



## **Malta Council for Science & Technology**

### **Literature Review**

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**Author:** Roxanne Mangion

**Supported by** Yasmin Marlow & Maya Pollacco



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# Introduction

Vocational education and training (VET) in Malta traces its origin to 1970s when a decision was made to vocationalise one-third of secondary schooling through the establishment of what were called “trade schools” (Sultana, 1994). However, history seems to be repeating itself, and, the last two decades have seen an upsurge in research related to the importance of re-introducing vocational education in Malta’s Compulsory Education System. VET subjects can take many forms and are regarded as one of the most diversified forms of learning within the main education and training sectors in Europe at present.

That said, personnel from Malta and other five different partner organisations have come together to analyse, evaluate, and collect data on the respective VET/STEAM (Science, Technology, Engineering, Art, and Music) careers in their own country together with other related information. The Malta Council for Science and Technology was responsible for collecting and assembling the respective literature reviews presented by all six partner organizations which included European, National and local perspectives on VET and its prospects. The results of the research will then be shared during the first transnational meeting and used to feed the creation of an app.



## What is understood by Vocational Education and Training in Malta?

The European Centre for the Development of Vocational Training (CEDEFOP) describes VET as “...education and training which aims to equip people with knowledge, know-how, skills and/or competences required in particular occupations or more broadly in the labour market” (Cedefop, 2014a, p. 292).

Along with other EU member states, Malta has been focusing on enlarging apprenticeships and other types of work which are based on job skills. The country established VET institutes where one can improve one’s skills in the career aspired for. VET institutes expand opportunities for those students who will be seeking a job after completing their studies at the same institute. (CEDEFOP, 2017a)

The current system in Malta distinguishes between compulsory and further and higher education. Compulsory education, which is between the age of 5 till 16, is offered by State Schools, Catholic Church Schools and Independent schools.

Once students finish secondary school at 16 years of age, they may wish to choose to take part in the national secondary education certificate [SEC] exams in order to continue on to post-secondary schools. Furthermore, students who manage to succeed in gaining six SEC passes can enter sixth form, provided they meet the general requirements. Alternatively, these students can also enter into one of the two main VET institutions in Malta. These are: the Malta College of Arts, Science and Technology (MCAST), and the Institute of Tourism Studies (ITS). Each of these institutions is described in brief hereunder. It is also interesting to note that a number of private organizations are also offering VET courses (Spiteri & Kissaun, 2017). In conjunction with this, research shows that private VET contributors are now catering for more than 12% of VET students and hence, changing the scenario of education provision in Malta (enic-naric.net, n.d.). The Malta Vocational Centre in Sliema, and the European Pilot Academy in Luqa are two examples of such private VET institutions.

MCAST was set up by the Minister for Education and it is in charge of most vocational education and training for 16-year olds and over, merging skills, abilities, knowledge, and flexibility. It consists of 9 institutes including: arts and design, community services, maritime institute, information and communication technology, mechanical engineering, agribusiness, electric and electronic engineering, business and commerce, building and construction engineering. The majority of the courses are full-time and students are given a prize at the end of the programme. (CEDEFOP, 2017a).

ITS, on the other hand, upskills students, employees, managers and technicians in travel, hotel management/hospitality and the tourism industry. Their leading role is to supply the tourism sector with a skilled labour force who can assure a superb level of goods and services in the industry of Hospitality. With the use of high quality lifelong learning programmes, ITS, tutor students by insisting on excellent services and standards within the Hospitality Industry. (Institute of Tourism Studies, n.d.).

It is also important to note that, students attending MCAST and ITS, are being given the opportunity for apprenticeship. This is a work-study programme where part of it takes place within the venture and the rest takes place at MCAST or ITS. The programme is split up into 2 levels: The Extended Skills Training Scheme or regular employee skill level, and The Technician Apprenticeship Scheme or technical skill level (Cedefop; Ministry for Education and Employment, 2019, p.39)

One of the main challenges faced by students that choose to start their post-secondary education in VET subjects is the limited flexibility for students to move from a VET pathway to a general education pathway since such students are not given the opportunity to complete one year of studies in a VET institution and then progress to their second year of studies in a different institution. For example; an MCAST student is not allowed to follow a year at MCAST and then move to Ġ.F. Abela Junior college to complete their second year of studies. On the other hand, students who start their first year of studies at Giovanni Curmi Higher Secondary School have the chance to complete their second year at Junior College as long as they satisfy the requirements needed to enter the latter college. (Ministry for Education and Employment, 2017).

