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Physiological and Therapeutic Outcomes of Intermittent Fasting versus Calorie-Restriction Diet in Patients suffering from Metabolic Syndrome

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Abstract: The main objective of this study was to determine whether an intermittent fasting diet in combination with a CR diet results in better outcomes on risk factors associated with metabolic syndrome (such as lowering of triglycerides, fasting blood glucose, and blood pressure decrease in abdominal obesity and an increase in HDL-cholesterol and related weight loss for both male and female patients) than with a conventional CR diet alone.

A 12-week retrospective case-control study was carried out and involved 78 females and 22 males who exhibited or were receiving medications for three or more conditions related to metabolic syndrome and who completed the study out of 120 participants at baseline. These were randomly assigned to either a conventional calorie-restriction diet or to an intermittent-fasting diet. Relevant baseline parameters were measured during the first encounter and were then repeated after twelve weeks. Professional contact was maintained on a fortnightly basis for both groups.

Subjects randomly assigned to the intermittent fasting diet lost more weight than subjects on a conventional calorie-restriction diet after 12 weeks (mean ± SD, 5.7 ± 3.2 kg vs 11.4 ± 6.4 kg; $p < 0.001$). There were also statistically significant decreases in waist circumference (10.1 ± 7.2 cm vs 4.5 ± 3.3 cm; $p < 0.001$), serum triglycerides (0.31 ± 0.29 mmol/l vs 0.16 ± 0.16 mmol/l; $p = 0.002$), and systolic blood pressure (11.1 ± 8.2 mm Hg vs 5.2 ± 4.8 mm Hg; $p < 0.001$) and an increase in HDL-cholesterol (0.25 ± 0.16 vs 0.14 ± 0.15 mmol/l; $p = 0.001$). However, no statistically significant changes in diastolic blood pressure and fasting blood glucose were recorded. The intermittent fasting diet gave better weight loss outcomes (6.67% vs 12.35%) than did the conventional calorie restriction diet when compared to the baseline weight after the conclusion of the 12-week programme. The intermittent fasting diet was also associated with statistically significant improvements in four out of the six parameters measured and associated with metabolic syndrome. Longer-term studies are required to determine whether these outcomes will be maintained over longer periods of time assuming that there is compliance by the participants.

Keywords: metabolic syndrome, diet, intermittent fasting, calorie restriction, non-pharmacological intervention

Literature Review

Metabolic syndrome

The prevalence of obesity has increased markedly in the past decade (WHO 2013) with some studies showing that this has actually doubled in the past 20 years (Flegal *et al*. 2010); as a consequence so have the associated metabolic comorbidities (Mokdad *et*

al. 2003; Ford *et al.* 2002). The current worldwide mortality rate due to obesity-related conditions is estimated to be nearly 3 million adults per annum (WHO 2013). Metabolic syndrome (also referred to as MeS) is a term used to describe the clustering of risk factors, mainly hypertension (high blood pressure), dyslipidaemia (deranged blood lipid levels), hyperglycaemia (high blood glucose levels), and abdominal obesity (Grundy *et al.* 2004a), all of which contribute to cardiovascular disease or CVD . The National Cholesterol Education Programme's Adult Treatment Panel III (or ATP III) recognises six metabolic syndrome risk factors that relate to cardiovascular disease:

1. Excessive abdominal adiposity or obesity;
2. Atherogenic dyslipidaemia;
3. Hypertension;
4. Insulin resistance with or without glucose intolerance;
5. Pro-inflammatory states;
6. Prothrombic states (Grundy *et al.* 2004b).

According to ATP III (Beilby 2004), an individual suffers from metabolic syndrome if s/he exhibits or is receiving medication for three or more of the following conditions:

Criterion or risk factor	Defining level
Abdominal obesity (measured as waist circumference)	Males > 102 cm; females > 88 cm
Triglycerides	≥ 1.7 mmol/l
High-density lipoproteins (HDL-chol)	Males < 1.04 mmol/l; females < 1.30 mmol/l
Blood pressure	≥ 130/≥85 mm Hg
Fasting blood glucose	≥ 6.1 mmol/l

Table 1: *Table showing the defining levels for criteria or risk factors used to establish whether a patient suffers from metabolic syndrome*

Although obesity in general is considered as a risk factor, abdominal obesity has been found to be more correlated with metabolic syndrome risk factors than a BMI of greater than 25.0 (Beilby,2004). Studies have shown that weight gain during adulthood is directly related to an increased risk of coronary heart disease (CHD) (Mercuro *et al.* 2011).The effects of metabolic syndrome are not only limited to the defined risk factors; individuals with MeS are more susceptible to other diseases or conditions such as asthma, sleep disturbance, some cancers, fatty liver disease, cholesterol gall calculi, and polycystic ovary syndrome (Grundy *et al.* 2004a; Grundy 2005).

The effects of diet on metabolic syndrome

Diet, together with physical exercise and other factors, remains one of the most important lifestyle interventions in a bid for an individual to lose weight, with energy or caloric restriction (CR) and dietary fat limitation being the two most common dietary strategies (Gogebakan *et al*. 2011). CR has also been shown to increase life expectancy and, together with other factors such as meal frequency, nutritional patterns, and sleeping habits, it has a large effect on human health in general (Aksungar *et al*. 2017). A

diet should not control calorific intake only via the macronutrient proportions but also through portion size; the problem with many obese individuals is that they are unable to control portion sizes which, in turn, diminishes overall weight loss (Davis *et al*. 2007).

Weight loss due to dietary measures is typically about 5–10% of the baseline weight (Lindstrom and Uusitupa, 2008), but even such modest weight loss results in health benefits as indicated by biomarkers of diabetes mellitus, cardiovascular disease, hypertension, and MeS (Eriksson *et al.* 2006; Phelan *et al.* 2007). In fact, weight loss, together with physical activity, is recognized as the first line non-pharmacological treatment for MeS (ATP III, 2001); low-carbohydrate diets, for example, have been shown to give changes in biochemical marker levels that approach those obtained with pharmacological medications such as fibric acid or niacin derivatives (Foster *et al.* 2003). Several short-term epidemiological studies show that diet plays a key role in the management of metabolic syndrome (Esposito *et al.* 2007; Lofgren *et al.* 2005; Poppitt *et al.* 2002; Case *et al.* 2002). However, very few long-term studies have been carried out to investigate this issue (Orchard *et al.* 2005; Despres *et al.* 2005; Van Gaal *et al.* 2005; Pi-Sunyer *et al.* 2006).

Several early studies showed that the most important factor in a diet is energy deficiency and that, when this is stable, the macronutrient composition does not bear any effect on weight loss (Yang and Van Itallie, 1976; Rabast *et al.* 1978; Golay *et al.* 1996a; Golay *et al.* 1996b). However, in recent years, weight management has turned to the conventional dietary approach as recommended by several researchers which is a high-carbohydrate, low-fat and energy-deficient diet (Seagle *et al.* 2009; Krauss *et al.* 1996). Amongst one of the benefits of this diet is the lowering of LDL-cholesterol levels (Noakes *et al*. 2005). However, several other studies have shown that other diets have better outcomes on metabolic syndrome than the conventional diet. One study showed that the increase in HDL-cholesterol and lowering in triglycerides was significantly better throughout the study when individuals were placed on a low-carbohydrate diet than in other subjects who followed a conventional diet (Foster *et al.* 2003); however, systolic blood pressure and both total and LDL cholesterol did not change significantly in either group although the latter two markers were significantly lower in the conventional diet group during the third month. Low-carbohydrate diets are also associated with a more significant decrease in triglycerides and increase in HDL-cholesterol concentration when compared to the outcomes of the conventional diet (Foster *et al*. 2003). Several other studies show that high-carbohydrate, low-fat diets have the reverse effect of lowering HDL-cholesterol and raising serum triglycerides (Mensink and Katan, 1992; Garg *et al.* 1992; Ornish *et al.* 1998; Wing *et al.* 2010).

Foster's study also showed that both a low-carbohydrate diet and a conventional diet significantly lower diastolic blood pressure as well as improve insulin response. However this latter study had its limitations: (i) attrition rates were high; (ii) a self-help approach was used as opposed to direct counselling and this proved to be less effective; (iii) in contrast to the clinical reality where diabetes is prevalent amongst the overweight and obese population, diabetic individuals were excluded from the study (Stern *et al.* 2004). Caloric restriction (CR) has been shown to have a positive metabolic effect especially in pre-diabetes and insulin resistance without any pharmacological assistance (Aksungar *et al.* 2017).

Foster *et al.*'s (2003) study had other deficiencies:

1. The low-carb diet was not calorie-controlled, i.e. there was no restriction in the consumption of fats and proteins. Consuming unrestricted amounts of saturated fats subsequently increases LDL-cholesterol concentration which, in itself, is a risk

factor for CHD;

2. The calorific deficit was not the same for each participant as females were ascribed a 1200-1500kcal/day diet and males a 1500–1800 kcal/day intake, i.e. the calorific deficit was not calculated according to each individual's daily energy requirements;

3. There were twice as many female participants as there were males.

This study however showed that subjects who had followed a low-carb, high-protein, and high-fat diet had lost more weight than those individuals on the conventional diet at both 3 and 6 months but the difference at 12 months was not significant, possibly due to a greater weight regain in the low-carb group and also the small sample size. This suggests that long-term adherence to a low-carb diet may be difficult. Apart from weight control reasons, a normal diet should limit the intake of (i) saturated and trans fats and cholesterol, (ii) sodium, and (iii) simple sugars but encourage consumption of fruits, vegetables, whole grains, monosaturated fat, and fish. This is very much in line with what is now being termed as the 'Mediterranean diet', which is characterized with high levels of fibre, omega-3 fatty acids, antioxidants, and phytochemicals from foods such as olive oil, legumes, and whole grains, all of which may be the reason for the health benefits that this diet seems to have on MeS patients (Esposito *et al.* 2007, Esposito *et al.* 2013).

One dietary approach that has gained popularity with the scientific community as well as with the lay public and media over the past decade is the intermittent fasting (IF) diet (Mattson and Wan 2005). This practice of intermittent fasting is not new as it has been practised globally in several different formats for different religious or health reasons (Patterson and Sears 2017). Fasting has been known to be a non-pharmacological method of counteracting several diseases such as CVD, cancer and diabetes (Mattson *et al*. 2017). The long-standing assumption was that fasting slowed down an individual's metabolism; however, research indicates that fasting for a period limited to a few days actually increases metabolism (Zauner *et al*. 2000; Webber *et al*. 1995) possibly due to an upsurge in the production of noradrenaline which is responsible for fat metabolism (Zauner *et al.* 2000; Patterson *et al.* 2015).

The most popular regimen of intermittent fasting is the 5:2 diet and involves severely limiting the calorific intake to approximately 500–600 kcal/day (75-90% of an individual's daily energy needs) for one or two non-consecutive days a week rather than totally restricting it (Harvie *et al*. 2011) by limiting carbohydrate and fat intake but eating normally for the remaining 5 days. Several review articles on both animal studies and human trials give strong evidence that there is a need for more rigorous clinical studies on intermittent fasting as a means of improving human health (Gotthardt *et al.* 2016; Harvie and Howell 2016; Headland *et al.*, 2016). There is also evidence that such a diet may reduce markers related to aging and risks for age-related illnesses (Wei *et al*. 2017). The weight loss can then be augmented by combining the two-day IF with a daily CR diet on the rest of the week. Animal models have shown that this combination therapy gives greater weight reductions when compared to regimes that used each intervention separately (Buschemeyer *et al*. 2010). A 24-week randomized clinical trial showed that IF led to a 7% reduction in body weight in obese female subjects (Harvie *et al*. 2013). Studies have shown that both triglycerides and LDL-cholesterol decreased by 17% and 10% respectively in individuals placed on an IF diet for 12 weeks (Harvie *et al.* 2011). Animal models have also been used to show the superior changes in CVD risk factors when using an IF diet (Buschemeyer *et al.* 2010) in comparison to a conventional diet. Another study showed that the 5:2 diet is a successful diet; however, as in the case of a conventional diet, there was no significant change in diastolic blood pressure, fasting blood glucose or lipid

levels (Conley *et al*. 2018).
However, most of these studies had major deficiencies: (i) there was no individualised daily energy requirement assessment for participants; (ii) participants were not given direct counselling; (iii) high attrition rates; (iv) lack of adherence to prescribed diets; (v) small numbers of participants; (in some cases less than 50 participants) (Varady *et al.* 2009; Varady *et al.* 2013; Hoddy *et al.* 2016; Harvie *et al.* 2011; Harvie *et al.* 2013). This latter factor therefore limits the statistical power of analysis. The overall evidence shows that the 5:2 diet is successful but does not give better results when compared to a conventional diet but further research is needed to investigate its long-term effect and also its effectiveness on other groups or populations (Conley *et al*. 2018).

The main objective of this study was to determine whether an intermittent fasting diet in combination with a CR diet results in better outcomes on risk factors associated with metabolic syndrome (such as lowering of triglycerides, fasting blood glucose, and blood pressure, decrease in abdominal obesity and an increase in HDL-cholesterol and related weight loss for both male and female patients) than with a conventional CR diet alone. In the case of individuals who are under medication for any of these risk factors, a lowering in dosage of medication was considered to be a successful outcome of the regimen.
Several of the studies were carried out for a duration of twelve weeks (Harvie *et al.* 2013; Foster *et al.* 2003; Conley *et al.* 2018) and hence this study endeavoured to be of a similar duration but prospective studies should be of a longer duration, e.g. at least one year.

Methods

Study design

This study was a retrospective case-control study in which the physiological and therapeutic outcomes in individuals suffering from MeS and opting for an IF plus CR diet (case group) were compared with the outcomes in patients suffering from MeS and choosing a conventional CR diet alone as their mode of intervention (control group). According to Creswell (2014), the criteria for selecting this quantitative research design can be deduced from the research problem: the issue that needs to be addressed and the identification of the factors that influence the outcomes, whether there is a better dietary (non-pharmacological) treatment that collectively addresses the cluster of risk factors affecting individuals suffering from metabolic syndrome to the conventional calorie-restriction diet traditionally used. We also need to answer the question, 'What is the utility of this intervention?' The answer would be whether IF plus CR will significantly and positively affect MeS when compared to conventional calorie-restriction diets alone. The study's potential audience consists of medical practitioners, nutritionists, and weight management practitioners who are all involved in the treatment of metabolic syndrome patients and those who are in the field of preventive medicine. This was a repeated-measures experimental design as this study involved a comparison of the data gathered before and after the intervention, as well as a between-subjects design as a comparison between the two groups (individuals on IR and CR diets) was carried out. Measures to minimize internal validity threats (Creswell 2014) such as invalid biochemical (blood glucose, triglycerides and HDL-cholesterol) and physical measurement of blood pressure and weight were taken with the use of standards and regular calibration where necessary. External validity threats such as whether the subjects were truly following the diet to the letter and whether they had really understood how the diet works could only be partially mitigated through food records and fortnightly encounters. However, there was a risk that subjects might not record all their food and beverage intake or that they may have opted out of the diet as they would have envisaged this recording process as a burden.

Subjects

A total of 100 persons (78 women and 22 men) participated in this study. Patients attending a general practitioner's private clinic and suffering from metabolic syndrome were offered the services of a resident weight management consultant (the researcher in this study). Subjects who accepted to utilize this service were assessed and consulted in the initial encounter and were then given the option to choose between the conventional calorie-restriction diet and the intermittent fasting diet.

Outcomes

In the initial encounter the aim of the consultation was to gather data such as age, gender, level of activity, risk factors that the subject suffers from, and to note whether the subject was on any relevant medications. Physical parameters such as height, weight, waist circumference, and blood pressure were measured. The same apparatus was used for all the subjects and in all other repeated measurements throughout the duration of the study and all the apparatus used, such as weighing scales (Detecto PD200 Digital Weighing Scales) and sphygmomanometer, were regularly calibrated throughout the study. In this initial consultation and in future encounters, subjects were asked to attend the session wearing a tracksuit and T-shirt (preferably the same ones at each encounter) and they were asked to remove their shoes before any weight or height measurements were taken. A fasting blood sample was taken at this initial consultation and at the final encounter to determine the subject's fasting blood glucose, triglyceride, and HDL-cholesterol levels. Analysis of the samples were carried by the researcher using standardized techniques where commercially purchased chemical standards were utilized to ensure reliability. These specific parameters were chosen as they are the major criteria used to define metabolic syndrome (Beilby 2004).

With these parameters, the researcher could work out the resting metabolic rate of the individual using the Schofield equation (Henry 2005). A diet with a calorific deficit of 500–600 kcal/day and divided into the different macronutrients for which different number of portions were allotted and portion size was controlled, was then ascribed to the subjects (Harvie and Howell 2017). Those individuals opting for an intermittent fasting diet were also ascribed a two-day fasting diet according to their resting metabolic rate. On these days, both carbohydrate and fat intake was kept to a minimum and portion sizes from the different macronutrient groups were controlled. Over the following 12 weeks, which were the duration of this study (determined from the average duration of other studies referred to in the literature review), subjects in both groups were consulted on a fortnightly basis to ensure that they were following the diet correctly, to deliver direct counselling, and to offer psychological support; all this was done as reinforcement in a bid to minimize attrition rates. Subjects were asked to keep a record of their food and beverage intake to ensure that they were following the prescribed diet according to instructions. Weight, waist circumference, and blood pressure readings were also taken during these fortnightly encounters. Patients were advised that should any health concerns have arisen during these encounters, they would be directed to the general practitioner immediately.

At the end of the 12 weeks, physical parameters (weight, blood pressure, waist circumference), status of medications (increase or decrease of types and dosage of medications received), and biochemical parameters (fasting blood glucose, triglycerides, and HDL-cholesterol) were repeated in both groups (i.e. for both individuals on IR and CR diets). Subjects who had any changes in their relevant medication type or dosage during the course of the study were excluded from this study.

Statistical analysis

Statistical analysis was carried out with the use of SPSS software. Only data for subjects who completed the entire programme was considered for this study. Hotelling's T^2 test was used to assess the differences in the six parameters that were chosen (waist circumference, serum triglycerides, HDL-cholesterol, systolic and diastolic blood pressure, and fasting blood glucose) as risk factors indicative of metabolic syndrome. This test combines all the dependent variables to form a 'new' dependent variable so as to maximize the differences between the two groups of the independent variable (those on the conventional calorie restriction diet and the second group on the intermittent fasting diet). Pearson correlation coefficients were used to test for multicollinearity, boxplots, and Mahalanobis distance were used to test for univariate and multivariate outliers respectively while the Shapiro-Wilk test, Box's M test, and Levene's test were used to test for multivariate normality, homogeneity of variance-covariance, and homogeneity respectively. As the outcome of the Hotelling's T^2 test was statistically significant, post-hoc tests (independent-samples t-test) were run for each dependent variable.

Results

A total of 100 persons (78 women and 22 men) completed the 12-week programme of the study; 48 of these subjects followed the conventional calorie-restriction diet while 53 chose to follow the intermittent-fasting diet. Originally 60 subjects were randomly assigned to each diet.

Characteristic	Conventional calorie-restriction diet (N = 48)	Intermittent fasting diet (N = 53)
Gender (number of subjects)		
Males	6	38
Females	40	16
Age (years)	48 ± 6.8	53 ± 9.7
Weight (kg)	85.7 ± 12.9	92.1 ± 19.3
Body mass index	33.0 ± 5.4	35.5 ± 7.9
Waist circumference (cm)	96.6 ± 10.2	103 2 ± 13.9
Serum triglycerides (mmol/l)	1.59 ± 0.5	1.65 ± 0.5
HDL-cholesterol (mmol/l)	0.98 ± 0.1	0.97 ± 0.1
Systolic blood pressure (mm Hg)	140 ± 6.3	143 ± 10.7
Diastolic blood pressure (mm Hg)	89 ± 3.2	90 ± 6.2
Fasting blood glucose (mmol/l)	5.85 ± 1.5	6.04 ± 1.3

Table 2**:** *Base-line characteristics of subjects following the two diets*

Hotelling's T^2 was run to determine the effect of the two different diets on factors that relate to metabolic syndrome. Six risk factors or parameters were assessed: waist circumference, serum triglycerides, HDL-cholesterol, systolic blood pressure, diastolic blood pressure, and fasting blood glucose. Subjects were randomly assigned to the two different diets: a conventional calorie-restriction diet or an intermittent-fasting diet. Data are expressed as mean ± standard deviation. Preliminary assumption checking revealed that data was normally distributed for all parameters except for waist circumference, serum triglycerides, and fasting blood glucose, as assessed by Shapiro-Wilk test ($p>0.0042$ due to application of Bonferroni adjustment). However, the Hotelling's T^2 test was still run as it is fairly robust to deviations from normality with respect to Type I error (Bray & Maxwell 1985). There were some univariate outliers in the data, as assessed by inspection of boxplots and only one multivariate outlier, as assessed by Mahalanobis distance ($p>0.001$; critical level = 22.46); however these were accepted. There were linear relationships, as assessed by scatterplots and no multicollinearity ($r<0.9$). The assumption of homogeneity of variance-covariance matrices, as assessed by Box's M test ($p<0.001$) was violated but, since relatively equal sample sizes were assessed for both groups, the violation was ignored; however, Pillai's criterion was used for the Hotelling's T^2 assessment as it is more robust to unequal covariance matrices (Olsen 1976). Mean and standard deviation values for the six parameters assessed are shown in the table below.

	Diet chosen	Mean	Std. Deviation
Difference in weight	conventional calorie restriction diet	5.7	3.2
	intermittent fasting diet	11.4	6.4
Difference in waist circumference	conventional calorie restriction diet	4.465	3.2830
	intermittent fasting diet	10.144	7.1869
Difference in serum triglcerides	conventional calorie restriction diet	.157	.1635
	intermittent fasting diet	.312	.2898
Difference in HDL cholesterol	conventional calorie restriction diet	.139	.1519
	intermittent fasting diet	.247	.1588
Difference in systolic blood pressure	conventional calorie restriction diet	5.152	4.8165
	intermittent fasting diet	11.148	8.2105
Difference in diastolic blood pressure	conventional calorie restriction diet	3.717	3.2705
	intermittent fasting diet	6.111	5.6290
Difference in fasting blood glucose	conventional calorie restriction diet	.385	.6080
	intermittent fasting diet	.653	.7662

Table 3: *Table of mean and standard deviation of weight and the six parameters assessed*

The differences between the two diets on the combined dependent variables were statistically significant, F (6, 93) = 4.898, p<0.0005; Pillai's Trace = 0.240; partial η^2 = 0.240. A Bonferroni-adjusted α level of 0.008333 with a simultaneous 99.1667% confidence level was used. The table below shows the mean differences together with the lower and upper bound of the 99.1667% confidence intervals.

Dependent Variable	(I) Diet chosen	(J) Diet chosen	Mean Difference (I-J)	Sig.	99.1667% Confidence Interval for Difference	
					Lower Bound	Upper Bound
Difference in waist circumference	conventional calorie restriction diet	intermittent fasting diet	-5.679*	.000	-8.778	-2.581
	intermittent fasting diet	conventional calorie restriction diet	5.679*	.000	2.581	8.778
Difference in serum triglcerides	conventional calorie restriction diet	intermittent fasting diet	-.155*	.002	-.285	-.025
	intermittent fasting diet	conventional calorie restriction diet	.155*	.002	.025	.285
Difference in HDL cholesterol	conventional calorie restriction diet	intermittent fasting diet	-.108*	.001	-.192	-.024
	intermittent fasting diet	conventional calorie restriction diet	.108*	.001	.024	.192
Difference in systolic blood pressure	conventional calorie restriction diet	intermittent fasting diet	-5.996*	.000	-9.704	-2.287
	intermittent fasting diet	conventional calorie restriction diet	5.996*	.000	2.287	9.704
Difference in diastolic blood pressure	conventional calorie restriction diet	intermittent fasting diet	-2.394	.013	-4.931	.143
	intermittent fasting diet	conventional calorie restriction diet	2.394	.013	-.143	4.931
Difference in fasting blood glucose	conventional calorie restriction diet	intermittent fasting diet	-.268	.058	-.645	.109
	intermittent fasting diet	conventional calorie restriction diet	.268	.058	-.109	.645

Table 4: *Table showing the mean differences together with lower and upper bound of 99.1667% confidence intervals*

There was a statistically significant difference in waist circumference, serum triglycerides, HDL and systolic blood pressure between subjects placed on a conventional calorie-restriction diet and an intermittent fasting diet ($p<0.008333$ as a Bonferroni adjustment was applied) but not for diastolic blood pressure and fasting blood glucose ($p = 0.013$ and 0.058 respectively).

Discussion

The results of this retrospective case study demonstrate that the intermittent fasting diet in combination with a conventional calorie-restriction diet produces greater weight loss (11.4 ± 6.4 kg) than the conventional calorie-restriction diet on its own (5.7 ± 3.2 kg) for subjects following their respective diet programmes for a period of twelve consecutive weeks. These findings are similar to those in other recent similar studies (Klempel *et al.* 2012; Johnson *et al.* 2007; Harvie *et al.* 2011); however, some of these studies were carried out for a different duration of time. This statistically significant difference in weight between the two groups ($p < 0.001$) – conventional calorie restriction diet 4.9 (-0.3 to 17.4) kg compared with intermittent fasting diet 10.4 (-1.9 to 32.4) kg – shows that overall there was a larger energy deficit in the intermittent fasting group than in the conventional calorie-restriction group. The percentage weight loss when compared to baseline weight in both groups (conventional calorie restriction 6.67% versus intermittent fasting 12.35%) is similar to that observed in other weight loss studies (Lindstrom and Uusitupa 2008; Harvie *et al.* 2013) Other reasons for this difference in weight loss could be attributed to the fact that, since participants were allowed to choose the diet that they wished to follow, those individuals who chose the intermittent fasting diet were more motivated to lose weight. This could also be the reason for the lower attrition rate in this group. Also subjects may have actually consumed less foods then their daily allowance so that the energy deficit was, in fact, less than that calculated.

Subjects on the intermittent fasting diet also showed statistically significant decreases in waist circumference (10.1 ± 7.2 cm), serum triglycerides (0.31 ± 0.29 mmol/l), and systolic blood pressure (11.1 ± 8.2 mm Hg) and an increase in HDL-cholesterol (0.25 ± 0.16 mmol/l) when compared to those individuals on the conventional calorie-restriction diet – waist circumference (4.5 ± 3.3 cm), serum triglycerides (0.16 ± 0.16 mmol/l), systolic blood pressure (5.2 ± 4.8 mm Hg), and HDL-cholesterol (0.14 ± 0.15 mmol/l). Serum triglycerides and HDL-cholesterol levels are also both considered to be very important coronary heart-disease risk factors (Szapary and Rader 2001; Forrester 2001; Boden 2000). The magnitude of the changes recorded in these biochemical markers are close to those obtained in subjects on pharmacological treatment, e.g. niacin, fibric acid derivatives, etc. (Szapary and Rader, 2001, Foster *et al.* 2003) but obviously without the associated side-effects of the medications.

The observed changes in the levels of the biochemical markers may have been caused by changes in the macronutrient content of the subjects' diets as individuals were prescribed a specific number of portions for different macronutrient groups, thus ensuring a varied diet and controlling for carbohydrate and fat intake which contribute greatly to calorific intake. Individuals who previously consumed, for example, relatively large proportions of fats, were considerably reducing intake of such macronutrients and were also made aware of what is an acceptable portion size (Davis *et al.* 2007). As a result, such macronutrient changes may have been responsible for the improvements in HDL-cholesterol and serum triglyceride levels as shown in other studies (Westman *et al.* 2002; Golay *et al.* 1996a; Lewis *et al.* 1977). It may also be that the increased consumption of fruits, vegetable, and fibre may have caused an independent decrease in these biochemical markers

and subsequently decreased the risk not only for metabolic syndrome but also for coronary heart disease (Dansinger *et al.* 2005; Schaefer 2002). Another factor that may have contributed to the statistically significant changes in parameters may have been an increase in physical activity; this was encouraged during the regular encounters but its contribution was not factored into this study. It would have been interesting to observe whether these statistically significant differences would have persisted after six or even twelve months.

The overall attrition rate of 16.7% was quite satisfactory when compared with that attained in other studies (Foster *et al.* 2003; Harvie and Howell 2017). The individualized and regular encounters with the subjects may have been a major contributing factor as most other studies rely on self-help but one cannot absolutely ascertain the extent of compliance of the subjects to either of the two diets. The study had several limitations, some of which were: (i) the short duration of the study (although other weight loss studies have been carried out for the same period of time); (ii) most of the subjects (78%) were females; (iii) the exact calorific intake of the individuals could not be definitely established; (iv) the assumption that all subjects whose medication type or dosage had changed had informed the researcher; (v) compliance to the diet and relevant medications through the course of the study.

Conclusions

This study has come to a similar conclusion to other studies regarding the effect of diet on metabolic syndrome – diet can play a major role in the non-pharmacological management of metabolic syndrome (Esposito *et al.* 2007; Lofgren *et al.* 2005; Poppitt *et al.* 2002); however, it is now evident that the intermittent fasting diet give better outcomes than a conventional calorie-restriction diet. The study has also shown that there is a statistically significant difference in anthropometric, physiological and biochemical parameters, namely weight, waist circumference, serum triglycerides, systolic blood pressure but not diastolic blood pressure, and fasting blood glucose levels. Further long-term studies are needed to observe if these differences persist, if attrition rates increase and whether latter parameters would show significant differences over longer periods of time.

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Alleviating Poverty in Malta: Changing Minds through Education

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Abstract: Education plays an important role in minimizing the risk of a person falling into poverty. Studies have shown that persons who pursue an education to post-secondary and tertiary level are considered to be less at risk of poverty. Studies also show that the impact of education and the risk of poverty may also be generational. Individuals born in families with a lower educational level are more likely to be at risk of poverty. Research has shown that children who experience poverty very early in life may tend to have issues with achieving a complete education. This may have a ripple effect since education effects employability; that, in turn, plays an important role to address the importance of improving the financial capability of the individual and his family. This research aims to indicate strategies that may be drawn up in order to address the important role of education in eradicating poverty. A holistic approach which offers the right content, structure, and facilities is important in order to guarantee a sound basis on which more educational building blocks may be built by the individual during the educational path that the person decides to follow. Changing minds of professionals involved in planning and devising educational reforms and strategies, together with providing the most adequate support for inclusive education, key skills tutoring, and mentoring, will ensure more success stories. All these strategies will concurrently help in different ways to address the issue of financial capability of an individual and his family, and thus alleviate poverty.

Keywords: Poverty, education, curriculum, educators, holistic approach

Background to the Study

The researcher's interest in this area of study stems from the fact that the researcher has been involved in education as a profession and in voluntary work for a number of years. The researcher has been involved in voluntary work with various organizations and has come across numerous cases of poverty in Malta and the difficulties that these people face. Over the years, the researcher has also been involved in opportunities to offer help in the preparation and delivery of financial literacy programmes to people who are near the poverty line or at risk of falling below the poverty line. The researcher has also been collaborating with organizations that offer financial literacy programmes and mentoring services to their service users who are mainly people in vulnerable situations.

Encountering these difficult situations and observing the difficulties faced by different people, including those who contact NGOs for help, has made the researcher realize that very often there are a number of common factors that may contribute to people finding themselves in difficult situations. It is regularly observed that these people have low academic background, may not have basic financial literacy knowledge, and find it very difficult to try to improve their difficult situation. These people may at times find themselves in such situations from a very early age and at times accept it as the reality

of life. They do not realize that there is a way forward. The situation becomes even more difficult if the individual does not have the support of family members.

Purpose Statement

The purpose of this research is to explore the different measures and/or strategies in education that may be introduced or reinforced in order to alleviate poverty in Malta. Its scope is to indicate ways how such poverty may be alleviated through education, both by the state and by other organizations. The researcher's intentions were to analyse the different educational measures that are being considered to alleviate poverty in Malta. This includes analysing what types of educational programmes are being offered at different levels and by different organizations in Malta. The research considers the new measures that may be implemented to eradicate poverty, including changes in the education system that may bring about the much-desired changing of mentalities even as from the early years of childhood. This may include educational programmes in primary schools about prioritizing expenditure, differentiating between needs and wants, and learning to make the right choices from a young age.

Literature Review

Poverty is very often defined in terms of income poverty and refers to the number of people living below the poverty line. According to the publication by NSO (Malta) SILC 2018: The Salient Indicators, people who are considered to be materially deprived are classified as persons who are considered to be at risk of poverty or social exclusion. The people interviewed in the study were asked nine questions. The interviewed person would have been classified as materially deprived if he was not able to meet a number of set criteria 3 or 4 out of a list of nine, that include affording to own a car, telephone or mobile phone, colour TV, or washing machine. This basically indicates that poverty in Malta is considered to be related to whether the person or family meets the basic needs like food, warmth, clothing, and basic necessities.

The Importance of Addressing Poverty

According to Tilak (2010), alleviating poverty has always been an important issue. It is in fact considered to be one of the most important goals of strategic development. It features on the agenda of several organizations, including international development organizations like the World Bank and UNICEF. The effects of poverty, especially on children can lead to great difficulties and even life-long struggles. Childfund International states that this is especially the case when children and young people do not receive a full education. It is stated that poverty and education are linked. Very often people living in poverty end up not attending school because they need to work which results in the children abandoning schooling and ending up without literacy and numeracy skills that are required to find suitable employment.

Measures to Alleviate Poverty

The importance of taking measures to reduce poverty was one of the declared Millennium Development Goals by the United Nations. The objective was to reduce the population of people living in poverty by one-half. There are several approaches that are considered as effective measures to reduce poverty. These measures are subdivided into two: direct measures and indirect measures.

