CREATIVE LITTLE SCIENTISTS:
Enabling Creativity through Science and Mathematics in Preschool and First Years of Primary Education

D3.2 Report on Mapping and Comparing Recorded Practices

ADDENDUM 7 of 13:
National Report on Approaches in Maltese Policy

Author:
Suzanne Gatt, University of Malta, Malta

www.creative-little-scientists.eu

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Contact Information
Coordinator
Ellinogermaniki Agogi, Greece:
Dr. Fani Stylianidou

Lead partners for this deliverable
Institute of Education, University of London, UK
Dr. Esmé Glauert, Dr. Andrew Manches

Website: http://www.creative-little-scientists.eu

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Executive Summary

Malta is a small country with only about 450,000 inhabitants. The yearly cohort of births is about 3800-4000. Compulsory education in Malta ranges from age 5 years. However, children can start pre-school, known as kindergarten, at the age of 3. Two years of kindergarten exist before compulsory schooling. The majority of children attend pre-school, with over 85%, starting at 3 years old and over 90% by the age of 4 years. Child-care at earlier age is also present even if supply is less than demand.

Education in Malta and is provided by three sectors: the State 60%, the Catholic Church 30%; and the Independent sector 10%. It is regulated by the Education Act which allows the Minister of Education to regulate the curriculum provided in schools. The National Minimum Curriculum of 1999 is the current official legal document regulating the curriculum. In 2011, a proposed National Curriculum Framework for consultation to update the National Minimum Curriculum was published. The policy documents reviewed for this exercise include: National Minimum Curriculum; Towards a Quality Education for All: National Curriculum Framework Consultation Documents 1-4, A Vision for Science Education, Early Childhood Education and Care – A national Policy, National Standards for Child Care Facilities, Draft National Children's Policy, Record of Development and Progress at Kindergarten Level, and National Policy and Strategy for the Attainment of Core Competences in Primary Education.

Both the Curriculum framework and the Vision for Science Education specify the aims and objectives for science education at early years level and advocate the implementation of inquiry-based learning pedagogy at all levels of education. An argument is made to let children develop their knowledge and understanding of the world, as well as develop their scientific skills through engaging with and observing objects, events, animate and inanimate things. Creativity is hardly linked to science in the policy documents reviewed.

There are no specific subject areas at pre-school level, with learning considered holistically. Science and Mathematics are considered as separate subject areas in the compulsory years of early years education. Both science and mathematics are considered to be core subjects in the primary curriculum by the National Minimum Curriculum. Learning outcomes for the early years (including the first two years of compulsory education) focus on the process aspects of doing science, mainly through the inquiry-based approach. Learning methods at pre-school level is informal and involves creating environments, both indoors and outdoors which 'invite children to test their ideas'. There is reference to more structured science activities for the ages 5-10 years, these including the early years within compulsory schooling. Inquiry is considered to include: investigating phenomena and science processes including planning investigations, making predictions, deciding how to check predictions fairly, making observations and taking accurate and reliable measurements, analysing the evidence obtained, critically evaluating evidence, and drawing conclusions; as well as

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communicating scientific knowledge in different ways. The National Curriculum Framework documents talks about creativity coupled with innovation as one of five cross-curricular themes promoted across all subjects.

Teachers are encouraged to use pedagogies which provide direct, hands-on experiences which promote interaction, engagement as well as involvement, considered essential for understanding, recall and development of mental representations. The main learning aspects highlighted included: story-telling; authentic real situations; child-centred approach; problem-solving; social perspective to learning; and using interactive media. In assessment, the approach in science is formative with the mention of experiments, portfolios and story-telling techniques mentioned as examples.

Types of resources identified for the implementation of the new science curricula include: the production / selection of interesting and attractive curriculum materials; and adequate laboratory facilities, ICTs, equipment, chemical and biological resources, as well as suitable software, learning guides and other curriculum materials that are relevant to the local context. There is also a shift in the vision of learning towards socio-cultural learning theories which emphasise the importance of socio-cultural experiences in influencing development and that theories about learning suggest that students learn best when they engage with each other and learn from one another where learning occurs groups.

Creativity was barely tackled in the documents with respect to science, and particularly so in the case of the Vision for Science education.

There is a demarcation at the present stage in the initial teacher-training required to teach at pre-school level and at compulsory stage. The national legal framework regulating teacher qualification level at compulsory level is the Education Act and requires teachers to be at Bachelor level. In the pre-school years the main initial teacher-training is at vocational level. There has been the development of a Bachelor's degree in the Early Years following this policy document, but teacher qualification requirements at this level have not changed. The duration of the courses are usually of duration of 2 years each for the vocational courses and 4/5 years for the Bachelors courses. All the courses have both a content and practice component aspect. The teacher-training staff for initial teacher-training are required to have experience in the educational field as well as higher post-graduate studies than the course level being taught. Teachers are requested to follow one in-service course every two years, and at times they are called for specific training.

Overall, more attention is being given to the early years in recent policy documents, with sections dedicated specifically to the early years in contrast to the primary years of education. However, the distinction between the two is not yet clear. Science is given particular attention, this mainly due to the publication of the policy document Vision for Science Education.

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1. Introduction

1.1 Aims of national report

This main aim of this National Report is to map existing approaches, as recorded in public policy documents and official statements of policy, to the teaching, learning, and assessment of science and mathematics in the early years and to teacher education in early years mathematics and science, in Malta. This report has been prepared as part of Work Package 3.2 of the Creative Little Scientists project (D3.2 Report on Mapping and Comparing Recorded Practices) which aims to map and compare policy within and between European partner countries. The main research question for this phase of the project was: How is teaching, learning and assessment of science and mathematics conceptualised? What role does creativity play in these?

In order to analyse Maltese policy documents, this report draws upon previous reports delivered in the Creative Little Scientists Project, the D2.2 Conceptual Framework and D3.1 List of Mapping and Comparison factors, which identified key dimensions pertinent to the role of creativity in early science and mathematics. As well as providing a structure for this report and facilitating comparison with other European policies, these frameworks help identify inconsistencies and tensions in the key policy messages within Maltese policy.

1.2 Defining terms

Three terms often used in this report that would benefit from defining are: 'policy', 'curriculum', and 'creativity'.

1.2.1 Policy

The term 'policy' is used in this report to refer to policy texts, which Ozga (2000, p.33) defines as any *"vehicle or medium for carrying and transmitting a policy message"*. However, in accordance with the aims of this report, policy will be examined in relation to messages in formal written documentation. These may include either statutory requirements or guidance.

1.2.2 Curriculum

The term 'curriculum' is often used to refer to different aspects of educational policy. In a narrower sense it refers to the content and activities prescribed. In contrast, the term can be used to capture the wider aspects of educational policy. For example, Alexander (2010, p.250) refers to the curriculum as 'what is intended to be taught and learned overall (the planned curriculum); what is taught (the curriculum as enacted); what is learned (the curriculum as experienced)'. In a similar way, Van den Akker (2007) describes three levels of curriculum policy: what is intended (the ideal and formally written), what is implemented (perceived and enacted by practitioners) and what is attained (experiences and outcomes of learners). In this light, policy texts are an element of the intended or planned curriculum: what is formally written.

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1.2.3 Creativity

As reported in the *Conceptual Framework* (D2.2), the *Creative Little Scientists* project indicates a focus on little c, or personal, or everyday, creativity, i.e. 'purposive imaginative activity generating outcomes that are original and valuable in relation to the learner'. In the *Literature Review of Science and Mathematics Education* (Addendum 1 of 4 of D2.2 *Conceptual Framework*) in pre-school and early years of primary school, the following definition is used in relation to being creative in science and mathematics: 'to generate alternative ideas and strategies as an individual or community, and reason critically between these'.

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2. Overview of National Early Years Education Provision and Policy

Malta is a small country with only about 450,000 inhabitants. The yearly cohort of births has been about 3800-4000 babies since 2008[1]. The Law which governs education provision in Malta is the Education Act[2] . This Act specifies compulsory education to include any children of age from five years to fifteen years, both inclusive, that is, if children have attained the age of five years and have not attained the age of sixteen years, they are obliged to attend school. All children who turn five years by the end of the year i.e. 31st December are placed in the first year of compulsory education which starts in September of the year. Primary Education is 6 years long with the first two/three years considered to be early-years education. Education Law in Malta is regulated by the Education Act of 1988 which is continually updated (last update in 2012). This legislation lays down the role and responsibilities of the Minister of Education in regulating compulsory education, as well as describes how major State education establishments are organised and governed. Among the important aspects of education, this Act gives the Minister of Education the responsibility of specifying the National Minimum Curriculum for all children in Malta.

2.1 Child-care provision

Child-care centres are available for children younger than 3 years. Various childcare centres have been opened both by the Public and Private Sector in recent years and all conform to the National Standards for Childcare Centres[3]. Regulation of Childcare centres falls under the responsibility of the Ministry of the Family. Provision of child-care at a younger age than 3 years in Malta is limited. A number of schools, particularly Independent schools, offer child-care, often from an age of one and a half years old. One also finds a number of state child-care centres either close to work places or else attached to primary schools. There are also a number of private child-care centres. The supply of service is less than the need.

The National Standards for childcare services[4] indicates the allowed child-carer ratio to be the following:

- 3:1 for children aged 0-12 months
- 5:1 for children aged 13-24 months
- 6:1 for children aged 25-36 months

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1 National Statistics Office, (2011), Press Release: International Day of Families 2011, 13 May 2011, Valletta: National Statistics Office, http://www.nso.gov.mt/statdoc/document_file.aspx?id=3027 accessed 3/6/2012.

2 Government of Malta, 2011, CHAPTER 327: EDUCATION ACT, ACT XXIV of 1988, as amended by Legal Notices: 98 of 1988, 63, 64, 135 and 136 of 1989, 153 and I56 of 1990 and 10 of 1991; Act X of 1991; Legal Notices: 66 and 153 of 1991, 67, 89, 90 and 105 of 1992, 21 and 117 of 1993, 5, 12, 110 and 149 of 1994; Act II of 1995; Legal Notices: 79 of 1995 and 165 of 1996; Act XVIII of 1997; and Legal Notices: 177, 181, 183, 184, 189 and 202 of 1997, 9, 30 and 172 of 1998, and 41, 101 and 102 of 1999; Acts VI of 2001, XVIII of 2002 and III of 2004; Legal Notices 144 and 363 of 2004; Acts II of 2005 and XIII of 2006; Legal Notices 293 of 2006, and 327, 391 and 424 of 2007; Act XXXII of 2007; Legal Notices 212 of 2008, and 21 and 85 of 2009; Act XXIII of 2009; and Legal Notices 102, 418, 419 and 515 of 2010, and 150 and 151 of 2011, http://www.justiceservices.gov.mt/DownloadDocument.aspx?app=lom&itemid=8801 accessed 3/6/2012

3 Ministry for Social Policy, (2006), National Standards for Child care Centres, Valletta: Government of Malta.

4 Ministry for Social Policy, (2006), National Standards for Child care Centres, Valletta: Government of Malta. https://www.education.gov.mt/MediaCenter/Docs/1_national_childcare_center_policy_en.pdf accessed 5/6/2012.