This situation is worrisome since it hinders students from mastering their subject's practical and academic knowledge. Therefore, policy makers should seek to provide our next generations with post-secondary level courses that cater for both aspects to better prepare students for their future workforce (Ministry for Education and Employment, 2017).

## **What VET subjects are being offered in Malta?**

### **How are subjects being structured to reflect VET status?**

### **What is the VET education set up like in Malta?**

In line with the educational reform known as “My Journey”, vocational subjects are also being introduced in lower secondary education which has been a crucial move in order to avert Early School Leavers by providing different ways for learning, even though the system which is used in the present is suitable for all circumstances (Ministry for Education and Employment, 2016). This project will be implemented nationwide as from the beginning of 2019 (Malta Eurydice Unit, 2017) and the number of vocational subjects offered at secondary level will be extended. This is because with the subjects offered in 2016/2017, which included: agribusiness, engineering technology, health and social care, hospitality, and information technology, one should add engineering technology, media literacy, retail, fashion and textiles, and hairdressing and beauty (Ministry for Education and Employment, n.d.). It is also interesting to note that, in the scholastic year 2016/2017, a quarter of governmental secondary school students opted for VET subjects listed above rather than for traditional academic subjects (CEDEFOP, 2017).

Until recently, such subjects were only offered at MCAST or ITS. However, with such a reform, students can now start gaining VET skills during their compulsory schooling years and then continue when they enter post-secondary education. In addition, such subjects are not being assessed summatively and therefore, students are being given more responsibility for their own learning and also an opportunity to learn how to be more critical in their ideas (CEDEFOP, 2017). Just like traditional examinations, students are being given a certificate of accomplishment at the end of an assessment task. Rewards motivate students to work hard and achieve their ultimate goals. Educators are also being provided with the necessary tools and equipment that they need in order to facilitate their students’ learning process.

The VET subjects offered are also in line with the Malta Qualifications Framework (MQF). The latter comprises of eight levels of qualifications and is compatible with the Framework of Qualifications of the European Higher Education Area (EHEA) or the Dublin descriptors (A National Qualifications Framework for Lifelong Learners, 2007). As shown in Figure 1 below, MQF Levels 1-3 can be obtained during compulsory schooling, MQF Level 4 can be obtained during Upper Secondary Education whereas MQF Level 5-8 can be obtained by students who successfully complete their studies at tertiary education (Ministry for Education and Employment, 2017)