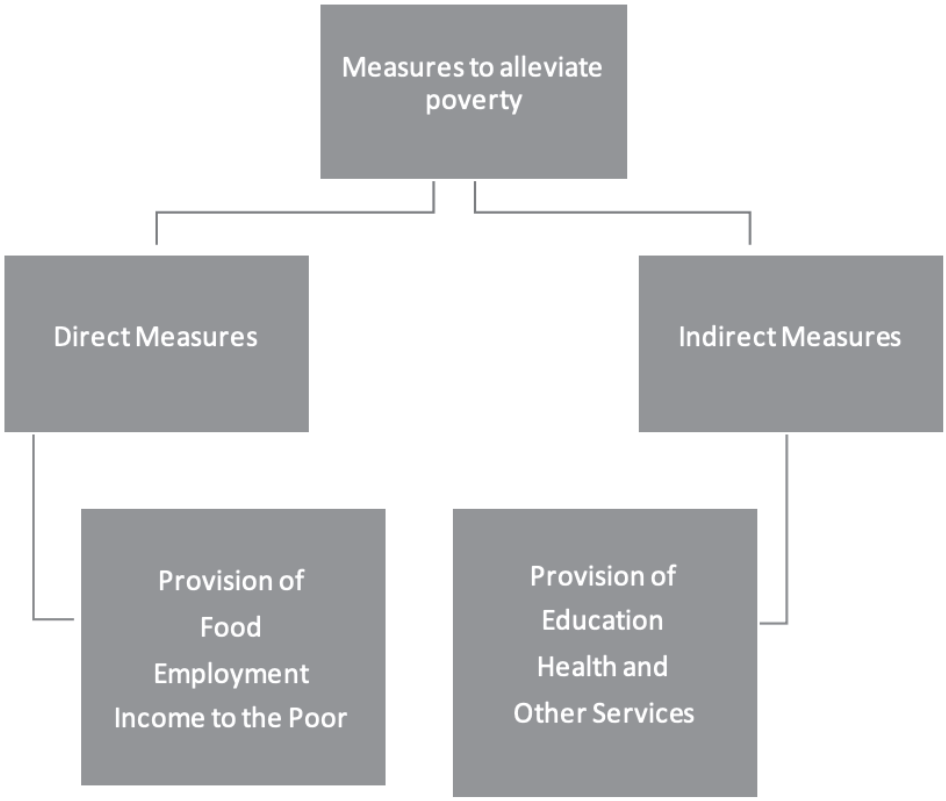


Figure 1: *Measures to alleviate poverty: Direct and indirect measures*

Research has indicated that the indirect measures are considered as long term in effect and nature. However, they are considered to be more effective and sustainable. Education is considered as one of the most effective measures to address poverty.The researcher has carried out an extensive literature review that has indicated various forms of education that are considered as contributing to alleviating poverty. The researcher has found it extremely helpful to refer to the Literature Map (Creswell) to organise ideas and to plan the Literature Review. In the initial readings that were carried out the researcher was able to find interesting readings that show the relationship between education and poverty and how different forms of education may have an impact on alleviating poverty. The literature map in Figure 2 gives an indication of relevant sources of information from a variety of sources that researcher has consulted in order to obtain a deeper insight on the area of study.

The Role of Education as an Effective Tool to Address Poverty

The role of education as a measure to address poverty by improving the possibilities of individuals to improve their current situation has been the highlight of various studies over the years. The researcher intends to focus on the important role of education as a means of alleviating poverty in Malta.Research has shown that poverty is linked to finacial capability. Financial capability may be improved through the acquisition of further training and educational programmes in order to be in a position to seek employment and/or improve the income of the individual. Entrepreneurship programmes are being introduced and given importance even from an early age in order to encourage individuals to find creative and innovative ways to develop business ideas. This will in turn result in improving the financial capability of the individual/s.

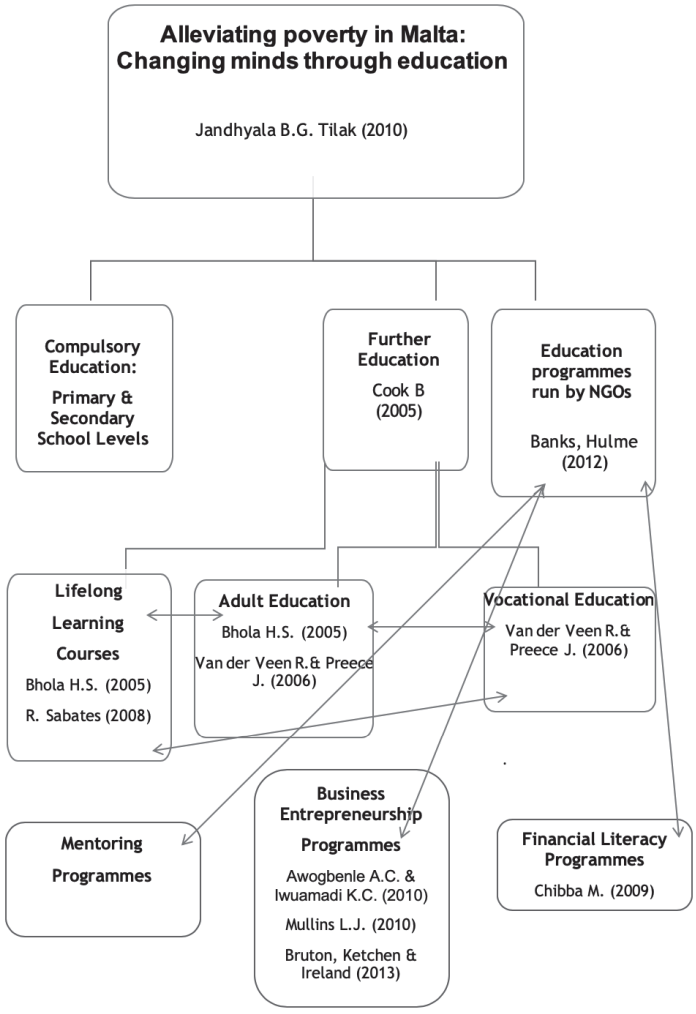


Figure 2: *Literature map*

Literature gives indications that the following forms of education all provide valid contributions to alleviate poverty:

- Compulsory education – primary and secondary school levels;
- Further education – adult education, life-long learning, vocational education, entrepreneurship, and financial literacy programmes;
- Education programmes offered by NGOs and third parties.

The Education System in Malta

The education system in Malta starts at an early age in kindergarten setting and continues to primary and secondary education levels achieved by the age of 16 years. Individuals are encouraged to further their education at post-secondary level, following the different routes leading to higher levels of education, including those in vocational settings at MCAST. Training programmes and further educational courses are also offered through adult education programmes and life-long learning courses. These offer the possibilities to adults to pursue a course of studies to be able to take up employment or to improve their financial capability.

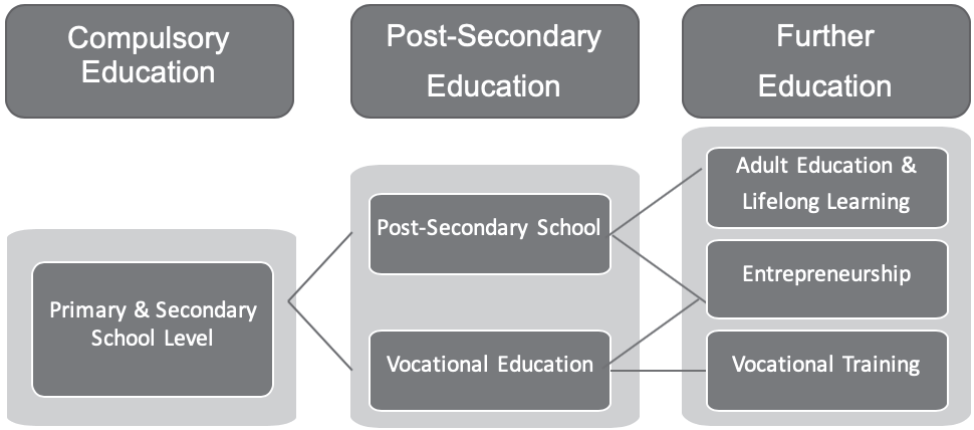


Figure 3: *The education system in Malta*

Lifelong Education, Adult Education and Vocational Education

As contended by Bhola (2005), adult education and life-long learning play a very important role in poverty reduction. The author highlights the importance of a strategy relating to adult education which involves a team of dedicated and committed adult educators who are willing to offer a sound system of adult life-long education, which is also commensurate with short-run and long-run strategies to address the issue of alleviating poverty through education.

Sabates (2008) discussed the interaction between life-long learning, poverty, and related issues, such as health. The author states that very often poorer parents struggle to give children a good start in life. Upgrading adult skills and parental involvement in the education of children will lead to enabling adults to acquire basic skills, thus increasing

employment prospects which will improve the financial capability of the individual and the family. Sabates emphasizes that the effectiveness of life-long learning may be achieved when there is interaction with other policies.

The author indicates that the impact of learning on employment possibilities is instrumental for poverty reduction. In the case of employed individuals, further education and training will eventually lead to improved income and promotion prospects. Adult education together with the provision of financial literacy and support to access public funds may help to narrow the gap in financial services for families who have a low income or are at the risk of poverty. The author also indicates that there are also other benefits associated with adult learning, including the feeling of self-worth and health-related issues. In their research on vocational education and adult learning, Van der Veen and Price (2006) state that focus has very often been placed on literacy and basic education. However, it is contended that adult education may be potentially more effective than literacy and basic education skills. The contribution of adult education to addressing poverty-reduction programmes also includes vocational education, community development, training for active citizenship, and even agricultural extension in most developing countries. The authors state that, in the case of developing countries, there may be a greater need for a more flexible and targeted education system.

Entrepreneurship Education Programmes

According to Awogbenle and Lwuamadi (2010), entrepreneurship education offered through vocational and entrepreneurial training programmes is considered as an effective short-term mechanism to address problems of unemployment and poverty, especially in African countries. The authors contend that entrepreneurship programmes are considered an important strategic educational approach to create employment and to improve the lives and economic independence of youths. Entrepreneurship education programmes involve conveying entrepreneurial competencies to students. This involves addressing concepts, skills, and mental awareness that are required by individuals during the process of considering and developing a business idea and eventually setting up a business (Table 1).

Entrepreneurship Educational Programme		
Technical Skills	Business Management Skills	Personal Entrepreneurial Skills
Writing Listening Oral presentation Organising Coaching Technical know-how Working in a team	Skills relating to: Starting Developing Managing an enterprise	Discipline Risk-taking Innovative ideas Change-oriented Persistence Have vision for the future Leadership

Table 1: *The ideal components of an Entrepreneurship Educational Programme*

According to Mullins (2010), business entrepreneurship programmes involve passing on knowledge, skills, and attitude to perform specific tasks effectively and efficiently. Entrepreneurship programmes very often involve training on technical skills, business management, and personal entrepreneurial skills.

Researchers contend that entrepreneurship education is an effective way to address poverty. More emphasis should be placed on this type of training and education as opposed to business education since entrepreneurship education is considered to be a life-long learning process. Entrepreneurship education programmes can help to address the issue of poverty. Researchers argue that there are cases where entrepreneurship in itself can help to address poverty. Researchers indicate that much can be learnt through observing and understanding that entrepreneurship among those living in poverty or at risk of poverty. In such cases, entrepreneurship amongst those living in poverty may create a long-lasting solution to their poverty.

Financial Literacy Programmes

Financial exclusion is a major socio-economic problem faced by individuals living in poverty or at risk of falling into poverty. Financial literacy or financial inclusion is considered as an effective tool to alleviate poverty and redistribute income in developing countries. More importance is being placed on financial literacy programmes that are delivered by the state, organizations for their employees and even NGOs for their service users. Such courses empower people with financial knowledge about managing expenses, planning expenditure, distinguishing between needs and wants, preparing a budget, learning about the different sources of finance and related costs, the variety of services offered by banks, and identifying ways of increasing financial capability.

As contended by Chibba (2009), financial inclusion offers incremental and complimentary solutions to address poverty. This is achieved through the promotion of inclusive development and the need to address the Millennium Development Goals. The Millennium Development Goals were set to address the issue of poverty, hunger, disease, and illiteracy. These are established targets for achieving gender equality, empowerment of women, environment sustainability, and strengthening a global partnership for development.

Education Programmes Run by NGOs

There are other forms of education programmes followed by NGOs as a means of helping service users address the difficult situations that they may find themselves in. Some the educational programmes are run in collaboration with government departments. Two of the most important organizations in Malta involved in providing such services are St Jeanne Antide Foundation (SJAF) and the Paolo Freire Institute. *St Jeanne Antide Foundation* in Tarxien is a registered social purpose non-profit organization that offers social work and counselling service, learning-support service, and a volunteering programme. It is run by the Sisters of Charity in collaboration with a team of professionals. It involves a door-to-door outreach programme that is carried out by a team of social workers who have knowledge and experience, including personal experience. The organization is involved in areas that include family work, mental health, health, and education. The organization is involved in education programmes that include non-formal education courses, especially for women to help to address issues of self-esteem, self-confidence, parenting skills, financial literacy, basic skills education, and learning-support for children.

The *Paolo Freire Institute* in Żejtun that was set up by Maltese Jesuits. Its aim is to promote literacy and community development by empowering individuals and promoting self-development, self-confidence, talents, the importance of education and financial literacy of individuals, especially those considered as vulnerable persons. The Paolo Freire Institute offers training programmes in basic literacy skills and basic IT skills. These training programmes are run in collaboration with Jobsplus. Individuals are referred to the organization in order to help to improve their basic education, and thus increase their employability. These education programmes are offered free of charge. The aim is to help to address employability and therefore to help individuals to improve their situation, including financial capability.

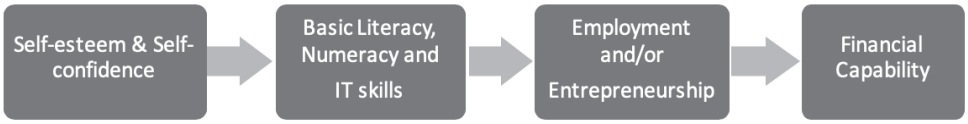


Figure 4: *Main components of programmes run by NGOs that offer services to people in vulnerable situations*

The Importance of Access to Education and the Quality of Education

The Education for All (EfA) initiative initially emerged in a conference in 1990. This initiative focuses on improving all the aspects of the quality of education offered, while considering as a priority the ensuring of excellence in the quality of the educational service. This conference agreed that there are six goals aimed at providing quality education to every citizen in every society. These goals included providing early childcare and education especially for children coming from vulnerable families, providing access to quality-free and compulsory primary education, eliminating gender disparities, ensuring that all learning needs are addressed through inclusion, and working towards an improvement in adult literacy (UNESCO 2011).

Brundrett (2014) points out that, besides access to education, importance should be given to the quality and duration of education, especially since in many developing countries the majority of students do not reach the last grade of schooling. Research has shown that education is one of the most important and effective tools to help to address the issue of poverty. Adult education is considered as having a higher potential. Research has indicated that successful poverty-reduction programmes include vocational education, community development, training for active citizenship, as well as agricultural extension. It is also indicated that in developing countries there is the need for a more flexible and focused system of adult education and not just traditional practices. van der Veen and Preece (2006) have shown that it is not only basic education and literacy that helps to eradicate poverty.

The European Perspective

The article Europe 2020 indicators – poverty and social exclusion reports on recent findings on poverty and social inclusion in the European Union. The Europe 2020 strategy in itself has established a target of ´lifting at least 20 million people out of the risk of poverty or social exclusion` by 2020, when compared to 2008. The article states the importance of identifying groups with a higher risk of poverty or social exclusion, determining the reasons behind this vulnerability, and generating policies to alleviate poverty.

With reference to the proposed area of research, the article states important findings that are most relevant to the study. This is because the issues relate to poverty and education-related matters. These issues relate to current issues that are being addressed by the organizations that have been selected to participate in the study through interviews that the researcher intends to conduct. The main statistical findings relating to the article Europe Indicators 2020, that were published in June 2017, that are considered to be of relevance include:

- Women and young people are more likely to live in poverty and social exclusion than men;
- Lack of work increases the risk of poverty or social exclusion;
- People with low educational achievement are more likely to be at risk of poverty; Single parents are more at risk of poverty or social exclusion;
- The risk of poverty or social exclusion due to low educational levels is passed on to the next generation.

A New Reality: The New Education-Poverty Trap

Traditional studies of development and education normally focus on education as an effective tool to alleviate poverty. However, there is also the reality of the vicious circle that may be created when education is not provided for free and people may even need to borrow to finance their education. This has brought about a new reality: the new education-poverty trap.

Zhang (2014) points out that research has shown a new reality in countries where education is not provided for free. Data from a large-scale survey of the western regions in China has revealed that low- and middle-income families face hardships to finance the education of their children. They consider the costs of higher education as way beyond their means and affordability. They face the dilemma whether to borrow money or to offer education to their child, or to forgo the opportunity of further education, mobility, and prospects for a better future.

Research Methodology

The researcher has adopted a constructivist approach through the application of an abductive philosophical mindset, moving away from Glacier's positivist's epistemological underpinnings. In this research study, the method of qualitative research was selected. The researcher has adopted grounded theory as the methodological stance. Grounded theory was selected as it has enabled the researcher to carry out interviews and to develop a theory from observations. The grounded theory approach is considered as the most appropriate method of research as it is renowned to elicit rich insights into

measures that may be taken to alleviate poverty in Malta through education. MAXQDA software was used to simplify the analytical procedures involved in grounded theory. As contended by Rizzo (2011), grounded theory has important advantages not found in other methods of enquiry. These advantages include that an emphasis will be placed upon the development of a theory and the construction of a model. It is important to note that the process of comparative analysis, coding, and saturation of categories brings about a strong concept of verification relating to the area of research being conducted. The major advantage of grounded theory is that it provides the opportunity of the creation of a 'parsimonious model within the substantive area of enquiry'.

Inductive/Abductive Approach

The researcher has designed and conducted this research by developing a partnership with the participants involved in a manner that would enable a mutual construction of meaning at the data collection stage when the interviews are conducted. The researcher's inductive/abductive approach has provided a meaningful reconstruction of data collected and developed into a grounded theory model.

Data Collection

The researcher opted for interviews with individuals in order to provide an opportunity for the individual from an identified organization to elaborate on its line of thought. The researcher also considered the option of a focus group. However, it was decided that the option of separate interviews would hopefully yield better results, especially since the individual being interviewed would not be influenced by other people, as may be the case in a focus group. The individual would also be able to elaborate on areas that are considered as most important and the person conducting the interview would be able to ask for further information on any issues that may arise during the interview itself.

Sampling

For this research study, purposeful sampling was used to identify potential participants. The three participants were selected on the basis of their involvement at MCAST as an educational institution in Malta. In their role at MCAST, these persons occupy key roles and are involved in curriculum design and student support services while also offering different forms of support and counselling to students. They are in direct contact with individuals who are either considered to be on the poverty line or at risk of falling below the poverty line.

Data Analysis/Interpretation

This research method enabled the researcher to develop a theory from observations made through interviews to be carried out. This theory would provide an explanation to the area of research. The researcher adopted the procedure of collecting data through carrying out the interviews with the selected participants. The researcher has carried out an interview with three participants who are employed at MCAST. The three participants were selected through purposeful sampling.

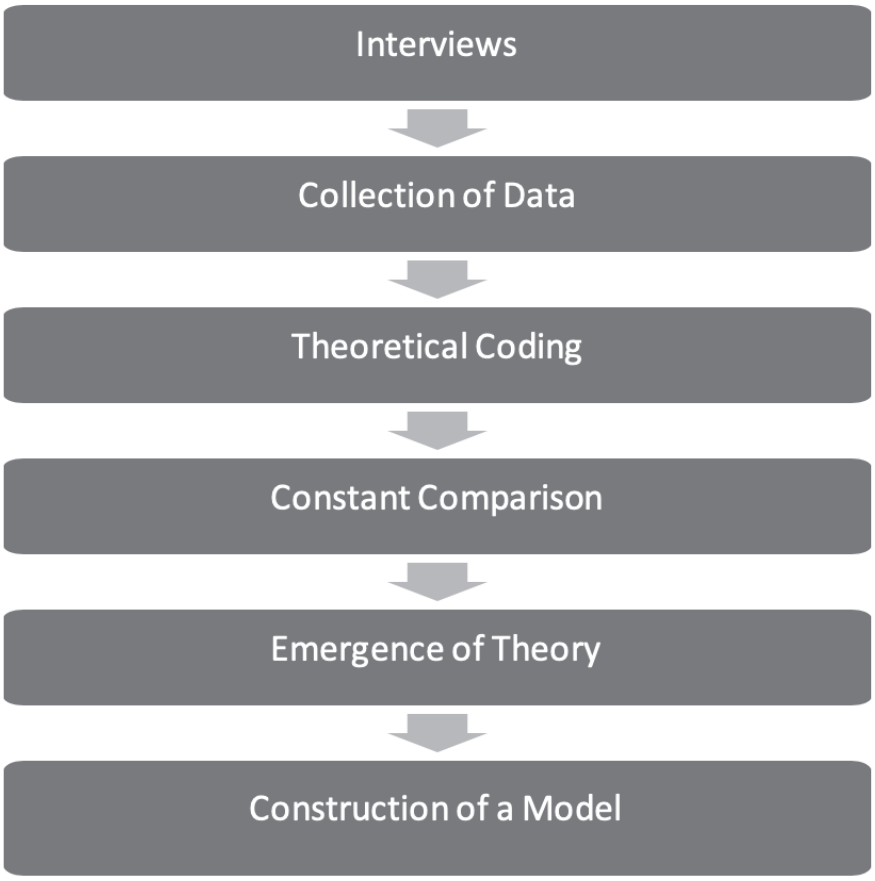


Figure 5: *The Grounded Theory process*

Following the consent of each participant, each interview was digitally recorded. A transcript of each interview was prepared by the researcher. The researcher utilized MAXQDA software to create codes from the transcribed interviews. Data was interpreted through a system of coding for the classification and organization of data.

Research Findings and the Evaluation of Emerging Constructs

This grounded theory study was based on the participation of three individuals with key roles at MCAST. This study provides a framework for the preparation of constructs relating to the area of research conducted: alleviating poverty in Malta and changing minds through education. The hierarchical structure as shown in Figure 6 includes three main categories that are then further developed into sub-categories (Figure 7). The categorization into three main categories is based on the coding paradigm of the 'Conditional and Consequential Matrix' in Strauss and Corbin (1998). The three main categories relate to contextual conditions, actions and reactions, and consequences and outcomes.

Contextual Conditions include factors such as what may have led to poverty and/or

reference to situations that may give rise to poverty.

Actions and Reactions include education systems and programmes that are offered in Malta by the different educational institutions involved in the provision of various educational programmes, as well as NGOs which offer a variety of services to individuals and/or families who may find themselves in dire financial situations, who are at risk or are already on the poverty line. It may also include educational programmes that were sought by individuals to address the situation of poverty that they may have found themselves in.

Consequences and Outcomes refers to the outcomes of existing education systems that are already in place and any recommendations that can influence changes in the education systems and programmes.

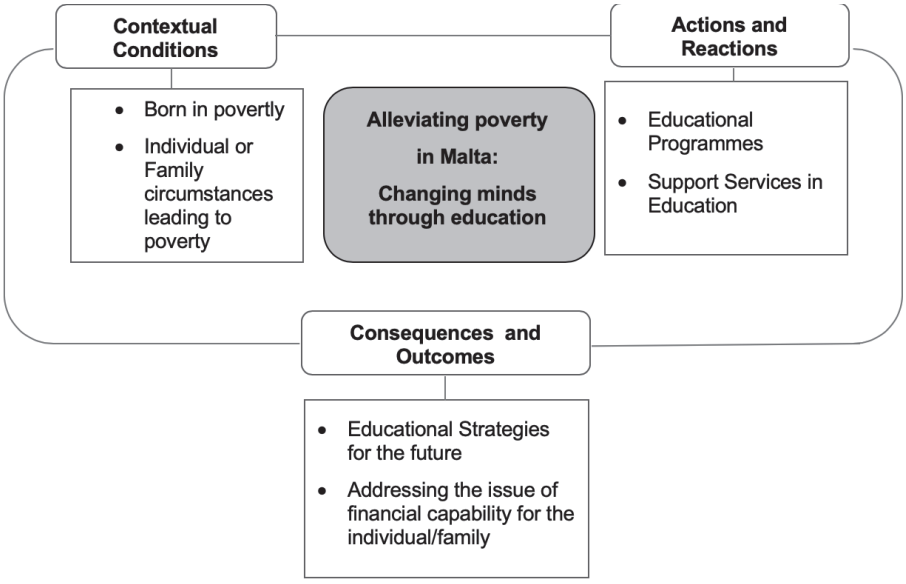


Figure 6: *An evaluation of interrelationships between these emerging constructs within the hierarchical structure showing contextual conditions, actions/reactions, and consequences and outcomes was carried out*

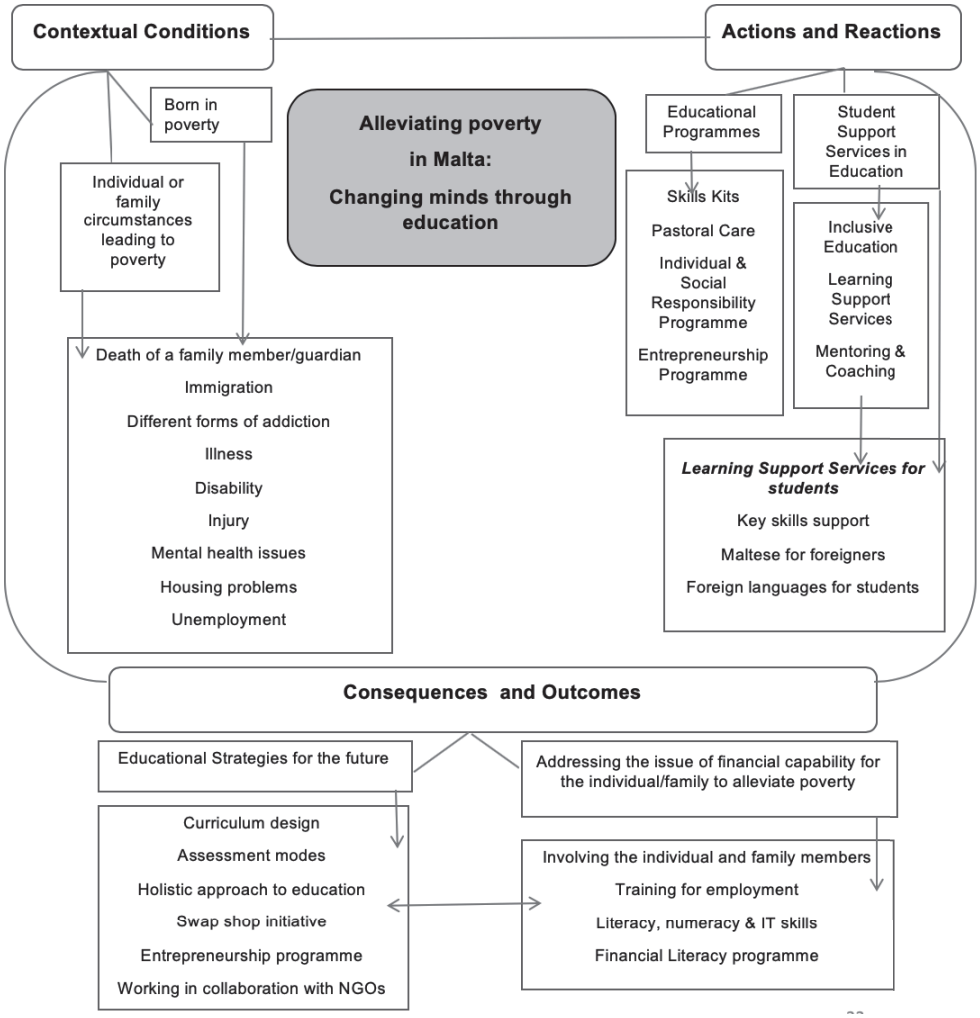


***Figure 7**: Framework for alleviating poverty in Malta through education*

Grounded theory research provided some important insights on education as a means of alleviating poverty. The constant comparison of the responses from the three participants allowed for the subsequent compilation of the conceptual model are shown in Figure 8.

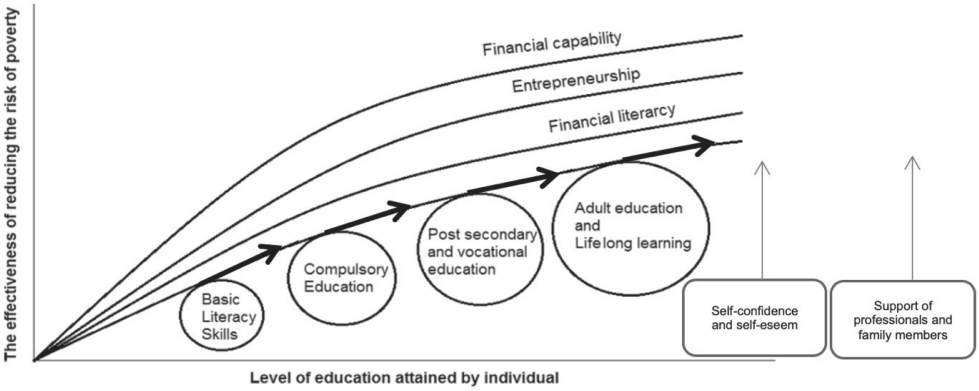


Figure 8: *Grounded theory model for alleviating poverty through education*

The model shows that the various forms of education all contribute towards addressing the issue of poverty. When the individual is empowered and works together with professionals in the field to address issues that include self-esteem and self-confidence, the individual will be more receptive to knowledge and learning. A holistic approach and the support of family members, as well as family involvement, ensure a better success rate.

In order to alleviate poverty, it is important to address areas of weaknesses and build on solid foundations. This may very often involve working on moving from one education to another gradually, in stages, by first addressing basic literacy, numeracy, and IT skills, before proceeding to higher levels of education that may include primary and secondary level, post-secondary and vocational education, as well as further education levels. In order to address the issue of poverty, it is important to take a multi-disciplinary approach to ensure a more effective success rate. As the model indicates, when education is combined with financial literacy and entrepreneurship, this will lead to an improvement in employment prospects and financial capability respectively. This is the most effective approach to addressing the issue of poverty. Such strategies may also result in a ripple effect, not only in the life of the individual but the positive effect is also extended to other family members.

Poverty Defined

Research findings indicate that the three participants have defined poverty as not being in a position to meet the basic needs of the individual or the family. According to Maslow's hierarchy of needs, the basic needs refer to food, shelter and clothing. Literature indicates that there is a link between poverty of the family and children's health, behaviour and achievement, including educational level attained. Studies have shown that family income may be strongly related to the child's ability and achievement. Research has shown that children who live in extreme poverty or below the poverty line for a number of years, very often appear to be the ones suffering the worst outcomes and consequences. Children who actually experience poverty in the early years of their lives, during preschool and early years tend to have lower possibilities of school and academic achievements than children and adolescents who experience poverty in later years. Research findings show that the most effective ways to reduce poverty is by interventions during early childhood.

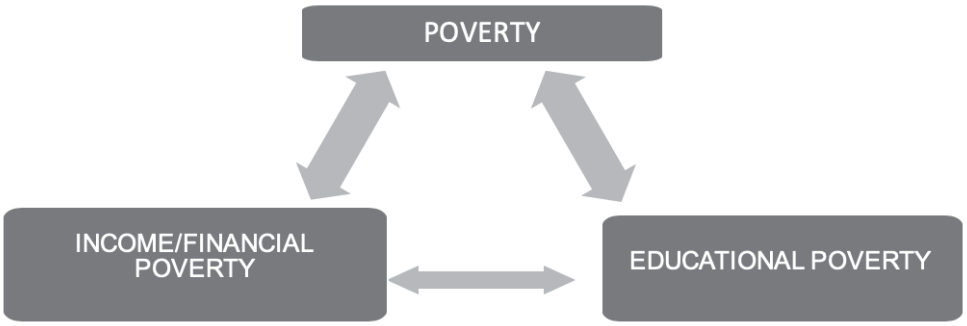


Figure 9: Poverty: Income/Financial and educational poverty

Research findings indicate that all the three participants have agreed on how to define poverty. The participants have also indicated that education is considered as one of the best tools to eradicate poverty. The participants have indicated that poverty may be subdivided into two main areas: Income/Financial Poverty and Educational Poverty. A person may end up in poverty either as a result of incorrect decisions taken by the individual and/or family and also as a result of circumstances, such as:

- Children born in poverty;
- Single-parent families;
- Children brought up by a carer/parents who are on state pension;
- Unemployment of parents/carers;
- Illness or medical condition of parents/carers including long-term illness, terminal cancer, severe mental health issues;
- Addictions – drugs, alcoholism, gambling, usury;
- Lack of awareness of financial planning;
- Housing problems and high rental prices;
- Immigrants from other countries who may have fled their countries in search of a better future.

Findings show that the participants all agreed that poverty may very often be the result of circumstances that the individual or the family find themselves in. The participants have highlighted that one of the major causes of financial difficulties in Malta, that very often leads to poverty is linked to two main issue – immigration and the high rental prices currently being charged in Malta. These two situations are linked to the high influx of immigrants and foreigners that are coming to Malta in search of a better future.

Participant B emphasized two main problems relating to housing and lack of sanitary facilities and poverty in immigrant communities. Individuals or families may be faced with situations where they may end up homeless due to a number of reasons. There is also the situation where individuals may be living in places which are sub-standard and do not have adequate sanitary facilities. This issue has also been recently reported in the media where, owing to a high influx of immigrants, there have been reported cases of people living in farms or in garages. Their conditions are sub-standard and a number of issues relating to poverty arise.

Research findings show that some people ended up homeless or living in sub-standard facilities because they have never owned a home. They may not be in a position to pay the rent, that is currently on the increase. The family home may also have been lost for a number of reasons including addictions such as gambling and drug abuse or usury. There are also cases where people ended up in prostitution because it was the only way they knew how to quickly get access to money to pay for rent. This also includes under-age prostitution. There are also cases where the mother has fled the family home to seek shelter and/or protection because of severe problems in the matrimonial home. Such cases are very often related to abuse – physical, emotional, and financial. Other problems may also be linked to these situations such as addictions (alcohol, drug abuse, gambling, usury) that very often bring about immense hardships not only to the addict but to the whole family. Housing problems a may also be the result of issues relating to inheritance and division of property following the death of a family member.