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- 6:1 for children of mixed ages.

There is no official curriculum for child-care provision. However, the national standards indicate that a learning environment be provided to children. Qualified caregivers are expected to *'talk, listen to and otherwise interact with children and cater for their physical, social, intellectual and emotional needs. Activities and opportunities for play are organised so as to meet the full range of children's developmental needs'* (pg. 12)[5]

The standards also indicate that children are cared for by a designated carer who is responsive to their individual needs. Children are also to have the opportunity to participate in various activities to encourage their physical activity and playing, and given the opportunity for self-expression. They are to be allowed to play individually as well as to interact with other children. The staff members are also expected to consult with the parents on the progress and development of the children on a regular basis.

2.2 Pre-school education

Although compulsory education starts at the age of 5, children can start pre-school, or what is commonly known as kindergarten, at the age of 3. Two years of kindergarten exist before compulsory schooling. The majority of children attend pre-school, with over 85%, starting at 3 years old and over 90% by the age of 4 years. Regulation of Kindergarten education falls mainly under the Ministry of Education and Employment, even if policy documents issued by the Ministry on social policy on childcare in the early years talk also about this age group. Kindergarten education in Malta is provided by the State, the Catholic Church, and Independent sectors. The Ministry of Education and Employment is responsible to provide and regulate kindergarten institutions. State kindergartens form part of primary schools. In fact, it also provides the licensing of and regulates education provision by Independent providers. Intake into State pre-school is three times a year, at the beginning of each term (autumn, winter, and spring). Parents can send their children as soon as they turn 3. In the case of other providers, many kindergartens start children with the start of the academic year in September.

The table below gives the number of children attending kindergarten school in the different providers in 2011.

5 Ministry for Social Policy, (2006), National Standards for Child care Centres, Valletta: Government of Malta. https://www.education.gov.mt/MediaCenter/Docs/1_national_childcare_center_policy_en.pdf accessed 5/6/2012.

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Kindergarten populations, by school sector, June 2011			
	Kindergarten 1	**Kindergarten 2**	**Totals**
State Schools	3,334	2,387	5,721
Church Schools	387	761	1,148
Independent Schools	765	690	1,455
Totals	4,486	3,838	8,324

Table 1: Number of children attending kindergarten school in the different providers[6]

At kindergarten level, children are generally grouped according to their age (in terms of the months born). In Kindergarten 1 classes there is one Kindergarten Assistant for every fifteen pupils while this ratio rises to one adult for every twenty four-year-olds in Kindergarten 2[7]. Children with special educational needs in kindergarten classes are supported by a Learning Support Assistant. A child may need one-to one full-time support, full-time support, shared in the same class support or shared support.

At pre-primary no formal teaching takes place. Educational activities organised are aimed at developing children's social attitudes, language and communication skills, cognitive skills as well as creative expression in preparation for primary education. Aspects of science and mathematics are included within cognitive skills. The Record of Development and Progress at Kindergarten Level is the formal evaluation/assessment tool used from school year 2011/2012. Assessment is done by the teacher through observation and targets the development of skills.

2.3 Early years as part of compulsory education

Primary Education, of which the first two/three years[8] (up to the age of 7/8), are considered to be also part of early-years education in Malta and is provided by three sectors: the State, the Catholic Church; and the Independent sector. The independent sector refers to the private education providers and every provider needs to obtain a license as indicated by the Education Act. The distribution of provision is around 60% by the State; 30% by the Church; and 10% by the independent sector.

The maximum number of pupils in each primary class is thirty, even if in practice the number is much smaller, with an average of 17 children per class. This maximum number is reduced to twenty-six if a student with a statement of needs is present in the class.

6 Eurydice database https://webgate.ec.europa.eu/fpfis/mwikis/eurydice/index.php/Malta:Early_Childhood_Education_and_Care accessed 7/6/2012

7 Eurydice database; https://webgate.ec.europa.eu/fpfis/mwikis/eurydice/index.php/Malta:Organisation_of_Programmes_for_Children_over_2-3_years accessed 7/6/2012

8 It is to be noted that some policy documents, like the National Curriculum Framework indicate the first two years of primary as early years, other documents group years 1-3 in primary as one cycle, reflecting the prior considering of the first three years as early years.

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Children have one class teacher who is responsible for the teaching of core subjects and in making sure as far as possible that the teaching in one area is integrated with the other areas. There is a specific curriculum for both mathematics and science, both of which are to be taught by the class teacher. In the case of science, there exist a number of peripatetic teachers who provide support to primary teachers in science at primary, among them also those teaching the early years. Assessment in the first years of primary is formative. A policy document[9] specifies the core competences to be achieved and the method for assessing the development of the mathematical skills. Science in the early years is treated in the policy document on the vision for science education[10], and which promoted an inquiry-based approach in science from the early years.

2.4 Financing

The Government fully finances States Schools. It also covers teachers' salaries and other expenses for Church Schools. It has this year also started allocating a budget for the development of Independent schools. State Schools are free of charge; Church schools usually require an annual donation which should be around 600euro a year; Independent schools are against payment with fees of around 700-1200 euro per term (at 3 terms per year).

The National Minimum Curriculum[11] is the current official legal document which regulates what type of curriculum is to be provided as a minimum to all children within compulsory age in Malta. This implies that the National Minimum Curriculum states the type of curriculum that children are to receive between the ages of 5-16 years. The current National Minimum Curriculum has been in force since 1999. In 2011, government has published four documents as part of a proposed National Curriculum Framework for consultation. These documents were intended to be an update to the National Curriculum Framework and would eventually replace the current National Minimum Curriculum[12] once these documents have been finalised.

9 Ministry of Education, Employment and the Family, (2009), National Policy and Strategy for the attainment of core competences in Primary Education, Valletta:Ministry of Education, Employment and the Family.

10 Ministry of Education, Employment and the Family, (2011), Vision for Science Education, Valletta:Ministry of Education, Employment and the Family.

11 Ministry of Education, (1999), National Minimum Curriculum, Malta:Government of Malta

12 Ministry of Education, (1999), National Minimum Curriculum, Malta:Government of Malta

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3. Research Questions and Methodology

3.1 Research Question

The main research question for Work Package 3.2, adapted for this National Report is:

How is teaching, learning and assessment of science and mathematics in the early years conceptualised in policy in Malta?

The sub questions identified within this overarching research question were:

- *What is the role of creativity in the way teaching, learning and assessment of science and mathematics in the early years are conceptualised in policy in Malta?*
- *What are the main similarities and differences between mathematics and science in the way teaching, learning and assessment of these areas in the early years are conceptualised in policy in Malta?*
- *What are the main similarities and differences between pre-school and school phases in the way teaching, learning and assessment of science and mathematics in the early years are conceptualised in policy in Malta?*

In order to examine how teaching, learning and assessment are conceptualised across Maltese policy, this report drew upon the framework of curriculum components *'the vulnerable spider web'* (see van den Akker, 2007) that identifies the following key questions related to student learning:

- Rationale or vision: Why are children learning?
- Aims and objectives: Toward which goals are children learning?
- Content: What are children learning?
- Location: Where are children learning?
- Learning activities: How are children learning?
- Teacher role: How is the teacher facilitating learning?
- Materials and resources: With what are children learning?
- Grouping: With whom are children learning?
- Time: When are children learning?
- Assessment: How to measure how far children's learning has progressed?

As well as factors relating to the curriculum, the *Conceptual framework* (D2.2) identified Teacher factors as a significant in teaching, learning and assessment approaches in the classroom. This is further indicated in the D3.1 *List of Mapping and Comparison factors* derived from the *Conceptual Framework*. Consequently, this project set out to examine Teacher factors addressed in policy, in particular the approaches documented in relation to both:

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- Initial Teacher Education: What are the requirements for initial teacher education?
- Continuing Professional Development: What are the opportunities for Continuing Professional Development?

3.2 Method

3.2.1 Data selection

There were a number of policy documents which were reviewed. Some of these documents have been published and are currently implemented and in the process of implementation. Other policy documents are currently in the consultation phase and may change by the time that they are finalised. However, they reflect the direction currently being proposed by government. Most documents tackle education provision on a general level. One policy document tackles core competences, while another tackles science. The policy documents reviewed were the following:

- ***National Minimum Curriculum***[13] (1999) is the current legal document which states the minimum level of education which each and every child in Malta is entitled to. This document is based on a number of principles and objectives. This document has been under review in the past three years, but as yet has not been officially updated. Among other main aspects, this document reconfirms mathematics as one of the core subjects as well as recognises science as a core subject. The document also describes science education in terms of knowledge, skills and attitudes and advocates the constructivist approach;
- ***Towards a Quality Education for All: National Curriculum Framework Consultation Document 1– Executive Summary***[14] (2011): This document provides an executive summary of all the details of the National Curriculum Framework i.e. the rationale and components; the three cycles; and the implementation plan. It is considered to provide an overview of the update to the National Minimum Curriculum and considers education provision on a general level, highlighting the main perspectives;
- ***Towards a Quality Education for All: National Curriculum Framework Consultation Document 2*** **- Rationale and Components**[15] **(2011):** This document includes a detailed introduction to the theoretical background against which the proposals of the national curriculum framework were conceptualised. It presents the rationale and main principles on which the National Curriculum Framework is based. This document is currently in consultation phase and the final version has as yet not been published. The documents related to the National Curriculum Framework are not yet legally binding;

13 Ministry of Education, (1999), National Minimum Curriculum, Malta:Government of Malta

14 Ministry of Education, Employment and the Family, (2011), Towards a Quality Education for All: National Curriculum Framework Consultation Document 1– Executive Summary, Malta:Government of Malta

15 Ministry of Education, Employment and the Family, (2011), Towards a Quality Education for All: National Curriculum Framework Consultation Document 2 - Rationale and Components, Malta:Government of Malta

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- ***Towards a Quality Education for All: National Curriculum Framework Consultation Document 3* - The Three Cycles: The Early Years, The Primary Years and the Secondary Years [16](2011):** This document presents details of how the national curriculum framework is to be reflected in the learning programme for children and young people in the early years, the primary years and the secondary years. As in the case of the other National Curriculum Framework documents, the document is still in consultation phase;
- ***Towards a Quality Education for All: National Curriculum Framework Consultation Document 4* - The Way Forward[17] (2011):** This document presents a summary of the recommendations of the national curriculum framework and identifies the implications which result. It presents ideas about the management of change based on an understanding of a change management process. As in the case of the other National Curriculum Framework documents, the document is still in consultation phase;
- **A Vision for Science Education – Consultation Document[18] (2011):** This document presents the country's vision for the development of science education in Malta from the early years (age 3) to the end of compulsory education at secondary level. This document promotes the adoption of Inquiry-based learning in science across all levels. This document is still in the consultation process;
- **Early Childhood Education and Care – A national Policy?[19] (2006)**: This document presents government's vision and direction with respect to the development of child care services as well as the provision of early childhood education. This document states the commitment to raise the training of early childhood educators to a professional level;
- **National Standards for Child Care Facilities[20] (2006)**: This document states the standards which every child care centre needs to fulfil in all aspects when running a child care centre in Malta. This document is in force and implemented;
- **Draft National Children's Policy[21] (2011)**: This policy was drawn up by the Commission for Children and discusses children's welfare in Malta. One particular chapter focuses on fostering creativity among children. This document is still at consultation stage;
- **Record of Development and Progress at Kindergarten Level[22] (2011)**: This document is the official assessment document which each and every kindergarten assistant in State

16 Ministry of Education, Employment and the Family, (2011), Towards a Quality Education for All: National Curriculum Framework Consultation Document 3 - The Three Cycles: The Early Years, The Primary Years and the Secondary Years , Malta:Government of Malta

17 Ministry of Education, Employment and the Family, (2011), Towards a Quality Education for All: National Curriculum Framework Consultation Document 4 - The Way Forward , Malta:Government of Malta.