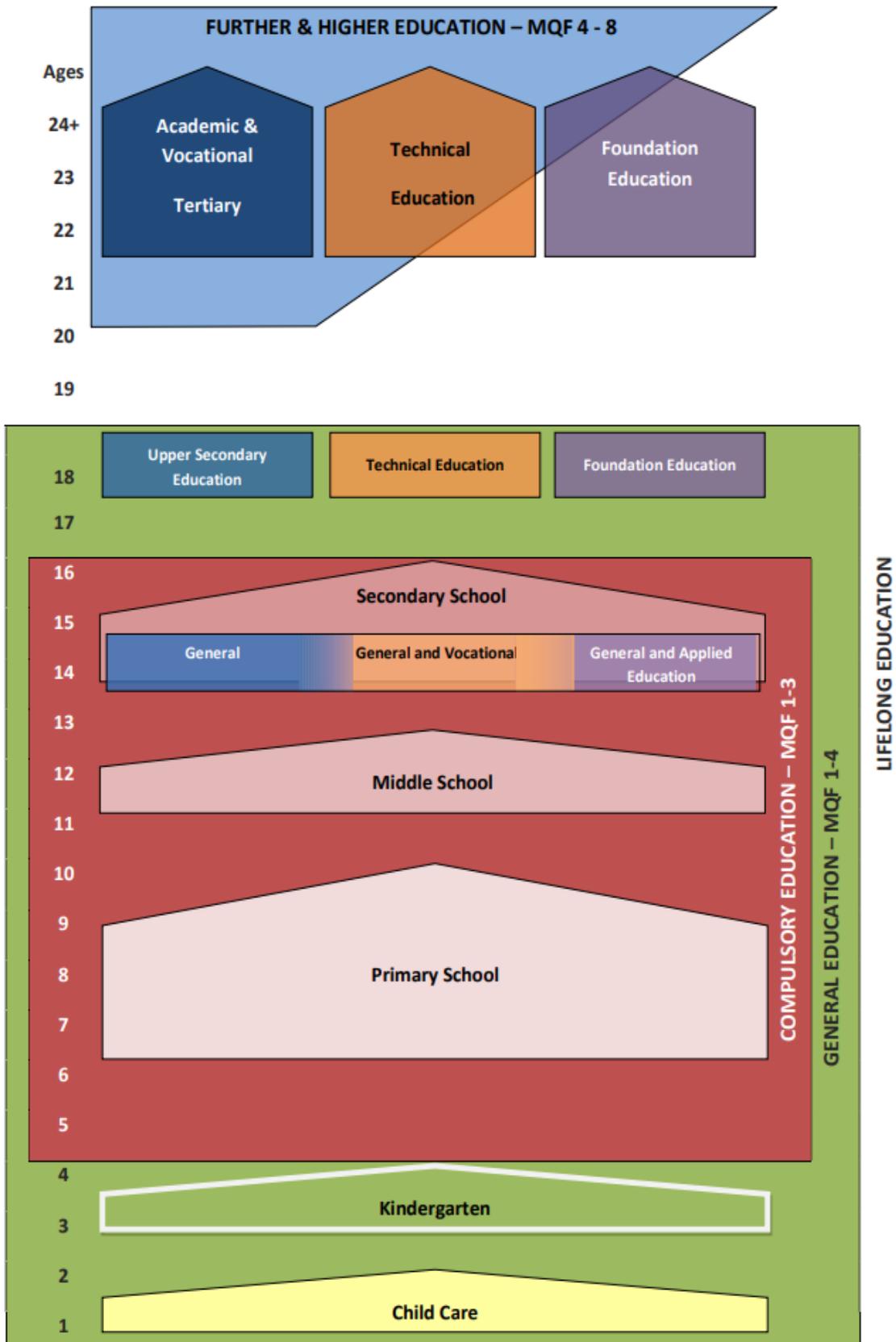


Figure 1: Overview of Lifelong Education in Malta

Furthermore, this framework had also sent forth the equality between vocational education and academic education. VET qualifications are now opening doors to several courses at advanced MQF levels and also gave access to VET training providers to connect their qualifications of MQF. Students who pursue their vocational studies at MCAST can then get certified up to MQF Level 6 which is equivalent to a Bachelor's degree gained from the University of Malta. In their 2018/2019 prospectus, MCAST is also offering five complete Masters Degree Programmes at MQF Level 7.

ITS students, on the other hand, can get certified up to Diploma Level (MQF Level 5) (Ministry for Education and Employment, n.d.). However, both vocational institutions are now providing their students the chance to further their studies at higher MQF levels by entering Tertiary Education (CEDEFOP, 2017b). For instance, postgraduates who have been rewarded with the higher diploma in hospitality management are able to go straight into their second year of the Bachelor's degree in tourism at the University of Malta. (UoM) (University of Malta, n.d.).

It is also important to point out that, students who still do not manage to gain a certificate when they finish their obligatory secondary school education, can still start afresh by starting a Foundation Course at MQF Level 1. Such courses are offered at MCAST with the aim of supporting further and higher education amongst tomorrow's generation. The latter is in line with the National Commission for Further and Higher Education (NCFHE) which identifies qualifications and accredited certifications against the MQF (Ministry for Education and Employment, n.d.).

