made public (e.g., a medical record or student record). "Identifiable" means that the identity of the participant may be ascertained by the investigator or associated with the information (e.g., by name, code number, pattern of answers, etc.).

5. ☐ YES ☒ NO Does the study present more than minimal risk to the participants?

"Minimal risk" means that the risks of harm or discomfort anticipated in the proposed research are not greater, considering probability and magnitude, than those ordinarily encountered in daily life or during performance of routine physical or psychological examinations or tests. Note that the concept of risk goes beyond physical risk and includes psychological, emotional, or behavioral risk as well as risks to employability, economic well-being, social standing, and risks of civil and criminal liability.

CERTIFICATIONS:

For James Madison University to obtain a Federal Wide Assurance (FWA) with the Office of Human Research Protection (OHRP), U.S. Department of Health & Human Services, all research staff working with human participants must sign this form and receive training in ethical guidelines and regulations. "Research staff" is defined as persons who have direct and substantive involvement in proposing, performing, reviewing, or reporting research and includes students fulfilling those roles as well as their faculty advisors. The Office of Sponsored Programs maintains a roster of all researchers who have completed training within the past three years.

Test module at OSP website: http://www.jmu.edu/sponsprog/irb/irbtraining.html

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<td>June 03, 2012</td>
</tr>
<tr>
<td>Jonathan Miles</td>
<td>July 30, 2012</td>
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For additional training interests visit the National Institutes of Health Web Tutorial at: http://cme.nci.nih.gov/

By signing below, the Responsible Researcher(s), and the Faculty Advisor (if applicable), certifies that he/she is familiar with the ethical guidelines and regulations regarding the protection of human research participants from research risks. In addition, he/she agrees to abide by all sponsor and university policies and procedures in conducting the research. He/she further certifies that he/she has completed training regarding human participant research ethics within the last three years.

Principal Investigator Signature Date

Principal Investigator Signature Date

Principal Investigator Signature Date

Principal Investigator Signature Date

Principal Investigator Signature Date

Faculty Advisor Signature Date

Submit an electronic version of your ENTIRE protocol to jmu.grants@jmu.edu.

Provide a SIGNED hard copy of the Research Review Request Form to:
Office of Sponsored Programs, MSC 5728, James Madison Administrative Complex, Bldg #6, Suite 26
**Purpose and Objectives**

What is the purpose of the study? Include any hypotheses or research questions. (Limit to one page)

The purpose of this study is to research teachers' opinions on the growing use of online media as an integral part of educational resource tools. This study will contribute to the student's completion of his dissertation on Integrated Science and Technology at James Madison University and Sustainable Environmental Management Resources at the University of Malta.

**Procedures/Research Design/Methodology/Timeframe**

Describe your participants. From where and how will potential participants be identified (e.g. class list, JMU bulk email request, etc.)?

Participants will be educational professionals, identified for participation through emails of those willing participants associated with the Department of Education at the University of Malta. Participants will be recruited in person from the department prior to emailing participants.

How will subjects be recruited once they are identified (e.g., mail, phone, classroom presentation)? Include copies of recruitment letters, flyers, or advertisements.

Participants will be sent an email to a link for an online survey which they are requested to complete for the purposes of this study. Participants will be asked to read a Cover Letter prior to clicking the link for the survey.

Describe the design and methodology, including all statistics, IN DETAIL. What exactly will be done to the subjects? (Emphasize possible risks and protection of subjects.)

Participants will be requested to complete an online survey, hosted via the Survey Gizmo website, which will inquire as to their opinions on the use of online media as an educational resource tool. Data will be stored on the Survey Gizmo server until analysis of data is completed by the researcher. Data will be protected via an Advanced Encryption Standard. After the research has been completed, all associated data will be deleted.

Will data be collected from or about any of the following populations?