18 Ministry of Education, Employment and the Family, (2011), Towards a Quality Education for All: National Curriculum Framework Consultation Document 4 - The Way Forward, Malta:Government of Malta.

19 Ministry for Social Policy, (2006), Early Childhood Education and Care – A national Policy?, Malta:Government of Malta

20 Ministry for Social Policy, (2006), National Standards for Childcare Facilities, Malta:Government of Malta

21 Ministry for the Family,(2011), Draft National Children's Policy, Malta:Government of Malta

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schools in Malta. It is to be filled in for each and every child and targets a wide variety of skills which are to be developed in the pre-school stage. This document has started being used this academic year (2011/2012);

- **National Policy and Strategy for the Attainment of Core Competences in Primary Education[23] (2009):** This policy lists the core competences which children in primary education are to develop. Competences in literacy in Maltese and English, numeracy, literacy. This document is currently being implemented.

In addition to these policy documents, additional documents and sources of information were consulted in order to map as best possible, the state of provision of science and mathematics education and the promotion of creativity in the early years.

3.2.2 Survey tool

A survey tool was developed in order to quantify judgments about the extent to which particular approaches were emphasised in Maltese policy documents. Whilst quantifying approaches is problematic, this was considered important in order to support comparisons between European partners, as well as provide an informative representation of approaches within Maltese documents.

The survey tool comprised of two main sections: one relating to Teaching, Learning, and Assessment approaches. This was subdivided according to the dimensions of curriculum described previously, namely: *Rationale; Aims; Content; Location; Learning activities; Teacher role; Materials and resources; Grouping; Time.* The other section focused on Teacher Education, subdivided into Initial Teacher Education and Continuing Professional Development.

The sections were comprised of a series of questions about approaches advocated in national policy. In each section researchers in partner countries were asked to provide background information or evaluate the extent to which particular approaches were, or were, not emphasised across policy documents, and also the extent to which the role of creativity is emphasised in these approaches. These approaches listed were carefully drawn from prior work in the Creative Little Scientists project, namely the D2.2 the Conceptual Framework and the D3.1 List of Mapping and Comparison factors, which drew attention to significant approaches characteristic of creativity in early years science and mathematics. A summary of the emphasis ratings given for Maltese policy is presented in Appendix A; information on the background sections of the questionnaire are integrated into the main text of this report.

[22] Directorate for Quality and Standards in Education, (2011), Record of Development at Kindergartern Level, Malta:Ministry of Education and Employment

[23] Ministry of Education, Employment and the Family, (2009), National Policy and Strategy for the Attainment of Core Competences in Primary Education, Malta:Government of Malta

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4. Approaches to Teaching, Learning and Assessment

This section summarises and reflects upon the findings from the policy questionnaire. The overarching aim is to draw out key messages and highlight any issues, tensions or criticisms that may exist for different aspects. Reflecting the questionnaire, the findings are reported under headings taken from van den Akker's framework of components (van den Akker, 2007) as follows:

- Rationale or Vision
- Aims and Objectives
- Content
- Learning Activities
- Teacher Role / Location
- Materials and Resources
- Groupings
- Time
- Assessment

4.1 Rationale or Vision

It is to be noted that the current rationale and vision for science education which is in force in schools in Malta is the current National Minimum Curriculum[24]. However, this document was published in 1999 and reflects mainly the view of science education at the time. When this document was drawn up, it tackled mainly the compulsory years and talks about science education in a holistic way for the ages 5-16 and only considers early years (both pre-school and compulsory age levels in a holistic way). With respect to the kindergarten level, science is not mentioned specifically, but one finds reference to the development, among children, of concepts and information which lead to a greater awareness of the immediate world around them. The concepts identified include those of: time (today, yesterday, tomorrow); quantity, volume and mass; identifying and attributing names to environmental species (plants, animals, people); use of comparative (more/less, large/small, longer/shorter); the identification and use of words which describe an item's characteristics (e.g. colours, shape, size); description of an object's location (down, up, inside); matching of objects. These include a combination of mathematics and science aspects.

In 2011, five new policy documents[25] considered as updates of the National Minimum Curriculum were published for consultation and with the aim of replacing the current

[24] Ministry of Education, (1999), National Minimum Curriculum, Malta: Government of Malta.

[25] Ministry of Education, Employment and the Family, (2011), Towards a Quality Education for All: National Curriculum Framework Consultation Document 1– Executive Summary, Malta:Government of Malta
Ministry of Education, Employment and the Family, (2011), Towards a Quality Education for All: National Curriculum Framework Consultation Document 2 - Rationale and Components, Malta:Government of Malta

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National Minimum Curriculum. While four of these policies present a National Curriculum Framework and considers education of children from a number of different aspects, among them including science, the fifth policy document[26] focuses on the country's vision for science education specifically. On carrying out a review of the documents, one can note that there is consistency in the policy with respect to science education, and with respect to science and mathematics education in the early years.

There is reference to science education at both pre-school and compulsory age early education in the National Curriculum Framework policy documents, the vision for science education, as well as in the record of work for kindergarten children[27]. The Vision for Science education identifies the purpose of science education in Malta to be twofold: the dirst is to develop the scientific literacy of all learners enabling them to make informed decisions as they strive to improve their quality of life and to understand the changing contexts. Besides imparting knowledge, science education also has the purpose of also developing skills and ways of thinking that are important for decision-making and problem solving using an evidence-based approach. The second purpose is to produce scientists through promoting and encouraging students to take science as specialisation in their secondary level of education. All the documents recognise science as one of the core subjects. They also all tackle the inclusion of science in the early years curriculum.

The role of creativity did not change much between the National Minimum Curriculum and the new policy documents. One still finds that although the documents do tackle and promote creativity, this is mainly linked with Arts education, and one hardly finds any reference to enhancing creativity through science or mathematics. However, one finds that in the recent National Curriculum Framework, there is reference to promoting creativity and innovation as a cross-curricular theme which cuts across the curriculum. However, when one reads the policy document on the vision for science education, there is no reference to creativity, and only one reference to innovation is made, this with respect to secondary level education.

4.2 Aims and Objectives

The aims and objectives of science education in the National Minimum Curriculum[28] have already been highlighted within the rationale. It is more relevant to look at what the new policy documents, the Curriculum Framework as well as the vision of science education, are

Ministry of Education, Employment and the Family, (2011), Towards a Quality Education for All: National Curriculum Framework Consultation Document 3 - The Three Cycles: The Early Years, The Primary Years and the Secondary Years , Malta:Government of Malta

Ministry of Education, Employment and the Family, (2011), Towards a Quality Education for All: National Curriculum Framework Consultation Document 4 - The Way Forward , Malta:Government of Malta.

[26] Ministry of Education, Employment and the Family, (2011), Vision for Science Education, Malta:Government of Malta

[27] Directorate for Quality and Standards in Education, (2011) Record of Work for Kindergarten Children, Malta:Ministry of Education and Employment

[28] Ministry of Education, (1999), National Minimum Curriculum, Malta:Government of Malta

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proposing as they reflect the way which is being contemplated in Malta for the education system.

It is to be noted that both the Curriculum framework and the Vision for Science Education specify the aims and objectives for science education at early years level. The Vision strongly advocates the implementation of inquiry-based learning pedagogy at all levels of education. It highlights that in the early years children are to be '*provided with different environments and opportunities that stimulate their curiosity; develop their observation skills; support and promote a sense of inquisitiveness; and learn how to ask questions about how and why things work and how to investigate objects and materials and their properties'* (pg.10)[29].

The learning outcomes for science in childcare at ages younger than age of three were not specified. One only finds a general reference in the National Standards for Child Care Provision which states that children are to be provided with learning experiences which '*promote the intellectual curiosity and development of children*' (pg.12)[30]. At kindergarten level, there is reference to *Intellectual Development – Understanding The World We Live In*[31]. Although one does not find direct reference to science but there is mention of the following skills:

- Shows interest in exploring the environment by using all the senses as appropriate;
- Observes, chooses and handles objects and materials;
- Is aware of obvious similarities and differences in the surroundings;
- Constructs in a purposeful way, using toys and objects;
- Is aware of and talks about his/her likes and dislikes in the environment; and
- Asks questions about why things happen.

The learning outcomes for science education at compulsory and in the early years particularly were specified in the vision for science education[32]. When referring specifically to three-four-five year olds, the document makes reference to children's natural curiosity about the world around them and how they still have limited experiences of the world. An argument is made to let children develop their knowledge and understanding of the world, as well as develop their scientific skills through engaging with and observing objects,

29 Ministry of Education, Employment and the Family, (2011), Vision for Science Education, Malta: Government of Education

30 Ministry for Social Policy, (2006), National Standards for Childcare Facilities, Malta: Government of Malta

31 Directorate for Quality and Standards in Education, (2011), Record of Work for Kindergarten Children, Malta:Ministry of Education and Employment

32 Ministry of Education, Employment and the Family, (2011), Vision for Science Education, Malta: Government of Education

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events, animate and inanimate things. There is also reference to developing children's language through the questions and answers which they seek or provide, and when they learn to give labels for objects they encounter. Concepts specified are related to data, shapes and measurement, as well as making comparisons, discovering patterns and identifying properties of objects.

The document then tackles the ages 5+ to 15 together and provides the overall learning outcomes for all the compulsory levels of education which include:

- ***Understanding*** *the world through asking questions about it, and finding ways of answering these questions. This is linked to lead to better understanding of nature and for improving quality of life;*
- ***Investigating*** *phenomena through the process of science by planning investigations, making predictions, deciding how to check predictions fairly, making observations and taking accurate and reliable measurements, analysing the evidence obtained, critically evaluating evidence, and drawing conclusions;*
- ***Communicating*** *scientific knowledge orally, in written format, graphically and using scientific language and using terminology, conventions and techniques appropriate to the task;*
- ***Linking*** *science to everyday life; and* ***Applying*** *if to explain natural phenomena and how things work.* (pg.12)[33]

In discussing science at primary level, focus is placed on inquiry with children participating in meaningful science activities where they connect with the natural world around them and allow them to acquire a sense of their own competence in understanding and doing science.