A Malta Qualifications Council (MQC) for vocational and technical education was also set up in order to draw up standards and recognition for teaching organisations. (Malta College of Arts, Science and Technology [MCAST], 2015, p.12). The MQC aims to: support the National Qualifications Framework and establish policies that should act as a baseline for such a framework; ensures that publications of national standards of expertise, skills, and competences are being issued; approves the provision of VET training in both state-affiliated and non-governmental institutions; and keeps official records of the certification awarded to course attendees (A National Qualifications Framework for Lifelong Learning, 2007).

## What are the statistics of Malta as regards STEAM subject uptake from 2010 onwards?

Two decades ago, a study investigating the uptake of science subjects in secondary schools showed that, unlike popular belief, the number of students following science and applied science courses increased in all educational sectors (Pace, 2000 a). However, in the more recent past, Malta has experienced a deficit in the number of students who choose science subjects both during their compulsory schooling and also at post-secondary and tertiary level. This, in turn, could be correlated to the challenges that our country is facing due to the limited number of workers trained to enter into a science-related workforce.

This can be further supported by a study which shows that the number of students sitting for Biology, Chemistry, and Physics MATSEC exams has declined. In fact, the number of students applying for the three main scientific subjects offered at secondary level went down from 6,824 in 2010 to 5,135 in 2017. This indicates that, in seven years, Malta experienced a decline of over 1,000 students who took up science-related MATSEC exams, and hence, were less likely to choose a career in science (Musumeci & Pirotta, 2018). A slight decline was also recorded in the number of students who took up sciences at Advanced (AM) and Intermediate levels. In fact, it can be argued that in a two-year span, from 2010 to 2012, the number of students sitting for Advanced Level exams went down from 672 to 642 whereas the number of students sitting for Intermediate Level exams went down from 240 to 230 respectively (Musumeci & Pirotta, 2013).

The same study also makes reference to the main contributing factors that might have led to such worrisome results. Such factors include: students' socio-demographic and psychological factors; their family's socio-economic status; students' beliefs and values; learners' experiences at school and their relationship with their teacher; and the level of awareness that pupils hold in regards to the available scientific careers.

That said, students from high socio-economic status and students who did well in their primary level examinations and assessment tasks are more likely to take up STEAM subjects than their counterparts (Musumeci & Pirotta, 2018). Apart from this, in "A Vision for Science Education in Malta" (2014), it was pointed out that another main reason why more students underachieve in STEAM subjects is because of the way that science is being represented in schools. Unfortunately, school science is devoid of teaching approaches that increase students' critical thinking skills which are much needed for the place of work (Ministry for Education and Employment, 2011).

Results obtained from international studies like the Programme for International Student Assessment (PISA); and the Trends in International Mathematics and Science Study (TIMSS) further support the argument put forward so far. This is because in both PISA 2015 and TIMSS 2015, Malta's mean science score was significantly lower than the international average (Marmarà, 2018).

## What are the current policies in Malta with regards to promotion of STEAM careers? Are there any initiatives that promote these types of careers?

Considering the fact that there was a drastic decrease in the number of unskilled people who were capable of pursuing a scientific career on a European level, a need to develop new initiatives that aim to encourage more people to work into a STEAM-related job was identified. The latter can be supported by a report published by the European Union Commission which suggests that more policy makers should strive to enhance and increase the skills needed for STEAM employments amongst the entire countries which form part of the European Union. This is especially important when STEAM-based work sectors were forecasted to increase by nearly 7% from 2013 up to 2025 (European Parliament, 2015).

A significant number of local policy documents shed light on the troublesome situation that Malta is facing with regards to encouraging more people to gain the skills needed to work in STEAM jobs. In a green paper published by the Malta Chamber of Scientists, reference is made to the important role that policy makers have in narrowing the gap between the scientific and the social worlds and engaging Maltese citizens in STEAM subjects and future careers related to such fields. The latter could be made possible through: a shift in the way that science is being taught in schools at all levels; activities aimed at engaging different segments of society with science; devoting more funds for scientific research and how it could be effectively disseminated to the public; and investing in a knowledge-based economy which, in turn, promotes a stronger, knowledge-based economy resilient to future challenges (Malta Chamber of Scientists, 2016).