The Important Role of Educators

All the three participants have indicated that the role of the educator may be considered as crucial to ensure the effectiveness of the educational strategies and programmes. Participants B and C placed high importance on the need for educators to be on the look-out for problems that exist in the lives of students. These indicative signs of poverty may include lack of personal hygiene that may be the result of lack of sanitary facilities in the home or even homelessness. Such situations may also be the result of mental health issues of the parents/carers or the students themselves. The participants stressed the importance of being on the look-out for these warning signs and referring them to the right people, such as student support, guidance and counselling, and social workers. Very often this may require dealing with the family situation as a whole in order to ensure an effective approach.

The Important Role of Education: The Need for a Holistic Approach

Research findings highlight the importance of investing in education through a holistic approach. It is vital that an individual is empowered to learn basic skills and literacy and numeracy skills as these are the first steps in education. Then the individual may be in a position to continue to build up and follow compulsory education, as well as post-secondary and tertiary education. It is important to note that providing free access to education enables the individual to broaden one's horizons and employment prospects. Being in a position to seek employment or to set up a business is an effective way of improving financial capability of an individual and family members. It is important to address the initial stages of education properly and to offer adequate support when and as required. Support may be vital in situations where there may be learning difficulties, emotional and social behaviour problems, and social issues at home.

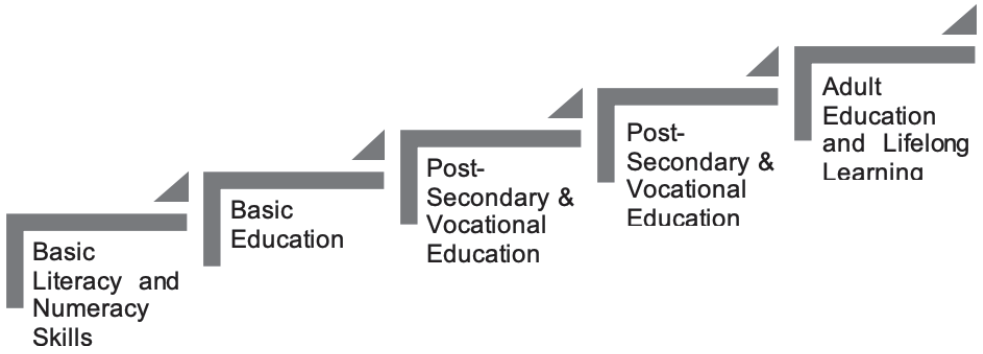


Figure 10: *The building blocks of education*

All the three participants have indicated that it is instrumental to build solid foundations in education. It is very often found that, when students reach post-secondary education, there is a good number who do not have the basic literacy and numeracy skills and a basic level of education. This may be the result of different factors, including living in poverty, learning difficulties, high absenteeism from school, and other factors. Research findings highlight the importance of considering the education system as building blocks. This means that it is a system building on the previous block. It is important to have sound foundation stones before building at higher levels.

Participant A has indicated that MCAST considers it a priority to address all levels equally. However, an effective strategy has been drawn up to address the difficulties at the lower levels, especially up to Levels 1 and 2. This is being done as it is considered to be the foundation to the future of individuals and to empower them for the future. The way forward is to have a holistic approach that involves the students, and even their families if necessary, through a team of professionals. These professionals include lecturers, LSAs, student-support services team, guidance and counselling, lecturers from LSU, social workers, and other professionals who may offer assistance, including educational psychologists. This approach would ensure that the needs of the students are addressed, including the role of a social worker who may be in a position to offer professional assistance that may be required to help the situation in the family environment.

The Important Role of MCAST as a Key Player to Alleviate Poverty in Malta

Findings have highlighted the leading role that MCAST plays when it comes to strategies to alleviate poverty in Malta. MCAST currently offers a wide range of educational programmes at various levels, ranging from Level 1 to Level 6 courses. MCAST is also involved in offering a large variety of courses and training to a wide range of people, locals and foreign.

MCAST is involved in providing training in various sectors, mainly to full-time and part-time students. Furthermore, MG2i courses are offered in collaboration with compulsory education at secondary school level. MCAST is also working in collaboration with government departments and NGOs, on financial literacy programmes and employment initiatives. Research findings have stressed the need for an effective holistic approach in education in order to ensure better success rates. All the three participants have stressed the importance of offering learning support and other forms of support to students,

especially those who may be considered as vulnerable persons. Offering support through a team of professionals is vital, especially in cases where the individual may be on his own or does not have the support of the family.

Participant A has stressed the importance of involving the family of the individual in the training programmes in order to ensure a better success rate. Involving family members may also lead to addressing the issue of poverty of the whole family indirectly, yet more effectively. It very often leads to a better success rate and may also be the turning point, not only in the life of the individual, but of the family as a whole. Research findings indicate the existing and future plans at MCAST as a key player in the education system in Malta.

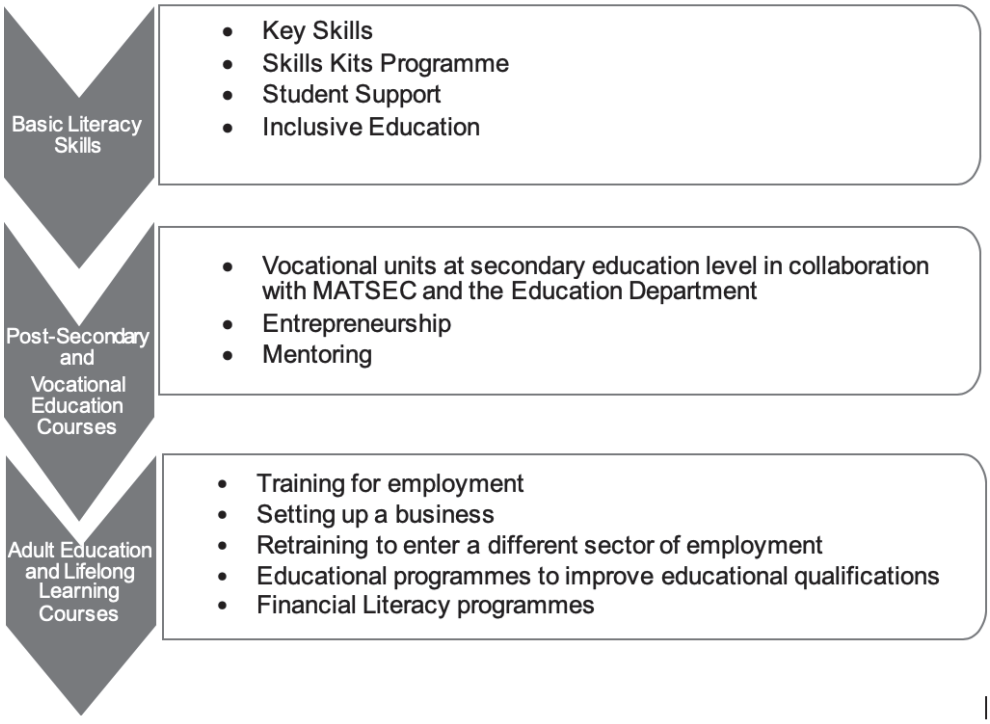


Figure 11: *MCAST's role in the education system in Malta and the vision for the future: The participants' perspective*

The Need for an Effective Strategy that Incorporates a Holistic Approach

The findings of this research highlight the importance of drawing up a strategy in Malta on effective ways of how to eradicate poverty through education. Findings reveal that such strategies may include:

- Helping the individuals to believe in themselves and their self-worth, build on

their self-confidence and self-esteem, and thus empowering them to believe in themselves and their potential. This will help the individuals to believe in their potential and to seek to improve their current situation.

- Educating the individuals themselves about basic skills, literacy, and numeracy.
- Involving parents in educational programmes so that they can support their children in education and to further their studies.
- Providing training for educators to look out for possible indicators of poverty (Figure 12), and to equip them with the right skills of referring these cases to student support and counselling, as necessary.
- Providing free access to education and training in order to be in a position to improve the financial capabilities of individuals and their families.
- Introducing financial literacy programmes from early years education to instil the culture of budgeting, saving, and borrowing sensibly.
- Offer financial literacy programmes to professionals who come across service users who may be in poverty or at risk of poverty.

Embarking on a holistic approach in education, to be able to reach out to students, by having a team of professionals on board who may be in a position to offer the type of support needed. It may also be necessary to extend this type of support to family members who may be going through difficult times because of situations that they find themselves in. The team of professionals may include educators, educational psychologists, counsellors, social workers, and professionals who may be in a position to address issues relating to health, mental health, and different forms of addictions that may be behind the root of the issue of poverty of the individual and/or the family.

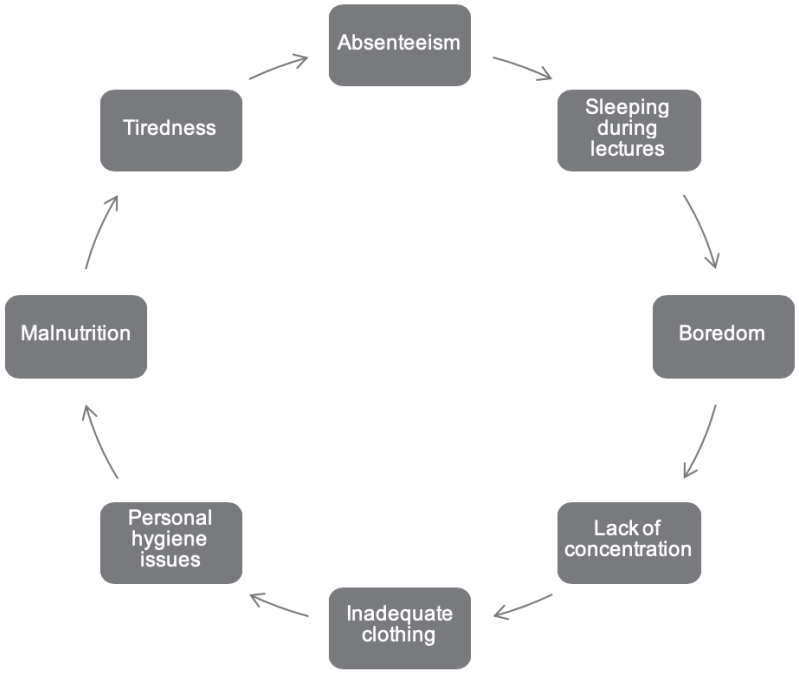


Figure 12: *Possible indicators of poverty*

Recommendations for Future Research Directions

The objectives of this section are to recommend further research on related areas. It is intended to be a platform from where further research will develop. As suggested by Curran and Blackburn (2001: 7), it is important that in order to ensure the quality of the emergent model, there exists the possibility of research findings to be transferable to a wider audience. It is highly recommended that there should the possibility that the model can be developed further and strengthened through further research and through testing in a variety of contexts, including comparisons to small island states. It is contended that further research should be carried out relating to the possibility of integrating the two aspects of education and social care to alleviate poverty. If there are parallel and interlinked strategies, these will make strategies to alleviate poverty more effective. Further research in this area may be carried out and even relating it to other important aspects, such as the effectiveness of alleviating poverty in Malta effectively through a parallel education and social policy strategy.

It is also recommended that research is carried out on the role of NGOs as organizations that offer support and guidance to help service users and their families to overcome difficult situations, such as abuse, that may be in different forms including emotional, verbal, physical, and financial abuse. Other situations may include service users who are themselves or are related to individuals who may be victims of addictions such as drugs, alcohol, gambling, and borrowing money through usury. Such difficult situations may also be interlinked to situations of mental health problems that may have already been existent or be the result of these difficult situations. In desperate situations, poverty may also lead to mental health issues, suicidal thoughts and attempts, addictions, and even resorting to crime. It is vital that the authorities and NGOs concerned work together – 'front wiehed' – in order to come up with practical and effective ways to eradicate poverty. This will be for the benefit of individuals, their families, the community and the country as a whole.

An area of research that would be particularly interesting is the effective role of MCAST as a service provider of education in Malta and the role that this organization has in addressing the issue of poverty. Further research may also be conducted in relation to the catchment area of students attending MCAST, who are considered to be vulnerable individuals, and the related issues leading to the vulnerable situations that they have found themselves in. It would be interesting to research the success rate of the different educational measures currently in force, or new strategies that are as yet at an introductory stage. It is also expected that further research may involve testing of the model in a variety of contexts, including measuring the effectiveness of strategic measures in education in terms of curriculum, assessment modes, and support provided to students.

Conclusion

Educators cannot turn their backs on vulnerable and poor people. They need to work together for the benefit of our students, their community, and their country. The timing is ripe for making the necessary changes and improvements in the educational system, including the introduction of innovative modes of teaching, delivery, and assessment. Strategies should also include a holistic approach with the interventions in families, if necessary, and empowerment of family members in order to ensure that the issue of poverty is addressed effectively. These collective efforts would contribute towards meeting the Millennium Development Goals of eradicating poverty.

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Labour Migration into Malta and the Effect on the Maltese Economy

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Abstract: Labour migration is a significant and yet still uncharted phenomenon in the context of the Maltese islands. This paper will examine the extent of the existence of the relationship between foreign workers and a set of macro-economic variables. Based on secondary data, time series data covering a 12-year period from 2006 to 2017 are used to establish and quantify the impact of inward labour migration onto the macroeconomic variables that make up the Maltese economy. These are tourism, minimum wage, gross domestic product, government expenditure, government revenue, the number of yearly crimes, total population, air pollution, unemployment rate, inflation, property prices, and inward foreign direct investment. The Pearson Correlation Coefficient is utilized to determine the association between the independent and the dependent variables and Simple Linear Regression to statistically estimate and quantify the correlation between the dependent and each independent variable. Results show that 11 out of the 12 macroeconomic variables have a statistically significant correlation with the increase of foreign workers as operationalized through the population of foreign workers. While the most statistically significant relationship was observed between foreign workers and the population, the least statistically significant relationship was observed between foreign workers and government revenue.

Keywords: Maltese economy, inward labour migration, foreign workers, economic impact

Historic Perspective of the Maltese Context

Upon gaining independence in 1964, local governments started introducing innovative industries since the main pillars of the Maltese economy, at the time being the British services and the naval dockyard, had downsized their operations in Malta. Until the new sectors started to reap economic benefits, unemployment rates soared alarmingly, so much so that a United Nations study had suggested that the only practical solution for the long-term economic development of Malta was mass emigration (Stolper, Hellberg, and Callander 1964).

Along the years, the Maltese economy strengthened and its economic accomplishments transformed the perception of Malta and started attracting foreign workers. In 2000, the total foreign working population coming from EU member states stood at 900, a figure considerably lower than that of third-country nationals. By the time Malta joined the EU in 2004, the total population of workers from third countries had risen by 35.8%, still surpassing the total number of EU workers. The trend and proportionality among the foreign workers' nationalities changed drastically in the first three years of Malta's

membership in the EU. Statistics show that, had migration to Malta not occurred following Malta's accession to the EU, the working population in Malta would have declined by 1% (National Statistics Office 2015).

Since the 2008 economic crisis, local employment opportunities have been equally apportioned between Maltese and foreign workers. Whilst it is evident that the foreign workforce is heterogeneous in terms of its occupational composition, the majority of these employments involved technical staff, managers, and professionals. The engagement of foreign workers in fundamental corporate positions increased the probability for European workers to be absorbed in either managerial or clerical positions to more than twice that of Maltese workers (Grech 2016).

Purpose Statement

In recent years, international labour migration and labour diversity have attracted the substantial attention of academics and literature; however, no consensus has been reached over the consequences of international migration, since significant studies presented contradictory conclusions (Borjas 2014; Fenech 2016; Peri 2012; Somerville and Sumption 2009). With a total population nearly double the figure of 100 years ago (National Statistics Office 2012), Malta ranks as the most densely populated country within the EU and is categorized amongst the most heavily populated countries in the world (Government of Malta 2015). The aim of this quantitative correlational study is to analyse how and to what extent foreign workers affect Malta's major macroeconomic variables through the conceptual framework illustrated in Figure 1.

Research Objective

The study aims to assess the impact of foreign workers on a set of macroeconomic variables that contribute to the making of the Maltese economy over a 12-year period through the use Pearson Correlation Coefficient and Simple Linear Regression. The motivation behind this theme rests on the importance this topic has gained over the years, with the intent to uncover and redound exclusive results.

Literature Review

Macroeconomic Factors Affected by the Foreign Working Population

As a complex phenomenon, labour migration may influence various sectors and elements of host countries, similar to El-Bahlawan and Al-Maadeed's (2018) study where the macroeconomic variables of Saudi Arabia as a host country were used to determine the impact of foreign workers. This study investigated the impact of foreign workers on Malta by utilizing the country's major macroeconomic variables.

Tourism

For small countries with limited natural resources, tourism is a major economic industry (Ellul 1999; Liu and Jenkins 1996; McElroy and Olazarri 1997),In Malta too the tourism

industry is a key economic driver and a major comparative advantage (Briguglio 2008), contributing to 27.1% of GDP in 2017 (World Travel and Tourism Council 2018). The nexus between tourism and foreign working populations is well-known; however, this is mainly associated and restricted to the Visiting Friends and Relatives component (VFR), referring to all individuals travelling to visit their friends or relatives that had formerly migrated to another jurisdiction (Feng and Page 2000; Williams and Hall 2002; Boyne, Carswell, and Hall, 2002; King 1994). Literature suggests that that inward migration is one of the main pull factors of the total inward tourist arrivals from the main markets of origin (Backer 2010; Dwyer *et al.* 2010; Seeteram and Dwyer 2009).

Wages

The effect of inward migration on wages still remains ambiguous because, while a number of studies observe improvements in average native wages (Ottaviano and Peri 2006; Card 2007), others report an overall decline (Borjas 2003; Aydemir and Borjas 2006). The simple laws of demand and supply in economics attest that an increase in labour supply reflects into a reduction in the average wages for native workers in the short term. When labour supply exceeds the demand for labour (Somerville and Sumption 2009), Peri (2009) estimates that a 1% increase in foreign workers leads to a 0.5% growth in average income per worker.

GDP

Literature suggests that the GDP is the macro-economic variable most affected by foreign labour immigration. Substantial findings from existing literature observe a long-term positive impact from foreign workers towards the host country's GDP in terms of labour-productivity and economic contribution (Peri 2012; Fenech 2016; Zaleha *et al*. 2011). A number of studies suggest that the optimal allotment of foreign labour provides a series of economic benefits to receiving countries, predominantly in efficiency, investment savings, increased financial transactions, and overall domestic expenditure of the country. All these enhance the overall quality of life and living standards of the nation (Somerville and Sumption 2009; Rodrik 2003; Palát 2012).

Government Expenditure

Government expenditure tends to respond effectively to changes in the supply of workers in a country. Empirical evidence suggests that the relationship between foreign workers and increased government expenditure is positive; that is governments need to make up for the increased demand for state-aid benefits (Borjas 1995; Jensen 1988; Borjas and Trejo 1991). Correspondingly, population surges lead to greater governmental costs relating to congestible public goods, including public infrastructure, military defence, and public safety in order for the country to acclimatize with the changing needs of the economy (Wadensjö 2000; DeVoretz 2006).

Government Revenue

Empirical evidence shows that the impact of foreign workers on local government revenue is strongly dependent upon the labour market performance of the foreign workers. Theories hold that tax contributions from foreign-born workers reaches a climax at midlife and is lowest at the earliest and latest stages of the human life-cycle (DeVoretz 2006). Accordingly, Simon (1984) suggests that, since foreign workers contribute positively to the treasury, a country is to admit foreign workers until their contribution becomes insignificant.

Crime

Crime is believed to be a critical economic variable in the context of labour migration. The difference in crime propensities between local and foreign populations has a direct impact on crime rates. According to the economic theory of crime, this stems from the inequalities in the labour market among local and foreign workers (Becker 1968; Ehrlich 1973). Devadason (2013) argues that since foreign workers may be tempted to work in inadequate working conditions, they are easily more prone to be involved in crime to make up for the inadequate earnings. On the other hand, Bianchi, Buonanno, and Pinotti, (2008), Plecas, Evans, and Dandurand (2002), Butcher and Piehl (1998), Albrecht, (1997), and Francis (1981) claim that economic migrants are less involved than locals in criminal activities in Germany, Italy, Australia, Canada, and the United States respectively.

Population Growth and National Fertility Rate

Labour migration is a fundamental variable that accounts for increases in the total population of the receiving countries. In recent history, migrant-receiving countries, predominantly in Western Europe, have experienced a 0.1% increase in the average fertility rate, as a direct result of population diversity. The difference in the demographic profile and fertility rate among native and foreign populations affects the birth rates of the host country. This may stem from the fact that workers from developing countries would experience an improved standard of living and hence procreate more (Sobotka 2008; Westoff and Frejka 2007). Bloom, Canning, and Fink (2008) suggest that changes in population structure may lead to economic difficulties, particularly due to eccentricities in the age structures. Remarkably, Borjas (2003) argues that the convergence and concentration of foreign populations discourages natives and leads them to migrate to other regions.

Carbon Dioxide

Pollution is a severe threat to human and environmental health in almost every country in the world (Brennan 1996). Although there are various pollutants, one of the most common is carbon dioxide to which has been attributed adverse impacts on cardio-vascular, respiratory, and neurological systems, in addition to the unfavourable effects on agriculture, woodlands, eco-systems, and vegetation. It is argued that population growth increases demand for services operated by non-renewable energy such as transportation, which in the long-term causes highway congestions and encourages deforestation for highway widening, leading to higher pollution proportions (Klasen *et al*. 2010; Grimm and Klasen 2015). Consequently, pressures on natural resources, deforestation and land degradation in destination countries rises (Bremner and Hunter 2014; Fraser 1998; Amelung and Diehl 1992; Kartasubrata 1993; World Bank 1990) for the provision of goods, services, and housing facilities, implying that it would result in increased greenhouse gases and synthetic pollution, causing greater health implications.

Inflation

It is generally argued that increases in the supply side of labour stimulates economic demand for goods, services, and housing, the demand and supply of which influence regional market prices (Sighvatsson 2007). In fact, elasticities in the labour supply contribute to changing inflationary pressures on domestic economic activity (Engler and Razin 2007). Meanwhile, other studies suggest that inflation is either impacted solely by the short-term temporary patterns of the aggregate demand and supply (Nickell 2010)

or that on the short-term inflationary pressures are eased (Blanchflower, Saleheen, and Shadforth 2007).

Unemployment

An expansion in the labour supply of a country has a direct impact on the general employment of the whole economic workforce. A study by De Voretz (2006), whose results are also supported by Jimenez and Jean's (2007) study using panel data from 1984 to 2003, shows that foreign workers substitute native workers and prompt unemployment among the local workforce. However, Ortega (2000) shows that labour migration has a positive effect on unemployment, aligning with the findings of Aragonès, Salgado, and Rios (2012) indicating that growth in the number of foreign workers and foreign direct investments in France and the United Kingdom reduced national unemployment rates significantly.

Property Price Index

Economic migrant population growth has a great impact on property price indexes owing to increased demand for local housing because markets with a high inelastic supply result in inflated prices due to the increased demand from a larger population (Saiz 2007). Although considerable research finds that labour migration and general house prices have a positive association (Ottaviano and Peri 2007; Gonzales and Ortega 2013), or a significant but slight effect (Ayede and Akbari 2012), Sá (2011) shows that labour migration decreased property prices in the United Kingdom; similarly, Accetturo *et al.* (2014) find that house prices in regional areas in Italy suffered reduced price growth as a consequence of foreign populations.

Foreign Direct Investment

There is abundant theoretical and empirical literature investigating the connection between economic migration and inward foreign direct investments. A clear and positive relationship is observed between increased foreign populations, trade, and inward foreign direct investment (Aroca and Maloney 2005; Buch *et al*. 2006; Kugler and Rapoport 2007; Tong 2005), mainly due to foreign diasporas exerting great demands for their home country products and services (Dubey and Mallah, 2015). Other reputable studies find that highly educated foreign economic migrants have a positive impact on foreign direct investment in host countries (Foley and Kerr 2008; Kugler and Rapoport 2007). Nevertheless, other researchers discover that a negative and significant impact on foreign direct investments (Aroca and Maloney 2005; Foad 2012).

Substitutability

Whilst it is likely that migrant and local workers have different sets of skills, potential employers are inhibited from putting them on the same level playing field as perfect substitutes. The lack of relevant local experience, cultural knowledge, and language articulacy forces migrants to seek employment in industries that require minimum skills and sectoral cognitive skills (Somerville and Sumption 2009). According to theory '*the impacts of immigration on wages and employment of existing workers critically depend on whether and to what extent migrants' skills are complements or substitutes to the skills of existing workers*' (Ruhs and Vargas- Silva 2012: 3).

The Conceptual Framework

Founded on local and foreign literature, this study investigates the relationship between the dependent variable, being the foreign working population in Malta, and each independent variable highlighted in Figure 1 through a Pearson Correlation Coefficient analysis and Simple Linear Regression. According to Kelle (2005) and Reichertz (2010), studies based on secondary research should be conducted by exploiting extensive sources of literature and encouraging new ideas without generating new biases. Furthermore, Figure 1 portrays the conceptual framework established for this study.

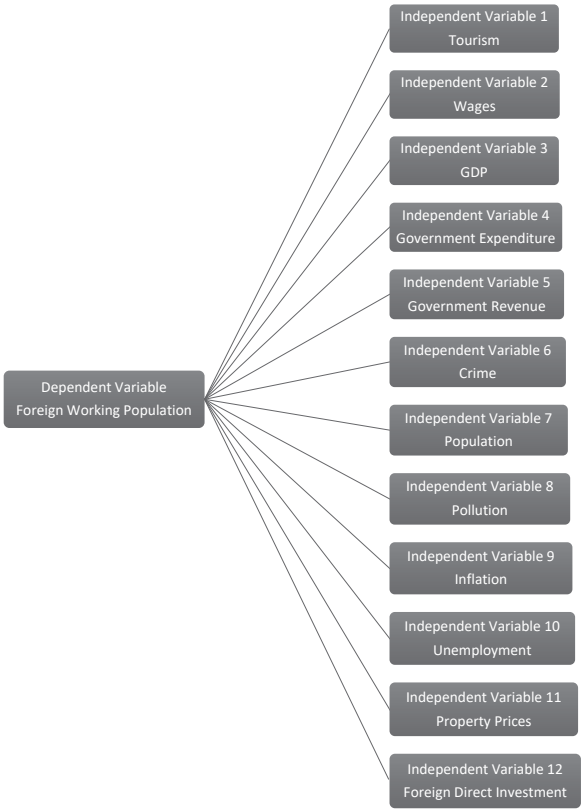


Figure 1: *Conceptual Framework*

Methodology

Methodology Utilized

The methodology of this study is based on secondary data, more specifically time-series data of a period of 12 years from 2006 to 2017. This exploratory study is to involve measurements of tangible and countable variables associated with macro-economics. Moreover, the reliability and accurateness of the collected secondary data, obtained from reputable sources, allowed for the Pearson Correlation Coefficient, a measure of strength developed by Karl Pearson in 1948 (Pearson 1994), and the Univariate Regression to be used as the main data analysis techniques.

Pearson Correlation Coefficient

Pearson's correlation co-efficient measures the direction and strength of the linear association between two variables with a range from -1 to +1. In this study, the relationship between the foreign working population over the years will be evaluated against the macroeconomic variables. Furthermore, the strength of the relationship will be expressed with arithmetical numbers between -1 and 1, where 0 would indicate no relationship, and 1 would indicate a strong and perfect relationship between the two assessed variables (Blecic and Deborah 1999).

Simple Linear Regression

This univariate regression is a statistical method that estimates the correlation between a dependent variable (y) and an independent variable (x), mainly to serve three major purposes: description, control, and prediction (Neter *et al*. 1996). Kleivbo (2017) asserts that simple linear regression is a statistical model that provides a numerical description about the variation in one variable in relation to a change in another variable. Furthermore, the relationship between an independent variable (x) and a dependent variable (y) can be quantified by constructing an equation for a straight line in the form of:

$$y = a + bx + e$$

Equation 1: *General Univariate Regression Model*

The regression parameter *a* is the intercept on the y axis, while the regression parameter *b* is the slope of the regression line. The term *e* denotes the random error, which is assumed to be uncorrelated; with a mean of 0 and having a constant variance. Moreover, this analysis method is generally utilized to model casual associations, inferencing, hypothesis testing, and predicting of time-series data. In addition, the effect of one variable on the other is estimated through the 'Beta Coefficient', indicating an increase or decrease of (y) for every unit of (x) (Zou, Tuncali, and Silverman 2003).

Data Description

The presented literature provided a firm underpinning on various macroeconomic variables that can be affected by economic migrants. These variables were initially analysed to determine their practicality on the local economy and were consequently considered and applied to the local economic spectrum. Subsequently, these variables were examined against the dependent variable to determine whether there is a correlation; assess the corresponding strength if there had been a relationship; and quantify the impact of the dependent variable onto each independent variable.

The Dependent Variable

The dependent variable which will be investigated in this study is the total population of foreign workers in Malta over 12 years between 2006 and 2017. This variable is projected to affect the economic and social aspects of Malta, hence the Pearson Correlation is to implicitly conclude how the set list of macroeconomic variables are affected by the foreign working population in Malta. Subsequent to the Pearson's Correlation, the Simple Linear Regression is to enumerate the impact of foreign workers on each macroeconomic variable. The data for the total number of foreign workers in Malta was obtained from Jobsplus.

The Macroeconomic Variables

Founded on existing literature, various macroeconomic variables were utilized to investigate their association with inward foreign workers in Malta. In this section, a priori expectations of the associations are given. According to presented literature, inward economic migration is expected to act as a pull factor to the inward tourist flows, thus implying a positive relationship. The statistics of tourists in Malta was obtained from data published by the Central Bank of Malta which includes tourists from all nations, represented in terms of thousands of tourists. Wages is considered to be another macroeconomic variable which is affected by foreign workers. The expected relationship between inward labour migration and national wages is positive, since other countries with similar economic characteristics found a strong and positive relationship. For this study Malta's national minimum wage is used to represent the wages in Malta; this data was acquired from a published report by Eurostat.

Based on previous studies, GDP is another important variable which is commonly taken into consideration to evaluate the impact of foreign workers on host economies. The data for the GDP, expressed at current market prices in millions, was obtained from the Central Bank of Malta. Furthermore, GDP is expected to have a significantly positive correlation with the level of inward foreign workers. In addition, government expenditure and government revenue are two other variables used in this study and are expected to be positively affected by inward foreign workers. The data indicating the total government revenue and expenditure was obtained from published statistics of the Eurostat, represented as a percentage of the current year's GDP.

Population, another macroeconomic variable used in this study, is anticipated to increase the local population as well as the birth rates of the country. Data for the population of Malta was obtained from published reports by Eurostat, representing all Maltese nationals residing in Malta. Another important variable that is expected to have a positive relationship is inflation, for which data was collected from the Central Bank of Malta, measured by the Harmonized Index of Consumer Prices (HICP). Also, unemployment rate is considered to be a major macroeconomic variable for this study. Substantive literature suggests that labour migration conveys a positive effect on unemployment. The unemployment rate figures of Malta were attained from published statistics of the Labour Force Survey.

Additionally, the Property Price Index is another variable that has been widely studied in the international spectrum and which is anticipated to be highly influenced by the level of foreign workers in Malta. The Property Price Index figures of Malta, based on advertised prices, were obtained from the Central Bank of Malta. Lastly, significant sources of literature include foreign direct investment as a variable that is affected by the foreign stock of labour. The data for the total foreign direct investment (FDI) in Malta was obtained from NSO; stated figures are represented in billions.

The collected data pertaining to each variable was put in a table as represented in Table 1. In order for the data to be utilized effectively and according to the objective of this study, the data had a shared principal factor being the year to which data pertained to, thereby allowing for comparative analysis to be performed accurately.

Dependent Variable (y)		Independent Variable 1	Independent Variable 2	Independent Variable 3	Independent Variable 4	Independent Variable 5	Independent Variable 6	Independent Variable 7	Independent Variable 8	Independent Variable 9	Independent Variable 10	Independent Variable 11	Independent Variable 12
Year	Employed Foreign Workers in Malta	Tourists (Millions)	Minimum Wage (€)	GDP in € Billions	Government Expenditure (as a % of GDP)	Government Revenue (as a % of GDP)	Total Crime Rates	Population (Thousand)	Co2 (Tonnes per capita)	Total unemployment rate (%)	Annual Inflation Rate HICP (%)	Property Prices Index	FDIs (Stock Position in € Billions)
2006	6,839	1.12	584.24	5.39	42.3	39.8	16,538	404.99	8.2	5.0	83.79	177.0	46.84
2007	8,191	1.24	601.90	5.76	41.1	39.0	15,050	405.61	8.4	4.5	84.38	178.9	75.97
2008	9,987	1.29	617.21	6.13	42.6	38.5	13,800	407.83	8.4	4.1	88.33	174.1	84.20
2009	9,530	1.18	634.88	6.14	41.9	38.6	11,951	410.93	7.8	4.8	89.95	165.3	87.01
2010	10,687	1.34	659.92	6.60	41.1	38.7	13,306	414.03	7.9	4.6	91.79	167.1	97.20
2011	12,388	1.41	664.95	6.84	41.2	38.8	14,248	414.90	8.1	4.2	94.10	169.3	113.12
2012	14,842	1.44	685.14	7.17	42.7	39.2	15,618	417.55	8.4	4.3	97.13	170.1	125.54
2013	18,585	1.58	702.82	7.65	42	39.5	17,584	422.51	7.5	4.5	98.08	173.7	133.47
2014	23,582	1.69	717.95	8.51	41.3	39.6	16,648	429.42	7.5	4.1	98.84	185.7	142.82
2015	28,613	1.78	720.46	9.64	40.1	39.0	17,138	439.70	5.8	3.0	100.00	197.4	152.20
2016	35,738	1.97	728.04	10.34	37.1	38.1	17,298	450.42	5.0	1.9	100.90	219.7	162.25
2017	44,564	2.27	735.63	11.34	36.2	40.5	17,136	460.30	5.0	1.3	102.18	245.6	171.04

Table 1: *Data Set (Sources: Eurostat, CBM, NSO, CrimeMalta)*

Data Analysis

Descriptive Statistics

		Minimum	Maximum	Mean	Standard Deviation	Unit
Dependent Variable (y)	**Employed Foreign Workers**	6,839	44,564	18,629	12,103	Thousands
Independent Variable 1	**Tourists**	1.12	2.27	1.53	0.35	Millions
Independent Variable 2	**Minimum Wage**	584.24	735.63	671.10	52.18	Euro
Independent Variable 3	**GDP**	5.39	11.34	7.63	1.93	Euro Billions
Independent Variable 4	**Government Expenditure**	36.2	42.7	40.80	2.08	Percentage
Independent Variable 5	**Government Revenue**	38.1	40.5	39.11	0.66	Percentage
Independent Variable 6	**Total Crime**	11,951	17,584	15,526	1844	Thousands
Independent Variable 7	**Population**	404.99	460.30	423.18	18.20	Thousands
Independent Variable 8	**Co2**	5.0	8.4	7.33	1.3	Tonnes
Independent Variable 9	**Unemployment**	1.3	5.0	3.86	1.14	Percentage
Independent Variable 10	**Inflation Rate**	83.79	102.18	94.12	6.40	Index
Independent Variable 11	**Property Price Index**	165.30	245.60	185.33	24.41	Index
Independent Variable 12	**Inward Foreign Direct Investment**	46.84	171.04	115.97	38.37	Euro Billions

Table 2: *Descriptive statistics*

The data in Table 2 provided a general depiction of the dependent variable and the independent macroeconomic variables. Furthermore, Table 2 presents the dependent variable and the twelve independent variables with their respective unit and provides a summary of the mean, standard deviation, and minimum and maximum values for each variable.