Creativity is hardly linked to science in the policy documents reviewed. This said, it does not mean that there is no recognition of the value of promoting creativity as part of the educational process of children. However, there appears to be an underlying assumption that science may not be a medium through which creativity can be nurtured and developed. In fact, when one reviews documents related to kindergarten level[34], one find that in the record sheets developed, creative development is specifically linked to the expressive arts, and if one considers the skills identified at these ages (see table below), it is possible to identify activities which are also related to science in the skills related to exploration of materials (statement 2) and using the various senses (statement 3)

[33] Ministry of Education, Employment and the Family, (2011), Vision for Science Education, Malta: Government of Education

[34] Directorate for Quality and Standards in Education, (2011), Record of Work for Kindergarten Children, Malta:Ministry of Education and Employment

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Creative development through the expressive arts ***Stage of development:* 3 – *achieved* 2 – *still developing* 1 – *requires attention***
Explores colour and shape.
* Explores texture, form and space in two or three dimensions through the use of different media
Responds to a variety of sensory experiences
Engages in imaginative play (e.g. with toys, …)
Enjoys exploring sound by selecting and using musical instruments and other objects (e.g. empty bottles, bottles filled with water) and matches movement to music
Attempts to capture experiences, using a variety of different media (e.g. painting a picture, imitating and creating movement, creating role play)

Figure 1: Creative development through expressive arts in the Record of Progress for Kindergarten children in Malta

In the case of the vision for science education[35], one does not find any particular reference to creativity in the documents, and the word is never used. However, there is reference to innovation once with respect to secondary education. In the National Curriculum Framework documents[36], creativity is coupled with innovation, but it is not tackled with science specifically, as it is considered as a cross-curricular theme which is tackled across all the subjects within the curriculum. This is stated for all the levels of education, and thus also includes the early years.

4.3 Content

There are no specific subject areas at pre-school level, but learning is considered holistically as children are presented with experiences through activities. However, one finds that the Vision for Science Education[37] document does talk about science in the early years with young children from the age of three. Otherwise the only specific references identified at pre-school level are to skills and these are identified for the purpose of recording the children's progress and development at kindergarten[38]. The reference to science skills are found within the subheading of ***Intellectual Development – Understanding the World We Live In*** for science. There is also intellectual development in mathematics which is

[35] Ministry of Education, Employment and the Family, (2011), Vision for Science Education, Malta: Government of Education

[36] Ministry of Education, Employment and the Family, (2011), Towards a Quality Education for All: National Curriculum Framework Consultation Document 1– Executive Summary, Malta:Government of Malta

[37] Ministry of Education, Employment and the Family, (2011), Vision for Science Education, Malta: Government of Education

[38] Directorate for Quality and Standards in Education, (2011), Record of Work for Kindergarten Children, Malta:Ministry of Education and Employment

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subdivided into three main areas: numbers; shapes and space; and problem-solving. The skills identified within each subheading are provided in the tables overleaf.

As can be noted, the mathematical skills identified are more detailed than those for science and reflect the initial understanding and use of mathematical concepts on which compulsory education builds at a later stage.

Intellectual Development - Mathematics
Stage of development:* 3 – *achieved* 2 – *still developing* 1 – *requires attention
Says and uses the number names in order in stories, finger play, songs/rhymes and in other familiar contexts
Counts reliably up to 10 everyday objects
* Orders numbers up to 10
* Recognises numerals 1 to 9
In practical activities begins to use the vocabulary involved in adding and subtracting
Uses some of the vocabulary involved in addition and subtraction in stories, finger play and songs/rhymes
* Says number names in order up to 10, forwards and backwards
Uses language such as 'more' or 'less' in various contexts
* Finds one more or one less than a number from 1 to 5 objects
* Finds one more or one less than a number from 1 to 10 objects
* Begins to relate addition to combining two groups of objects and subtraction to 'taking away'
* Recognises differences in quantity when comparing groups of objects
* Uses language such as 'greater', 'smaller', heavier' or 'lighter' to compare quantities

Figure 2: Intellectual development – Mathematics in the Record of Progress for Kindergarten children in Malta

Intellectual development refers to aspects of number and covers both basic ability to count to ten as well as concepts such as more or less, and the use of mathematical language to express mathematical quantities and comparisons.

MATHEMATICS - Shapes and Space
Stage of development:* 3 – *achieved* 2 – *still developing* 1 – *requires attention
* Talks about, recognises and recreates simple patterns
* Experiments with various shapes and shows some mathematical awareness
Sorts and matches shapes and talks about the criteria used
* Recognises and talks about shapes in simple models, pictures and pattern
* Begins to talk about features of solid objects and flat shapes
* Uses language such as 'circle' or 'bigger' to describe the shape and size of solids and flat shapes
Uses everyday words to describe position

Figure 3: Maths- shape and space in the Record of Progress for Kindergarten children in Malta

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One particular set of mathematics skills focuses specifically on knowledge and understanding of shapes and space, and ranges from recognition of simple patterns to the identification of some of the features of solids and flat shapes. There is also reference to problem-solving which relates to the solving of simple problems related number, shape and space (as indicated below).

MATHEMATICS - Problem Solving
Stage of development:* 3 – *achieved* 2 – *still developing* 1 – *requires attention
* Uses developing mathematical ideas and methods to solve practical problems related to Number, Shape and Space

Figure 4: Mathematics-Problem solving in the Record of Progress for Kindergarten children in Malta

Science and Mathematics are considered as separate subject areas in the compulsory years of early years education. Both science and mathematics are considered to be core subjects in the primary curriculum by the National Minimum Curriculum. In the case of the National Curriculum Framework, this is again confirmed, with particular emphasis to science which despite the National Minimum Curriculum, in practice has never really taken off regularly in local state primary schools.

Details about content in science education in the first years of primary education (upper ages of early years) can be found in the policy document – Vision for Science Education[39]. When talking about learning outcomes for the early years (including the first two years of compulsory education) the document avoids focusing on the content aspect of science but focuses more on the process aspects of doing science, mainly through the inquiry-based approach. One finds that the document refers to the planned science curriculum and how it will identify general learning outcomes for science which focus on understanding, investigating, communicating, linking and applying science. There is no reference to specific topic areas.

It is acknowledged that science in the Early Years potentially offers many opportunities for inquiry with three, four and five-year-old children who are naturally curious and eager to find out how things work and function. It encourages teachers to promote among children to *use all their senses to acquire new information as well as to expand their prior knowledge about themselves, their immediate environment, within and outside the home as well as their surroundings* (pg.41)[40]. In line with inquiry, children are to be involved in activities where they observe, examine, try things out, predict, hypothesise and ultimately obtain results to be able to make associations, remember, recall, understand and consequently develop cognitively and intellectually.

39 Ministry of Education, Employment and the Family, (2011), Vision for Science Education, Malta: Government of Education

40 Ministry of Education, Employment and the Family, (2011), Vision for Science Education, Malta: Government of Education

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Suggestions for activities refer to having a discovery area in the classroom with materials which encourage children to become engaged and involved as well as conducting out-door activities where children can look for and observe natural phenomena, all of which should contribute to a rich Early Years programme. Scientific skills specified with some references to science content include:

- identifying properties and characteristics (e.g. sand, rocks & shells; leaves, seeds & flowers);
- observing and keeping records (e.g. weather patterns – rainy, cloudy, windy, sunny days);
- gaining insights into concepts of weight, volume, gravity and pressure (e.g. through water play, with funnels, containers, rubber tubing);
- reading or listening to excerpts from articles/books/newspaper leading to a discussion about environmental issues and possible solutions (e.g. waste and conservation of paper, electricity, water). (Pg. 41)[41]

The science content mentioned is only provided as contexts and examples and is in line with the document's statement that the focus of science education is mainly on the inquiry-based approach. Having stated this, there is still the intention to draw up a syllabus for science in the early years, but as stated, the intention is to provide a degree of flexibility to teachers to organise activities that are related to the school context and children's interests.

Science and Mathematics

The National Curriculum Framework documents do not elaborate much on science and refer to the Vision for science education for details. The document on the three education cycles[42], however, does make reference to mathematics and content areas to be targeted at the early years level. The document makes reference to:

- essential numeracy skills which support them in daily life;
- key numeric competences that include the understanding of concepts, principles, and applications;
- creative approaches in the four strands, namely, use of number, measurement, space and shapes and data handling; and
- Logical thought and engagement with investigative processes that lead to solutions

41 Ibid.

42 Ministry of Education, Employment and the Family, (2011), National Curriculum Frameword - document 3 - The Three Cycles: the Early Years, the Primary Years, the Secondary Years, Malta: Government of Malta

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The aims of numeracy targeted in the policy include basic competences[43] and identify these to be the following (by the end of primary education):

- to develop a positive attitude towards mathematics so that children enjoy learning the subject in an interesting and attractive manner;
- to enable learners to confidently use correct mathematical language and vocabulary;
- to enable learners to express themselves mathematically and to converse about the subject meaningfully;
- to enable learners to develop clear logical and sequential thinking;
- to ensure that every learner acquires a strong foundation in basic mathematical skills; and
- to equip learners with skills that will enable them to apply problem solving strategies to real and unfamiliar situations both in and outside the school.

4.4 Learning Activities

The National Minimum Curriculum[44] which is still the main legal document reflects the date when it was published (1999) with respect to pedagogical approaches to teaching science as it refers to constructivism and conceptual change. This document speaks about science education in general and does not tackle the early years specifically.

The National Curriculum Framework[45] being proposed reflects a more recent educational approach, as it endorses the inquiry-based learning approach for all ages which is being proposed in the Vision for Science Education document. The Vision for Science Education[46] is thus the main policy document which discusses the pedagogical approaches to be adopted in the classroom in science, even in the early years. This document states clearly that the main pedagogy which is being advocated in all years of schooling, even in the early years, is that of Inquiry-based learning. The vision for early years refers to *providing children with different environments and opportunities that stimulate their curiosity, develop their observation skills, support and promote a sense of inquisitiveness, and learn how to ask questions about how and why things work and how to investigate objects and materials and their properties* (pg10). The policy document reiterates that there is a need for a shift in the pedagogy being adopted by teachers in science and to recognise the sociological aspect of learning where children learn in groups. It is clearly stated that *the model of instruction which best reflects these ideas about learning is inquiry based learning which involves the use of a planned sequence of instruction that places the students at the*

[43] Ministry of Education, Employment and the Family, (2011), National Strategy for the attainment of core competences in primary education, Malta:Government of Malta

[44] Ministry of Education, (1999), National Minimum Curriculum, Malta: Government of Malta.

[45] Ministry of Education, Employment and the Family, (2011), Towards a Quality Education for All: National Curriculum Framework Consultation Document 1– Executive Summary, Malta:Government of Malta

[46] Ministry of Education, Employment and the Family, (2011), Vision for Science Education, Malta: Government of Education

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centre of their learning experiences, encouraging them to explore, construct their own understanding of scientific concepts and relate to other concepts (pg. 13)[47]. The inquiry identified is the 5E model which allows pupils to Engage, Explore, Explain, Elaborate, and Evaluate. This statement is made with respect to students of all ages (from pre-school to end of compulsory education).