Furthermore, one of the main contributing factors for such a decline in the number of Maltese people entering into STEAM-related careers is the summative exam-focused education system which is not equipping tomorrow's citizens with the necessary 21<sup>st</sup> century skills needed for the world of work. Such skills include: critical thinking, cooperation, team spirit, innovate thinking, analytical thinking and digital skills (Innovation Starts with action! STEAM, 2016). Apart from this, the European Union Law identifies eight main competencies that tomorrow's world ambassadors should master at the end of their compulsory education. Such competencies suggest that citizens should be: capable of communicating well in both their native and at least one foreign language, competence in the fields of science and technology; digital literacy, autonomous learning, proficiency on how to effectively work in a group and embrace the significance of team work, creativity and innovation, and awareness of the cultural aspects that shape people's lives (European Reference Framework, 2006).

As a matter of fact, a European Policy Network on Key Competences in School Education (KeyCoNet) was launched in order to implement the eight key competencies abovementioned across Europe including Malta. In fact, the Ministry of Education and Employment in Malta developed a programme aimed at enhancing the competences and skills amongst low-achieving students in order to better equip them for the world of work. The programme was entitled as the Core Curriculum Programme (CCP) (Ministry for Education and Employment, 2012).

Such initiatives are in line with two of the most important education policy documents in Malta - the National Curriculum Framework for All (2012); and the Educational Strategy in Malta 2014-2024 (2014) which both highlight the significance of narrowing the existing gap in learning outcomes and the need to increase student's literacy, numeracy, and scientific literacy skills amongst students (Ministry for Education and Employment, 2014).

In relation to this, results from TIMSS 2015 Malta Report have shown that Year 9 Maltese science students underachieved in tasks which entail higher-order thinking skills and reasoning whilst they overachieved in activities which entail lower order thinking skills (TIMSS, 2015). Such results indicate that Maltese students still lack the essential skills needed to be competent in their future careers.

In the face of this situation, a number of initiatives started to be implemented in order to increase people's interest in science and to encourage them to choose a career in STEAM. One of the most important initiatives was that of shifting the pedagogical approach practiced by science educators at all levels of education from primary up to University level. Science educators were encouraged to adopt a constructivist approach in their lessons and to move from a teacher-centred to a more student-centred approach to learning. Apart from this, in a Vision for Science Education in Malta, reference is made to the effective use of inquiry-based learning and its role in making students aware of the meaning behind doing science (Ministry for Education and Employment, 2011).

One of the most prominent non-formal science sectors in Malta, Esplora Interactive Science Centre, is also actively involved in increasing 21<sup>st</sup> century transferrable skills amongst the Maltese population. In fact, a number of activities and events are organised on a yearly basis with the aim of developing a culture of scientific curiosity and creativity amongst the public as a whole. The hope is that these, in turn, will motivate and engage more people with science. The organisation of activities such as science camps, STEM career workshops, and hands-on demonstrations, to name a few, all play an important role in increasing people's interest in science (Esplora, n.d.)

## **Is there a list of employment opportunities which can be pursued in STEAM?**

Choosing STEAM-related subjects at all levels of education is correlated to a higher chance of finding an employment and in having a high annual net salary (Employability Index, 2015). Apart from this, people who opt to study science-related subjects can choose from a milliard of science-related careers. The list hereunder offers a range of jobs related to STEAM. However, this list is not comprehensive, and considering the drastic advances in the fields of science and technology, such a list is subject to constant transformational changes. Current STEAM employment opportunities include: medical science; forensic science; science education and practice; science communication and public engagement; R&D and manufacture of products; stem cell research; nanotechnology; neuroscience; healthcare; genomics; bioengineering; biotechnology; environmental science; and drug discovery in cheminformatics (OCR, n.d.).