- Minors (under 18 years of age); Specify Age: __________
- Prisoners
- Pregnant Women
- Fetuses
- Cognitively impaired persons
- Other protected or potentially vulnerable population
- X Not Applicable

Where will research be conducted? (Be specific; if research is being conducted off of JMU’s campus a site letter of permission will be needed.)

The research will be conducted at the University of Malta, via an online survey.

Will deception be used? If yes, provide the rationale for the deception:

No deception will be involved with this study.
What is the time frame of the study? (List the dates you plan on collecting data. This cannot be more than a year, and you cannot start conducting research until you get IRB approval.)

Time frame of study will be from July 2012 (pending IRB approval) through July 2013 at the latest.

Data Analysis
What methodology will be taken to ensure the confidentiality of the data (i.e., how and where data will be stored/secured, how data will be analyzed, who will have access to data, and what will happen to data after the study is completed?)

No identifying data will be required to participate in the survey. All responses to surveys will be password protected via the Survey Gizmo survey hosting website. Data will be quantitatively analyzed and I will be the only one with access to the password protected data. All associated data will be deleted upon completion of the research period.

Reporting Procedures
Who is the audience to be reached in the report of the study?

My intended audience for this research will be professionals involved in the education sector in Malta.

How will you present the results of the research? (If submitting as exempt, research cannot be published or publicly presented outside of the classroom.)

Data will only be presented as part of a standard dissertation as required to graduate from the respective graduate program associated with this dissertation component.

How will feedback be provided to subjects?

If subjects request feedback on survey result, they have the option to leave any form of contact information of their choosing (including anonymously) to receive results.

Experience of the Researcher (and advisor, if student):
What is the prior relevant experience of the researcher, advisor, and/or consultants?

I am a graduate student, with no prior experience of any type with human research subjects work. Dr. Miles is co-coordinator of the graduate program for this dissertation and has many years teaching and guiding students with their research activities.
Electronic Survey Cover Letter

The purpose of this research project is to gather information from educators on the use of online media as educational resource tools. This survey is part of a research project currently being conducted by a graduate student and associated dissertation supervisors at the University of Malta and James Madison University. This study will contribute to the student’s completion of his dissertation in Integrated Science and Technology, and Sustainable Environmental Resources Management. You are invited to participate in this research project because you are involved in the education sector. Your participation in this research study is voluntary. You may choose not to participate. If you decide to participate in this research survey, you may withdraw at any time. If you decide not to participate in this study or if you withdraw from participating at any time, you will not be penalized. The procedure involves filling an online survey that will take approximately 10 minutes to complete. Your responses will be anonymous. The investigator does not perceive more than minimal risks from your involvement in this study (that is, no risks beyond the risks associated with everyday life). We will do our best to keep your information anonymous and all data is stored in a password protected electronic format. Potential benefits from participation in this study will provide knowledge information related to the use and potential uses of online media resources in education. The results of this study will be used for scholarly purposes only and may be shared with University representatives. This research has been reviewed according to James Madison University IRB procedures for research involving human subjects. Given the potential participant pool, it is possible that you could be identified through your demographic answers. The nature of the survey is not harmful and is opinion focused so I do not believe subject identification is harmful or risky; however, you should be advised of that possibility.

If you have questions or concerns during the time of your participation in this study, or after its completion or you would like to receive a copy of the final aggregate results of this study, please contact:

Terry Buchanan
Integrated Science & Technology
James Madison University
buchanta@dukes.jmu.edu

Dr. Jonathan Miles (Advisor)
Integrated Science & Technology
James Madison University
Telephone: (540) 568-3044
milesjj@jmu.edu

If you have any questions about your rights as a research subject, please contact:
Dr. David Cockley
Chair, Institutional Review Board
James Madison University
(540) 568-2834
cocklede@jmu.edu

I have been given the opportunity to ask questions about this study. I have read this consent and I understand what is being requested of me as a participant in this study. I certify that I am at least 18 years of age. By clicking on the link below, and completing and submitting this anonymous survey, I am consenting to participate in this research.