The learning methods of inquiry promoted at pre-school level referred to tends to be informal and refer to creating environments, both indoors and outdoors which '*invite children to test their ideas*' (pg. 39). The document encourages having *a discovery area in the classroom with materials which encourage children to become engaged and involved as well as conducting out-door activities where children can look for and observe natural phenomena. There is recognition that children can easily begin to identify properties and characteristics (e.g. sand, rocks & shells; leaves, seeds & flowers); observe and keep simple records (e.g. weather patterns – rainy, cloudy, windy, sunny days); gain insights into concepts of weight, volume, gravity and pressure (e.g. through water play, with funnels, containers, rubber tubing); read or listen to excerpts from articles/books/newspaper leading to a discussion about environmental issues and possible solutions (e.g. waste and conservation of paper, electricity, water)*. (pg. 39)[48]

There is reference to more structured science activities for the ages 5-10 years, these including the early years within compulsory schooling. Inquiry is considered to include: investigating phenomena and science processes including planning investigations, making predictions, deciding how to check predictions fairly, making observations and taking accurate and reliable measurements, analysing the evidence obtained, critically evaluating evidence, and drawing conclusions; as well as communicating scientific knowledge in different ways. Practical examples of pedagogical approaches within inquiry include: students encouraged to engage with science through investigations where they ask questions, observe, gather data and draw conclusions and engage in discussions and the use of multimedia resources to find information. The use of storytelling and drama in order to link science to daily living and the local environment in which they live are mentioned specifically.

Creativity in Science education

It is to be noted that the Vision for Science Education policy document does not refer to creativity specifically at any point. There is rather reference to inquisitiveness and curiosity. The National Curriculum Framework documents[49] do talk about creativity, but this is coupled with innovation. Creativity and innovation is listed as one of the five cross-curricular themes. This implies that creativity and innovation are to be promoted across all

47 Ibid.

48 Ministry of Education, Employment and the Family, (2011), Vision for Science Education, Malta: Government of Education

49 Ministry of Education, Employment and the Family, (2011), Towards a Quality Education for All: National Curriculum Framework Consultation Document 1– Executive Summary, Malta:Government of Malta

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subjects. However, the Curriculum Framework documents do not tackle any particular curricular subject and thus one does not find any specific reference to promoting creativity within or through science or mathematics education. It is also to be noted that in the early years guidelines[50] for preschool level to creative development, but this is related to creative development through the arts and thus does not reflect any reference to science (see figure below).

Creative Development
Stage of development: 3 – achieved 2 – still developing 1 – requires attention
Explores colour and shape.
Explores texture, form and space in two or three dimensions through the use of different media
Responds to a variety of sensory experiences
Engages in imaginative play (e.g. with toys, …)
Enjoys exploring sound by selecting and using musical instruments and other objects (e.g. empty bottles, bottles filled with water) and matches movement to music
* Attempts to capture experiences, using a variety of different media (e.g. painting a picture, imitating and creating movement, creating role play)

Figure 5: Creative development in the Record of Progress for Kindergarten children in Malta

Science and Mathematics

There is a difference in the attention given to Science and Mathematics in the policy documents. The policy documents on education provision in Malta tend to talk very much on a general level for both mathematics and science. There is reference to both science and mathematics as core subjects and some attention is given to both. However, whereas government has issued a policy document (even is still under consultation) for science, there is no official or other policy for consultation in mathematics. This is mainly due to the very poor performance of Maltese children in Science TIMMS results with 30th place in science achievement amongst 49 participating countries. Nearly all other participating EU countries attained a better placing than Malta. In addition the survey showed that 23% of the students achieved at the Low Benchmark. Although these results were attained at age 14, it was recognised that action in science education at the early years and primary level need to be taken. In the case of mathematics, Malta placed much better in TIMSS for mathematics at 18th place. The specific focus on Mathematics is found in the policy document on the core competences[51] as part of a policy document on assessment. Science

[50] Ministry of Education, Employment and the Family, (2011), National Strategy for the attainment of core competences in primary education, Malta: Government of Malta

[51] Ministry of Education, Employment and the Family, (2009), National Policy and Strategy for the Attainment of Core Competences in Primary Education, Malta:Government of Malta

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is not included in this document as the policy document for the vision of science education was being drawn up at the time.

It is also to be noted that the education policy documents tend to emphasise the inquiry-approach in a general way across the whole curriculum, but mainly for science. While there is a shift in science from conceptual change/construction of knowledge in the earlier policy documents to inquiry in the new documents, not much change in tackling mathematics teaching is present.

Creativity is only linked to science in terms to innovation, as one of the principles of the New Curriculum Framework[52] being proposed. Creativity is still mainly linked to the Arts and not considered as a transversal areas as in the case of innovation.

In assessment, the approach in science is formative with the mention of experiments, portfolios and story-telling techniques mentioned as examples[53]. The form of assessment for Mathematics[54] in the early years is well developed with all the different mathematical skills identified and for each of which, teachers are required to carry out formative assessment. This assessment process is currently being implemented in schools.

4.5 Teacher Role / Location

The National Curriculum Framework (Document 3)[55] talks about desirable pedagogies to be adopted within the early years (including the first years of primary education). The pedagogies are considered in a general way and do not specify any particular subject. The document stresses that children need to learn *through observation, experimentation, trial and error, exposure to stimulating environments and highly contextualised settings which facilitate their understanding of the world around them* (pg.14)[56]. The document emphasises the need for teachers to create learning environments which appeal to children's interests, are relevant to their everyday experiences they are likely to have and which they can explore. Teachers are encouraged to provide direct, hands-on experiences which promote interaction, engagement as well as involvement, considered essential for understanding, recall and development of mental representations. Good Early Years practice is identified to include the recognition and promotion of child-initiated activity and enquiry which are mainly child-initiated activities, acknowledging that learning is a process of co-construction and collaboration.

52 Ministry of Education, Employment and the Family, (2011), Towards a Quality Education for All: National Curriculum Framework Consultation Document 1– Executive Summary, Malta:Government of Malta

53 Ministry of Education, Employment and the Family, (2011), Vision for Science Education, Malta: Government of Education

54 Ministry of Education, Employment and the Family, (2011), National Strategy for the attainment of core competences in primary education, Malta: Government of Malta

55 Ministry of Education, Employment and the Family, (2011), Towards a Quality Education for All: National Curriculum Framework Consultation Document 3 - The Three Cycles: The Early Years, The Primary Years and the Secondary Years , Malta:Government of Malta

56 Ministry of Education, Employment and the Family, (2011), Towards a Quality Education for All: National Curriculum Framework Consultation Document 3 - The Three Cycles: The Early Years, The Primary Years and the Secondary Years, Malta:Government of Malta

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The main learning aspects which are highlighted in the vision for science education[57] as well as the proposed National Curriculum Framework are the following:

- ***The use of story-telling***: this aspect is mentioned several times both in terms of the overall educational process (i.e. beyond science) as well as also specifically with respect to science teaching in the Vision document;
- ***The need to have authentic real situations:*** There is a strong argument, again at both a general education level and in science for activities in the classroom to be relevant to the children in order to be able to engage actively in the learning process;
- ***A strong advocacy for a child-centred approach***: Again, we find that at both the general and science level, specifically at the early years, there is recognition that there must be activities which are initiated by the children themselves, and that at any point in the learning process, the children remain as the main focus;
- ***Emphasis on problem-solving***: There are several mentions in the different policy documents on the importance for children to develop skills in problem solving and how this is to be part of pedagogical approach of activities organised as part of the learning process. Problem-solving is also emphasised as an essential part of the early years curriculum in science;
- ***Acknowledgement of the social perspective of learning:*** Although the documents do not specify directly that children learn best in groups, this is strongly implied. The same approach is identified in both the general education policy as well as with respect to science;
- ***An emphasis on the use of interactive technology***: One can find an overall emphasis on the use of new and up-to-date interactive technology. This reflects the recent government investment in the purchase of interactive whiteboards for all classrooms and the belief that their use will stimulate further learning through enhancing already existing pedagogies when used alongside other more traditional resources.

There is little particular reference to how creativity is to be promoted among children in the early years. One only finds that in the record of development it is implied that creativity is promoted through the physical exploration of materials in order to promote imagination. Otherwise, the documents tend to talk about pedagogy in a general way, and on several occasions promote the use of creative pedagogies, and the use of ICT. Science is given more attention and with the policy in science education, there is throughout the documents reference to the use of inquiry-based learning in science as the main pedagogical approach.

The Vision for Science Education[58] refers to the *5E model of instruction which best reflects these ideas about what learning is inquiry involves - a planned sequence of instruction that*

[57] Ministry of Education, Employment and the Family, (2011), Vision for Science Education, Malta: Government of Education

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places the students at the centre of their learning experiences, encouraging them to explore, construct their own understanding of scientific concepts and relate to other concepts. This model ... allows pupils to Engage, Explore, Explain, Elaborate, and Evaluate (pg13)[59].

Science and mathematics

Education provision in Malta is tackled on a general level for both mathematics and science. There is reference to both science and mathematics as core subjects and some attention is given to both. Whereas government has issued a policy document (even is still under consultation) for science, there is no official or other policy for consultation in mathematics. This is mainly due to the very poor performance of Maltese children in Science TIMMS results and much better placing (16th) in the case of mathematics. In the case of mathematics, the core competences are included in the policy document on assessment – science is not included in this document as the policy document for the vision of science education was underway.

The policy documents tend to emphasise more the inquiry-approach, mainly for science, but also in a more general way across the curriculum. While there is a shift in science from conceptual change/construction of knowledge in the earlier policy documents to inquiry in the new documents, not much change in tackling mathematics is present.

Creativity is only linked to science in terms to innovation, as one of the principles of the New Curriculum Framework being proposed. Creativity is still mainly linked to the Arts and not considered as a transversal areas as in the case of innovation.

In assessment, the approach in science is formative with the mention of experiments, portfolios and story-telling techniques mentioned as examples.

4.6 Materials and Resources

The policy document on the National Curriculum Framework[60] acknowledges that good education provision requires adequate resources. In tackling education provision in general, the National Curriculum Framework makes reference to the need for textbooks, references as well as multimedia resources. A similar view is stated for science with the Vision for Science Education policy when it states *that Malta's commitment is towards investing resources to ensure good quality science education*(pg.41). The Vision continues to specify the types of resources are needed for the implementation of the new science curricula which include:

58 Ministry of Education, Employment and the Family, (2011), Vision for Science Education, Malta: Government of Education

59 Ibid.

60 Ministry of Education, Employment and the Family, (2011), Towards a Quality Education for All: National Curriculum Framework Consultation Document 1– Executive Summary, Malta:Government of Malta

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- *the production / selection of interesting and attractive curriculum materials.* There is also reference to the careful use of eLearning platforms and other digital media which was recently set up, as well as students'/teachers' guides and reference materials should be primary sources of information for learners and teachers. There is an expressed felt need that the resources must provide the necessary guidance about the expected levels of achievement and effective pedagogy;
- *adequate laboratory facilities, ICTs, equipment, chemical and biological resources, as well as suitable software, learning guides and other curriculum materials that are relevant to the local context* (pg 43). It is to be noted that this statement is made with respect to all levels of science education and not only to science in the early years.

There is emphasis on the use of multi-media since interactive whiteboards have just been implemented in all state schools. This is reflected in all the Curriculum Framework documents as well as several times in the vision for science education.