## **Is there data available establishing the skill sets which are currently missing in specific STEAM jobs? Which are the jobs have a higher demand than supply, and vice versa?**

Despite the fact that Malta has experienced an upsurge in the number of citizens into employment, there is still a deficit in the number of citizens that have the necessary skills needed to be competent in the world of work (National Employment Policy, 2014). This, in turn, has led to a number of initiatives and programmes aimed at increasing the number of citizens that master entrepreneurial skills. This is important especially in STEAM-related jobs where the evolution of new technological advances has brought with it the necessity for people to gain completely new skills to be suitable for such jobs. In line with this, Malta has been working in direct collaboration with CEDEFOP and other EU Member States in order to: embrace scientific approaches; forecast prospective emerging sectors and the corresponding skills required; and strategically plan new reforms and education programmes that could assist today's citizens to gain all the required skills needed to enter into these new work niches.

In relation to this, recent statistics show that nearly half of the Maltese population in employment age are deficient in digital skills. This contrast to the EU average which adds up to 41% of the whole European citizens. This should be regarded as a worrisome situation since STEAM jobs entail a workforce that is digitally literate (National Employee Skills Survey, 2017). There are a number of reasons that could justify why Maltese citizens as a whole are not gaining the skills needed for current forms of employment. The Employability Index 2015 referred to above distinguishes between two main types of skills mismatch. These are a horizontal and a vertical mismatch. The former connotes a situation where an employee has all the necessary qualifications except those specific to the employment that they are applying for. The latter connotes to a situation where an employee meets all the criteria for a job but is not in possession of the qualifications needed for the employment (Employability Index, 2015).

This problematic issue is not limited to Malta. In fact, a European Commission report entitled "Europe needs more scientists" (Gago et al. 2005) has shed light on the importance of sustaining and increasing the number of STEM experts to drive today's technologically competitive Europe. The report also makes reference to the fact that today's school science education should better reflect real science experience and address the needs and desires of young people in a more effective manner (Osborne, Tytler, Clarke, 2008). Furthermore, a study identifies four main factors which might lead to the present crisis in science education in Australia. However, such factors coincide with the main problematic issues faced by Malta's educational stakeholders in relation to raising the bar in the number of students who choose STEAM-related subjects during their compulsory schooling years (Times of Malta, 2017).

The first characteristic connotes to the notion that students develop negative attitudes towards science as they move from their primary to secondary years of schooling. That is

why awareness on STEM-related careers should start from a very young age. In line with this, a study shows that STEM engagement in primary years of schooling determines students' subject choices when they start their secondary schooling (Marginson et al. 2013). Secondly, there is a decline in the number of students, particularly girls (Bøe, Henriksen, Lyons and Schreiner, 2011), who choose science subjects during their post-secondary years of schooling. Thirdly, there is a deficit in the number of teacher professionals who are skilled in STEM-related working sectors, and lastly, there is a shortage in the number of qualified science educators (Tytler, 2007).

In addition to this, research points out that demand in STEAM occupations is directly related to a country's economic status and employment rate. The higher the rate of employment, the higher the demand for employees who are competent to work in STEAM related fields. That said, there are even some professions where their demand in the labour market is far higher than their supply. The latter is true for engineering, mathematics, earth sciences, chemistry and statistics STEAM job sectors (DEST, 2006a).

As a result of this, there is a dire need for governmental bodies to start setting new reforms within the current education system which substantiate the introduction of STEAM in compulsory schooling. This could be correlated to an increase in scientifically literate students and also an innovative STEM workforce in the pipeline (White House, 2009). In conjunction with this, science career exhibitions and career awareness informal talks can also play a pivotal role in raising students' interest in taking up STEAM subjects to one day pursue a scientific career (Wu-Rorrer, 2017).

Hence, it can be argued that both formal and non-formal science sectors have the potential to facilitate people in gaining the skills that they need to be competent in STEAM-related careers. The ability to integrate knowledge and skills in order to solve problems, make sense of information in a logical manner, and collect and evaluate evidence before taking a final, well-informed decision can be regarded as the most important skills needed in nearly all of today's STEM and STEAM jobs (Lanthan, n.d.).