Name of Researcher (Printed)  Date
Site Coordinator Letter of Permission

July 26, 2012

Institutional Review Board
James Madison University
MSC 5728
JMAC-6, Suite 26
Harrisonburg, VA 22807

Dear Institutional Review Board,

I hereby agree to allow Terry Buchanan, from James Madison University to conduct his research at the University of Malta. I understand that the purpose of the study is to conduct research related to technology enhanced learning in education for sustainable development.

By signing this letter of permission, I am agreeing to the following:

☒ JMU researcher(s) have permission to be on University of Malta premise.
☒ JMU researcher(s) have access to the data collected to perform the data analysis both for presentation to University of Malta and/or for publication purposes.

Sincerely,

University of Malta
Figure 3 - JMU IRB Approval Stamp Image

Protocol # 13-0017  Approved: 8/2/2012
From: 8/2/2012  through: 7/25/2013

James Madison University
Institutional Review Board
Appendix B: Full Survey

Thank you for your help!

ELECTRONIC CONSENT: Please select your choice below. Clicking on the "agree" button below indicates that: • you have read the above information • you voluntarily agree to participate • you are at least 18 years of age. If you do not wish to participate in the research study, please decline participation by clicking on the "disagree" button.*

( ) Agree
( ) Disagree


Survey Section A - General Evaluation of the Effectiveness of Online Media as an Educational Resource Tool

1) How would you rate the overall effectiveness of online media as an educational tool in general?

( ) An Excellent Tool
( ) A Good Tool
( ) Neutral
( ) Not Very Helpful
( ) Totally Unhelpful

Please elaborate, as you feel appropriate.

2) What is your professional teaching experience with using online media resources as a part of your teaching?

( ) I presently use online media resources as part of my teaching.
( ) I have used online media resources in the past, but do not currently use them.
( ) I have never used online media resources as part of my teaching.

3) Kindly provide some specific examples of ways in which you are now using, or have previously used, online media resources as part of your teaching?

4) Which age groups of students are the most appropriate to utilize online media as dedicated educational resources? (Tick all that apply)

[ ] Kindergarten
[ ] Early Primary (Years 1-3)
[ ] Late Primary (Years 4-6)
[ ] Early Secondary (Forms 1-2)
[ ] Late Secondary (Forms 3-5)
[ ] Post Secondary
[ ] University
5) Do your students have adequate access to online media to be used effectively in the classroom?

( ) Yes
( ) No
( ) Not Sure

Please elaborate, as you feel appropriate.

6) Do your students have adequate access to online media resources anywhere outside of school?

( ) Yes
( ) No
( ) Not Sure

Please elaborate, as you feel appropriate.

7) In your experience, do students effectively make use of online media resources on their personal time?

( ) Yes
( ) No
( ) Not Sure

Please elaborate, as you feel appropriate.

8) List THREE advantages for incorporating online media as educational tools as a regular part of your teaching.

9) List THREE disadvantages for incorporating online media as educational tools as a regular part of your teaching.

10) List the THREE most significant external factors, (not directly associated with the media resources themselves), that you think would mostly affect the overall effectiveness of online media educational tools for your particular requirements?

Survey Section B - Respondent Demographics

11) What is your gender?

( ) Female
( ) Male

12) What is your age?

( ) 18-24
( ) 25-34
13) Please define your teaching experience.

( ) I am currently teaching children and/or young people.
( ) I have previously taught children and/or young people, but am not currently teaching.
( ) I have never taught children and/or young people.

14) What are the ages of the students in your current teaching environment? (Tick all that apply)

[ ] Kindergarten
[ ] Early Primary (Years 1-3)
[ ] Late Primary (Years 4-6)
[ ] Early Secondary (Forms 1-2) [ ] Late Secondary (Forms 3-5)
[ ] Post Secondary
[ ] University

15) How many years in total have you worked as a teacher?