There is also reference for the need to invest in human resources. The National Curriculum Framework considers this from a general perspective and acknowledges that teachers need ongoing professional development to update their knowledge and skills base. This reflects the belief that teachers need to invest in their professional and pedagogical work through updating themselves with contemporary perspectives on research, theory, content knowledge and teaching practices and on their understanding of the learners. The official view is teachers *should consider themselves as critical and reflective professionals who engage with contemporary theory and practice, and who actively seek specific professional development opportunities to ensure their effectiveness as educators* (pg 21)[61]. The document continues to discuss how support to teachers through the College system (system where primary and secondary state schools are networked together within the college) of gathering schools together and other means of support.

The Vision for Science Education[62] also refers to professional development and the need to train teachers, but the emphasis is mainly on secondary level as new topic areas in science are involved.

4.7 Groupings

There is no definite statement which indicates that learning must be organised in groups. However, the National Curriculum Framework states that it promotes *learning programmes that focus on understanding and emphasise the process of learning and the active co-construction of meaning rather than the mere acquisition of content* (pg.12). More

[61] Ministry of Education, Employment and the Family, (2011), Towards a Quality Education for All: National Curriculum Framework Consultation Document 1– Executive Summary, Malta:Government of Malta

[62] Ministry of Education, Employment and the Family, (2011), Vision for Science Education, Malta: Government of Education

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specifically, the National Curriculum Framework[63], in discussing learning outcomes in the early years states that successful programmes in the early years are ones *which allow child-initiated activities acknowledging that learning in the Early Years is a process of co-construction and collaboration* (pg.18)[64]. On can thus find an underlying belief that children learn when they work together in groups.

This belief is reflected more strongly in the Vision for Science Education[65] which states clearly with respect to learning science at all ages, that there also needs to be a shift in the vision of learning towards socio-cultural learning theories which emphasise the importance of socio-cultural experiences in influencing development and that theories about learning suggest that students learn best when they engage with each other and learn from one another where *learning occurs in a 'community of practice'* (pg.13)[66]. In addition, in discussing the aspects of inquiry-learning, the document mentions specifically that in inquiry *learners are actively engaged in investigations and involved in working out meanings and explanations in groups – through the social construction of knowledge* (pg.33)[67].

4.8 Time

At preschool there is no official timetable and so there is no planned time for teaching of science and mathematics. At compulsory level, science has been recognized as one of the core subjects. At compulsory age, no specific timetable recommendation is made for the first two years. The recommendation made is that a topic/thematic-based approach is adopted[68]. This, it is argued, that science enriches the development of each learning area. It is believed that the different areas, among them Science support the development of oracy, literacy, numeracy and digital literacy skills. Possible timetables are proposed for the older years, which also include the 8 year olds. In these proposals, science is allocated between 1.5 and 2 hours a week. It is to be noted that in the proposals, science has been allocated the same or slightly less than citizenship education, religious education, Arts education and Health Education (which includes also P.E.). It can be concluded that the time allocated to science to degree does not reflect the degree of attention and commitment demonstrated in the policy documents.

63 Ministry of Education, Employment and the Family, (2011), Towards a Quality Education for All: National Curriculum Framework Consultation Document 3 - The Three Cycles: The Early Years, The Primary Years and the Secondary Years, Malta:Government of Malta

64 Ibid.

65 Ministry of Education, Employment and the Family, (2011), Vision for Science Education, Malta: Government of Education

66 Ministry of Education, Employment and the Family, (2011), Vision for Science Education, Malta: Government of Education

67 Ibid.

68 Ministry of Education, Employment and the Family, (2011), Towards a Quality Education for All: National Curriculum Framework Consultation Document 3 - The Three Cycles: The Early Years, The Primary Years and the Secondary Years, Malta:Government of Malta

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4.9 Assessment

The National Curriculum Framework states clearly that it promotes *an assessment policy that values and assesses both the processes and the products of learning* (pg. 12)[69]. Assessment and evaluation are considered as one of the seven main components of education. In discussing education in general, it is stated that *assessment in pre-school and school settings makes an essential contribution to learning and progress at all levels and that it should be seen as an integral part of the teaching and learning process, providing students and their parents with continuous, timely and qualitative feedback about children's progress, giving teachers information about their practice, and providing schools and colleges with information about their curriculum planning, learning and teaching. Assessment for learning (assessment for formative purposes) is a process carried out as learning is taking place* (pg.17).

At pre-school level the document of Record of Progress[70] focuses on skills in general. With respect to science, the document, as already highlighted earlier in this report, identifies the skills of exploration and imagination, and not only with respect to textures and getting to know more about the world around them.

There is specific reference to assessment modes in Science and the Vision for Science education[71] document. The document makes a strong argument in favour of assessment for learning. It also includes the additional dimension of the students' participation in the process. As it states, *for learning to occur; assessment also needs to be a participatory activity and allow learners to be able to assess their own work and the work of others. This allows learners to become autonomous and to take responsibility for their own learning.* (pg.37)[72]. The document goes on to identify different forms of assessments which can be used and mentions: investigations and problem solving activities; learning logs and portfolios; individual assessment; peer assessment; and formal assessment and tests. Aspects of science which have been identified included: various skills which students manage to develop such as using equipment in the correct manner, being able to follow instructions, being able to record and interpret results as well as to research and present information in an organised way. Both content and skills are mentioned.

Since creativity was barely tackled in the documents with respect to science, and particularly so in the case of the Vision for Science education, no specific mention is made to assessing aspects of creativity in science. At most aspects of creativity have only been implied in an indirect way in the form of imagination and problem-solving.

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69 Ministry of Education, Employment and the Family, (2011), Towards a Quality Education for All: National Curriculum Framework Consultation Document 1– Executive Summary, Malta:Government of Malta

70 Directorate for Quality and Standards in Education, (2011), Record of Work for Kindergarten Children, Malta:Ministry of Education and Employment

71 Ministry of Education, Employment and the Family, (2011), Vision for Science Education, Malta: Government of Education

72 Ibid.

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5. Approaches to Teacher Education

This section tackles teacher education for the early years at both initial training and continuous professional development.

5.1 Initial teacher education

There is a demarcation at the present stage in the initial teacher-training required to teach at pre-school level and at compulsory stage. The national legal framework to date regulates teacher qualification level at compulsory level, the Education Act, and which requires teachers to be at Bachelor level. In the pre-school years, even if the Policy document on Early childhood Education[73] talks about graduates, the main initial teacher-training is at vocational level. There has been the development of a Bachelor's degree in the Early Years following this policy document, but teacher qualification requirements at this level have not changed. The Education Act includes the setting up of a Teachers Council. This Council regulates the applications for teachers warrant. However, this council has not yet worked on the specific teacher competencies which need to be developed within initial teacher-training courses. Nor does the Council regulate the teacher-training institutions. Due to the smallness of the country, the institutions providing different levels of training are few and regulation has to date included the direct involvement/intervention of the Ministry of Education should there be any problems or issues relating to initial teacher-training programmes. The situation may change, however, as more institutions may start offering initial teacher-training.

Initial teacher-training for pre-school level is mainly vocational and includes the: MCAST-BTEC Higher National Diploma in Advanced Studies in Early Years which is offered by EDEXCEL and the MCAST-BTEC National Diploma in Children's Care, Learning and Development. The Higher National Diploma allows individuals to manage a childcare Centres. These qualifications are at levels 5 and 4 of the Malta National Qualifications Framework (MQF), which is equivalent to the same levels on the European Qualifications Framework (EQF). The Bachelor of Education (Hons) in Early Years is a degree qualification at level 6 of the MQF and the EQF. This qualification allows graduates to teach at both pre-school level and within compulsory education up to age 8 years.

Teaching early years within compulsory education requires a bachelor's degree. This can either be a Bachelor of Education (Hons) primary education which allows graduates to teach all the years in primary, or the Bachelor of Education (Hons) Early years which allows teaching between the ages of 3-8 years. It is also to be noted that those teachers with a Bachelor's degree are provided with a teachers' warrant following one year of successful teaching.

[73] Ministry for Social Policy, (2006), Early Childhood Education and Care – A national Policy?, Malta:Government of Malta

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The vocational training is provided by the Institute of Community Studies within the Malta College of Arts, Science and Technology (MCAST), the main state vocation education and training institution. The Bachelor of Education is provided by the Faculty of Education at the University of Malta. It is to be highlighted that MCAST will be introducing a Bachelor in Early childhood Education and Care, but it is not yet clear if this qualification will provide graduates with a teachers' warrant. One also finds a number of private training providers who offer short courses in Early Childhood education and care which provides access to working in childcare centres.

The main model for training is a consecutive one, where students follow the entire course after compulsory education/post secondary education, depending on the type of course. In none of the cases is initial teacher training a course which follows a degree (B.A. or B.Sc.) in any particular subjects.

Entry Requirements

Entry requirements for the different courses vary according to the different level of qualification. As expected, entry qualifications for the vocational BTEC qualifications are lower than those required for the Bachelor's degree. The following are a summary of the entry requirement for the four types of initial teacher-training. The full details are found in the questionnaires.

MCAST-BTEC National Diploma in Children's Care, Learning and Development

MCAST-BTEC Diploma in Health and Social Care or 4 SEC/O-Level passes ~(Level 3 MQF Qualifications)- Compulsory: English Language, Maltese and Mathematics

MCAST-BTEC Higher National Diploma in Advanced Studies in Early Years (For child care center manager)

MCAST-BTEC National Diploma in Children's Care, Learning and Development and SEC/O-Level passes in Mathematics, English and Maltese or 2 A-Level passes and 2 Intermediate-Level passes Compulsory A-level or I-level: Mathematics, English and Maltese.

Bachelor of Education (Hons) Early Years and Bachelor of Education (Hons) Primary Education

Applicants must satisfy the **General Entry Requirements** for admission, namely, the Matriculation Certificate (2 A-Levels and 3 Intermediates) and Secondary Education Certificate passes at Grade 5 or better in Maltese, English Language and Mathematics (Passes 1-5, grade 1 is highest). In addition, one advanced subject and two Intermediates must be at grade C or better from an approved list of subjects. In addition, all students need to have ECDL as well as sit for a proficiency test in English and Maltese is their SEC grade is 4 or 5.

One can see that there is a focus on the need for basic qualifications in the core areas of English, Maltese and Mathematics. In the Bachelors courses, different science subjects are

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included in the list of approved subjects which can be presented at Advanced and Intermediate level. This means that students taking sciences at post-secondary level (before entry into University) can follow any of the two Bachelor of Education Courses.

In all cases one finds the 'maturity clause' which allows insitutions to accept candidates to follow the courses if they they are twenty three years of age but do not have the necessary entry requirements. This decision is usually based on the outcome of an interview and a review of other education experiences which these candidates would have had as adults and considered as valid to allow them to follow the course successfully.

Duration of Courses

The duration of the courses are usually of duration of 2 years each for the vocational courses and 4/5 years for the Bachelors courses. The MCAST-BTEC National Diploma in Children's Care, learning and development is two 2 years full-time as is the MCAST-BTEC Higher National Diploma in Advanced Studies in Early Years. It is to be noted that many times students in vocational courses tend to follow the vocational route and thus many are those who move from one level to another. The result is that in many cases, students following the National Diploma would have previously followed the Diploma course, while many of those graduating from the National Diploma tend to proceed and do the National Higher Diploma. This means that students take a number of years to become early years practitioners and so many them would qualify to work in the sector at around the age of 20 years.