The Dependent Variable

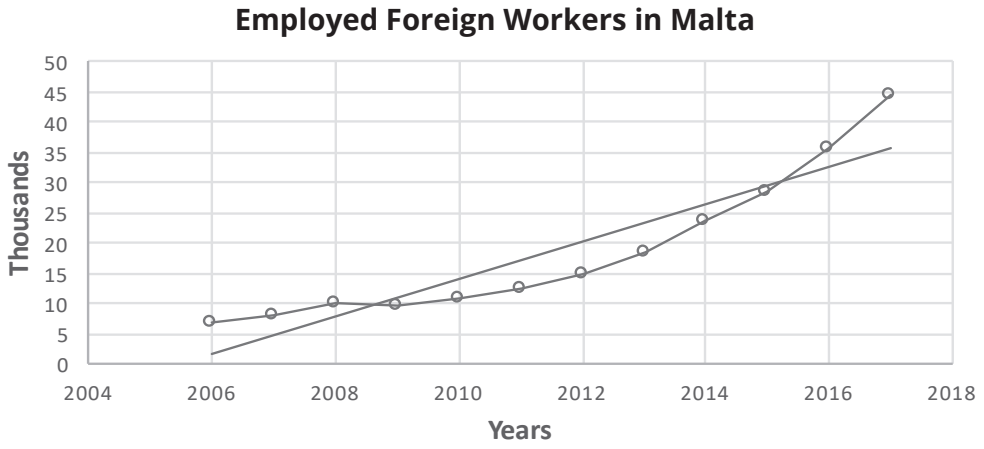


***Figure 2**: Foreign workers in Malta (Source: Jobsplus)*

The average number of foreign workers in Malta, as indicated in Table 2, is that of 18,629. Figure 2 shows a positive trend in the data, implying that the number of foreign workers in Malta has been increasing over the past 10 years. The highest point of foreign workers was registered at 44,564 in 2017 and the lowest at 6,839 in 2006.

Macroeconomic Variables

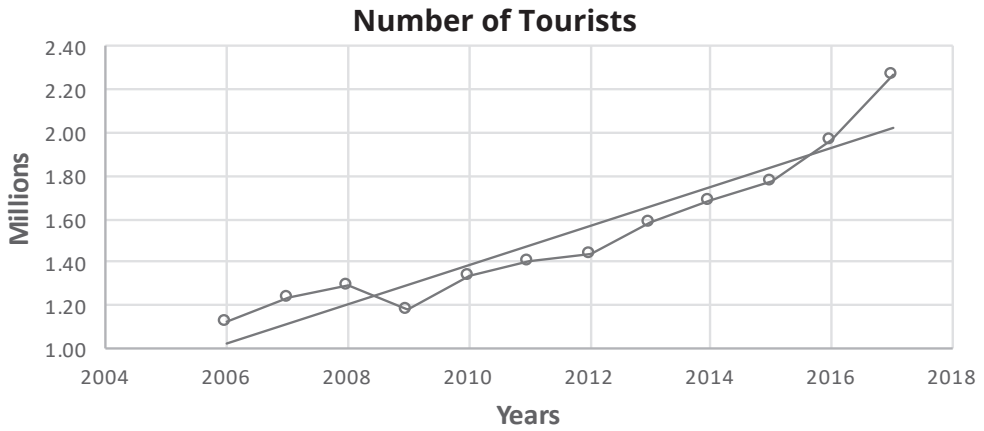


***Figure 3:** Number of Tourists (Source: Central Bank of Malta)*

Figure 3 shows the total number of tourists that visited Malta during the period 2006–17. Table 2 indicates that the average number of tourists totalled to 1.53 million with a standard deviation of 350,000. During the 12-year sample, the highest number of tourists (2.27 million) was registered in 2017, while 2006 was documented to have hosted 1.12 million tourists, the lowest tourist population during the period.

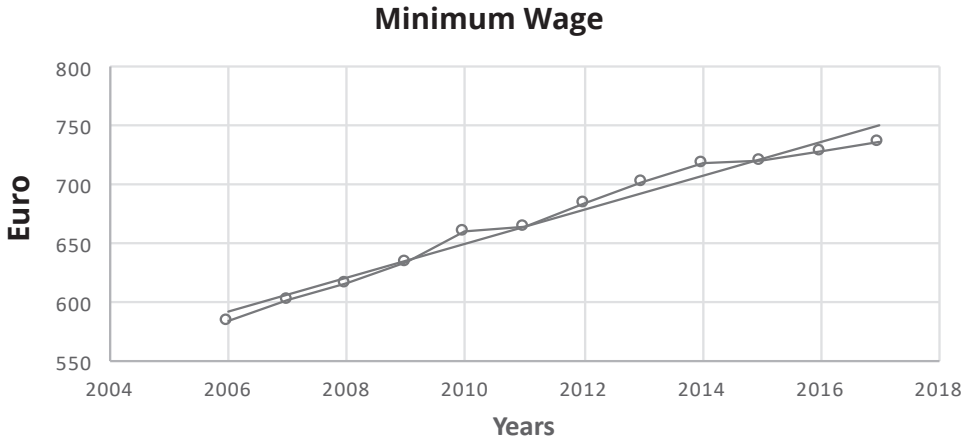


Figure 4: Minimum wage in Malta (Source: Eurostat)

Table 2 indicates that the average minimum wage in Malta stood at €671.10 with a standard deviation of 52.18. Overall, Figure 5 depicts a positive and upward trend, increasing gradually from €584.24 in 2006 to €735.63 in 2017.

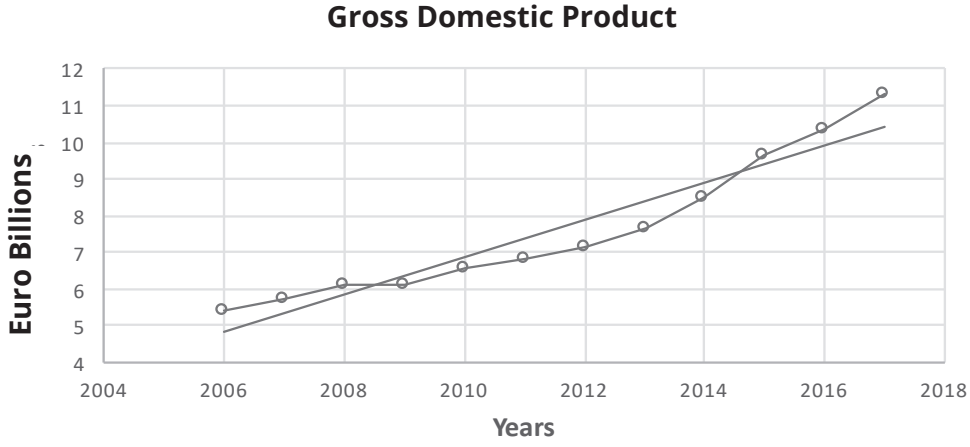


Figure 5: Gross Domestic Product (Source: Central Bank of Malta)

Figure 5 depicts a positive and surging trend line, suggesting that the gross domestic product is increasing over time and that the economy is expanding year on year; based on the GDP figures presented. The average GDP was noted at €7.63 billion with a standard deviation of 1.93. The highest GDP figure of €11.34 billion was registered in 2017, whereas the lowest GDP was recorded at €5.39 billion in 2006.

Government Expenditure as a Percentage of GDP

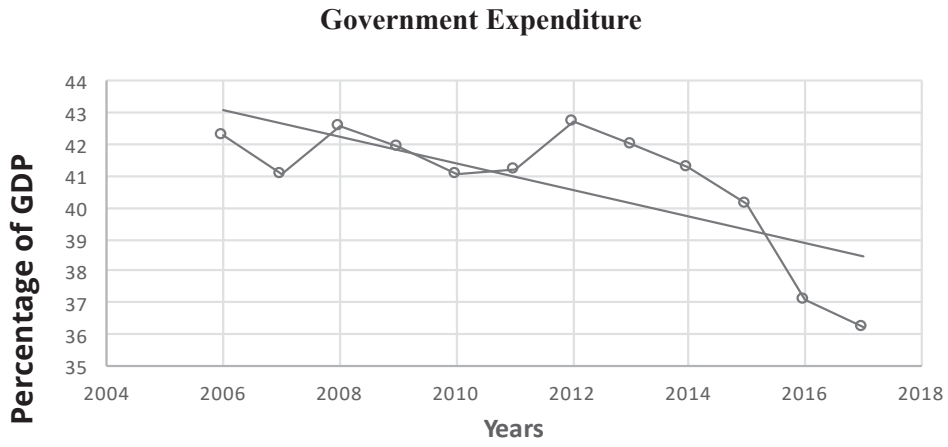


Figure 6: *Government expenditure (Source: Eurostat)*

Table 2 indicates that on average, the government expenditure as a percentage of total GDP stood at 40.8%. The highest government expenditure was recorded in 2012 with 42.7%, while the lowest government expenditure was recorded in 2017 with 36.2%. A downward trend is shown in Figure 6, most notably between 2012 and 2017.

Government Revenue as a Percentage of GDP

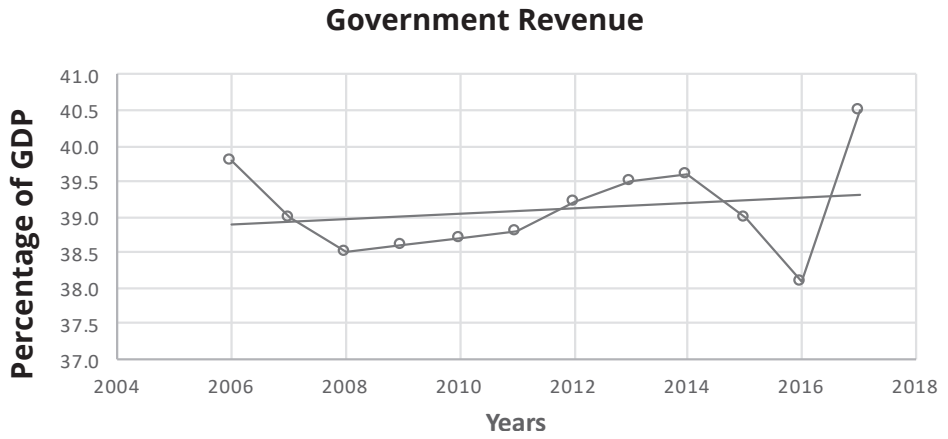


Figure 7: *Government revenue (Source: Eurostat)*

Table 2 indicates that the average government revenue in Malta stood at 39.11% of the country's GDP with a standard deviation of 0.66. Over the years government revenue varied incessantly however, a positive trend line was still recorded. The highest level of government revenue was registered in 2017 with a total of 40.5% with a positive overall trend.

Crime Rates

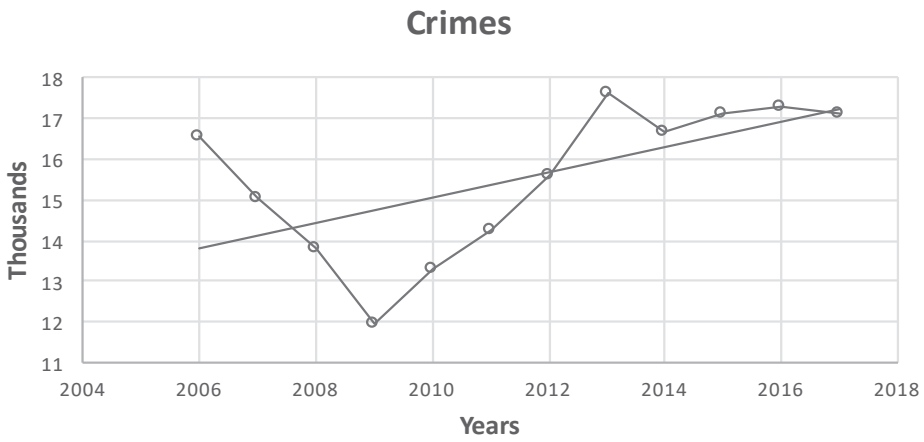


Figure 8: *Crime rates (Source: CrimeMalta)*

Table 2 shows that on average 15,526 yearly crimes take place in Malta and, with a standard deviation of 1,844, it is implied that on average crime rates increase or decrease by 1,844 reported offences on a yearly basis. Meanwhile, with a total of 17,584 reported offences, 2013 registered the most crimes in Malta within the period of investigation.

Population

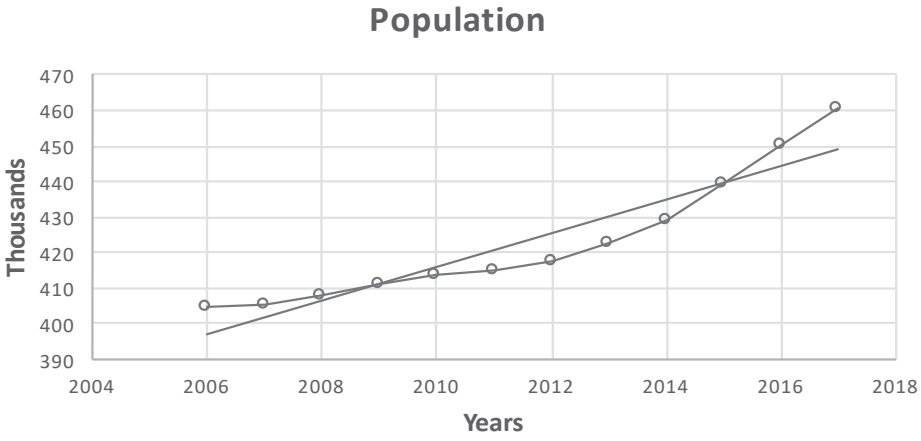


Figure 9: *Population (Source: Eurostat)*

The average population in Malta stood at 423,180 and, with a standard deviation of 18.20, it grew from 404,990 in 2006 up to 460,300 in 2017 as shown in Figure 9. Although Malta is one of the smallest countries in Europe, it has been ranked as having the highest population density in Europe (Azzopardi-Muscat *et al.* 2017).

Carbon Dioxide

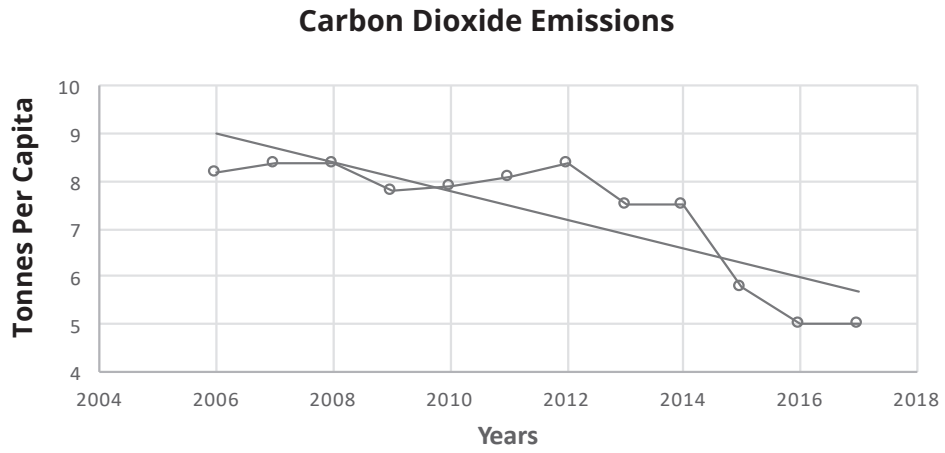


Figure 10: *Carbon Dioxide (Source: Eurostat)*

Figure 10 shows that over the 12-year period the level of Co2 decreased significantly, from 8.2 tonnes per capita in 2006 to 5 tonnes per capita in 2017. The overall trend line is downward sloping, mainly as a result of the continued efforts by local governments to decarbonize the energy sector in Malta, with the aim to eradicate carbonized energy by 2050 (Ministry for Sustainable Development, the Environment and Climate Change 2017).

Unemployment Rate

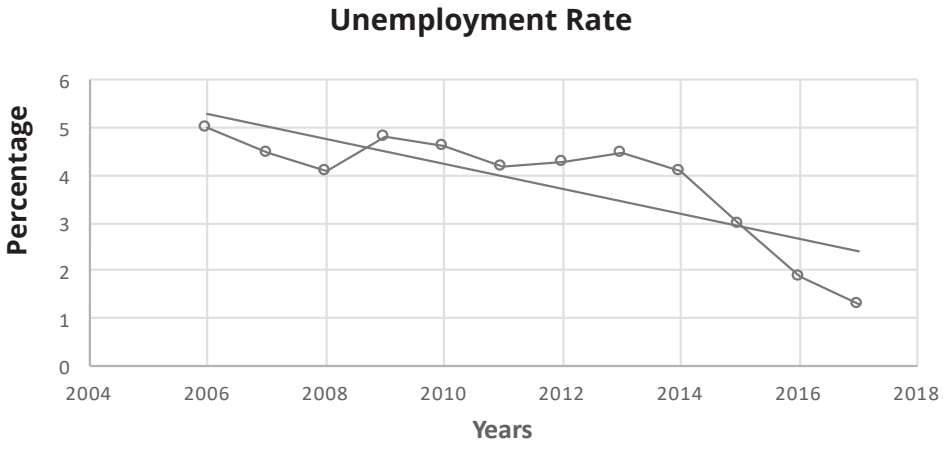


Figure 11*: Unemployment rate (Source: Labour Force Survey)*

Table 2 shows that the average unemployment rate in Malta stood at 3.8% with a standard deviation of 1.13. Overall, as Figure 11 shows, data for unemployment illustrates a downward trend, decreasing from an all-time high of 4.8% in 2006 to 1.3% in 2017.

Inflation Rate

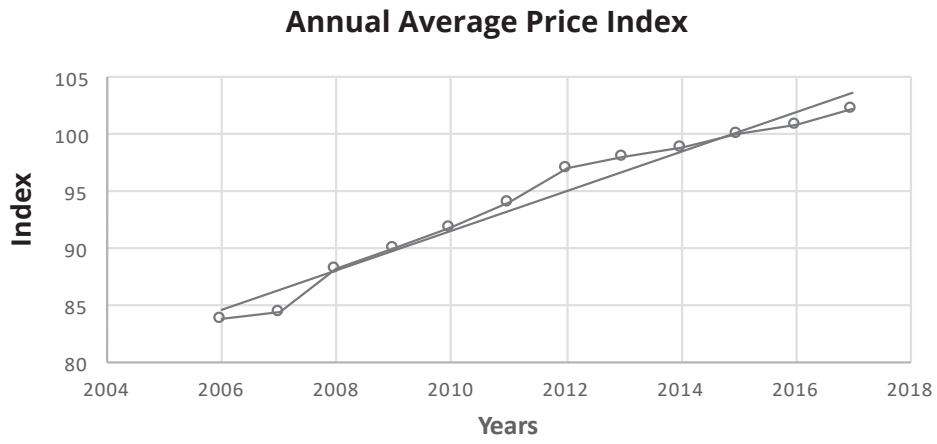


***Figure 12**: Annual Average Price Index (Source: Central Bank of Malta)*

Figure 12 portrays the performance of the Harmonized Index of Consumer Prices in Malta from 2006 to 2017. It is evident that the overall trend is positive and upward sloping, rising progressively from 83.79 in 2006 to 102.18 in 2017. In addition, the average index stood at 94.12 with a standard deviation of 6.40.

Property Price Index



***Figure 13:** Property Price Index (Source: Central Bank of Malta)*

As shown in Figure 13, the year 2017 attained the highest index of 245.6, implying that property prices increased by 145.6% since 2000. While a decrease was noted between 2007 and 2009 as a consequence of the contagion and systemic effects that the global financial crises prompted worldwide, the average index was of 185.33 with a standard deviation of 24.41. Moreover, Figure 13 shows an overall upward trend due to the positive trend line.

Inward Foreign Direct Investment



Figure 14: *Foreign direct investment (Source: National Statistics Office)*

Figure 14 illustrates the total stock position of foreign direct investment in Malta over the 12-year period. The average stock position of foreign direct investment stood at €115.97 billion with a standard deviation of 38.37 implying that on average the stock position of foreign direct investment in Malta increased or decreased by €38.37 billion around the mean value of €115.97 between 2006 and 2017. The year 2017 was observed to have attained the most foreign direct investments over the period with a total stock position of €171.04 billion. Consequently, the upward and positive trend line indicates that from the collected data the stock position of foreign direct investments in Malta increased.

Data Analysis

Pearson Correlation Analysis

From the collected data, the strength of the relationship between the paired data was measured by employing the Pearson Correlation Coefficient using SPSS. Moreover, correlation figures represent the extent of the relationship between the variables and indicate in which degree they correlate in a straight line. In addition, according to the guide set out by Zou, Tuncali, and Silverman (2003), correlations close to ±1 indicate a strong correlation whereas correlations close to 0 signify a weak correlation.

Summary of Results of the Pearson Correlation Coefficient

Independent Variable	Pearson Correlation Coefficient
Number of Tourists	0.990**
Minimum Wage	0.862**
Gross Domestic Product	0.990**
Government Expenditure as a % of GDP	-0.886**
Government Revenue as a % of GDP	0.318
Crime Rates	0.649*
Population	0.996**
Carbon Dioxide	-0.942**
Unemployment Rate	-0.947**
Inflation Rate	0.852**
Property Price Index	0.930**
Inward Foreign Direct Investment	0.903**

**Correlation is significant at the 0.01 level
*Correlation is significant at the 0.05 level

Table 3: *Summary Results of the Pearson Correlation Coefficient*

Table 3 provides a summary of the results obtained from the Pearson Correlation Coefficient Tests carried out using SPSS. It can be noted that 10 out of 12 tested macroeconomic variables are statistically significant at the 0.01 level. Meanwhile, from the other two variables, crime rates were found to have a statistically significant correlation at the 0.05 level, while government revenue as a percentage of GDP was noted not to have a significant correlation with the total number of foreign workers.

Also, from the results obtained it can be concluded tourists, minimum wage, GDP, population, inflation rate, Property Price Index, and inward foreign direct investment have a strongly positive relationship with foreign workers. meanwhile, unemployment rate, carbon dioxide, and government expenditure were noted to have a strongly negative relationship with the total of foreign workers in Malta over the 12-year period.

Simple Linear Regression

A simple linear regression computation using SPSS was carried out on each independent variable to test the significance of the relationship and conduct comparative predictions. Subsequent to the collation of the regression results, an analysis of the most significant variables was conducted.

Summary of Results of the Simple Linear Regression

Variable	β	T	B	Significance (P)
Tourists	0.991	22.785	28.376	0.000
Minimum Wage	0.862	5.372	0.004	0.000
Government Expenditure	-0.886	-6.047	0.000	0.000
Government Revenue	0.318	1.062	1.729	0.313
Gross Domestic Product	0.990	22.577	152142.064	0.000
Population	0.996	34.521	1.497	0.000
Property Price Index	0.930	7.978	0.002	0.000
Crime	0.649	2.699	0.099	0.000
Carbon Dioxide	-0.942	-8.898	0.000	0.000
Inflation (HICP)	0.852	5.140	0.000	0.000
Foreign Direct Investment	0.903	6.666	2864.135	0.000
Unemployment	-0.947	-9.324	-9.170	0.000

Table 4: *Summary results of the Simple Linear Regression*

The unstandardized coefficient (B) represents the regression coefficient and the quantified impact of the independent variable over the dependent variable. Meanwhile, the beta (β) shows what the regression coefficients would be if the model were fitted to standardized data, while the t-statistic (T) is an inferential statistic used to determine whether there is significant difference between the mean of the variables being tested. Subsequently, the significance value (P) describes the mathematical association between the two variables being tested.

The outcomes of Table 4 show that eight out of 12 macroeconomic variables are significantly affected by foreign workers in Malta. The values obtained for government expenditure, government revenue, carbon dioxide, and inflation are either not significant or not impacted by inward foreign workers, contradicting existing literature. Meanwhile, the coefficient for unemployment is recorded to be -9.170; it can be deduced that, for every additional worker in Malta, unemployment decreases by an average of 0.09% workers. This result disproves the outcomes obtained by Withers and Pope (1985) and Gross (1999).

On the other hand, the coefficient for tourists of 28.376 aligns with the findings of other existing studies (Basch, Schiller, and Blanc 1994; Gmelch, 1992). This implies that for every additional foreign worker in Malta, the number of tourists visiting the island increases by an average of 29. Additionally, the results for minimum wage support the works of Peri (2008) and Ottaviano and Peri (2008). With a coefficient of 0.004, it can be implied that, on average, an increase of 250 foreign workers increases the national minimum wage by €1.

Moreover, the coefficient for GDP in Malta, recorded as €152,142.064, is in parallel with the conclusions of Alesina and Rapoport (2016) and Ortega and Peri (2014). It suggests that, for every additional foreign worker, the GDP increases by an average of €152,142.06. Likewise, similar to the results obtained by Chanpiwat (2013), the coefficient for the Property Price Index is recorded to be 0.002; thus property price in Malta increase by 1% for every 500 additional foreign workers in Malta. Furthermore, the coefficient obtained for the population is recorded to be 1.49; hence, for every two additional foreign workers in Malta's workforce transmits an increase in the Maltese population by an average of three citizens, in line with the findings of Sobotka (2008) and Westoff and Frejka (2007).

In addition, this paper finds that the relationship between crime and foreign workers is directly proportional, supporting the works of Bianchi, Buonanno, and Pinotti (2010). The coefficient for crime is recorded to be 0.099 thus, an increase of 101 foreign workers in Malta increases the total crimes by 10 offences, on average. Finally, the coefficient for inward foreign direct investment is recorded to be 2864.135, implying that a total of €2,864.14 worth of inward foreign direct investment, is on average introduced in Malta for every additional foreign worker. This result is also in line with that obtained by Buch *et al.* (2006), Aroca and Maloney (2005), Tong (2005), Kugler and Rapoport (2007), Bhattacharya and Groznik (2008), Javorcik *et al.* (2010) and Federici and Giannetti (2010), all of whom observed a positive relationship between the two variables.

Implications of the Study

The results derived from this study indicate that foreign workers are impacting Malta's macroeconomic variables strongly and signify that foreign workers alleviated the economic growth of the country, mainly by increasing productivity through improved local skills base and enhanced innovation. Earlier in 2019, in an interview with the *Times of Malta*, Mr Clyde Caruana, the head of Jobsplus. mentioned that, in order for the country to retain its economic activity, an addition of 13,000 foreign workers should be introduced by the end of 2019 (Macdonald 2019). Consequently, based on the results of this study, an addition of 13,000 foreign workers in the Maltese economic system infers that tourists will increase by 377,000 over the course of a year and that the national minimum wage will increase by €52.

In addition, *ceteris paribus*, an increase of 13,000 foreign workers will increase the country's GDP by €1.97 billion in 2019; which amount incorporates the multiplier effect caused by an inflated population and excludes economic leakages. Furthermore, the population of Malta will expand by 19,461 and the advertised property prices will increase by an overwhelming 26%, along with an increase of 1,287 in the recorded offences in Malta. Similarly, as a result, the inward foreign direct investment will be expected to increase by €37.2 million and, subsequently, the unemployment will be expected to decrease by 91.7% thus furthering the assertion that the country will remain in full employment.

Recommendations for Further Study

Further studies may be carried out investigating other macroeconomic or microeconomic variables to identify other possible outcomes that did not feature in this study. Alternatively, another possible area for further research would be for a meta-analysis to be conducted using this study for Malta, and a similar study conducted in another European country that holds similar characteristics. In this manner, a greater understanding of the local

environment could be drawn when compared with other countries with comparable characteristics.

Conclusion

The results, based on collected secondary data from reputable sources, show that foreign workers as an economic variable is a living phenomenon that largely affects most economic variables that contribute to the making of the Maltese economy as indicated in Table 4. Based on the analyses of this study, it can be concluded that there is co-integration between the level of foreign workers in Malta and eight of the 12 employed macroeconomic variables, these being: tourism, minimum wage, GDP, population, property prices, crime, foreign direct investment, and unemployment. This indicates that there is a long-run relationship between the variables and that changes in the number of foreign workers alter the structure of the aforementioned variables. Although the majority of the findings in this paper portray a positive impact on the Maltese economy, studies on inward labour migration are to be continuously performed as this phenomenon is appearing to become more prominent as time goes by. Furthermore, since the fertility rates in Malta have dropped significantly, along with a considerable decline in death rates as a consequence to longevity, the inflow of foreign workers could possibly serve as a potential solution to the ageing pressures Malta is currently facing by contributing to the sustainability of the local economy and pension system.

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Performance Analysis of Ageing Domestic Water Meters with Respect to Apparent Losses: A Case Study

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Abstract: In water distribution networks, a substantial amount of Apparent Losses result from water-meter errors. This study aims to evaluate water-meter under-registration, specifically the effect of ageing on the meter measurement errors, controlled at different flow-rates. The study was initiated by establishing a holistic methodology highlighting the planning process and meter-testing procedure. The results achieved show that the metrological percentage meter error is highly pronounced at low flow-rates. In the case of medium to high flow-rates for one-year, three-year, and five-year-old class of meters, meter errors were not statistically significant. However, an opposite outcome for the same flow-rates resulted for the seven-year class meter.

Keywords: Apparent Losses (AL), ageing, water meter under registration

Introduction

Malta is the most water scarce country in Europe, ranking among the top ten globally in terms of water scarcity (Lee Roberts 2015). Moreover, the rapid increase in population and urbanization, combined with the effects of climate change, makes it more and more challenging to provide adequate water supplies. This scenario creates a pressing need to identify innovative solutions for reducing Non-Revenue Water (NRW). Defined by the International Water Association (Farley 2003), NRW refers to water which is not billed and hence no payment is received by the water entity for its consumption. The obvious consequence of NRW is the adverse financial consequences for the utility company. Furthermore, significant NRW can lead to rising unmet water demands combined with requirements for more resources and operational expenses to supply additional water.

Understanding elements of NRW is crucial for good governance of the water-supply system by a utility company, where aspects such as Apparent Losses (AL) and Real Losses (RL), have proven relatively challenging to adequately quantify. Vermesch *et al.* (2006) define AL as the volume of water consumption that reach consumers but is not billed. Moreover, RL refer to the water leakages in the water distribution network and storage facilities. Hence, in reducing RL the utility company can lower the overall cost of production whilst, in reducing AL, the utility company can increase the billing revenue without increasing the rates. In their study on developing the Best Practice for Reducing Commercial losses, Loupos *et al.* (2014) claim that, whilst utility companies strongly focus on reducing RL, AL are often overlooked and this can lead to a scenario where AL are higher in volume than RL.

A. Criminisi *et al*. (2009) explain that in most cases AL are often attributed to meter under-registration/meter inaccuracies. As with any measuring instrument, water meters

unavoidably have a margin of error in registering the true value which becomes more significant with meter age. The measuring error of a meter at a given flow-rate is defined as the difference between the volume registered by the water meter and the actual volume consumed. As can be observed in Figure 5, meter error varies according to water flow-rate passing through the meter. The resulting error maybe negative or positive, according to the flow passing through the meter. To analyse the metrological behaviour of any type of water meter, the ISO 4064-3:2014 standard identifies the criteria for the error curve through four flow-rates: Q1, Q2, Q3, and Q4. Q1 refers to the starting flow-rate, i.e. the minimum flow required for the internal friction present in the meter mechanism to be overcome and hence start registering consumption. Q2 refers to the permanent flow-rate at which the meter will be guaranteed to register water consumption within a margin of error no greater than ±2%. Q3 is referred to as the nominal flow-rate which is the expected maximum typical continuous flow-rate to be experienced by the meter and Q4, the overload flow-rate (December 2007).