## **Which VET careers are difficult to attract people? What affects uptake of certain careers versus others?**

Following the closure of technical schools in Malta, there was a decrease in the number of students who chose to pursue a vocational career. In fact, statistical data released by the European Vocational Skills Week held in November 2018, found that the number of 14-16-year-old Maltese students who chose vocational subjects were the fourth lowest rate amongst all European countries (Times of Malta, 2018).

Such a worrisome situation was mainly the result of an education system that placed more emphasis on summative forms of assessment and exam-oriented assessments. Another challenge could be attributed to the fact that most parents hold the wrong perception that if their children were to take up a vocational path, they would not be successful in their career (Times of Malta, 2018). Little do they know, however, that vocational jobs still enable people to demonstrate their potentials, talents and abilities (Cedefop, 2018).

In a local policy on national vocational education and training, it was found that VET careers related to Public Administration, Defence, Education, Human Health, and Social Work Activities are less popular amongst citizens when compared to jobs related to wholesale and retail, transportation and storage, and accommodation and food service activities (MCAST, 2015). Reference is also made to the fact that, as from the first analysis of such data way back in 2003, caring professions such as beauty therapy remained dominated by women whereas men dominated manual - related jobs such as construction and wood work (Jobsplus, 2004). This confirms that Malta is still gender-biased and that the majority of Maltese citizens still hold a significant number of gender stereotypes (MCAST, 2015).

In addition to this, the latest PISA study has shown that boys are more than twice as likely as girls to aspire for a career in engineering, science or architecture; five times more likely than girls to aspire for a career in computing and almost four times as likely as girls to aspire for a career as an electrical or communication engineering technician (PISA, 2015).

Discrimination against women in STEM is also an argument worth exploring and is not a recent phenomenon. Throughout the history of science, there was always a lack of female representation in STEM fields which, in turn, acted as an impediment for inspiring more girls and women to enter into STEAM careers (Laiviera, 2018). Apart from this, discrimination on the basis of gender results in and reinforces inequalities which, in turn, leave a detrimental effect on productivity, competitiveness in the market and employees' health and psychological care (Jobsplus, 2004).

Furthermore, there is a direct correlation between the socio-economic status and the type of employment pursued. Students who come from families of low socio-economic status are usually at a higher risk of leaving school early and find an employment at the lowest level of the hierarchical scale. Such job occupations include: factory workers; cleaners; security officers; and care takers (Ministry for Education and Employment, 2014).

In line with this, disadvantaged families do not have the necessary resources to support their children's education system and therefore, it is much harder for such children to further

their education beyond compulsory schooling and go up the social hierarchy ladder (Ministry for Education and Employment, 2014).

Research based on data obtained from an Australian Secondary School also shows that VET subjects are mostly chosen by students who come from a low socio-economic status and that attend state schools rather than private and church schools (Fullarton and Ainley, 2000). This can be adapted to a local context where the high-level occupations are mainly dominated by males, people coming from high-class families and people who had the privilege to follow private schooling or attend a catholic school.

There is also a direct relationship between the parent's educational expertise and their children's level of expertise. As a matter of fact, a Eurostat survey has shown that students who have parents that have high levels of education were more likely to engage in schooling and further their studies up to tertiary education as opposed to students whose parents had low levels of education (Malta National Lifelong Learning Strategy 2020, 2014).

## Conclusion

In conclusion, the Maltese education system should continue to evolve and transform itself to become more student-centred, to enhance students' 21<sup>st</sup> century skills and to better prepare them for the world of work. In conjunction with this, educational policies should seek to remove the wrong perception that students who pursue careers in VET subjects would be risking not finding a rewarding employment as they enter into the world of work. Apart from this, emphasis should also be placed on raising awareness on the necessity for more students to take up STEAM-related subjects since this opens a range of opportunities with the STEAM fields. This is because the economic, social, and environmental success of the world depend heavily on the amount of skilled people who are capable to observe, manipulate, solve problems, design, create, and evaluate what happens in their surroundings.

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