In the case of the Bachelor Courses, the one on early years has so far been offered only as a part time course with 180ECTS over a period of 5 years. The B.Ed (Hons) primary is offered full time with 240 ECTS over a period of 4 years of study.

Teacher Competences acquired

As has already been indicated, there is no regulatory framework which controls the competences which teachers in the early years are to develop in order to be able to practice in the sector. However, all the courses do specify the competences which the students develop as a result of following the course of studies.

The vocational courses are aimed at early childhood education practice at pre-school level and this is reflected in the competences which are developed during training. While the competences at the National Diploma level involve those related to direct interaction with children and include competences such as: planning activities for babies, toddlers and children 3 to 5 years old; maintaining health and safety standards in childcare and kindergarten settings; implementing activities and construct resources for children aged 0 to 5; as well as monitor and record the development of children aged 0 to 5, the Higher National Diploma focuses on the management of childcare centres. Competences developed in the Higher National Diploma thus include: conducting research in child care, kindergarten settings and primary schools; maintaining health and safety standards in child care and kindergarten settings; and managing child care centre settings.

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The Bachelor of Education (Hons) Early Childhood Education focuses more on the educational practice and it is officially stated that by the end of the course, it is expected that graduates would have:

- A deep theoretical understanding of how young children develop & learn;
- A broad pedagogical knowledge to determine appropriate and effective practices with young learners, therefore applying theory to practice;
- An awareness of a range of professional issues which impact directly on the management of and relationships amongst a group of learners;
- Developed skills to become competent professionals through the practical aspects of the course;
- Gained cognizance of and an ability to apply research skills which enable practitioners to understand on-going development in their field and critically position themselves when faced with research findings.

The competences identified for the Primary B.Ed.(Hons) course are related to the whole of the primary curriculum and thus make reference to the different subject areas. The course description states that the programme prepares students to teach each of the 8 subject areas in the primary curriculum: namely English, Mathematics, Maltese, Religion, Physical Education, Science, Expressive Arts and Social studies. It also has a strong component of professional educational issues which includes: Assessment, Health Education, Disability, Literacy Difficulties, Environmental Education, and Psycho-social and Legal Issues. General Pedagogy and Interpersonal skills are two areas which are given importance in the initial years of the programme.

Course content

All the courses have both a content and practice component aspect. The vocational courses have content which exposes students to the most innovative teaching techniques and are also trained in observation techniques required to monitor the development of young children. The practical component involves four different placements, namely: with a baby (age 0-18 months), with a group of toddlers (ages 19-23 months) and with both 3 year olds and 4 year olds in kindergartens.

The Bachelor Courses also have content and practical aspects. The content aspects for the early years course tend to be more holistic and areas rather than subject areas tend to be considered. Both general and subject pedagogies are included. In addition, periods of teaching practice are also included. In each of the courses this involves three sessions of 6 weeks of teaching practice where students take on the responsibility of a classroom. The specific details of the courses are listed in the questionnaires filled in.

There is no official mentoring programme and students on teaching practice are monitored by University teacher-training staff through onsite visits.

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Teacher-training staff

The teacher-training staff for initial teacher-training are required to have experience in the educational field as well as higher post-graduate studies than the course level being taught. In the case of MCAST, most of the lecturing staff tends to have a masters level of education. In the case of the Bachelor of Education at the Faculty of Education, teaching staff usually possess a Doctorate and many are also at Senior Lecturer and Professorship level. Although there are no official standards for teacher-training staff, teacher-trainers must be warranted teachers with experience in the level that they are teaching.

5.2 Continuing professional development

Teachers are requested to follow one in-service course every two years, and at times they are called for specific training. Currently in-service training focuses on the use of the interactive whiteboards as well as the use of the web platform 'frontier' as these are the last two innovations introduced in schools. There are also a number of afternoons per year in schools which are dedicated to professional development and which give schools a degree of freedom to decide the focus of this training. Many times, this training tends to target the whole school and thus incorporate early years and primary together.

In addition, a number of 3-day in-service courses are offered at the end of the scholastic year which teachers can attend. In some cases, teachers can be called in specifically. There are often in-service courses specifically for the early years.

The Faculty of Education at the University of Malta also provides opportunities for professional development in the early years through its Masters of Education in the Early Years which is a European Masters.

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6. Summary

This document has provided an overview of policies with respect to different aspects of early years education in science Malta. Policy documents relating to education and more specifically including policy with respect to early years education were analysed with a focus on science education, as well as the relation to mathematics and promotion of creativity. The policy documents reviewed included both existing policies as well as policies for the future of education in Malta which are still in consultation stage. It is of interest to note that early years and children's education was not only the target of policies on education, but there were also policies related to childhood as well as childcare provision.

It is to be noted that more attention is being given to the early years in the more recent policy documents, with sections dedicated specifically to the early years in contrast to the primary years of education. However, the distinction between the two is not yet clear. While the National Curriculum Framework specifies that the early years is up the second year of primary education and thus till age 7, it is not clear in the documents whether this is always the case. For example, the policy on assessment for learning in the early years for mathematics includes the first three years of primary education, thus up to age 8.

Science is given particular attention, this mainly due to the publication of the policy document Vision for Science Education. This document too tackles the early years as separate from primary and secondary level of education. This reflects a commitment to value science education also at a young age. There is also a strong direct commitment to inquiry-based learning as the main pedagogy to be used in science. Mathematics is given less attention in the policy documents, although it is included in the competences policy document. The policy documents do give creativity attention and value its importance as an integral part of today's education. The main curricular documents talk about creativity and innovation, but treat it as a transversal theme and thus one which cuts across all school subject areas. Unfortunately, however, the Vision for Science Education policy document does not tackle the promotion of creativity through science in a direct way.

6.1 Limitations

There are few possible limitations of the policy analysis exercise, this particularly since in Malta one could analyse the policies currently in place as well as those being proposed for the future. Having said this, from past experience, it is not the first time that the finalised policy published is significantly different from the one proposed for consultation. Consultation usually raises many issues and discussions about the most daring proposals put forward. Thus, the views and direction forward which the proposed policy documents currently portray may not necessarily become the ones which will eventually be in force and implemented. This thus limits the value of the review to a point in time where Malta is currently at the cross roads with respect to way forward.

The major bias which can be identified in the review is that that one of the authors of the review is also one of the authors of the policy document 'Vision for Science Education'. This

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could have led to biased interpretations in that the author knows the thinking behind the document and which may not have always been reflect exactly in the actual policy document.

6.2 Implications

This document has provided insight into how Malta looks at the early years and particularly on the level of importance it is giving to science at such a young age. It also provides insight into how science is viewed in comparison to mathematics and how creativity is considered within science education. These insights will allow a comparison between what Malta wants to achieve and what is currently in place in schools. It does provide a backdrop against which to compare practice and the official view of science. There is no specific research similar to this exercise which has been carried out with respect to early years in science in Malta. It can thus provide insights for understanding the match or mismatch between policy and practice.

One of the main recommendations for policy relates to promoting creativity through science education. It appears that while the National Curriculum Framework documents have identified creativity and innovation as a cross-curricular theme, that this is not discussed in any direct way in the document – Vision for Science Education, and that possibly, should be included in the finalised version of the document.

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APPENDICES

Appendix A

Survey Ratings: Analysis of Approaches to Teaching and Learning

Key
E: Early (Preschool)
P: Primary

Rationale or Vision

Ai. What are the purposes of science Education?

	NotMentioned	Single Mention	Various Mentions	Emphasised
a. To provide a foundational education for future scientists and engineers	E / P			
b. To develop socially and environmentally aware and responsible citizens			E / P	
c. To enrich the understanding and interaction with phenomena in nature and technology				E / P
d. To develop more innovative thinkers			E / P	
e. To develop positive attitudes to science			E / P	
f. To develop important attitudes and dispositions as a foundation for future learning			E / P	

Aii. What is the emphasis, if any, on the role of creativity in the purposes of science Education? (Adapted from T survey Q23)

	Counter Creative Emphasis	No Creative Emphasis	Slight Creative Emphasis	Highly Creative Emphasis
a. To provide a foundational education for future scientists and engineers		E	P	
b. To develop socially and environmentally aware and responsible citizens			E / P	E / P
c. To enrich the understanding and interaction with phenomena in nature and technology			E / P	E
d. To develop more innovative thinkers			E / P	
e. To develop positive attitudes to science		E	P	
f. To develop important attitudes and dispositions as a foundation for future learning			E / P	

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Aims and Objectives

Ai. What views are indicated about the importance of the following Science learning outcomes?

	Not Mentioned	Single Mention	Various Mentions	Emphasised
a. To know and understand the important scientific ideas (facts, concepts, laws and theories).	E	P		
b. To understand that scientists describe the investigations in ways that enable others to repeat the investigations.	E	P		
c. To be able to ask a question about objects, organisms, and events in the environment.			P	E
d. To be able to employ simple equipment and tools, such as magnifiers, thermometers, and rulers, to gather data and extend to the senses.			E / P	
e. To know and understand the important scientific processes.	E		P	
f. To be able to communicate investigations and explanations.			E / P	
g. To understand that scientific investigations involve asking and answering a question and comparing the answer with what scientists already know about the world.			E / P	
h. To have positive attitudes to science learning.		E / P		
i. To be interested in science.			E / P	
j. To be able to plan and conduct a simple investigation.			E / P	
k. To have positive attitudes to learning.				E / P
l. To understand that scientists develop explanations using observations (evidence) and what they already know about the world (scientific knowledge).	E / P			
m. To be able to collaborate with other children			E / P	

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Aii. What is the emphasis, if any, on the role of Creativity in the following Science learning outcomes?