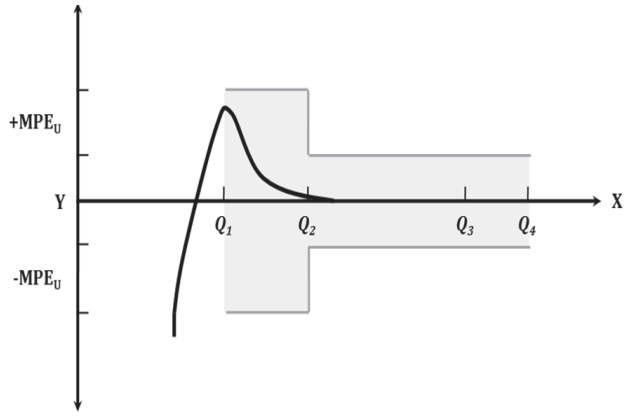


Figure 1: *Sample water meter error curve (ISO 4064-1 2005)[5],[7],[6]*

The negative or positive behaviour of the error curve shows that the water volume recorded by the meter is directly related to the consumption behaviour of the end-users. Water consumption at medium to high flow-rates, beyond Q2, result in minimal error. However, in water consumption at low flows, below Q1, the error will be negative resulting in high water meter inefficiency. As a consequence, AL are directly influenced by water consumption patterns at very low flows (Arregui *et al.* 2007; Male *et al.* 1985; Ferreol 2005; Arregui *et al.* 2006).

The use of private water storage tanks is a major contributor to low flow-rates. These challenges are further augmented in water networks, such as in Malta where consumers use private water storage tanks to cope with irregular water supply (Criminisi *et al.* 2009; Fantozzi *et al.* 2009). In contrast to a direct plumbing system, where water is fed directly from the main supply to the different outflow points (such as washing machine, flushing, water-heater tank, etc.), private cold-water storage tanks create an indirect plumbing system. Cobacho *et al*. (2008) conclude that the bigger the surface area of the water tank, the lower would be the starting flow-rate, hence the higher the meter under-registration. Similarly, Criminisi *et al*. (2009) conclude that, if the tank is almost full, the flow meter errors are amplified since the small trickles of water flowing into the tank go undetected by the water meter. On the other hand, if the tank is periodically emptied and refilled, this can lower meter under-registration as much higher flows would be required to refill it.
Coupled with the consumer consumption behaviour, Male *et al.* (1985) suggest that

another major factor affecting meter performance (assuming appropriate meter-sizing and no manufacturing faults) is meter age. This result is reconfirmed by a local study (Water Services Corporation 2017) which found that domestic meter performance reduction (under/non-registration) was primarily attributed to ageing (high meter average age at the time – prior to replacement programme initiation) and the domestic plumbing system. In 2008 an estimated combined weighted average meter error rate due to various meter ages stood at 16%, incurred by the Water Services Corporation (WSC) as unbilled water consumption. However, as part of the WSC's strategy towards addressing NRW, a meter replacement programme was initiated targeting meters over 10 years old, gradually phasing out older class C meters, with newer types of class D meters. This reduced the national water-meter average age from 9.2 years in 2010 to 7.0 years in 2013, significantly reducing meter under/non-registration due to meter ageing from 16–18% to 7–8% respectively (Galea St John 2013).

Arregui *et al.* (2006) indicate that the initial consequences of ageing occur at the low flows. Resistance to water-meter rotation due to ageing have a significant effect when the energy transferred to the meter impeller is at the lowest and subsequently at low flow-rates. This will result in increasing the starting flow-rate. Hence, the effect of decay of the water-meter inefficiency vis-à-vis the age is an important consideration for enhancing the meter management and possibly identifying the phasing-out period. Within this context, this paper aims to analyse water-meter under-registration, specifically the effect of meter ageing on the meter error, controlled at low flow-rates.

Materials and Methods

A deductive quantitative approach was selected as the method of inquiry to examine the relationship between water meter ageing and meter error. Creswell and Creswell (2017) define quantitative research as testing of objective theories by studying the association among variables. As indicated previously, the purpose of this experimental research study is to analyse water-meter under-registration, specifically the effect of ageing on the meter error, controlled at different flow-rates. Hence, in this study the independent variables refer to water meters at different age classes, the dependent variable is the percentage meter error while the controlling variables allude to the different flow-rates. The dependent variable being studied is in no way exhaustive in nature and omitted variables might also explain changes in the meter errors.

In order to establish a holistic testing procedure, a process depicted in the flowchart in Figure 1 was established. The initial step in the water-meter testing procedure entailed identifying the type of meters to be tested. Based on the commonly installed domestic water meters in Malta, the meters tested were all volumetric, R400 meters as defined through the Measuring Instruments Directive (MID) 2014/32/EU standard and with DN15 (inlet/outlet threaded pipe diameter size, mm). In this case volumetric, or positive-displacement meters, measure the volume of water by allowing a precise volume of the flow to physically displace the moveable mechanism (generally a rotating piston or nutating disk) within the meter, in direct proportion to the volume of water. The disk/piston in turn rotates a magnet which drives the numerical register (Van Zyl 2011). Moreover, the meters tested were all supplied from the same manufacturer to avoid any variations in the meter error resulting from specifications of different meter suppliers. The succeeding step entailed categorizing meters into age classes. Since the selected type of meter have been installed locally for the past seven years, it was decided that the independent variables would be classified into the following four age classes:

- Class 1: Five domestic water meters aged 1 year;
- Class 2: Five domestic water meters aged 3 years;
- Class 3: Five domestic water meters aged 5 years;
- Class 4: Five domestic water meters aged 7 years,

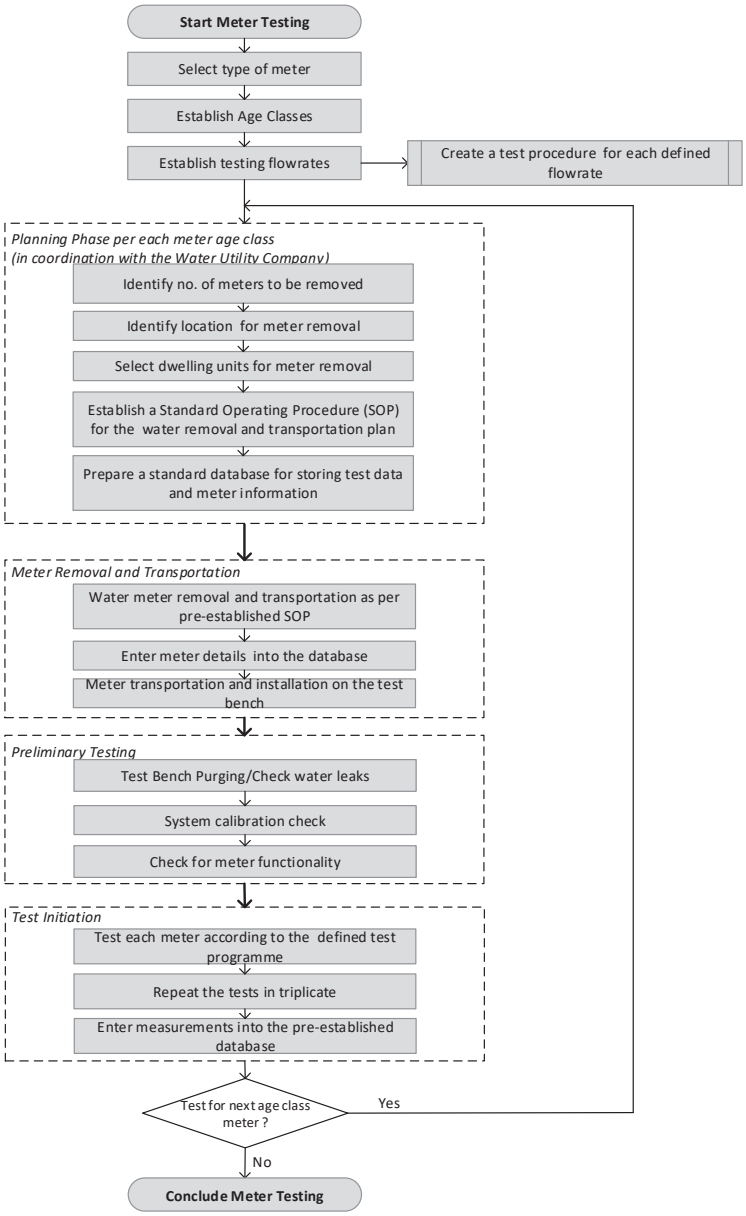


Figure 2: *Meter Testing Procedure*

When determining the flow-rates for which the water meters should be tested, it was decided to go beyond the legal metrology tests (ISO 4064:1993) and examine the meter-

error performance particularly at low flows. The challenge with ISO 4064:1993 is that it is based for new meters only (Arregui *et al.* 2018). If the tests conducted were limited only to flow-rates required for the metrological requirements, it would be challenging to define the meter error at low flows. This scientific methodology is also backed by other researchers who claim that this allows an accurate representation of the water meter error (Ibid.). Moreover, these additional flows are more representative of real life scenario (i.e. the indirect pluming system) in which these meters operate.

Hence, in order to identify further flow-rates, apart from the legal metrology, at which the meters shall be tested, the Standard Domestic Consumer Profile (SDCP) representative of the area under study was developed. The data, graphically displayed in Figure 3, was provided in yearly consumption profiles for households from different localities with different registered occupancies, in packets of 24hr periods with data (metered registration) logged in 1hr intervals, gathered through the WSC Automated Meter Reading (AMR) system currently in operation. Based on the data obtained, the ISO standard was enhanced to include the flow-rates indicated in Table 1:

Identifier	Flow-Rate (l/hr)
Q_0	1
Q_{med}	3
Q_1	6
Q_{high}	16
Q_2	25
Q_3	2500

Table 1: *Flow-rates based on ISO 4064:1993 and the SDCP*

Following the initial stages, the testing procedure was categorized into four sub-processes commencing with the initial planning phase, the material removal, the transportation process, and the preliminary and actual testing phases.

Planning Phase

The planning stage was carried out for each of the four age classes. All the meters tested were uninstalled from residential users in the St Paul's Bay area in the northern region in Malta so as to ensure that meters were subject to the same water quality and similar distribution pressure. This would minimize the influence of meter errors from other independent variables, namely variations in water quality and distribution pressures. Furthermore, all aged meters were removed from residential units occupied by two to four inhabitants, these being the most common house composition in Malta (National Statistics Office 2018). This was done to ensure that the water meters were subject to comparable water consumption patterns and hence they would have had similar wear conditions. This would minimize the effect of having meters in the same age class but with different wear conditions. Lastly, a Standard Operating Procedure for the transportation process and a database to input the meter details were created.

Transportation Process

The removal and transportation of water meters from dwellings to the Water Laboratory took into consideration various factors so as to minimize any effects to meter errors done during the process. Prior to the removal of the water meter, it was ensured that the sealing on the water meter was intact. This eliminated the possibility of any resulting meter errors due to tampering. Subsequently, water meters were carefully removed using adjustable spanners, without using mallets. Once removed, the outlet side of the meter was fitted with a plastic plug and filled with water from the inlet side to prevent any formation of water scale drying up which can result in the malfunction of the water-meter mechanism and hence contribute to meter error. Once filled, the inlet side was closed off using another plastic plug in order to retain water inside the meter during the transportation process. Lastly, the meters were placed in a specially designed transportation plastic box which includes foam/bubble wrap in order to act as a shock absorber during the transportation process. During each process, five meters from the same age class were uninstalled and transported to the laboratory for analysis on the same day of removal.

Preliminary Testing

The meter tests were implemented using the 'PT20 Test Rig for Water Meters' specially designed and assembled by SENSUS® (*SENSUS 2016*). The main function of the water-meter test bench/rig, as the name suggests, is to quantify accurately the operational characteristics for water meters and thus determine whether water meters conform to specifications and standards and/or for research and development purposes (such as meter inaccuracy profiling). The main basic concept behind the test bench is to pass a known volume/weight of water at a certain flow-rate under certain parameters (temperature, pressure, etc.) through the water meter in order to differentiate quantitatively between the meter registered value and the actual measured (true) value of delivered water mass/volume. Once delivered to the laboratory, the five aged meters were installed on the test bench in series. Prior to each test, the water rig and surrounding area was dried so as to detect any potential leaks during the preliminary testing process. Additionally, an initial preliminary test was performed to assess the functionality of the water meters. During the initial testing phase, calibration of flow measurement and weighing instrumentation was performed as per the Quality Assurance plan described in the system's manual.

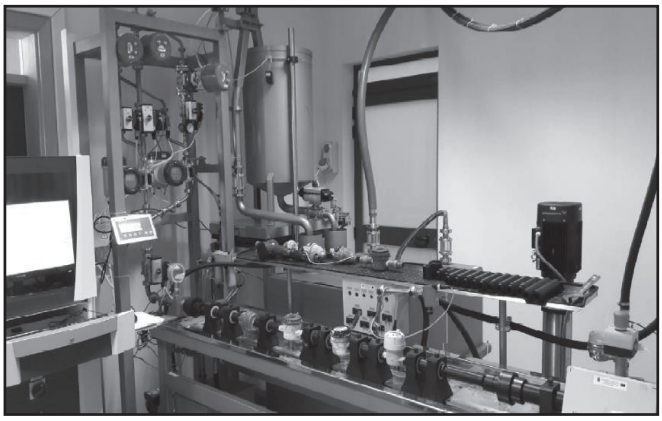


Figure 3: *PT20 Test rig for water meters*

Actual Testing

The test method adopted to determine the measurement errors is referred to as the 'collection method' (ISO 4064:2005). This method entails water being passed through the meter which is then collected in the calibrated water tank and the actual water quantity is determined by weighing. The meter error could then be established using the equation described in the introduction. In this case the actual water is determined by weighing the water, whereas the registered volume is determined by the water meter. The test bench, seen in Figure 4, was tailor-made to simulate very low flows, similar to those induced by the predominant indirect plumbing systems (using roof tanks) found in the Maltese Islands, with the aim of accurately quantifying meter inaccuracies as a result.

The tests were carried out in batches according to the meter each age classes. During each experiment, a predetermined volume of water was passed through the meter and deposited in the weighing tank at each flow-rate. All the experiments were controlled and monitored through the system's SCADA software. In order to provide the pre-defined flow-rates, a gravity tank system, incorporated in the water rig, was used so as to provide a constant and stable supply head by gravity to the flow and eliminate any pump pressure spikes. The gravity tank acted as an intermediary between the pressure pumps and the meter park, hence simulating the local roof water-tank scenario.

Data Analysis

Each test was done in triplicate to verify the similarity of dependent measurement results produced under repeatability conditions. The meter sample subjected to the tests was limited to ten samples per age class due to the long flow times required to measure the extremely small flow-rates and minimize uncertainty in the measurements.

After each experiment, the data obtained was input into to a database. This provided the researchers with the opportunity to compare the readings with the recoded times in a way that any results which were out of line would be observed easily and to minimize reading errors. Template Excel documents were used for inputting the data opened and provided a consistent method of data storage. The meter error expressed as a percentage of the actual volume passed through the meter was computed using the following equation (Arregui *et al*. 2007; December 2017):

$$\varepsilon_Q(\%) = \frac{Vol_{registered} - Vol_{actual}}{Vol_{actual}} \cdot 100$$

Results and Discussion

The results obtained assess the meter error, i.e. the fraction recorded by the water meter when compared to the real amount of flow force through it. The results achieved are presented in Table 2. The minimum and maximum error tolerances for the flow-rates specified in ISO 4064:1993 (December 2017) are also included in the table hereunder.

Diameter DN15 (1/2')	Flow (l/hr)					
	Q_0	Q_{med}	Q_1	Q_{high}	Q_2	Q_3
Class 1 (1 Year)	-99.94%	-9.44%	-2.78%	0.44%	1.33%	-0.05%
Class 2 (3 Years)	-100.00%	-23.78%	-6.24%	0.73%	1.69%	-0.02%
Class 3 (5 Years)	-100.00%	-48.10%	-24.44%	-7.99%	0.44%	-2.12%
Class 4 (7 Years)	-100.00%	-85.69%	-39.53%	-8.38%	-30%	-0.25%
ISO 4064 Error Tolerance	N/A	N/A	N/A	±5%	±2%	±2%

Table 2: *The average percentage error of different class meters against flow-rates*

The percentage errors results are graphically displayed as parabolic curves in Figure 1. The results clearly show that the metrological percentage error is highly pronounced at the low flow-rates (which fall beyond the ISO 4064:1993 requirement), namely at Q_0 and Q_{med}. At Q_0 (1 l/hr) none of the age-class meters registered any consumption hence, the effect of meter ageing at this particular flow cannot be assessed. The initial effects of ageing can be observed particularly, at Q_{med} where meter error increases significantly with the meter ageing. This finding tallies with similar studies performed by Arregue *et al.* (2018). The author claims that an increase in resistance to the rotation due to mechanical wear caused by ageing will have a more noticeable effect when the energy transferred to the impeller is lowest and hence, at low flow-rates. This implies that, as the ageing increases, the starting flow-rate also rises demonstrating the enlarging impact of wear and tear.

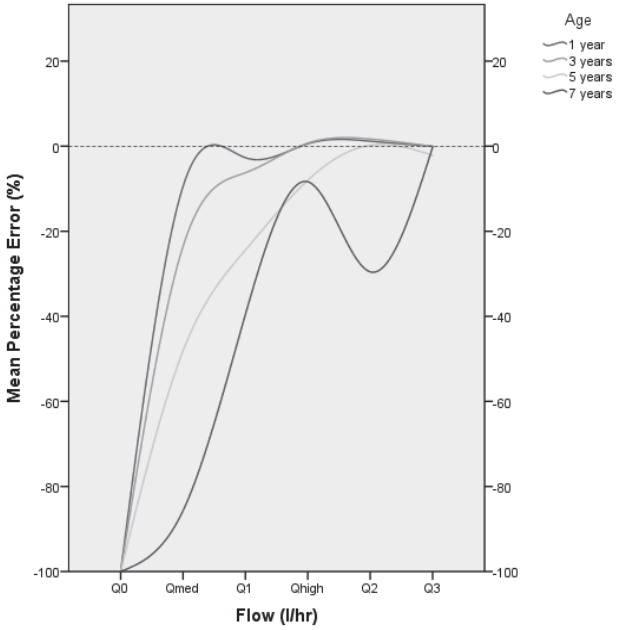


Figure 4: *Average error curve for meter age class*

Similar patterns can also be noticed for Q_1 and Q_{high} whereby the percentage errors also tend to increase with respect to age, mostly due to the accumulation of lime scale or calcium deposits across age which contributes to higher meter error. In line with the meter-error curve in Figure 1, the percentage meter-errors for medium (Q_2) and high flow-rates (Q_3) are stable. Apart from a few exceptions, the errors for Class 1, Class 2, and Class 3 meters fall within the allowed permissible error tolerance. Class 4 meters exhibited a poor metrological performance especially at Q_{High} and Q_2. The -30% error for the Q_2 flow-rate of Class 4 meters stands out from the rest of the results. This high percentage error is the result of the malfunction of a number of meters during the testing process. Increasing the sample size is important to lower the spread in the error values.
The independent sample test was used to compare the mean actual water flowing through the meters with the mean recorded water flow by the meter. As indicated in Table 3, this comparison was carried out for each flow-rate and according to each age class. The null hypothesis specifies that there is no difference between the actual and registered water flows and is accepted of the p-value exceeds 0.05 level of significance. The alternative hypothesis specifies that there is a significant difference between the actual and recoded water flows and is accepted, if the p-value is less that the 0.05 criterion.

Flow	Age	Type	Mean	Std. Deviation	P-value
Q_0	1 year	Vol_{actual}	2.000	.000	0.000
		$Vol_{registered}$	.001	.003	
	3 years	Vol_{actual}	2.000	.000	0.000
		$Vol_{registered}$	.000	.000	
	5 years	Vol_{actual}	2.021	.001	0.000
		$Vol_{registered}$	.000	.000	
	7 years	Vol_{actual}	2.021	.001	0.000
		$Vol_{registered}$	.000	.000	
Q_{med}	1 year	Vol_{actual}	6.000	.000	0.011
		$Vol_{registered}$	4.587	1.278	
	3 years	Vol_{actual}	6.000	.000	0.045
		$Vol_{registered}$	4.833	1.815	
	5 years	Vol_{actual}	6.125	.004	0.000
		$Vol_{registered}$	.024	.073	
	7 years	Vol_{actual}	6.125	.004	0.000
		$Vol_{registered}$	.877	1.676	
Q_1	1 year	Vol_{actual}	12.000	.000	0.001
		$Vol_{registered}$	11.674	.197	
	3 years	Vol_{actual}	12.000	.000	0.069
		$Vol_{registered}$	11.251	1.068	
	5 years	Vol_{actual}	12.275	.003	0.000
		$Vol_{registered}$	.619	1.716	
	7 years	Vol_{actual}	12.275	.003	0.030
		$Vol_{registered}$	7.422	5.530	
Q_{high}	1 year	Vol_{actual}	32.777	.005	0.086
		$Vol_{registered}$	32.967	.291	
	3 years	Vol_{actual}	32.765	.003	0.096
		$Vol_{registered}$	31.002	.065	
	5 years	Vol_{actual}	32.765	.003	0.069
		$Vol_{registered}$	30.874	2.707	
	7 years	Vol_{actual}	32.765	.003	0.000
		$Vol_{registered}$	30.881	0.386	
Q_2	1 year	Vol_{actual}	51.270	.004	0.088
		$Vol_{registered}$	51.879	.318	
	3 years	Vol_{actual}	51.270	.010	0.130
		$Vol_{registered}$	52.138	.563	
	5 years	Vol_{actual}	51.382	.339	0.087
		$Vol_{registered}$	36.254	23.287	
	7 years	Vol_{actual}	51.212	.006	0.000
		$Vol_{registered}$	6.821	16.791	
Q_3	1 year	Vol_{actual}	124.682	.002	0.519
		$Vol_{registered}$	124.617	.290	
	3 years	Vol_{actual}	124.663	.032	0.745
		$Vol_{registered}$	124.632	.269	
	5 years	Vol_{actual}	124.643	.010	0.130
		$Vol_{registered}$	124.326	.563	

Table 3: *Independent Sample t test*

Apart from one exception, the p-vales for all the age classes of flowrates Q_0, Q_{med}, and $Q_{1,}$ is less that the 0.05 level of significance. This implies that low flow-rates contribute significantly to meter under-registration, hence, confirming the results achieved in past studies (Arregui *et al.* 2006: 20–2). These results are within the limits stated in the manufacturer's datasheet which specifies significant meter under-registration for flow-rates of less than 10 l/hr.hilst this outcome is in line with manufacturer's specifications, it implies significant water apparent losses for the national water utility company. As highlighted in previous studies (Fontanazza *et al.* 2015), this phenomenon of high meter under-registration at low flow-rates is the primarily the result of the private water tanks interposed between the end users and the water meter. The sizable surface area of the private water tanks entails that water outflow from usage can result in a minor water level drop within the tank. Minimal water drops in the water tank cause the inflow valve to open slowly as the water level goes down and to close slowly as the water level goes up. This leads to a low flow supply of water to pass through the meter to refill the water tank, resulting in high meter under-registration.

In the case of higher flow-rates, i.e. Q_{high}, Q_2, and Q_3 for the one-year, three-year, and five-year class meters, the p-value obtained is higher than the 0.05 criterion; hence there is no statistical significance between the actual water flow and registered volume of water. This outcome suggest that for medium to high flow-rates between 16 l/hr to 2500 l/hr, the meter error for these age classes is minimal as per the standard water meter error curve in Figure 1. In the case of the seven-year age class, this age class has degraded significantly. In this case, the independent t-test confirms the observations in Figure 3, i.e. statistical significance is evident between the actual and registered flow-rate rates for Q_2 and Q_{High} with the exception of Q3, where the p-value suggest there was minimal meter error. Fontanazza *et al*. (Ibid,) attribute similar results to the accumulation of deposits over time which hinder the efficient rotation of the impeller (rotating piston in this case) resulting in substantial under-registration. Furthermore, the wear and deterioration over time which may be the result of poor water quality or network distribution pressure also contributes to this result.

Conclusion

This study has focused on assessing water meter under-registration, namely the effect of meter ageing on the meter error, controlled at low flow-rates. Primarily, this paper aimed at establishing a methodology describing step by step the testing procedure from the planning phase to the actual experiments. The raw results obtained confirm the hypothesis that meter error increases with respect to age. The data obtained demonstrated that, as the water meter gets older, the starting flow-rate also tend to increase due to the enlarging impact of wear-and-tear. The data was further validated through a statistical analysis which confirmed a statistical significance between the actual volume of water passed through the meter and the registered consumption for flow-rates lower than 10 l/hr irrespective of the meter age class. Statistical significance also resulted for the most of the flow-rates tested on the seven-year age class.

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Vocational Pedagogies for the Formation and Training of Early Childhood Educators: Perspectives of VET Lecturers and Level 5 Early Years Learners

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Abstract: This paper examines the kind of pedagogical approaches used in Higher Vocational Education, more specifically initial training programmes for early-years practitioners, from the perspectives of both VET lecturers and students currently involved or enrolled in these programmes. The focus is on understanding the ways in which the pedagogical models and tools adopted carefully match the requirements for the successful formation of early-years professionals. More specifically, this paper seeks to explore and understand the factors that influence the vocational pedagogical strategies used, the extent to which these pedagogies are learner-centred, the opportunities and challenges that Higher VET lecturers experience in their classrooms when embracing pedagogical innovation, the benefits for learners, as well as the impact on the quality of the training provided. Adopting a grounded theory methodology, with the aim of building theoretical ideas grounded in the data, two main data collection methods were used: one-to-one semi-structured interviews with a group of VET lecturers and a focus group with a group of Level 5 early-years learners who at the time of the study were in the process of completing the two-year higher diploma. Through a process involving inductive-abductive logic and the constant comparison, coding, and analysis of the data, a theoretical model of vocational pedagogies for the training and formation of early childhood educators emerged.

The findings indicate the need for clear pedagogical direction and informed choices to be made individually and collectively by the team of lecturers teaching the programme; this requires the presence of an ethos and climate of critical reflective practice and life-long learning through the creation or seeking of opportunities for continuous professional development. Its relevance becomes more pronounced in the context of a training programme that prepares future educators as there is a greater application of the pedagogy used at higher vocational training level for its transfer to early-years classrooms and settings. The role of the VET lecturer as a role model is highlighted as being significant in the formation and training of early childhood educators by both sets of participants. The current pedagogical picture portrays a situation where different lecturers adopt different pedagogical approaches that range from the traditional, teacher-focused ones to more innovative, participatory, and practice-based strategies. There is a consensus about the validity of adopting more learner-centred, hands-on pedagogical approaches though this is usually influenced by contextual, cultural-historical, and philosophical factors. The topical debate on professionalizing the Early Years sector is also reflected in the data and seems to influence expectations that both lecturers and learners have on the quality of the programme and the need for more focused exploration of effective vocational pedagogies. The importance of a strategic plan on the relevance and advancement of the teaching and learning practices within the vocational training programmes is highlighted.

Keywords: Vocational pedagogy; early childhood education and care; higher vocational education and training; grounded theory methodology; teacher-learner relationship; pedagogic leadership

Background

Teaching and learning in Higher Education, whether academic or vocational, is generally regarded as consisting of complex practices and processes that facilitate the development of not only knowledge, skills, and competences but also the cultivation of habits, values, and behaviours connected with a particular field, professional work, or vocation (Kemmis and Green 2013; Shulman 2005). Moreover, it is believed that for vocational education to reach the highest possible quality and the creation of centres of excellence, one aspect that requires close attention and constant review is the notion of vocational pedagogy and pedagogic leadership as vocational institutions strive to facilitate a climate of outstanding learning where teachers, employers, and leaders contribute to the learning processes (Lucas and Claxton 2013).

The researcher's background as an early-years educator and leader who eventually moved on to train early childhood educators and managers as well as manage programmes at a higher education level has triggered an interest in understanding more deeply the interactions, intricacies, and suitability of the pedagogical approaches being used from the perspectives of those directly involved in the process, i.e. the lecturers teaching on the programmes and the students on the receiving end and who will ultimately impact the lives of the young children they will be caring for and educating. Through a preliminary review of literature, a gap was identified in terms of research studies that specifically explain and render the complexity of pedagogical practices adopted in higher education programmes, including initial training programmes for early childhood educators and how they may influence the effectiveness and relevance of the programmes, the quality of the experiences for the students themselves, as well as the kind of professionals that such training develops. This qualitative research project aims to address and contribute to the filling of this gap in literature on vocational pedagogies in higher education, more specifically those adopted in the training of practitioners working in the field of the early years.

Literature Review

The field of Early Childhood Education and Care has been at the centre of many debates in the past decade with new efforts being made at the local and international levels to improve the quality of the services and experiences provided for young children and their families. The reason behind this interest in the early years is mainly due to an increase in the demand for well-equipped, high-quality and family-friendly settings that can care for and educate infants, toddlers, and young children whilst their parents are at work. In 2016 the Maltese government introduced a free-childcare scheme to benefit families whose parents were employed or pursuing their own education, with the intent to address socio-economic issues as well as to provide equal opportunities to men and women who wished to seek employment and help them to strike a good work/family-life balance (MEDE 2013). One of the recommendations presented in the White Paper on Early Childhood Education and Care in Malta (2013) was to have a minimum of fifty per cent of staff working in early-years settings with a relevant tertiary qualification to ensure good quality provision. Despite these efforts, it is felt that Early Childhood Education in Malta still 'struggles to find its voice' and seems to retain a low-status in terms of priorities

for high-quality provision by highly qualified practitioners and leaders (Sollars 2018). Notwithstanding this, as one of the main educational institutions providing training in the field of the early years, the Malta College of Arts, Science, and Technology has continued to review and develop related programmes to cater for the needs of the industry. Currently, two full-time programmes are delivered – at Level 4 to prepare trainee child-care workers to work with and care for babies, toddlers, and young children in childcare centres and at Level 5 to develop the knowledge, skills and competences required to lead and manage child-care settings as well as to teach in kindergarten classrooms for children aged three to five years. Moreover, MCAST students who successfully complete their Level 5 Early Years qualification have the possibility of pursuing their studies further to obtain a first degree in ECEC from the University of Malta, following a Memorandum of Understanding signed in 2017 between the two institutions. This is in line with similar international efforts where a critical debate on the professionalization of the Early Childhood Education sector and a drive towards higher status, better wages, and a professional identity for the Early Years workforce seems to be high on the agenda (Dalli 2010; Sollars 2018).

In order to explore the notion of *vocational pedagogies* adopted in vocational programmes that prepare students to facilitate play, learning, and development in young children, one must analyse the term 'pedagogy' and how it compares and contrasts with 'vocational pedagogy'. Davies (1994) defines *pedagogy* as 'any conscious activity by one person designed to enhance learning in another' which may involve complex processes influenced and shaped by one's own views on society, human learning, knowledge, power, and education, whilst Bernstein (1999) presents pedagogic practice as a kind of social context where cultural production-reproduction occurs as existing or new forms of conduct, knowledge, practice, and criteria are developed from an appropriate and knowledgeable person.

Both definitions are indicative of the changes that have occurred in educational practice, including pedagogy. Whereas schools and teaching have for decades been largely structured on the basis of the Piagetian model of cognitive development that presents the notion of maturation from one stage to another so that teaching and learning is linear and incremental to reflect the idea that development always precedes learning, Vygotsky's work on development as a consequence of learning has led to new models of pedagogy that view learning as a more complex activity that involves multiple actors and factors which interact amongst each other as well as with tools and artefacts in the learning environment that ultimately lead to new learning (Vygotsky 1978). These models are based on socio-cultural approaches to educational practices where learning happens as a result of an activity by which knowledge is co-constructed through the social interaction of various actors who are active agents in their own learning and development. A cultural-historical perspective also considers the 'mind' as an outcome of joint mediated activities that aim to develop, co-construct, and distribute knowledge and learning (Daniels 2001). With regards to vocational education, pedagogy is understandably more directly linked with the technical and vocational aspect of the learning processes. Lucas and Claxton (2013: 8) define *vocational pedagogy* as:

... the science, art and craft of teaching that prepares people for working lives. It is critically shaped by the decisions that are taken by teachers – both high-level strategies, and 'day-to-day-in-the-moment' ones – and the values that inform all interactions with students. Pedagogy is necessarily concerned with the particular practices and processes by which knowledge is produced, skills are developed and habits of mind are cultivated.

On the other hand, the Cedefop research paper number 47 (2015: 17) on Vocational Pedagogies and Benefits for Learners: Practices and Challenges in Europe focuses specifically on learner-centred pedagogy and defines it as an array of theories of learning as well as the methods and cultures of teaching that make educational provision more responsive and accessible to learners, closely synchronizing it with the processes of learning, connecting it to individual learners' interests, dispositions, and needs, whilst also linking it to curricula that are defined by learning outcomes.

The National Vocational Education and Training Policy (2015) for Malta recommends '... a paradigm shift towards student-centred learning, embedded learning, work-based learning, and various modes of assessment' (2015: 31) as a means to ensure that VET teacher training is effective in preparing vocational teachers and trainers who can confidently adopt various pedagogical and andragogic tools that make learning practices relevant to the students' and the industry needs. Loughran (2006) discusses the complex nature of developing a pedagogy of teacher education, highlighting the fact that, whilst student teachers usually enter a pre-service teacher preparation programme with strong ideas about what teaching and learning entail, mainly based on their own experiences as students in school settings, teacher-trainers and educators are then required to encourage student teachers to move beyond the need to seek and replicate familiar routines and strategies in order to develop broader and more contemporary perspectives of teaching and learning. One way of achieving this is through what Loughran calls effective reflective practice (Loughran: 133) whereby student-teachers engage in meaningful discussions to share their own assertions regarding their teaching practice, thus gaining professional knowledge and wisdom through reflection on practice. This clearly links to the concepts of reflective practice and experience in practice-based professional learning presented by Schon (1983, 1987) and Kolb (2015) as well as to notions of situated learning, communities of practices, and shared learning and collaboration in socio-cultural approaches put forward by Lave and Wenger (1991).

Research Methodology

This section highlights the method of inquiry chosen to conduct this qualitative piece of educational research and the philosophical underpinnings and frameworks that inform this study. As an educational researcher with an inclination towards interpretative and constructivist approaches to knowledge and research as opposed to a more positivist, quantifiable study of educational issues, the researcher opted for a qualitative methodology as her main aim was to explore and understand the meaning that VET lecturers and Level 5 Early Years students ascribe to the use of vocational pedagogies in the teaching and learning process. In order to do so, the researcher needed a method of inquiry that lends itself to inductive, exploratory means that allow a researcher to build theoretical ideas based on the data gathered from participants in the educational field.