Final Comments, Suggestions, Recommendations, etc.

16) Any further comments?

17) If you wish to receive a copy of this study’s results, and/or to provide more detailed information on your opinions on this topic, please contact the researcher.
Appendix C: Interview Guide - Proposed Field Questions Outline

1. Can you please tell me more about yourself, and what you do in your profession and where do you do it?
   a. Can you please tell me more about how you go about this?

2. What would you like to accomplish with your teaching practice?
   a. Can you please tell me more about where, when, and how you plan to achieve these goals?

3. What are the biggest issues you have concerning your teaching career?
   a. And in the classroom?
   b. And with administrative issues?

4. What are your most compelling and/or immediate constraining issues?
   a. Can you please elaborate on when, where, and how these affect you?
   b. Do you have any suggestions for solutions to these issues?
   c. Any comments regarding time constraint issues?

5. What are your thoughts on active learning methodologies, such as inquiry-based learning?

6. What are your thoughts on the use of Formative Assessments for assessing learning progress of students, as well as for learning?

7. What are your thoughts on Malta’s relatively low-ranking score on the international TIMMS assessment survey?

8. What are your thoughts on Communities of Practice resources, (for teachers as well as students)?

9. The Maltese NCF regards the current system of partitioning curricula into separate individual subjects delivers a fragmented view of knowledge that is not conducive to holistic education for students. In this regard, the plan proposes an alternative approach of curricular content that envisions learning as occurring through meaningful and challenging experiences.

   What are your thoughts on the importance of the proposed integration of learning areas?
Appendix D: Interview Guide - Curriculum Management and eLearning Department Questions Outline

1. Can you please tell me more about your role in the Directorate of Quality and Standards in Education?
   a. How do you accomplish these tasks?

2. Do you have any long-term goals or objectives you would like to accomplish with your practise?
   a. When, where, how do you intend to achieve these aims?

3. What are the biggest issues or concerns to getting your job done? And, what are your most immediate and/or critical constraining issues?
   a. Do you have any suggestions for solutions to these issues?
   b. Does teacher and/or student apathy play a part in any of these concerns?
   c. Does an apparent lack of active participation and/or agreement amongst any stakeholders besides teachers and students, (e.g. parents, NGOs, etc.), play a part in any of these concerns?

4. The Maltese NCF regards the current educational system of partitioning curricula into separate individual subjects as delivering a fragmented perspective of knowledge that is non-conducive to a holistic education experience for students. In this regard, the NCF plan proposes an alternative curricular content approach that includes cross-curricular themes, such as Education for Sustainable Development and eLearning. What are your thoughts on this?

5. What are your thoughts on the proposed integration of active learning methodologies in classrooms, such as inquiry-based learning to achieving these aims?
   a. How does technology play a role in its facilitation?
   b. Do you have any comments regarding time constraint issues that teachers have brought forward to achieving these aims?

6. Student apathy and boredom are reported to be leading causes of the relatively poor performance results from Maltese students from recently administered international assessment tests. This same issue is also reported as being one of the main reasons why such a limited number of students in Malta choose to pursue higher-level education and careers in fields considered essential to Europe’s continuing competitiveness at the global level.

   Inquiry based learning methodologies are considered by many to be a practical solution to these problems. What are your thoughts on this?
7. What are your thoughts on the value of Communities of Practice as a viable platform for the retraining and continual professional-development of teachers for incorporating newly proposed cross-curricular learning areas and alternative teaching methodologies into the classrooms?

   a. Do you have any comments regarding time constraint issues that teachers have brought forward to utilising these resources and applying what they have learned from them?

   b. What are your thoughts on establishing links through these types of resources with other countries that have successfully made the transition that Malta is now attempting? To what extent have initiatives been brought forward in this regard?

   c. What are your thoughts on providing some level of access to outside stakeholders through these resources for teachers to incentivising more active and enthusiastic participation from stakeholders?