	Not Mentioned	Single Mention	Various Mentions	Emphasised
a. To know and understand the important scientific ideas (facts, concepts, laws and theories).		E / P		
b. To understand that scientists describe the investigations in ways that enable others to repeat the investigations.		E / P		
c. To be able to ask a question about objects, organisms, and events in the environment.		E / P		
d. To be able to employ simple equipment and tools, such as magnifiers, thermometers, and rulers, to gather data and extend to the senses.		E / P		
e. To know and understand the important scientific processes.		E / P		
f. To be able to communicate investigations and explanations.		E / P		
g. To understand that scientific investigations involve asking and answering a question and comparing the answer with what scientists already know about the world.		E / P		
h. To have positive attitudes to science learning.		E / P		
i. To be interested in science.		E / P		
j. To be able to plan and conduct a simple investigation.		E / P		
k. To have positive attitudes to learning.		E / P		
l. To understand that scientists develop explanations using observations (evidence) and what they already know about the world (scientific knowledge).		E / P		
m. To be able to collaborate with other children		E / P		

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Content

A. How are Science and Mathematics presented as learning domains?

	As its own learning area	Encompassed within other social sciences (e.g. geography)	Encompassed within more general understanding
Science	E / P		E / P
Mathematics	E / P		

B. What are the key Science and Mathematics topics/strands/themes?

	Science	Mathematics
1	Inquiry	identifying, labelling, sorting, grouping, sequencing, classifying, categorising, and matching.
2	Asking questions, hypothesizing, predicting, comparing, sequencing, grouping experimentation	Basic concepts: colours, shapes, numbers, patterns Learn to see symbols as means of representation
3	Some Flexibility for school to find areas which are relevant to their school context	
4		Says and uses the number names in order in stories, finger play, songs/rhymes and in other familiar contexts Counts reliably up to 10 everyday objects * Orders numbers up to 10 * Recognises numerals 1 to 9 In practical activities begins to use the vocabulary involved in adding and subtracting Uses some of the vocabulary involved in addition and subtraction in stories, finger play and songs/rhymes * Says number names in order up to 10, forwards and backwards Uses language such as 'more' or 'less' in various contexts * Finds one more or one less than a number from 1 to 5 objects * Finds one more or one less than a number from 1 to 10 objects * Begins to relate addition to combining two groups of objects and subtraction to 'taking away' * Recognises differences in quantity when comparing groups of objects * Uses language such as 'greater', 'smaller', heavier' or 'lighter' to compare quantities
6	In the Primary years the purpose should be to create awareness and develop a sense of	essential numeracy skills which support them in daily life; • key numeric competences that include the

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	wonder about the world while introducing simple scientific concepts and vocabulary. Science programmes in the Primary years encourage children to: • develop an inquiry-based approach to finding out facts by observing, exploring and investigating their environment; • communicate their findings orally, pictorially and in writing; and • learn how science works, and how information has been discovered through biological, chemical, physical and environmental contexts.	understanding of concepts, principles, and applications; • creative approaches in the four strands, namely, use of number, measurement, space and shapes and data handling; and • Logical thought and engagement with investigative processes that lead to solutions
	Understanding the world around us by asking questions about it, seeking ways of answering these questions, and developing knowledge that helps us to understand nature and to improve our quality of life;	The numeracy aims □□ to develop a positive attitude towards mathematics so that children enjoy learning the subject in an interesting and attractive manner; □□ to enable learners to confidently use correct mathematical language and vocabulary; □□ to enable learners to express themselves mathematically and to converse about the subject meaningfully; □□ to enable learners to develop clear logical and sequential thinking; □□ to ensure that every learner acquires a strong foundation in basic mathematical skills; □□ to equip learners with skills that will enable them to apply problem solving strategies to real and unfamiliar situations both in and outside the school.
	Investigating phenomena and processes by planning investigations, making predictions, deciding how to check predictions fairly, making observations and taking accurate and reliable measurements, analysing the evidence obtained, critically evaluating evidence, and drawing conclusions;	

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	Communicating scientific knowledge by means of oral, written, graphical and other appropriate means using scientific language, that is terminology, conventions and techniques appropriate to the task;	
	Linking science to everyday life and **Applying** the scientific knowledge gained to explain natural phenomena and how things work, and to enjoy an improved quality of life.	

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Learning Activities

Ai. What activities are encouraged?

	NotMentioned	Single Mention	Various Mentions	Emphasised
a. Observe natural phenomena such as the weather or a plant growing and describe what they see.			E	P
b. Ask questions about objects, organisms, and events in the environment.			E	P
c. Design or plan simple investigations or projects.	E / P			
d. Conduct simple investigations or projects	E		P	
e. Employ simple equipment and tools to gather data and extend to the senses.	E / P			
f. Use data to construct reasonable explanations.	E / P			
g. Communicate the results of their investigations and explanations.			E / P	

Aii. What is the emphasis, if any, on the role of Creativity in the following activities?

	Counter Creative Emphasis	No Creative Emphasis	Slight Creative Emphasis	Highly Creative Emphasis
a. Observe natural phenomena such as the weather or a plant growing and describe what they see.		E / P		
b. Ask questions about objects, organisms, and events in the environment.		E / P		
c. Design or plan simple investigations or projects.		E / P		
d. Conduct simple investigations or projects		E / P		
e. Employ simple equipment and tools to gather data and extend to the senses.		E / P		
f. Use data to construct reasonable explanations.		E / P		
g. Communicate the results of their investigations and explanations.		E / P		
h. Other				

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Teacher Role / Location

Ai. What learning/teaching contexts and approaches are mentioned?

	Not Mentioned	Single Mention	Various Mentions	Emphasised
a. Open/unstructured play			E / P	
b. Role/Pretend play		E / P		
c. Drama		E / P		
d. Teaching science from stories		E / P		
e. Using history to teach science (e.g. transport, the work of scientists)	E / P			
f. Working in small groups				E / P
g. Physical exploration of materials		E / P		
h. Using outdoor learning activities		E / P		
i. Taking children on field trips and/or visits to science museums and industry	E / P			
j. Integrating science with other curricular areas	E / P			
k. Building on children's prior experiences			E / P	
l. Fostering collaboration			E / P	
m. Encouraging different ways of recording and expressing ideas – oral, visual, digital, practical			E / P	
n. Encouraging problem finding – e.g. children asking questions				E / P
o. Encouraging problem solving – e.g. children solving practical tasks				E / P
p. Encouraging children to try out their own ideas in investigations				E / P
q. Fostering classroom discussion and evaluation of alternative ideas	E / P			
r. Fostering imagination		E / P		
s. Relating science to everyday life			E / P	
t. Using questioning as a tool in science teaching	E / P			
u. Using digital technologies with children for science teaching and learning				E / P (even if not only specifically to science)
v. Fostering autonomous learning				E / P (same as above)

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Aii. What is the emphasis, if any, on the role of Creativity in the following learning/teaching contexts and approaches?

	Counter Creative Emphasis	No Creative Emphasis	Slight Creative Emphasis	Highly Creative Emphasis
a. Open/unstructured play			P	
b. Role/Pretend play		P		
c. Drama		P		
d. Teaching science from stories			P	
e. Using history to teach science (e.g. transport, the work of scientists)		P		
f. Working in small groups		P		
g. Physical exploration of materials			P	
h. Using outdoor learning activities		P		
i. Taking children on field trips and/or visits to science museums and industry		P		
j. Integrating science with other curricular areas		P		
k. Building on children's prior experiences		P		
l. Fostering collaboration		P		
m. Encouraging different ways of recording and expressing ideas – oral, visual, digital, practical		P		
n. Encouraging problem finding – e.g. children asking questions		P		
o. Encouraging problem solving – e.g. children solving practical tasks		P		
p. Encouraging children to try out their own ideas in investigations		P		
q. Fostering classroom discussion and evaluation of alternative ideas		P		
r. Fostering imagination		P		
s. Relating science to everyday life		P		
t. Using questioning as a tool in science teaching		P		
u. Using digital technologies with children for science teaching and learning		P		
v. Fostering autonomous learning		P		

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C. What, if any, Inquiry Approaches are discussed?

	A (Open)	B (Guided)	C (Structured)	N/A
a. QUESTION: Children investigate scientifically oriented question		E / P		
b. EVIDENCE: Children give priority to evidence		E / P		
c. ANALYSE: Children analyse evidence		E / P		
d. EXPLAIN: Children formulate explanations based on evidence		E / P		
e. CONNECT: Children connect explanations to scientific knowledge		E / P		
f. COMMUNICATE: Children communicate and justify explanation		E / P		
g. REFLECT: Children reflect on the inquiry process and their learning		E / P		

Materials and Resources

A. What materials are suggested?

	Not Mentioned	Single Mention	Various Mentions	Emphasised
a. Instructional materials (e.g. textbooks)		E		
b. Audio-visual resources	E			
c. Relevant library materials (e.g. story books)	E			
d. Equipment and materials for hands-on exploration in the classroom (e.g. magnets, building blocks)	E	P		
e. Equipment and materials for hands-on exploration outside the classroom	E			
f. Computers	E			
g. ICT resources (e.g. computer applications)			E / P	
h. Other digital technologies (e.g. interactive whiteboard, camera)			E	P
i. Budget for supplies (e.g. paper, drawing materials)	E / P			
j. Teaching support personnel (e.g. classroom assistant)			E / P	
k. Other support personnel (e.g. technical support)	E / P			

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Groupings

A. What groupings, if any, are suggested for teaching Mathematics and Science?

	Not Mentioned	Single Mention	Various Mentions	Emphasised
Individual work	E / P			
Pair work	E / P			
Small group work				Group work is implied/assumed but it is never mentioned specifically
Whole class activities	E / P			

Time

A. How much time should be planned for teaching Science and Mathematics per week?

	Science	Mathematics	Evidence or comments
a. Less than an hour			
b. 1-2 h	P		
c. 3-4 h		P	
d. More than 4 h		P	
e. N/A (Please explain)			At preschool there is no official timetable and so there is no planned time for teaching of science and mathematics

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Assessment

A. What purposes of assessment are included?

	Not Mentioned	Single Mention	Various Mentions	Emphasised
a. To identify areas for improvement in your science teaching	E / P			
b. To identify aspects of the science curriculum that could be improved	E / P			
c. To identify ways to improve child science learning			E / P	
d. To monitor regularly individual children's or cohorts of children's progress towards a set of desirable science learning outcomes	E / P			
e. To inform parents of their child's progress in science	E / P			
f. To help group children for science instruction purposes	E / P			
g. To monitor year-to-year child progress in science	E / P			
h. To provide feedback to children about their progress in science			E / P	
i. To set targets with children for their own development in science	E / P			

B. What importance is given to of the following priorities for children's assessment in Science?
To assess the development of children's:

	Not Mentioned	Single Mention	Various Mentions	Emphasised
a. Knowledge and understanding of scientific ideas (facts, concepts, laws and theories)	E / P			
b. Knowledge and understanding of scientific processes		E / P		
c. Competencies necessary to carry out scientific inquiry		E / P		
d. Understandings about scientific inquiry (e.g. how science and scientists work)	E / P			
e. Positive attitudes and increase of interest in science	E / P			
f. Positive attitudes and increase of interest in learning science	E / P			

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C. What ways of assessing are advocated?

	Not Mentioned	Single Mention	Various Mentions	Emphasised
a. Using checklists to record observations of children	E / P			
b. During classroom interaction		E / P		
c. Evaluating children's pictures, graphs etc which show their scientific reasoning	E / P			
d. Evaluating children's relevant gestures or physical activity	E / P			
e. Marking their homework	E / P			
f. Using authentic problem-based tasks	E / P			
g. Asking each child to reflect on their own learning and progress	E / P			
h. Using closed question tests	E / P			
i. Using open question tests	E / P			
j. Using questions in context	E / P			
k. Using portfolios (collection of evidence of children's work and progress)	E / P			
l. Children correcting each other's work and giving each other feedback	E / P			

D. What Creative attributes are addressed in assessment?

	Not Mentioned	Single Mention	Various Mentions	Emphasised
a. Sense of initiative	E / P			
b. Motivation	E	P		
c. Ability to come up with something new	P	E		
d. Ability to connect what they have learnt during your lessons with topics in other subjects	E / P			
e. Imagination	P	E		
f. Curiosity	P	E		
g. Ability to work together	E / P			
h. Thinking skills	E / P			

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