Located in a social constructivist paradigm, the research methodology applied for this project was grounded theory research (Charmaz 2006; Charmaz and Henwood 2008; Strauss and Corbin 1998; Glaser and Strauss 1967). Data was collected through two main tools, mainly the use of semi-structured interviews with a number of lecturers teaching on the Level 5 Early Years programme and a focus group with a group of learners currently enrolled on this course. Charmaz and Henwood (2008: 240) describe grounded theory methodology as a set of inquiry methods that 'provide flexible, successive analytic strategies for constructing inductive theories from the data' whereas Denzin and Lincoln (2008) highlight the rigour and structure in grounded theory where a set of systematic statements of possible conceptual relationships between data and sets of data is sought

out as a substantive theory that explains the phenomenon being studied emerges. This approach to conducting inquiry affords both flexibility and rigour as it is systematic, inductive, comparative, and interactive in nature (Charmaz 2006).

Convenience and purposeful sampling was used as grounded theory approaches the selection of participants via the criterion of information-rich cases rather than through the calculation of sample size. In-depth interviews were conducted with three lecturers teaching on the programme, whilst one focus group consisting of five Level 5 Early Years students was also carried out. All participants were familiar with the pedagogical practices adopted in the training programme. The use of qualitative in-depth interviews and focus group enabled the researcher to obtain the views of multiple participants who impact and are impacted by the pedagogies adopted in the classrooms so that a deeper understanding of what these approaches and strategies are, how and why they are used was achieved. The rich data collected through the dialogic conversations between the parties in both in-depth interviews and focus group data collection was also substantiated with information obtained through the observations of the people being interviewed and the interactions and dynamics of students participating in the focus groups (Rubin and Rubin 2005). Moreover secondary data consisting of syllabi, course specifications, and regulations pertaining to MCAST as an educational institution also contributed to the richness of the study.

Using open-ended questions in interviews and in the focus group to gather data, an inductive process of building theory from the data to broad themes to a generalized model that explains the effectiveness of pedagogical approaches adopted in initial EY educator training was used. As Strauss and Corbin (1998) explain, the inductive logic of research in qualitative studies requires a reciprocal relationship between the data being collected and the emerging theory that is grounded in the data and that is constantly revised and modified based on participants' views. The use of coding and category building happened over a process of continuous comparison between and within data so that ultimately the complex nature of the phenomenon being studied was understood and explained. During the analytic process, the researcher first engaged in a process of initial coding so that the data was opened to in-depth analysis and then to more focused coding as patterns began to become more evident. By doing so, she looked for broad patterns and generalizations in the themes and categories that emerged until theoretical saturation was achieved. Glaser and Strauss (1967) explicate that, through grounded theory methodology, a theoretical framework evolves as a result of systematic collection, comparison, and analysis of the data collected during the inquiry.

Presentation and Analysis of Findings

Using grounded theory methodology, data collected from the interviews and focus group went through a process of microanalysis, generating categories and themes that emerged directly from the data. Following Strauss and Corbin's (1998) techniques and procedures for developing theory, the researcher sought to strike a careful balance between objectivity and theoretical sensitivity through a careful scrutiny of the research materials in a way so as to represent the voices and ideas presented by the participants as authentically and fairly as possible. This was achieved through a careful dance between a conscious distancing away from the research data to ensure impartiality and objectivity on the part of the researcher on the one hand and a sensitive and creative response to the subtleties and nuances that gave meaning to the interactions, ideas, and events in the rich data on the other hand. Ultimately the process was one of inference and abductive reasoning that facilitated the development of theoretical insights as a way

of uncovering and understanding the phenomenon of pedagogical practices adopted in a vocational educational institution that is involved in the training and formation of childcare practitioners and early childhood educators in Malta (Strauss and Corbin 1998; Richardson and Kramer 2006). Adopting an inductive-abductive logic, a constant comparative method of analysis involved 'making comparisons at each level of analysis, including data with data, data with codes, codes with codes, codes with categories, category with category, category with concept' (Charmaz and Henwood 2008: 242). Categories and subcategories are presented in Figure 1 to highlight the higher level and medium level concepts that emerged from the analytic process. This gives a broad idea of the main constructs that arose from the data. However, a more in-depth analysis of these categories and sub-categories is provided in Figure 2 where the analysis and interpretation generated properties and dimensions that represent more layers and variations within each category to render the complexity and specificity of each conceptual idea (Charmaz 2006).

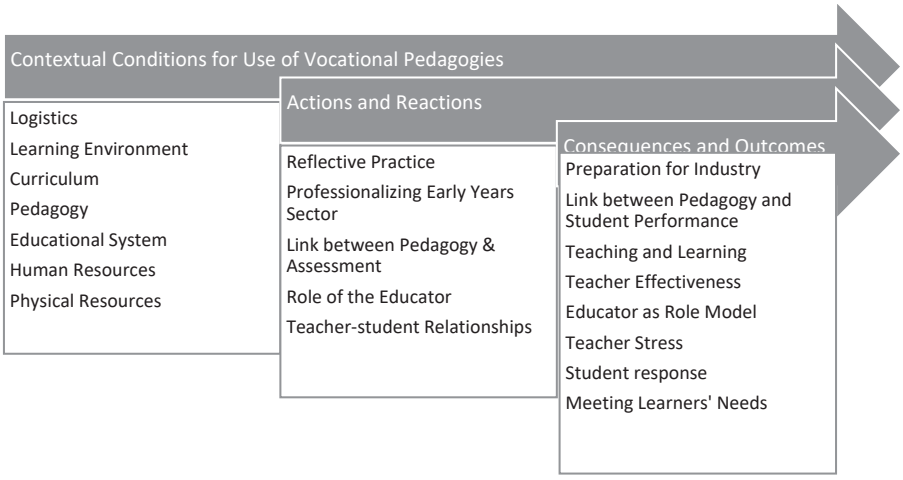


***Figure 1**: Emerging Constructs of the Use of Vocational Pedagogies in an EY Training Programme*

Both Figure 1 and Figure 2 follow the 'Conditional and Consequential Matrix' developed by Strauss and Corbin (1998). As can be seen in each figure, the coding exercise led to the grouping of subcategories and properties into three main categories consisting of the contextual conditions for the use of vocational pedagogies, the actions and interactions that occurred within these contextual conditions, and the consequences and outcomes that resulted from these actions. The set of conditions that influenced the adoption of vocational pedagogies in an Early Childhood Education training programme include logistics, the learning environment, the curriculum, the pedagogy pertaining to a vocational institution, and the educational system, as well as the physical and human resources available. As a result of these conditions, actions and reactions were recorded pertaining to the role of the educator, the link between pedagogy and assessment, the pervasive notion of reflective practice, the significance of teacher-student relationships as well as the constant efforts of professionalizing the Early Years sector, both locally and internationally at institution and policy levels.

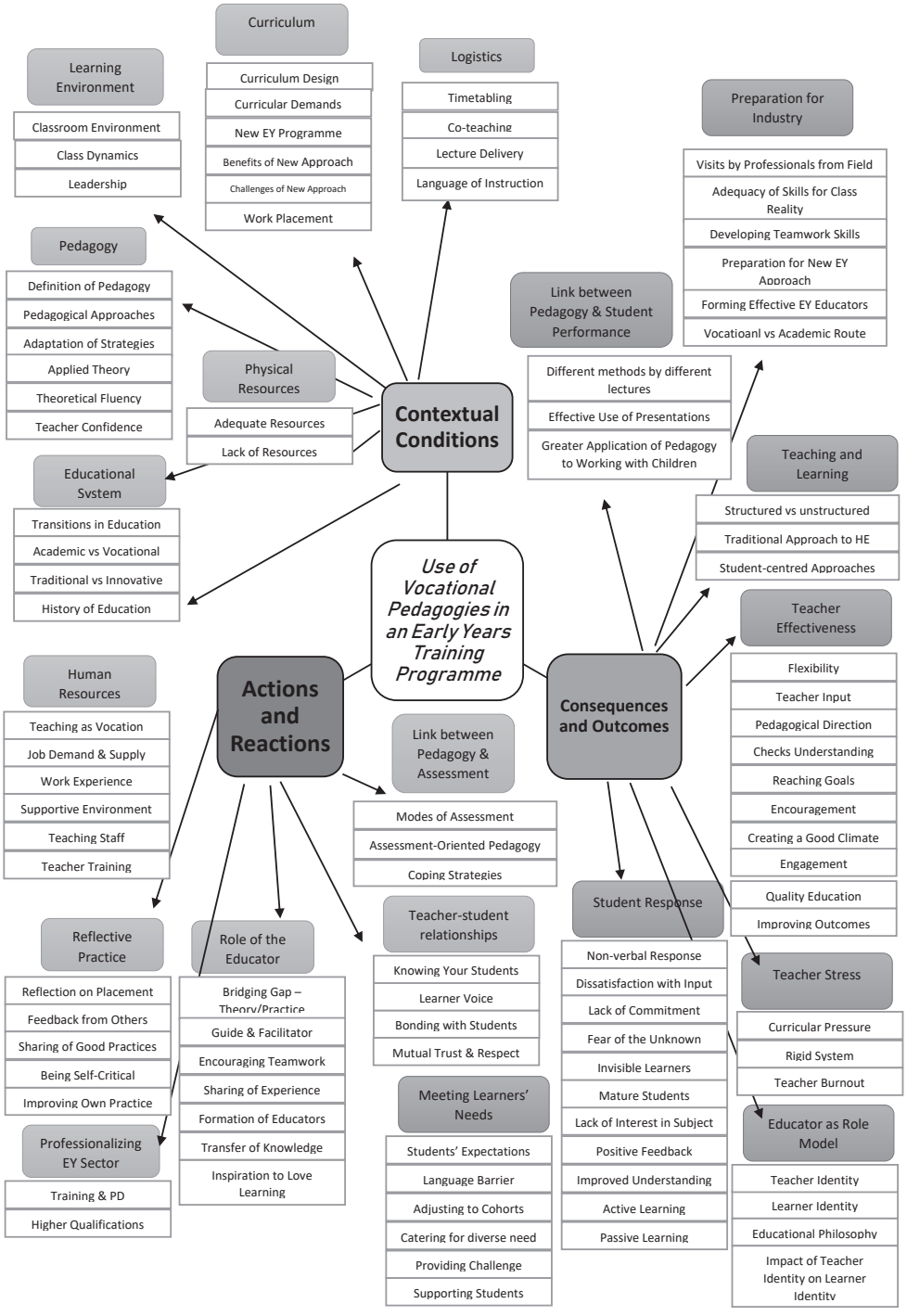


Figure 2: Conditional Matrix

These led to a variety of consequences and outcomes, including the resulting teaching and learning processes, the educator as role model who does not only develop knowledge, skills, and competences in learners but also instils values, positive attitudes, and habits pertaining to the role of early childhood educators, the effectiveness of the teachers, their wide-ranging efforts to meet the needs of their learners, the ways in which learners respond, the link between pedagogical choices and student performance, and the reality of teacher stress, as well as the ultimate preparation for industry. Figure 2 illustrates the intricacies and variations of each of the above sub-categories in a way as to show the multi-faceted nature of each theoretical concept as experienced by the different study participants in an attempt to start exploring the relationships and interconnectedness between these emerging concepts.

Using the respondents' views, constant comparisons were made between the experiences and perspectives of VET lecturers and those of their learners. Using the emerging constructs outlined in Figures 1 and 2, a conceptual framework grounded in the data was eventually developed to portray a vocational pedagogical model for the formation of early childhood educators (Figure 3). The model aims to explain the complex patterns and meanings that VET lecturers and Early Years learners on a Level 5 programme ascribe to the adoption of vocational pedagogies in the teaching and learning processes. A theory was thus built inductively, one that attempts to enhance understanding and offer insights into the various factors that come into play in the training and formation of future early childhood educators. The theoretical ideas that emerged from data which was systematically gathered, compared, and analysed are combined together through a visual model that elucidates the views and perspectives of the participants, whilst depicting in a simplified manner the relationships between the main theoretical concepts and ideas.

At the start of this research project, a gap in literature was highlighted regarding studies that explain and render the complexity of pedagogical practices adopted in higher education programmes, including initial training programmes for early childhood educators. The integrated model presented above provides clear insights into this phenomenon through the generation of a theoretical framework that seeks to explain the mechanisms and process involved. Through the interpretation of the model, one seeks to explore and understand the kind of vocational pedagogies that are used and how they may influence the effectiveness of the programme, the quality of the programme itself, as well as the kind of professionals that such training develops for the ultimate benefit of the programme itself, the prospective educators, and the quality of work and experiences provided through such training for all stakeholders.

At the centre of the model are four key aspects that are at the basis of the process of the training and formation of early childhood educators – contextualizing the study within the field of Early Childhood Education in Malta and focusing the research on the pedagogical practices and approaches employed by lecturers working with a group of prospective Early Years educators currently enrolled in a Level 5 vocational training programme. As outlined in Figure 3, each key aspect is connected with the rest in multiple ways, illustrated through the use of arrows and keywords. The central role of the key players involved i.e. the lecturing staff and the learners enrolled on the Level 5 programme is evident – the working relationships that are built between these two key players influence and are influenced by the contextual conditions and the actions and interactions that take place throughout the teaching and learning process that ultimately result in the prospective educators' preparation for industry.

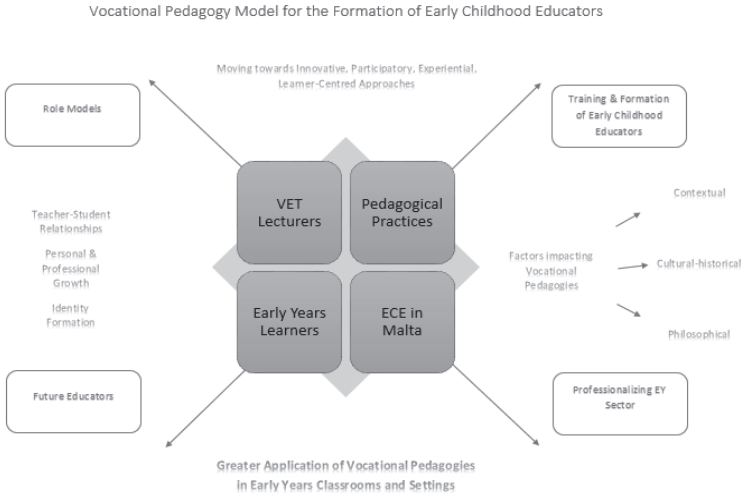


Figure 3: *Vocational pedagogy model for the formation of early childhood educators*

As lecturers and learners interact, work, and learn together, identities are established and renewed, goals are reached and outcomes improved, and personal and professional growth is experienced. The growing international efforts to professionalize the Early Years sector are translated through the continuous high-quality training and professional development that characterizes the field although, as highlighted by some participants, at times the demand for more staff to work in early years settings exceeds the supply of adequately qualified carers and educators. The pedagogical practices adopted in the vocational institution where the research study took place seem to rest upon three identified factors which are clearly outlined in the model: contextual, cultural-historical as well as philosophical influences. The educational provision is still characterized by a range of strategies and educational philosophies that fall somewhere along a continuum ranging from a fairly traditional, teacher-focused model to more innovative and participatory pedagogies. This seems to depend largely on the individual lecturer and his pedagogical choices based on the extent to which each individual possesses a sense of theoretical fluency and confidence in terms of choosing from a range of vocational pedagogies as opposed to a more direct transfer of knowledge.

Being viewed as a role model by their learners helps develop a teacher's identity which incorporates, amongst many aspects, one's educational philosophy as well as the pedagogical imprint with which one is associated and described. There is also evidence from the data gathered of a certain level of impact of a teacher's identity on the learners' emerging identities both in terms of their capacity for learning and development as well as their future roles as fully-fledged educators. Ultimately the kind of pedagogies adopted in the vocational classrooms with trainee educators has a direct link with the quality of the services provided eventually in early years settings as well as the kind of professionals who are formed. There seems to also be a move from teacher-centred curricula and pedagogies towards more innovative, participatory, experiential, and learner-centred approaches to learning and pedagogy. All participants, at different points during the study, made clear reference to the distinction between these two ends of a continuum, indicating clearly a preference for more participatory, active learning approaches that place the learner at the centre of the training programme. As depicted

in Figure 3, this has implications for a greater application of the vocational pedagogies adopted in vocational and higher education classrooms to the kind of experiences made available in early years classrooms and settings.

Vocational Pedagogies for the Training and Formation of Early Childhood Educators

Professionalizing the Early Years Sector

Early Childhood Education in Malta is undergoing significant transformations triggered mainly by local and international efforts to professionalize the field as demands for high quality early childhood education and care have increased exponentially over the past two decades (Sollars 2018). Set in a vocational setting where training programmes at Level 4 and Level 5 are provided for prospective early years practitioners and educators, this research study highlights the views of lecturing staff who strongly believe in their role not so much as transmitters of knowledge, but more as role models who facilitate and guide their learners whilst instilling a love for the profession as well as inculcating good values and positive attitudes and habits that will help form their students' character as well as their professional identity. This resonates with the definition that Lucas and Claxton (2013: 8) give to the term 'vocational pedagogy' where teaching and learning in a vocational setting is said to be 'concerned with the particular practices and processes by which knowledge is produced, skills are developed, and habits of mind are cultivated'. On the other hand, from the perspective of the learners, one is also reminded that this shift in ECEC is being endorsed by the prospective educators themselves who aspire to keep developing professionally and advancing in their careers, progressing from a first degree to postgraduate qualifications. Thus, the aim to provide high-quality training to move the early years sector towards a professional teacher status has been a welcoming factor in the lives of prospective early childhood educators enrolled on the course. The transformation of the early years workforce into a highly-qualified one stems from similar efforts across the globe (Dalli 2010) although, as things currently stand in Malta, the first cohorts of Early Years graduates have been absorbed by early primary classrooms rather than kindergarten ones (Sollars 2018).

Lecturing staff participants believe in the raising of expectations within a vocational institution to help eliminate stigma associated with vocational programmes as opposed to academic ones. According to participants, pedagogy plays an important role in ensuring high quality training programmes that develop learners' creative and critical thinking skills and their ability to problem-solve and to take a proactive role both in their studies and in their future roles. This need to raise the station of vocational education to its academic counterpart is not new on the educational debate (Lucas and Claxton 2013).

VET Lecturers and their Roles in Educating and Forming the Educator

One striking feature that comes across in the data is the notion that teaching is regarded as a vocation by the lecturing staff interviewed and thus the roles that they feel they need to play are multifold. As already mentioned, they feel a sense of responsibility towards their learners as well as towards the ECEC sector – they have all brought with them a baggage of experience in early-years classrooms and schools, some working more specifically in specialized units, such as early intervention. They comment about the need to use their experiences to bridge the gap between theoretical knowledge and practical strategies.

The learners also point out this quality as a desirable one and applaud those lecturers who can use plenty of examples or case studies from their own field experiences. The work-placement component where learners are prepared to spend a period during their studies immersed in a real-life classroom situation is seen as instrumental in providing a more hands on, practical and authentic learning experience by both lecturers and trainee educators. It has been labelled as characteristic of a vocational route for prospective early childhood practitioners and educators as opposed to a more academic one. The National Vocational Education and Training Policy (2015: 31) highlights the need for more work-based learning in addition to student-centred instruction, learning that is embedded and connected with the vocation, and the use of different modes of assessment. Linked to this, there seems to be a dissatisfaction with the significant reduction in the number of hours on placement that resulted from a change in curriculum for the Level 5 Early Years programme. It is felt that the work placement, apart from allowing learners to actually gain experience working with children and managing a classroom on their own or with a partner, also provides them with an experiential component that can then be used during the training programme at college when discussions are created in classrooms and dialogic conversations facilitate deep learning as theory is applied using case studies or examples from placement.

During the data collection process, the notion of identity formation was evident as an underlying mechanism that permeated all actions and reactions taken by the lecturing staff and their learners. As interactions were made and relations were formed throughout the Early Years training programme, lecturers continued to develop their professional identity whilst impacting the identity formation of the learners they taught. This process was closely influenced by philosophical understandings of the role of education and the kind of approaches suitable for an early childhood education initial training programme. Data point to various important aspects including an adoption of a learner-centred educational philosophy in the training programme, which eventually would be translated in the classrooms when interacting with young children. Education is viewed by some participants as a source of empowerment and emancipation which then impacts the actions taken in the classrooms – this view echoes Freire's philosophical and social-constructionist ideas on the emancipatory role of education (Freire 1970). It is also evident that participants from the teaching profession as well as from the student population view themselves as life-long learners or wish to instil and nurture a love for learning. Working together with mutual respect and trust is regarded as essential for both personal and professional growth as lecturers provide challenge and support learners to move out of their comfort zones and to develop positive self-concept. This encourages learners to strive for excellence and believe in their capabilities to learn and eventually work effectively with young children and their families. It is interesting to link the processes of identity-formation to one's self-concept in terms of how limiting or growth-oriented it is. Freire (Ibid.) has discussed the notion of a 'fixed self-identity' that perpetuated one's internalized oppression and prevented any change or advancement in status and position. On a similar note, Kolb and Kolb (2009) also put forward notions of learners' fixed view of themselves that hindered them from developing their potential further, whilst Dweck (2000) used 'self-theories' to differentiate between people who view their attributes and abilities as fixed and static and those who were convinced of their potential to direct their learning, thus grow and develop incrementally. It seems that participants in this study gave value to each other's growth rather than fixed mindset that allowed them to view themselves and others as life-long learners who can develop their skills, knowledge, and competences.

Vocational Pedagogies Adopted: VET Lecturers' and Learners' Views

The lecturers in the study all view themselves as dedicated, well-prepared, and innovative educators who strive to make informed choices when it comes to pedagogy that ultimately encourages participation and engagement by their learners. They are aware of different methodologies adopted in the programme and also point out that at times they themselves feel compelled to vary the kind of pedagogies they adopt depending on the level of understanding, the subject matter, the particular cohort and their commitment to their studies, as well as other factors that may at times hinder them from using more participatory methods of teaching. They distinguish between participatory and experiential pedagogies used in vocational settings as opposed to more theoretical ones employed in academic settings.

Lecturer participants are aware of students' expectations for more active participation and hands-on learning. They seek to organize and structure their lectures in a way as to fulfil these expectations and find a number of strategies as highly effective, including the use of dialogic conversations as a learning tool where learners develop their knowledge and skills through interaction and sharing of knowledge with others, the use of case studies and their field experiences as basis for discussion, the organization of the class into different kinds of groupings who collaborate during problem-based learning activities, more creative approaches such as organizing activities out of campus, as well as encouraging students to carry out tasks during placement or at home as remote preparation for lectures. Lecturers also commented about the importance to develop critical and creative thinking skills in their learners, to encourage autonomous and independent learning, to inspire students to strive for excellence in their studies and future roles, and to ensure that learning is relevant to students' lives and their interests. This brings to mind the argument presented by Lucas and Claxton (2013) who contend that the creation of centres of excellence where focus is given to vocational pedagogy and pedagogic leadership facilitate the development and fostering of a climate of outstanding learning in vocational education – such efforts lead to high-quality educational provision and a higher status, closer to the level of academic learning.

Assessment-oriented pedagogical choices were also regarded as good and effective strategies – learner participants were highly conscious of the curricular and assessment demands and felt that when lecturers incorporated assessment in their pedagogy, they felt more at ease than when assessment was separate from the lectures and activities carried out during the semester. This was seen as a way to support learners along their journeys and reduce stress related to overload of content and assessment. As mentioned earlier, the use of a wide range of assessment modes is one of the recommendations put forward by the National Vocational Education and Training Policy for Malta (2015).

As outlined in Figure 3, there are several overarching factors that seem to influence VET lecturers' pedagogical choices, namely contextual, cultural-historical, and philosophical ones. The vocational setting has a significant impact on both the students' expectations of the kind of pedagogies adopted as well as the efforts that lecturers make in creating links between the theoretical component and the practical implementation of theories into the classroom reality. Other aspects of the contextual conditions are discussed throughout the analysis including logistics, the learning environment, curriculum, and the resources available. Culturally and historically, early childhood education was initially more concerned with the caring aspect rather than the educational and developmental ones and seemed to start and end with the vocation to care for and work with young

children, a job that any caring person or mother could take up without the need for any specific qualifications or training. We have evidently come a long way from that era and nowadays efforts to professionalize the sector and ensure high-quality early childhood education and care are high on the agenda, although there are also instances where demand is greater than the supply of suitably qualified staff, and thus unqualified carers are employed (Sollars 2018). Philosophical underpinnings that inform lecturers' pedagogy are usually connected with their views on the role of education and educators, their views on children and childhood, as well as their own professional identities.

Greater Application of Vocational Pedagogy in Early Years Classrooms

VET lecturers argued in favour of innovative, learner-centred approaches to model the pedagogical practices that need to be adopted in early years classrooms and settings. They incorporate reflection and self-criticism in their daily practices to continually evaluate the impact of their pedagogy on the trainee educators, particularly so because they are conscious of the fact that their own practices in the training programme will be scrutinized by their students who will eventually apply pedagogical approaches they were exposed to with young children in early years settings.

Amongst the strategies adopted by VET lecturers that would eventually be transferred and applied by the trainee educators in their classrooms are the kind of approaches they adopt ranging from traditional, teacher-focused strategies to more innovative, participatory, learner-centred approaches, creating a supportive environment where all learners with diverse abilities, interests, and needs thrive and learn, the provision of support and challenge to cater for different needs, the integration of foreign students in a Maltese classroom reality that is increasingly becoming multicultural and multilingual, as well as the use of constructivist approaches that take into consideration prior knowledge and experiences before presenting new knowledge and learning experiences.

Conclusions and Recommendations

Societal changes underlying the cultural-historical development of the field of Early Childhood Education in Malta, particularly the increase in the need for high-quality services and for the professionalization of the sector, need to be embraced when debating issues related to vocational pedagogies that are effective in the training and formation of early childhood educators. Early childhood professionals have requirements in terms of their personal and professional growth trajectories that rely heavily on experiential, practice-based, and participatory approaches that are directly connected with the roles and responsibilities they are expected to take up (Hobson 2009; Loughran 2006). The need for a strategic plan in terms of the advancement and relevance of teaching and learning processes and practices adopted in a vocational and higher educational setting is also inherent in the recommendations provided by the participants who directly or subtly point to more democratic consultation and active participation at policy and programme-design level for the benefit of the learners themselves, their teachers, and ultimately the industry. The need for further training and professional development on pedagogical and andragogic practices that are relevant to the formation and training of early childhood educators is also mentioned. Continuous professional development for teachers and teacher trainers and the conception of 'teachers as life-long learners' is high on the educational agenda today (Adey 2004; Hirsh and Hord 2008; MEDE 2015). The role of the VET lecturer remains significant as data in this study clearly points to

ways in which lecturers inspire and influence the directions and aspirations of vocational and higher education learners.

Limitations of the Study

By adopting a grounded theory approach through the systematic analysis of data gathered qualitatively from eight participants, the researcher's interest was mainly focused on the seeking and interpretation of meaning that individuals give to the use of vocational pedagogies in an initial training programme for early years educators rather than to generalize the findings. Being deeply influenced by a constructivist and sociocultural stance to knowledge construction, the researcher was also aware of an element of subjectivity in the direction of the interviews and focus groups as well as in the interpretation of the findings. However, the use of grounded theory was a clear attempt to balance this with an objective effort to distance myself from the data and allow the rigour and systematic analysis of this methodology guide the research process. Also, although theoretical saturation was not reached and more data collection would have benefited the richness and depth of the findings, one cannot disregard the fact that a clear and interesting model of vocational pedagogies emerged from the data.

Implications of the Study

The implications for vocational teacher-training and for the professionalization and advancement of the Early Years sector are numerous and include the need for constant revisiting and sharing of best practices, the use of teacher and learner voice to continually develop the profession and the sector, the need for continuous professional development for the lecturers to fill any gaps in theoretical and pedagogical fluency, as well as for closer links with the field so that lecturers continue to interact and touch the reality of early years classrooms and settings in order to impact positively the formation and training of prospective early childhood educators. The implications for programme management and delivery point to better coordination and consultation between different managerial levels and the lecturing staff as well as the need for mentoring of newly appointed lecturing staff who join the team of lecturers. Accountability measures that ensure pedagogy and andragogy are given their due importance in a vocational training programme were also implied in the data. The implications for research are also wide ranging and include a filling of a gap in literature on understanding the complex nature of pedagogy in vocational and higher education programmes, the quality of the experiences provided to the trainee educators, as well the relevance and effectiveness of the approaches and methods used to form future educators. Further exploration into the experiences and perspectives of both lecturers and learners regarding the prevalence, validity, and relevance of vocational pedagogies in training programmes as well as more research into new, innovative, and future-proof strategies and practices that may be more relevant to the twenty-first century are also recommended.

Concluding Comments

The insights gained from this research inquiry will hopefully encourage more VET lecturers in both initial teacher-training programmes as well as other vocational fields to reflect more deeply about the impact of their pedagogical awareness and choices on the kind of learning that takes place in their institutions. From the theoretical framework that was developed from the data, the researcher would argue for more direct efforts to

place pedagogy and andragogy high on the vocational educational agenda, particularly for programmes that train future educators, considering the implications that such pedagogical choices and innovation may ultimately have on the teaching and learning practices adopted in early years classrooms and settings, which in turn influence the lives, experiences, and identities of young children.

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Irrigation-Water Demand in the Maltese Islands – A Comparative Study between CROPWAT Analysis and *In-Situ* Monitoring for Ten Horticulture Crops

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Abstract: In Malta, freshwater resources are scarce and their availability and accessibility are likely to be further exacerbated as a result of changing climatic patterns and increased urbanization. The agriculture sector, namely the consequence of irrigation demand, is heavily dependent on freshwater, making use of private boreholes to extract freshwater from underground aquifers. Numerous studies and reports have attempted to quantify and estimate the water use by agriculture. However, there exists a great deal of variability in the reported estimates as well in the models themselves. This paper presents an up-to-date compilation of the current irrigation use models and datasets for the Maltese islands and provides a critical assessment of the main principles behind the methodologies used. In order to understand better the adequacy and suitability of current estimates, a series of field studies were carried out to monitor the irrigation use in ten horticulture crops and compared against evapotranspiration and irrigation demand modelling using CROPWAT analysis. Field studies have indicated that irrigation was applied with care and overall resulted in lower water consumption (44%) when compared to model-generated estimations. Our study indicates that water consumption for crop production on a national scale is significantly lower than previously reported estimates. For the first time, irrigation demand figures have been compiled on a crop-by-crop basis, based on both field data and CROPWAT estimates. This study leads the way for the inclusion of crop-specific parameterisation which can be implemented into future water demand models, thus minimizing the risk of parameter errors and uncertainty for national water-use estimations.

Keywords: Applied irrigation monitoring; Irrigation demand; CROPWAT; Crop evapotranspiration modelling; Crop gross water requirements

The most critical resource for the agroecosystems in Malta is water. Owing to its geographic and semi-arid climatic conditions, the islands of Malta have virtually no exploitable surface-water sources. The requisite to meet elevated freshwater demand, arising from a high population density combined with the short supply due to low and unpredictable rainfall patterns, ranks Malta in the top ten water-scarce countries, with an estimated annual allowance of just 220m^3 of freshwater per inhabitant (EUROSTAT 2018). To produce good quality water, Malta is entirely dependent on a combination of marine desalination plants and groundwater extraction. The latter originates from the slow percolation of rainwater into underground aquifers with residence times estimated at around 15 years and 40 years for the perched and mean sea-level aquifer respectively (Conrad and Cassar 2014; Stuart et al. 2010).

Agriculture in Malta relies heavily on groundwater. Rainfall cannot meet crop-water requirements and, in an increasingly competitive market along with growing production

and labour costs, crop yield stabilization depends on the all-year-round supply of irrigation water. In fact, the last decades have seen a drastic increment in the number of operational boreholes which in some measure was facilitated by better access to drilling and pumping technology, and driven by the need to expand crop cultivation period over the hot summer months (FAO 2006). The unrestricted access to groundwater has drastically impoverished the quality and the quantity of the aquifer reserves with serious issues such as nitrate contamination and saline intrusion directly threatening the sector's capability to sustain its economic and labour force activity in the future (Atriga 2018; Dwyer *et al.* 2014).

It is thus extremely important for sustainable agriculture and water management to explicitly estimate groundwater consumption and demand. The reliable and scientific estimation of groundwater volume and irrigation water demand are at the heart of water governance and policy development. Likewise, field-water efficiency strategies can be enhanced and better implemented when based on accurate field-use and irrigation demand data. A key challenge, however, remains unsolved. While the rising importance of groundwater withdrawal and consumption by agriculture is well established, agriculture-water abstraction data is very limited and data on the actual volume consumed and the spatial distribution can be highly variable (Hallett *et al.* 2017).

The assessment of the agricultural water footprint can be derived from both indirect estimations and also direct measurements of the volumetric water use at source. Indirect estimates are model-driven figures, determined through the mathematical combination and simulation of irrigation demand factors reflecting local agronomic practices. These models are powerful tools that facilitate the evaluation of the applied irrigation and serve as a cost- and resource-efficient alternative to measuring the applied water use in-situ. However, results obtained from water-consumption modelling are normally associated with a higher degree of uncertainty due to their limitation in representing accurately the climatic, sociological, crop and soil drivers affecting water consumption (Chavez and Subedi 2015; Chen *et al.* 2017). Local assessment of irrigation demand and consumption has been widely based on the use of such models, adopting multiple model structures and varying model parameterization. As a result, water-demand figures do not deliver the necessary complementarity required by decision- and policy-makers (FAO 2006; NSO 2009; NSO 2015; MRA 2015). Table 1 shows the great degree of variability between the reported estimations across the different government and public entities. The latest figures reported by the National Statistics Office (NSO) estimated water use by agriculture at around 31.5 Mm^3 in 2013 based on an extension of a formerly done farmer survey-type study (NSO 2015). On a much reduced scale, estimations documented in the 2nd Water Catchment Management Plan (WCMP) range between 10–18 Mm^3 for the same year. The latter were estimated via a triangulation model, part of which was performed with CROPWAT (MRA 2015). CROPWAT is a software package developed by the FAO which is used to compute crop-water requirements based upon existing climatic, soil, and crop data (FAO 1998). The use of CROPWAT has been extremely popular and important to sustain water resources planning both locally and worldwide. Its application has been adapted to both tropical climates such as India (Surendran *et al*. 2015) as well as semi-arid climates like Iran (Najafi 2007). Nonetheless its performance and accuracy relies on the input of accurate data and valid parameterization.

Report (year)	Model Type	Agriculture – Water use (x 1000 m^3)
FAO (2006)	CROPWAT	18,000
WATER SURVEY – NSO (2009)	Farmer-Panel Survey Model	19,100
FARM CENSUS – NSO (2010)	Farmer-Panel Survey Model	28,176
World Water Day – NSO (2015)	Farmer-Panel Survey Model	31,500
2nd WCMP – MRA (2015)	CROPWAT	18,000
	Crop-Market	9,800
	Borehole metering	9,500

Table 1: *Reported estimations of agriculture water use for the Maltese islands*

In contrast to the above, direct measurements refer to the applied water-use measurements as obtained from at-source methods. Compared to water consumption estimations, at-source measurements provide a factual and precise method for measuring applied irrigation over land areas of agriculture interest. A direct measurement of irrigation water is currently being monitored on-site via the application of flow-meters feeding out of the groundwater farm boreholes. Operators abstracting groundwater are now obliged to have their boreholes registered and metered. Nevertheless, it is perceived that this represents only a part of the total operating boreholes, rendering actual estimations of water consumption difficult to quantify. In addition, unlike irrigation measurements, borehole metering is limited in giving insight of groundwater abstraction and is not correlated with climatic and crop irrigation demand factors easily.

Following a review of the current irrigation estimates in Malta, it was observed that water-demand figures are too divergent to be representative and useful for monitoring and reporting water use in the field. Therefore, this study proposes a simplified method to measure the field-applied volume of irrigation utilized for the most common crops grown in the Maltese islands. Unlike previous studies, a bottom-up approach has been adopted whereby the applied irrigation water was metered and monitored during the complete period of crop cultivation. In parallel, the crop-irrigation demand was modelled via CROPWAT using crop-specific parameters. The objectives of this study were threefold: (1) to understand and measure the irrigation demand using both a direct approach (metered measurements) and indirect approach (CROPWAT), (2) to compare and assess the variability between the both approaches, and (3) to proceed to make recommendations on the basis of our results with regard to the applicability and shortcomings of the two approaches for the calculation of the irrigation water use in the Maltese islands. Our results can thus prove beneficial for the understanding and assessment of uncertainties related to the existent irrigation-demand figures and models. Whilst we acknowledge that this study is by no means exhaustive in estimating the irrigation water consumed, it should pave the way for a cooperative spirit and improve the confidence between

the farmer or grower and the respective regulatory authorities. This aspect is of crucial importance for Malta to enable a better allocation of the naturally occurring water resources based on in-situ farm data rather than mathematical models alone.

Methodology

Study Area

The total area of the holdings selected amounted to 20,464 m^3 and the spatial distribution covers the major farmland zones in the northern districts of Malta. Study area covered the towns and villages of Mosta, Mġarr, Rabat, Żebbuġ, Ta' Qali, Manikata, and St Paul's Bay. The study sites lie within one of the major agro-producing districts in Malta wherein they are associated with high crop-productivity. Excluding rainfall, the main source of freshwater for the fields under study are the perched and mean sea-level aquifers. Supplementary irrigation is known to be extensively used through the area under study. The main source of irrigation water arises from four different aquifer systems: Rabat-Dingli Perched, Mġarr-Wardija Perched, Pwales Coastal aquifer, and the mean sea-level aquifer.



Figure 1: *A) Spatial distribution of testing sites, localities, and horticulture crops; B) Map of the Perched aquifer system in the Maltese Islands (dark blue) and mean sea-level aquifer (light blue)*

Determination of actual water use from field study

To determine the applied water use, a total of eight commercial holdings were selected covering ten different crop-types. Crops selected for this study were chosen to reflect major horticulture products grown in Malta during the seasons of spring, summer, autumn, and winter. The crops included wine grapes, marrows, cauliflower, cabbage, potatoes, green peppers, carrots, water melons, garlic, and tomatoes grown for processing. The length of the growing period covered the stages from sowing and planting to complete plant maturation. The rooting depth and the type of field irrigation method were noted for further use in the CROPWAT analysis.

Crop	Location	Site	Sowing/Planting date	Harvest date
Potato	Mġarr	A	01.12.2017	02.05.2018
Processing Tomato	St Paul's Bay	B	01.04.2018	30.06.2018
Marrow	Mosta	C	06.12.2017	29.03.2018
Watermelon	Manikata	D	25.01.2018	07.06.2018
Garlic	Manikata	E	27.12.2017	06.05.2018
Carrots	Rabat	F	05.01.2018	01.07.2018
Green Peppers	Żebbuġ	G	07.12.2017	30.07.2018
Vines	Ta' Qali	H	09.01.2018	30.07.2018
Cabbages	Manikata	E	09.7.2018	11.10.2018
Cauliflower	Manikata	D	09.08.2018	10.11.2018

***Table 2**: Metered crop cultivation sites and planting periods*

To measure the total volume of irrigation water used per product, flow-meters (Elster R160.H) were installed on straight sections of irrigation main lines which supplied water into the field area. Study areas were monitored periodically and the water-flow noted down until complete harvest.

Determination of irrigation requirements by CROPWAT analysis

Estimation of crop-water requirements was performed with the CROPWAT 8.0 software package, developed by the FAO (FAO 1998). The program uses the FAO Penman-Monteith model to calculate crop evapotranspiration (ET_C) which is derived from the reference evapotranspiration (ET_O) and the crop coefficient (K_C) as described in equation 1.

$$ET_C = ET_O \times K_C \qquad \text{Eq. 1}$$

The assessment of the reference evapotranspiration was based on the FAO Penman-Monteith model (Ibid.) and derived from the products of the climatic data as collected from the National Meteorological Office in Luqa. Climatic parameters compromised: radiance (Hrs), minimum & maximum temperatures (°C), total rainfall (mm), humidity (%), and wind speed (Km/day) for the period 2006–16. The mathematical expression used to calculate the reference evapotranspiration (ET_o) is follows:

where,

$$ETo = \frac{0.408\Delta(Rn-G)+\gamma\frac{900}{T+273}u2(es-ea)}{\Delta+\gamma(1+0.34u2)} \qquad \text{Eq. 2}$$

ET = REFERENCE EVAPOTRANSPIRATION (MM/DAY)
RN = NET RADIATION AT THE CROP SURFACE (MJM^{-2} DAY^{-1})
G = SOIL HEAT FLUX DENSITY (MJM^{-2} DAY^{-1})
T = MEAN DAILY AIR TEMPERATURE AT 2 M HEIGHT (^0C)
U_2 = WIND SPEED AT 2 M HEIGHT (M/SEC)
E_S = SATURATION VAPOUR PRESSURE (K PA)
E_A = ACTUAL VAPOUR PRESSURE CURVE (K PA /^0C)
Γ = PSYCHROMETRIC CONSTANT (K PA /^0C).

The irrigation water requirement is defined as the amount of water that must be supplemented for optimal growth following the inclusion of effective rainfall into the irrigation calculation. The effective rainfall was estimated as the proportion of rain reaching the rooting depth, where the USDA Soil Conservation Service method in CROPWAT was selected (Chapagain and Hoekstra 2010). The effective rainfall was calculated using the formula in Equation 3.

$$P_{eff} = P_{month} \times (125 + 0.1 \times P_{month}) \quad \text{Eq. 3}$$

where,

P_{month} = Monthly rainfall (< 250 mm) and
P_{eff} = Effective rainfall

Other datasets included crop and soil parameters reflecting the type of crops and soil present in the field study. Crop parameterization compromised water stress coefficient (K_s), the length of the growing season, critical depletion level, and yield response factor (K_y). CROPWAT default parameters for the crops under study were optimised to reproduce better field studies. Method modifications were (1) alteration of harvest date and planting date, (2) rooting depth set at 0.5 metres, (3) modification of K_C values as per literature (FAO 1977; FAO 1998). The soil data included total available soil water content and the maximum infiltration rate for run-off estimates in addition to the initial soil water content at the start of the season. A soil type category of red-loamy soil was used in CROPWAT so as to reflect the major soil texture present on the islands.

To compare crop water demand and agriculture production, the gross water requirement (GWR) was taken as comparison. GWR takes into account any water loses arising from the irrigation system. Drip system irrigation and sprinkler system were valued at 90% and 75% efficiency respectively.

Results & Discussion

The results of the comparison of CROPWAT-estimated irrigation water requirements and actual amounts of irrigation applied for Maltese horticulture crops as well as corresponding comparisons with previous CROPWAT estimations are discussed in the following sections.

Crop Evapotranspiration & CROPWAT analysis for crop-water demand

Crop evapotranspiration, ET_o, refers to the evaporative demand arising from a hypothetical grass surface and it is solely dependent on the climatic parameters. The crop characteristics and soil factors are not expressed in the calculation and hence ET_o is conveniently used to compare irrigation demand between different locations, time periods, and agro-climatic conditions (FAO 1998). The model here utilized is based on the Penman-Monteith method which is generally viewed as the most accurate approach to estimate ET_o (Chavez and Subedi 2015). Using meteorological data for 2006 to 2016, the ET_o process was assessed on a monthly basis to investigate peak annual water demand. Total ET_o was estimated at 1399 mm per year and the mean annual figure reaches 116.6 mm. As anticipated, ET_o values were recorded to be the highest during the hotter months of May to August, exceeding water losses of 150 mm of per month. Contrarily, the months September to April demonstrated the lowest ET_o range, accounting for 47.9 % of the total annual ET_o. The periods described coincide with the dry and rainy seasons respectively. It is evident that the evaporative demand in agriculture correlates with climatic factors such as temperatures, solar radiation, wind, and relative humidity. In general, the summer season is characterized by a slowdown in the humidity and wind-speed levels and accompanied by a drastic surge in the maximum and minimum temperatures along with an increment in the daylight hours and solar radiation. Under these conditions, the rate of plant transpiration and soil evaporation on local horticulture increases and as a result the crop demand for water rises exponentially.

The availability of water resources is also a significant denominator in the demand for irrigation. A plot of the ET_o and the effective rain (Eff. rain) for Malta, clearly demonstrates how peak plant-water loss coincides with the period when the amount of soil moisture and subsequently soil water recharge are at their lowest. In fact, effective rain ranges between 0 to 7 mm per month only during the hot season from May to August. Coincidently, this period overlaps with peak agriculture production in Malta wherein most of the summer annual crops as well as perennial fruit trees are experiencing high growth rates and increased fruit set and development. Additionally, the uninterrupted low soil-moisture and water levels during the dry season amplifies the problem of water scarcity experienced by the plant root system. The hardening and compaction of soil surfaces during the summer period contributes to a reduction of the soil pore diameter and, as a result, water infiltration and irrigation efficiency diminishes. As a result, the soil- and plant-water balances for the period May to August experience an intense water deficit that must be supplemented by the farmer in the form of artificial irrigation via sprinkler or drip-irrigation. Excluding rainfall, our estimations indicate that during the summer period, the farmer must supplement around 173 mm of irrigation water on a monthly basis on average. Irrigation input declines in the autumn-winter months as the monthly rainfall starts to exceed the evapotranspiration rate. The months November to January are characterized by a surplus of effective rainfall, thus receiving enough rainfall to compensate for the loss of water via evaporation.

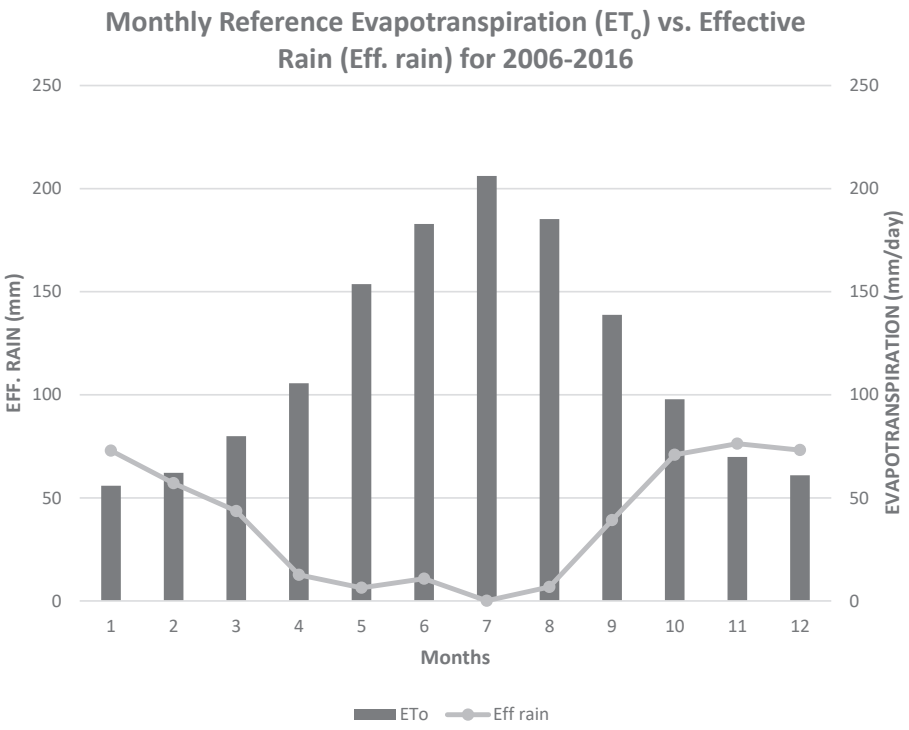


Figure 2: *CROPWAT generated monthly ET_o (grey bars) superimposed under effective rain levels (line) for the years 2006–16*

Using the potential soil moisture deficit approach as adopted in the study by Hellet *et al.* (2017) for the Maltese islands, our calculations indicate that the mean soil moisture deficit is around 929 mm of water per year. On comparing our estimate with the historical range dating 1953 to 2015 for the same indicator, it is observed that our annual estimate falls within the upper limit of the 400 to 975 mm range, thus highlighting that the water deficit is increasingly becoming larger, likely as a result of warming temperatures and climate. Hence it is arguably important for the future estimation of water demand to provide methods that foresee the effect of climate on soil-water availability and thus consider the inclusion of high-impact parameters such as annual temperature, wind speed, humidity, and radiance level in the modelling of water consumption. From a water-resource point of view, these calculations are important because they explore the temporal arrangement of irrigation demand as function of the climatic factor over the islands.

Crop	Planting – Harvest1	Crop Water Requirements				
		Actual crop-water requirement (mm)2	Effective precipitation (mm)3	Net irrigation requirement (mm)2-3	Gross irrigation requirement (mm)4	Efficiency index (1/4 x 100)
Spring Potato	December – May	446.2	200.7	245.5	326.5	1.83
Tomato (Processing)	April – June	423.1	22.1	401	450.4	0.66
Marrow	December – March	163.5	104.9	58.6	83.3	4.80
Watermelon	January – June	384.1	122.0	262.1	321.7	1.86
Carrots	January – July	658.1	131.0	534.3	820.7	0.85
Green Peppers	December – July	872.5	221.3	653.8	805.2	0.99
Vines	January – August	511.5	141.8	371.0	391.4	2.04
Garlic	December – May	312.8	185.5	127.8	170.5	3.51
Cabbage	July – November	506.6	169.7	345.5	404.4	2.22
Cauliflower	August – November	336.8	130.6	206.2	263.0	1.52

Table 3: *Crop specific irrigation demand estimations generated by CROPWAT. Efficiency index tallies the number of months divided by the gross irrigation requirement*

Besides climate data, the loss of water and subsequently irrigation demand, depends on the crop type and crop factors such as resistance to transpiration, crop height, crop roughness, reflection, ground cover and crop rooting characteristics. Thus, it is imperative to fine tune irrigation demand via the assimilation of the climatic model with crop-specific characteristics. Estimating the individual crop-water demand can thus be useful when working on the compilation of environmental inventories and for statistics offices to better reflect irrigation consumption with the crop-physiological water demand. Consequently, this approach leads to a more robust and accurate representation of irrigation water demand and it may be used to establish an index of the 'water thirsty 'crops according to Malta's agronomic conditions, hence shedding light on where efficiency in irrigation investment is most required. In the current practice of modelling irrigation-demand for Malta, the crop-factor is either completely omitted in the final model or sometimes the specific crop-type and its influence on the water demand is not specified wherein all types of fruits and vegetables are parameterised equally. To our knowledge, the crop-based demand estimates as found in Table 3 represents an initial mark into the modelling of irrigation demand on a crop by crop basis for Malta.

Examination of the above table as generated by CROPWAT, shows that green peppers and carrots are the highest water demanding crops with a gross irrigation demand of 805.2 and 820.7 mm respectively. Marrows are the least demanding crop with just 83 mm of irrigation water required whilst spring potatoes, watermelon and vines show very similar gross irrigation requirement with estimates ranging from 321.7 to 391.4 mm. In

general, water demand estimates increase as the crop cultivation period extends into the dry season, in line with the increment of the reference evapotranspiration rate for reasons explained previously. When considering the cropping pattern, efficiency can be represented by the amount of water consumed vis-à-vis the amount of cultivation days. In so doing we see that vines are very water efficient with just 391 mm of irrigation required even tough peak plant vigour overlaps with the dry and hot season. Considering its market value, it is evident that vine cultivation is one of the best adaptable crops for cultivation in Malta. Marrow cultivation as shown above can also be considered as water efficient compared with the rest of the crops. Marrow cultivation in Malta can be achieved all year round depending on the cultivation method employed. Hence it would be interesting to compare different cropping patterns for marrows to investigate the impact on irrigation demand. Cropping patterns for carrot and green pepper cultivation on the other hand are estimated as some of the least efficient from the investigated lot.

Field Water Use and Comparison against CROPWAT Analysis

As with all models, there are differences between the in-field reality and model results. Therefore, it is invaluable that modelled estimates are corroborated against applied water use per crop, in order to assess the accuracy and validity of the models in use, and eventually study the variability between the reported figures. For this reason, in this study, flow metres were installed during the entire cultivation periods, and the volume of irrigation applied was monitored accordingly so as to assess the variability between previous model estimations and actual water use in-field.

Crop	Gross Irrigation demand estimated(a) (m3/ha)	Irrigation water applied(b) (m3/ ha) Quantity (m3)	Difference (a-b)	
			Percentage (%)	
Potato	3256	2108	1156	35.4
Tomato (Processing)	4496	2804	1700	37.7
Marrow	833	1450	-617	-74.0
Watermelon	3211	2671	546	16.8
Carrots	8207	1072	7135	86.9
Green Peppers	8052	5171	2881	35.8
Vines	3914	1722	490	12.5
Garlic	3410	1760	194	48.3
Cabbage	4041	1282	2759	68.3
Cauliflower	2630	3478	-848	-32.2
TOTAL	42,050	23,518	18,532	44.0

Table 4: *Comparison of the Gross Irrigation Demand against applied water use as monitored from field studies*

A comparison of the applied water measurements and the CROPWAT estimations can be found in Table 4. It is striking to note that, excluding marrows and cauliflowers, applied irrigation figures are far less than CROPWAT generated. Differences range from around 12.5% in vines to more than 86% in carrots. Applied water was highest for green peppers with 5171 m^3 per hectare and lowest in carrots with 1072 m^3 per hectare. Conversely, the CROPWAT estimates for carrots were estimated as the highest amount of irrigation. For marrows, the farmer applied a higher amount irrigation when compared to CROPWAT estimates. Marrows are essentially cultivated all-year-round in Malta. However, during the three months of winter, the plantlets are grown under tunnels with plastic mulching covering the soil area. The application of mulching could possibly limit a proportion of rainfall from reaching the soil surface. Consequently, this could explain why a the farmer has to supplement extra irrigation, particularly during the early developmental stage of marrow.

Field crop-water demand seems to correlate with the increase in the ET_o during the dry and hot season for summer cropping patterns. However, it is worth noting that overall farmers utilized a staggering 18,532 cubic metres less water in their fields compared to the recommend irrigation estimates generated by CROPWAT. There are likely two reasons for this variance: water conservation methods adopted by farmers and imprecisions arising from the CROPWAT model. In the first scenario, best practices as well as constraints experienced by the agricultural sector in general are a major motive for the marked difference in water use. Considering that field experiments coincided with a three-year period of drought, the applied water data set indicates that, on the contrary of what it is perceived by the general public, farmers have taken on board management practices that limit the indiscriminate use of water.

In fact, the majority of fields sampled, excluding spring potatoes and carrots, were equipped with drip irrigation which is arguably the most efficient method to water crops. At face value, one may consider that groundwater abstraction comes at no cost. However, pumping operations require a constant supply of electricity along with the construction and maintenance of water-bearing harvesters to store groundwater prior to field irrigation. All this carries a significant monetary cost besides further constraining the amount of arable land devoted for cultivation practices. Although several past studies have concluded that the irrigation practices in Malta are inefficient (Attard and Azzopardi 2005; Attard *et al.* 2007), detailed statistics on irrigation and crop production are missing or derived solely from estimations. In the comprehensive review by Hellet *et al*. (2017), it was recommended that irrigation-water statistics must be ideally derived from an ensemble of datasets which should include temporal and spatial variations of the irrigation-water use and correlated with the volumetric irrigation-water as measured from the field.

Intrinsic limitations derived from the parameterization of irrigation-models are a second probable reason for the variance in irrigation-water use. Though, with careful calibrations, the crop model can provide relatively accurate estimation of crop water consumption, the difficulties in collecting huge amount of information on soil profiles, crop biology, and phenology together with the complicated parameterization, restrict the wide application of crop models. Studies on the development of crop and soil parameters reflecting local agronomic conditions are in fact missing or scarce. This restricts the use of crop models such as CROPWAT to calculate water demand based on gross estimations of the crop and soil characteristics. In the latest figures computed by CROPWAT as found in the 2nd Water Catchment Management Plan, 18 Mm^3 of water was reported to be consumed for

the scope of irrigation (MRA 2015). This estimation was computed by assuming that the majority of the crops grown locally have equivalent demands and subsequently identical crop-water demand

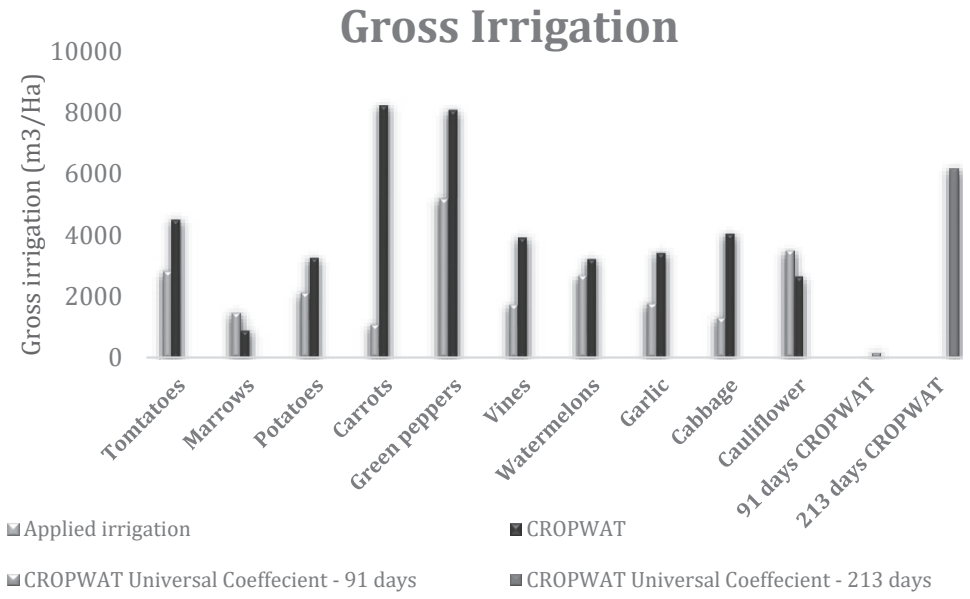


Figure 3: *Chart outlining the gross irrigation requirement (CROPWAT) versus the field applied irrigation over ten horticulture crops. 213 CROPWAT and 91 CROPWAT refer to gross irrigation required modelled with a universal crop parameter over the stipulated cultivation periods using CROPWAT*

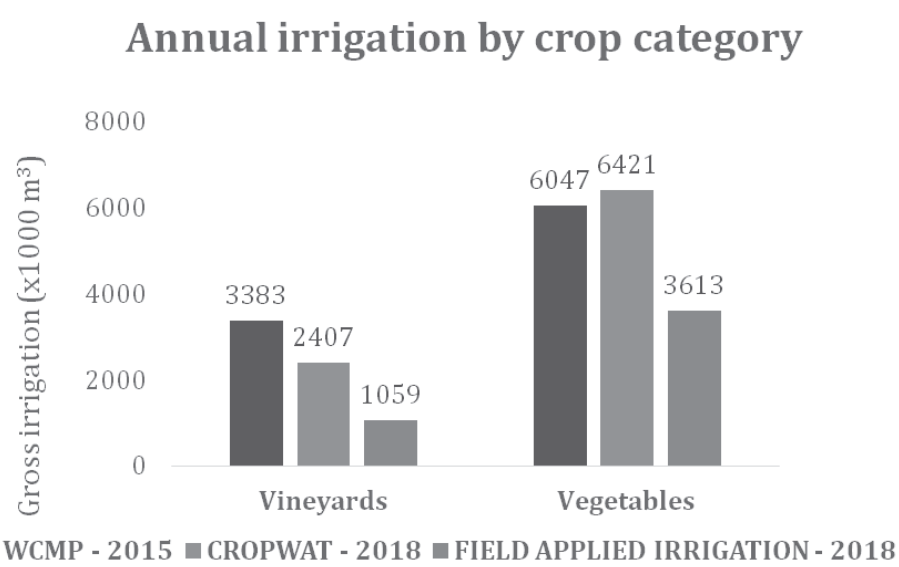


Figure 4: *Annual gross irrigation for Vegetables (right) and Vineyards (Left). Estimations were calculated on the land use data as found in the working document for the 2nd Water Catchment Management Plan (WCMP) and represented here for comparison purposes (Energy & Water Agency, personal communication). Land cover for total vegetables and vineyards amounted to 1492 ha and 615 ha respectively. The average field water consumption for vegetables in 2018 was calculated by taking the mean irrigation of the horticulture crops excluding vines*

Taking cropping patterns of 91 and 213 days respectively (Figure 3), an irrigation-demand modelling was performed using a universal crop parameter for vegetables in CROPWAT as computed in the 2nd WCMP (Ibid.). These cropping patterns were selected to represent two major planting and harvest dates as observed in the field trials. As shown in the chart above, the estimations calculated using all-purpose parameters differ substantially from applied water-use statistics obtained from field trials as well to those generated by CROPWAT using crop-specific parameters. This goes on to show that parameter precision has a huge weight in the generation of irrigation-demand and water-consumption figures. Moreover, the input of crop parameters, adjusted to reflect the regional climate and local agronomic conditions is imperative in order to decrease uncertainties in the estimation of water-demand figures. When we compared and extrapolated our estimates and measurements against reported annual water-use figures as found in the 2nd WCMP for the two major crop categories, we obtained lower gross irrigation figures. For vineyards, based on a land cover of 615 hectares as reported in the same document, we found that our field trials would have consumed in one year a total of 1.1 Mm^3 of water, which translates to 30% less than WCMP estimates. In the vegetables category, which includes all the crops produced under irrigated management, a total of 3.6 Mm^3 of irrigation would have been necessary to supply irrigation to 1492 hectares of land. This is equivalent to around 60% less of irrigation when compared to the WCMP annual figures. This implies that previous reports might have likely contributed to an overestimation in the total irrigation consumption, since it appears that calculations in the 2nd WCMP were based on gross assumptions of the crop- and water-demand parametrizations to the extent that individual crops analysed and global means are significantly lower than reported estimates. It can also not be precluded that the size of the irrigated area used to compute the 2nd WCMP figures are somewhat overestimated which could have contributed to

further inaccuracies in the total annual consumption figure. On balance, the net effect of imprecisions and variances in the different models and parameters used leads to a deterioration of the water-demand and consumption figures and, as a consequence, it limits the adoption of an evidence-based policy system for agriculture water use.

Conclusions

The accurate simulation of water balance processes and their relationship to crop-water demand depend on quality environmental and cropping management data inputs. Detailed irrigation management information as well as crop response behaviour under various irrigation scenarios is crucial for a quantitative evaluation of Malta's hydrologic resources. Several estimations have alluded and quantified the irrigation water footprint for the Maltese islands on the basis of a divergent range of data inputs, parameterization, and model structures. This study has analysed two approaches that are commonly adopted in the measurement and estimation of the irrigation-water demand. The results highlight the importance of assessing the demand figures critically, based upon realistic irrigation conditions. It has also shed light on the probable biasness found in the CROPWAT model to overestimate crop-water demand as compared to current farmer practices. It is of the utmost importance that any alteration or modification of current models must take into consideration the integration of datasets from in-field applied water use so as to improve the accuracy and precision of the irrigation estimates.

Acknowledgment

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A Study of the Factors that Lead to Student Drop-Out: The VET Context

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Abstract: This paper aims to investigate different factors which ultimately lead a student in a VET (Vocational, Education, and Training) context to consider dropping out of the course of study. This study was carried out within the Malta College of Art, Science, and Technology (MCAST) as it is Malta's leading VET institution. In order to address the major problem of school drop-outs, one has to understand why students consider dropping out of college. Identifying the reasons that lead to dropping out is extremely difficult because of the range of factors related to the individual student, the family, the community setting in which the student lives, and the school. The purpose of this study is to explore reasons leading students to consider dropping out in a VET context. It seeks to analyse any relationship between different factors in the life of a student and whether these factors lead a student to consider dropping out of a course of study. The school drop-out rate is an important indicator in assessing the performance of the education system, by level of education. From another perspective analysis, it signals some aspects of social and economic life which can influence people's access to education' (Blandul and Abela 2015). Dropping out of school is the ultimate phase in a dynamic and cumulative process of disengagement (Newmann *et al.* 1992). The main objective of this research is to understand the main factors leading a student to consider dropping out of college in a VET context. It will also investigate what measures can be taken and what can be done within the college to minimize the drop-out rate. The independent variables in this study are the factors which previous studies have shown that they influence the drop-out rate. The dependent variable is the drop-out rate of students at MCAST. This analysis will study the existence of a relationship between these independent variables and the dependent variable.

Keywords: Drop-outs, Lecturers, Malta College of Arts, Science, and Technology (MCAST), Vocational Education and Training (VET)

Despite the progress the college system has been making throughout the years, a number of students still drop out during each scholastic year. Focus need to be placed on other risk factors, other than the standard ones which seem to be in the main focus. The purpose of this research is to study the factors which lead students in a Vocational Education and Training (VET) context to consider dropping out of school.

Below is a list of the hypothesis considered for this research:

- A feeling of disconnectedness to the school leads to drop-outs;
- *Involvement in extracurricular activities helps students further their education;
- Participation in sports helps students further their education;
- Adequate support helps students further their education;
- Negative student-teacher relationship leads to drop-outs;
- Negative effect of peer groups and the community leads to drop-outs;
- Low scores in tests lead to drop-outs;
- Misbehaviour leads to drop-outs;
- Teen parenting leads to drop-outs;
- Part-time job leads to drop-outs;
- Having friends dropping out of their course of study leads to drop-outs;
- Forming part of single-parent/step families leads to drop-outs;
- Having a feeling of loneliness and isolation leads to drop-outs;
- Parental level of education effects whether students further their education or drop-out;
- Absenteeism leads to drop-outs;
- Parental involvement in their child's education helps students further their education;
- Repeating a year within the college leads to drop-outs.

Literature Review

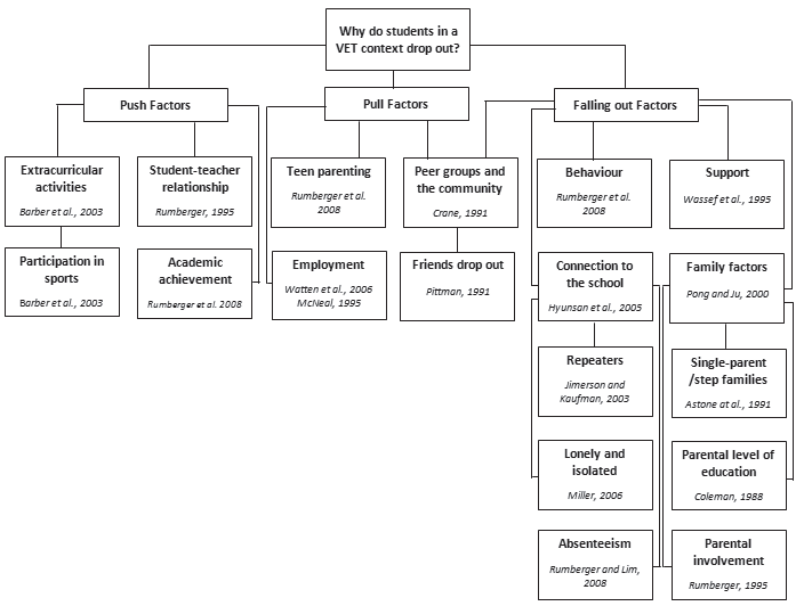


Figure 1: Literature map

Figure 1 *is a literature map of the research literature about the main factors leading students to drop out of college.*

There are severe consequences for a student who drops out of school, and the effects can be long-lasting. Such effects can be both individual and social. One of the first studies on school drop-outs dates back to 1927 and associated those at risk of dropping out of school with possible mental inferiority (Fuller 1927). Studies suggest that students who drop-out of school are likely to work at low paying jobs (Smith 1997; Miller 2006) and are higher in urban areas to that of the national average (Smith 1997). In the United States of America, 85% of adolescent justice cases, 82% of the prison population, and 53% of welfare recipients are high school drop-outs (Stanard 2003). Internationally, a number of studies have been conducted to study the reasons which lead students to drop-out of school. It is theorized that poverty, race or ethnicity, configuration of family, parental education, and limited proficiency in English are five major factors which result in students dropping out (Norwicki, 2004). Grade retention (Jimerson and Kaufman 2003) and teen pregnancy (Wassef *et al.* 1995) are also factors affecting drop-out rates. Studies show that students who do not participate in extra-curricular activities are more likely to drop-out (Quiroz 2000).In a research by Quiroz (Ibid.), drop-outs were directly asked for the reasons leading them to drop-out of school. 39% of the reasons for dropping out were bad grades and family matters, 29% were due to work responsibilities, and 24% indicated teacher problems. These pupils were also asked to indicate the things they liked and disliked about school. Socialization, teachers, sports, and counsellors were some of the factors indicated by these students as to what they like about school. On the other hand, gang violence, boring and uncaring teachers, and overcrowded classrooms were mentioned as to what they dislike (Ibid.). It is very interesting to note that teachers were mentioned as both the best and worst factors in school by these drop-outs interviewed. This study also indicates that important factors for school drop-outs include the setting and the operation of their school. A number of drop-out causes were also mentioned by Dalton, Glennie, Ingels, and Wirt (2009). Missing too many school days, getting poor grades, not keeping up with schoolwork, not getting along with teachers and students, not feeling a sense of belonging, getting suspended, getting pregnant, getting a job, and supporting the family were amongst the most common causes in this study.

Another study, during which student drop-outs were interviewed, was conducted by Miller (2006). The study showed that during the time that the interviewees made the decision to drop out or sometime before they dropped out of school, they all had a family trauma or difficulty which was not addressed. All participants in this study mentioned that they had an experience with a teacher at some point in their education which had a negative effect on their self esteem. Some participants pointed out that they were not involved in any extracurricular activities but wished to be involved at some point during their school years. Other participants mentioned that being involved in extracurricular activities and the close relationships they had with their peers kept them in school and it was the fact that they no longer had the option to participate in sport that made them give up on school. 'Elementary school has an environment that is usually more child-centred and seems to provide a safe haven from the events that transpire in the home, while as students grow into middle and high school, this appears to change from a nurturing and helping environment, to one that demands responsibility and maturity which children from chaotic homes often aren't prepared to handle' (Miller 2006: 43) Once again the influence of teachers was mentioned both as positive and negative factors.

Finn (1989) developed two models as influential on dropping out: the 'frustration-self-esteem' model and the 'participation-identification' model. For the 'frustration-self-esteem' model, Finn states that an initial factor affecting withdrawal from school is school failure in the early schooling years. This is likely to lead to low self-esteem and subsequently results in problematic behaviour. By time these students either decide to drop out of

school or are suspended from school because of their problematic behaviour. For the 'participation-identification' model, the initial factor affecting withdrawal from school is the lack of involvement in school activities. This results in poor school performance and subsequently in less identification with the school. School participation includes participation in both academic and non-academic activities. Other causes found through literature to influence drop-out rate are grouped in the sub-sections below:

Connection to the school

One of the factors noted as a reason for student drop-outs is school disconnectedness. 'Students who feel connected in their educational environment are less likely to have substance abuse issues or interpersonal conflicts with their peers, exhibit violent behaviours, be truant from school, or engage in risky sexual behaviour. They are ultimately less likely to drop-out. Conversely, students who feel alienated in their school environment are more likely to exhibit these problems, as well as academic failure, strained relationships in their social and home settings, and deviant peer bonding' (Hyunsan *et al*., cited in Miller 2006: 9). Therefore, the factors which make a student feel connected need to be examined, as do the variables that can make an unconnected student feel connected to school. Jimerson and Kaufman (2003) support the theory that students who had to repeat a year in school were 2 to 11 times more probable to drop out than students with similar academic performance but are promoted to the following year of studies. This might be because students might feel embarrassed and lonely if their peer group has left, which will then result in a feeling of disconnectedness. This was also noted by Miller (2006) who pointed out that students who feel lonely and isolated become detached from school and their performance deteriorates. Another indicator of lack of engagement which shows an effect on the drop-out rate is absenteeism. The higher the absenteeism, the more likely a student is to drop-out of school (Rumberger and Lim 2008).

Extracurricular activities:

Barber *et al.* (2003) suggest that students have a higher chance of progression if they are involved in extracurricular activities. This study also shows a link between sports participation and lower likelihood of school drop-outs and higher college attendance rate. Similarly, Smith (1997) concluded that students who participate in extracurricular activities in school are less likely to take on activities that are detrimental to their future education and likely not to drop out. Extracurricular activities should form part of everyone's school experience (Cassel and Reilly 2002). Through the study of various analyses done by Rumberger (2008), 14 of the 26 analyses concluded that the likelihood of dropping out is reduced when students take part in extracurricular activities. On the other hand, 11 analyses of the 26 found no significant influence of participation in extracurricular activities on the dropping-out rate, while one study concluded that the chance of dropping out increases for students participating in extracurricular activities. Theories suggest that there are two dimensions to engagement: academic engagement and social engagement within schools. Engagement is indicated by the students' attitudes and behaviours towards the formal aspects of school and the informal aspects. Both of these dimensions of engagement can affect the decision to drop out of school. 'Engagement and educational achievement are influenced by students' background prior to entering school, including their educational aspirations and past achievement.' (Rumberger 2001).

Support:

Having adequate support is another important factor which helps students further their education. According to Wassef *et al.* (1995) the health and well being of the students is affected by social support and this leads to better social relationships and better rates of success in their lives, particularly in the educational setting.

Push, pull and falling out factors:

An article by Doll, Eslami, and Walters (2013) examined several nationally representative studies about causes and prevention of school drop-outs. Factors effecting drop-out rates were grouped in three: push factors, pull factors and falling out factors. 'Push factors include school-consequences on attendance or discipline. Pull factors include out-of-school enticements like jobs and family. Falling out factors refer to disengagement in students not caused by school or outside pulling factors.' (Doll *et al.* 2013). This study concluded that 'pull factors elicited the highest rates overall for all the studies, while eliciting prominence in four of seven studies'. Some of the pull factors having the greatest influence on school drop-outs from these studies include marriage, work, financial difficulties, teenage pregnancy and family obligation.

Family factors:

Research has also demonstrated that students from two-parent families are less likely to drop-out of school when compared to students from single-parent and step families (Astone and McLanahan 1991). On the other hand, a study by Pong and Ju (2000) found that a change in dissolution of two-parent families did not increase the change of withdrawal from school, apart from the effect that this change has on income. The effect of parental education in the education of their children depends on the choices they make about the amount of time and resources invested in their children, which is based on their objectives for education. As an example, the income of the parents allows them to provide more support to their children's education through better schools, after school programs and support from home learning. Coleman (1988) argued that parental level of education and parental income were insufficient to explicate the relationship among school achievement and family background of students. More recent studies however confirmed that a strong relationship between parents and students is likely to reduce the change of dropping out of school (McNeal 1999). Students are less likely to drop-out of school if their activities are being monitored and regulated by their parents; emotional support is provided at home; independent decision-making is supported and their parents are more involved in their schooling (Rumberger 1995).

Student-teacher relationship:

The ratio of students to teachers has a positive and significant effect on the drop-out rate in high schools, according to Rumberger (Ibid.). In another study by Rumberger and Thomas (2000), it was found that the higher the quality of the teachers as perceived by the students, the lower the drop-out rate.

Peer groups and the community:

Factor which affect the drop-out rate are not only associated with the school and the family. Peer groups and the community within which a student lives also have an effect on the students' withdrawal from school. Crane (1991) argues that the lower quality neighbourhoods result in a higher school drop-out rate. Although studies have confirmed the influence of communities on the drop-out rate, they are unable to clarify how this happens. Studies have shown that having friends who are interested in school can decrease the chance of dropping out. On the contrary, having friends participating in illegal actions or having friends who have previously dropped out of the educational system, increases the likelihood of dropping out (Pittman, 1991).

Academic achievement:

Academic achievement was found to be another predictor of school drop-out. Test scores and grades achieved are two measures of academic achievement. Rumberger and Lim (2008) found that academic achievement is likely to influence drop-out rate and that low scores in tests increase the likelihood of dropping out.

Behaviour:

Misbehaviour was indicated as one of the factors associated with drop-outs. 14 of the 31 studies analysed by Rumberger and Lim (2008) found that there is a significant relationship between misbehaviour and drop-outs, 12 studies found no significant association while five studies found a negative relationship.

Teen parenting:

Rumberger and Lim (2008) identified 62 different analyses which study whether there is a relationship between teen parenting and school drop-outs. 50 of these 62 studies concluded that teenage parenting does increase the chance of dropping out of school. This has a larger impact on female student than on male students.

Employment:

Employment during post-secondary education is widespread. This is because of the valuable experience students' gain while working, and also for the income it provides. Studies focus mainly on whether the number of hours students work affect drop-out. Warren and Cataldi (2006) found that students are more likely to drop-out if they work more than 20 hours a week. Another study by McNeal (1995) found that students who work less than 7 hour per week have a lower chance of dropping out of school when compared to those students who work more than 7 hours and to those students who do not work. From the literature, the initial conceptual framework is created. The following is the conceptual framework for this study. A conceptual framework is the understanding of how the variables in this research connect with each other. Thus, it identifies the variables required in the research investigation.

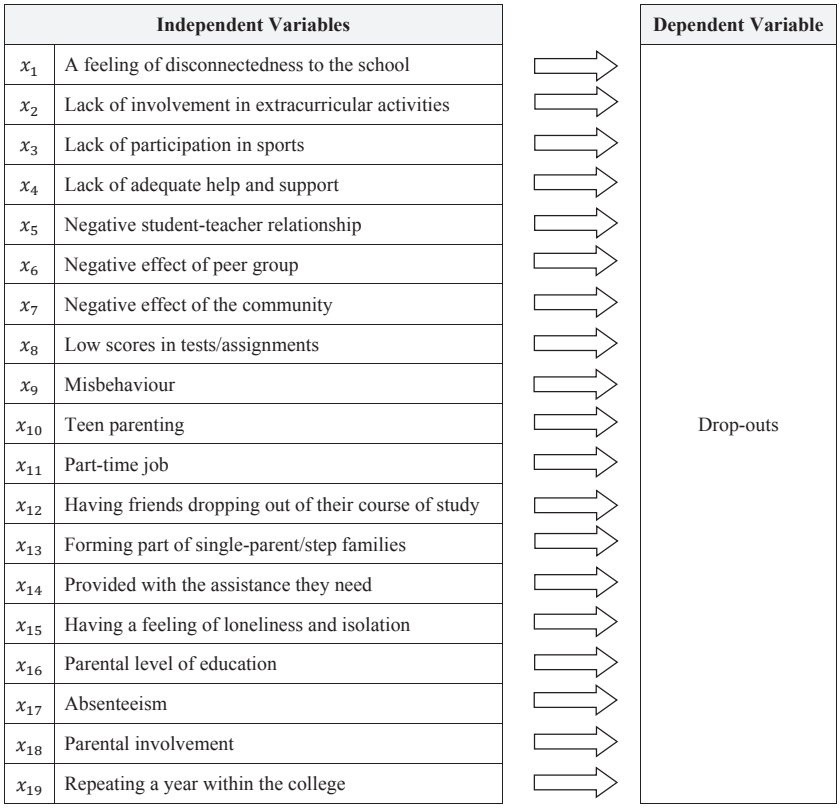


Figure 2: *Initial Conceptual Framework*

Research Methodology

A quantitative research examines the presence of a relationship between the independent variables and the dependent variables. Sources of collecting quantitative data include questionnaires and experiments. Numerical data is then analysed using statistical and mathematical procedures and software. This study used a quantitative research approach. This research was conducted through self-administered questionnaires (a respondent-oriented method) which were distributed to a random sample of lecturers at MCAST. This was a cross-sectional survey, in which data was collected at one point in time. In the questionnaire for educators, mostly closed-ended questions were asked. Likert Scale responses were used in a number of questions so as to rate the severity of the factors indicated. Epistemology studies the nature of knowledge, justification, and belief. Research begins with claims made; data is then collected (which supports or contradicts the theory) and necessary revisions are made. Claims made are refined or abandoned. Most quantitative research starts with the test of a theory.

A post-positivist approach was used for the purpose of this research (a theory-testing and verification process). The post-positivist approach challenges the belief of the absolute truth of knowledge and recognizes that 'we cannot be positive about our claims of knowledge when studying the behaviour and actions of humans'. (Creswell 2014: 36) 'The knowledge that develops through a post-positivist lens is based on careful observation and measurement of the objective reality that exists "out there" in the world.' (Ibid.) In a quantitative research study, variables are related to answer a research question or to make predictions about what the researcher expects the results to show. These predictions are called 'Hypotheses'. 'Quantitative research is an approach for testing objective theories by examining the relationship among variables. These variables, in turn, can be measured, typically on instruments, so that numbered data can be analyzed using statistical software' (Ibid.: 32). This approach was chosen as the study will be testing and examining whether the factors which were previously found through literature to influence school drop-out rates significantly influence students considering dropping out of their course at MCAST. The data gathered was analysed through a statistical software (SPSS) and the final results will be compared to the literature. The results will then be generalized from the sample to the whole population of interest.

Analysis of Research Findings

A total of 90 questionnaires were distributed to a random sample of MCAST lecturers from different institutes within the college. These were distributed at the end of the scholastic year 2017–18. The non-response rate for this study amounted to 9%: 82 lecturers answered the survey.

The questionnaire included a variety of questions. The first questions were related to the individual lecturers and their teaching within the college. These were followed by questions related to the number of students dropping out from their course of studies. Next, the lecturers were asked how strongly they agree or disagree with a number of factors leading their students to drop-out of college through a set of Likert Scale questions. The Likert Scale used is a 5-point scale that offers a range of answer options varying from 'Strongly disagree' to 'Strongly agree'. At the end, an open-ended question was included, asking the lecturers' opinion on how the drop-out rate at MCAST can be minimized.

Validity Test

Within the questionnaire, 18 statements were included for which the lecturers had to state how strongly they agreed or disagreed that each of these factors lead students to drop out of their courses. With these statements, one negatively worded statement was included. This was done to check the validity of the responses, as a 'check' that the respondent was paying attention and answering the survey honestly. The statement 'Provided with the assistance they need' was added to the questionnaire as the negative of 'Lack of adequate help and support'. Once the questionnaires were filled up and collected, these two statements and their responses within each filled-up questionnaire were checked for opposite responses. Questionnaires with a similar answer for both the original statement and its negatively worded statement were eliminated from the study. In this process, a total of 23 filled-up questionnaires were eliminated, leaving 59 responses to by analysed.

Reliability Test

The software used to analyse the collected data was SPSS and the Cronbach's alpha value was first found. The Cronbach's alpha is a coefficient of reliability which measures internal consistency, that is, how strongly related a set of variables are as a group. For this study, the coefficient of reliability was found for the Likert Scale questions asking how strongly a lecturer agrees that the mentioned factors lead students to drop out. The alpha coefficient for the 19 factors was found to be 0.718, suggesting that the variables have relatively high internal consistency. This is because an alpha value higher that 0.7 is considered 'acceptable'.

Reliability Statistics

Cronbach's Alpha	N of Items
.718	19

Table 1: *Cronbach's Alpha*

Results

MCAST, being a VET institution, offers both vocational and key skills subjects. Vocational subjects aim to provide students with the necessary skills, technical knowledge, and appropriate training related to a particular profession. Within the college, key skills subjects also form part of the syllabus for each course of study. The key skills include Mathematics, English, Maltese, Information Technology, Individual and Social Responsibility, and Science and Technology. MCAST lecturers teach various subjects, according to their expertise, with some lecturers teaching both vocational and key skills subjects. MCAST comprises six institutes: the Institute of Applied Sciences (IAS), the Institute for the Creative Arts (ICA), the Institute of Engineering and Transport (IET), the Institute of Business Management and Commerce (IBMC), the Institute of Community Services (ICS), and the Institute of Information and Communication Technology (IICT), providing all the technical and professional skills towards the delivery of the courses.

MCAST offers a wide range of courses varying from certificates to degrees (MQF Level 1 to Level 7) throughout its six institutes around the Maltese Islands. The college comprises of three colleges, each with different levels under its remit. The colleges are:

- Foundation College: The Foundation College provides courses at MQF Level 1, 2, and 3. Students in these courses are provided with different learning pedagogies addressing their individual needs and learning styles, preparing them to further their education and training within the Technical College.
- Technical College: The Technical College provides courses at MQF Level 4. Students are provided with the right knowledge, skills, and competences in their fields of study. Once students complete a course successfully within this college, they can progress to continue their studies within the University College.

- University College: The University College provides higher education programmes and vocational degrees (MQF Level 5, 6, and 7).

Lecturers at MCAST may have teaching responsibilities in all three colleges. Through literature, it was found that the size of the class can lead to disengagement and eventually drop-outs. Class sizes at MCAST vary, with the majority having between 21 and 25 students. Despite the progress the college system has been making throughout the years, a number of students still drop out during each scholastic year. Students are expected to attend all lectures, but a minimum of 80% attendance is required during a scholastic year. One of the measures recently introduced is that, when absenteeism reaches 10%, students are contacted by their corresponding Deputy Director – Programme Management (DDPM). Still, a number of students drop out from their courses each scholastic year without obtaining any academic qualification or without completing their course of study. Unfortunately, the number of students considering dropping out of their course from each class within MCAST seems to be quite high. The questionnaire was produced with these aspect in mind. The following table (***Table 2***) simplifies the results for the descriptive questions in the questionnaire:

Question	Options	Frequency	Percent
Gender:	Female	35	59.3
	Male	24	40.7
You teach:	Vocational subject/s	31	52.5
	Key Skills subject/s	20	33.9
	Both	8	13.6
During the last scholastic year, the majority of your teaching load was within the:	Institute of Applied Sciences	9	15.3
	Institute for the Creative Arts	3	5.1
	Institute of Engineering and Transport	13	22.0
	Institute of Business Management and Commerce	11	18.6
	Institute of Community Services	12	20.3
	Institute of Information and Communication Technology	11	18.6
During the last scholastic year, the majority of your teaching load was within the:	Foundation College	22	37.3
	Technical College	21	35.6
	University College	16	27.1
You have been teaching for:	1–5 years	17	28.8
	6–10 years	22	37.3
	11–15 years	10	16.9
	16–20 years	5	8.5
	More than 20 years	5	8.5
The average number of students in the classes that you teach is approximately:	6–10 students	1	1.7
	11–15 students	16	27.1
	16–20 students	18	30.5
	21–25 students	21	35.6
	More than 25 students	3	5.1
Along the years, the number of students considering dropping out of their course of study has been:	Decreasing	4	6.8
	Constant	34	57.6
	Increasing	21	35.6
On average, the number of students considering dropping out of their course of study in each class that you teach is approximately:	None	2	3.4
	1–2 students	16	27.1
	3-4 students	20	33.9
	5-6 students	16	27.1
	More than 6 students	5	8.5
Do you believe that the drop-out rate within MCAST can be minimized?	Yes	40	67.8
	No	19	32.2

***Table 2**: Results*

The main objective of this research is to understand the main factors leading a student to consider dropping out of college in a VET context. It will also investigate what measures can be taken and what can be done within the college to minimize the drop-out rate. Because of this, at the end of the questionnaire, lecturers were asked whether they believe that the drop-out rate within MCAST can be minimized. Two-thirds of the lecturers believe that the current drop-out rate can be minimized, while 19 lecturers believe that this is not possible.

Can_minimize_drop_outs

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Yes	40	67.8	67.8	67.8
	No	19	32.2	32.2	100.0
	Total	59	100.0	100.0	

Table 3: *Drop-out rate can be minimized*

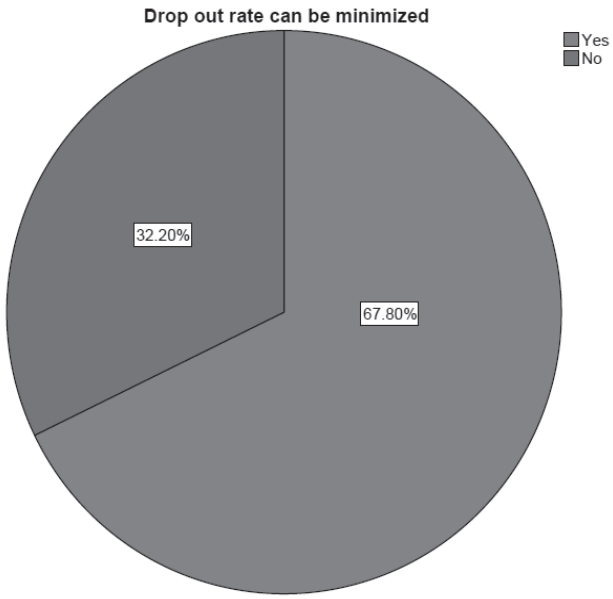


Figure 3: *Drop-out rate*

Furthermore, lecturers who answered 'Yes' to this question were also asked to give their opinion on how can the current drop-out rate be minimized. Out of the 40 lecturers answering 'Yes', 35 lecturers provided their opinions. A large variety of interesting responses were given by the lecturers. Eight lecturers mention the importance of providing students with better support throughout the scholastic year, both academically (from lecturing and administrative staff) and socially, by professionals. One lecturer specifically mentioned the help provided by the Learning Support Unit (LSU) within the college. Another very important point mentioned by a number of lecturers was to ensure

that the students are fully aware of what the course they enrol into entails. It is a known fact that some students are not aware of what the course really involves and of the different units that it is made up of. With MCAST being a vocational institution, a number of students believe that only vocational subjects are taught and that no writing, studying, or theory are involved. Some of these lecturers even suggested interviewing applicants before starting a course, with different reasons for these interviews being given. A lecturer suggested that, during these interviews, students should be given a summary of what the course entails; another lecturer argued that through these interviews one can figure out whether the applicant is genuinely interested in the course or not; while another lecturer said that this should be done since 'not all students are eligible for some particular courses, such as Early Years'.

Some lecturers believe that students at MCAST lack a feeling of belonging. Attention has to be given to help students from the beginning of the scholastic year to develop a sense of belonging within the class and with their peers by involving all students during lectures. A lecturer suggested 'increasing the sense of community within MCAST and having a common place for students to meet up' while another comment was that 'MCAST lacks an identity which instils in students a sense of belonging'. Extracurricular activities may help in this regard.

At MCAST attendances are recorded and monitored; however, lecturers suggest that action should be taken earlier in cases of high absenteeism. Earlier intervention is also essential to students in need of support. More practical and hands-on sessions were suggested since MCAST is a vocational college. Assignments seem to be another issue which needs improvement to help students. This includes assignments being well-spaced throughout the scholastic year, with advance notifications of assignments being given and more preparation time allowed before the synoptic assignments. 'More attention should be given to those who show potential. It does not mean that one should not care for those who need most help – far from it. But whilst these are being given substantial help, those who want to learn and achieve are not challenged enough leading to disinterest and finally dropping out.'

More importance has to be given on teaching the students on why it is important to continue studying and finish their course in relation to finding a job. Better communication between the staff, both academic and administrative, is also essential. Administrative factors were also mentioned to help reduce the drop-out rate, including revising course structure and time-tables, reducing class size, changing course entry requirements, spreading courses over more time, and stricter progression regulations. One lecturer commented that some courses are wrongly marketed as 'easy' and MCAST as a college being marketed as a 'second change' to those who failed within the educational system. Another comment was to emphasize on 'quality not quantity'.

Factor Analysis for Data Reduction

Factor analysis is a procedure used to reduce a large number of variables into fewer interpretable underlying factors by investigating variable relationships. The main idea of factor analysis is that various variables have similar patterns of responses since they are all related with a latent variable. In this research, factor analysis was carried out on the 19 factors being tested as to whether they lead students to consider dropping out of their course of study.

Table 4 below was extracted using SPSS. The value of the initial eigenvalues is displayed under the column named 'Total'. This value indicates the amount of variance in the original variables accounted for by each component. A factor with an eigenvalue of 1 accounts for as much variance as a single variable. The factors that explain the least amount of variance are commonly discarded. For the data in this study, seven factors have an eigenvalue larger than one. The extracted solution of these seven factors is formed since eigenvalues greater than 1 were requested to be extracted. The seven extracted components explain nearly 70% of the variability in the original 19 variables.

Total Variance Explained

	Initial Eigenvalues			Extraction Sums of Squared Loadings		
Component	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.901	20.529	20.529	3.901	20.529	20.529
2	2.423	12.750	33.280	2.423	12.750	33.280
3	1.717	9.038	42.318	1.717	9.038	42.318
4	1.663	8.752	51.070	1.663	8.752	51.070
5	1.284	6.757	57.826	1.284	6.757	57.826
6	1.203	6.332	64.158	1.203	6.332	64.158
7	1.050	5.524	69.682	1.050	5.524	69.682
8	.957	5.036	74.718			
9	.836	4.400	79.118			
10	.644	3.390	82.508			
11	.557	2.931	85.440			
12	.528	2.781	88.221			
13	.491	2.586	90.807			
14	.435	2.291	93.098			
15	.414	2.180	95.278			
16	.375	1.974	97.252			
17	.230	1.212	98.464			
18	.171	.898	99.362			
19	.121	.638	100.000			

Table 4: *Initial eigenvalues and extraction sums of squared loadings*

The rotation (shown in **Table 5**) maintains the cumulative percentage of variation explained by the extracted components; however, the variation is now spread more evenly over the seven components.

Total Variance Explained

Component	Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %
1	2.423	12.753	12.753
2	2.222	11.695	24.448
3	2.078	10.939	35.387
4	1.735	9.134	44.521
5	1.632	8.591	53.112
6	1.615	8.502	61.614
7	1.533	8.068	69.682
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			

Extraction Method: Principal Component Analysis.

Table 5: *Rotation sum of square loadings*

The scree plot below (**Figure 4**) was plotted using SPSS. It plots the component number on the -axis and the eigenvalue on the -axis. This plot helps to establish the optimal amount of components. The components on the steep slope are to be extracted as the components on the shallow part of the slope have a slight contribute to the solution. The point where the slope levels off indicates the number of factors to be generated. In this research, this occurs after the sixth point and thus six factors will be generated. These six factors represent 64.158% of the meaning of the data.

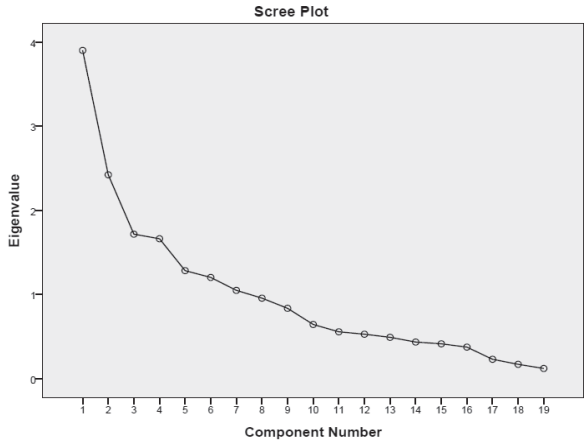


Figure 4: *Scree plot*

The rotated component matrix is then generated, extracting six factors. This helps in determining what the components represent. It is known that rotation converged in 16 iterations.

Rotated Component Matrix[a]

	Component					
	1	2	3	4	5	6
Disconnectedness_to_school	.081	-.010	.358	-.034	.118	.812
Lack_extracurricular	-.118	.101	.879	.099	-.095	.133
Lack_sports	-.092	.024	.910	-.122	-.011	.083
Lack_support	.128	.218	-.054	.106	.767	.155
Negative_student_teacher_relationship	-.092	.243	-.036	.269	-.035	.698
Negative_effect_of_peers	.273	.759	.134	.049	.174	.194
Negative_effect_of_community	.326	.660	.158	-.192	.102	.040
Low_scores	.586	.323	-.083	-.028	.013	.204
Misbehaviour	.381	.296	.128	.293	.258	-.181
Teen_parenting	.443	.012	.322	.237	.465	.002
Part_time_job	.478	.391	.014	-.051	-.591	-.018
Friends_drop_out	.485	.118	-.175	.136	.128	-.279
Single_parent_or_step_families	.411	-.170	-.162	.588	-.079	.141
Provided_with_assistance	-.091	-.368	.172	.169	-.602	.141
Lonliness_and_isolation	-.214	.698	-.111	.375	.117	.022
Parental_level_of_education	.001	.000	-.024	.784	.117	.270
Absenteeism	.728	.106	-.107	.118	.091	.028
Parental_involvement	.205	.297	.164	.616	-.009	-.312
Repeating	.766	-.028	.008	.050	-.020	-.069

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.[a]

a. Rotation converged in 16 iterations.

Table 6: *Rotated component matrix*

Table 7 shows how the 19 factors being studied were reduced to six variables using factor analysis.

Dimension reduction	
Original variables	New variable
Low scores in tests/assignments	Lack of interest
Misbehaviour	
Having friends dropping out of their course of study	
Absenteeism	
Repeating a year within the college	

Dimension reduction	
Original variables	New variable
Negative effect of peer group	Lack of belonging
Negative effect of the community	
Having a feeling of loneliness and isolation	
Lack of involvement in extracurricular activities	Lack of involvement in non-academic activities
Lack of participation in sports	
Forming part of single-parent/step families	Parental support
Parental level of education	
Parental involvement	
Lack of adequate help and support	Personal provision
Teen parenting	
Part-time job	
Provided with the assistance they need	
A feeling of disconnectedness to the school	Institution disconnect-edness
Negative student-teacher relationship	

Table 7: *Dimension reduction (new variables)*

Following factor analysis, and the reduction from the 19 original variables to the new six factors, the conceptual framework for this research was updated as follows:

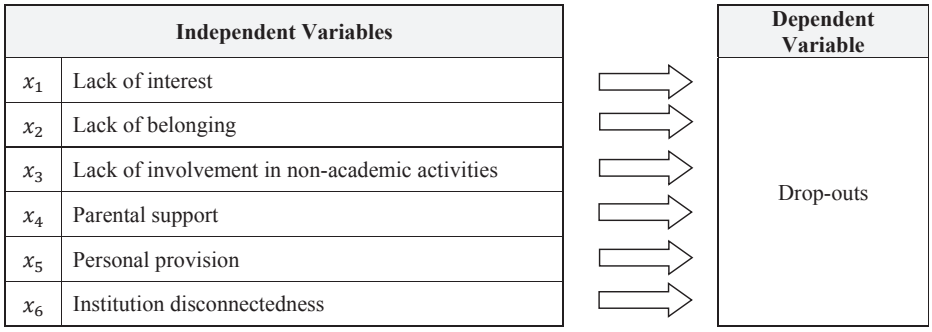


Figure 5: *Updated conceptual framework*

Conclusion

The focus of this study is to explore why students in a Vocational, Education, and Training (VET) context consider dropping out of school, with the research being carried out through questionnaires addressed to MCAST lecturers. The ultimate aim is to investigate what can be done to tackle this issue and minimize this drop-out rate, thus having more students completing their courses of study and possibly furthering their education. To date, the first phase of this study was finalized. Past researches on college drop-outs around the world were studied in order to establish factors which in these researches resulted in students dropping out from colleges. These factors form the set of hypotheses for this study and were included in the designed questionnaire.

Questionnaires were distributed to a random sample of MCAST lecturers and factor analysis was carried out to reduce the number of variables from 19 into fewer interpretable underlying factors by investigating variable relationships. The final set of factors resulted in six factors, namely, lack of interest, lack of belonging, lack of involvement in non-academic activities, parental support, personal provision, and institution disconnectedness. The next phase of this study includes testing whether the factors which were previously found through literature to influence the drop-out rate significantly influence those students who are considering dropping out of their courses of study at MCAST. The final results will then be compared to the literature and generalized to the whole population of interest.

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Students' Perception of Global Warming on the Maltese Islands

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Abstract: In Malta, global warming (GW) can be perceived negatively or positively: negatively due to the effects caused by the rise in temperature, desertification effects, rise in illnesses, and others and positively due to the fact that people might invest in GW mitigation solutions, such as the selling of solar water panels and solar water heaters, developing new ways to mitigate GW, devising plans how to live comfortably even under a rise in temperatures, such as reaching a net carbon zero emission from households, and others. This paper focuses on how the students at MCAST perceive GW in three different concepts, namely, meanings and related concepts, causes and effect of GW, and actions that can be taken to mitigate GW. The research aims to verify by means of enquiring data, through a closed questionnaire with a set of Likert-scale variables (dependent and independent) using a quantitative approach, to find out if there is a correlation between knowledge gathered through the course of study and the contribution that the students can input in mitigating GW effects.

The analysis showed that it is possible to represent all variables by five factors and, by using regression analysis, it was possible to test the hypothesis. Results show that there is a strong correlation between knowledge gathered through the course of study and contributing to mitigate GW. The knowledge contribution was mainly characterized by a strong belief that actions towards mitigating GW exists, and can be studied and implemented. Government initiatives and decisions taken towards mitigating GW contribute slightly to this correlation. The relationship is 100% there since the chance that this answer happened by chance is practically zero. All of this indicates that the studies being carried at MCAST are reflecting in the students' attitude towards greener initiatives.

Keywords: Global warming, knowledge, causes and effects, mitigation solutions, technical and university MCAST students

The Concept

The idea of the research was to find out if students attending MCAST are aware of the consequences of Global Warming (GW), such as Climate Change (CC), and if they think that this is a serious issue, one that could change their way of living in the future and that therefore they have to start to act now to find ways and means to mitigate or develop a new behaviour to live with the problems it causes. This research will gather information related to:

- assess how knowledgeable the students are in this area;
- from where they derive their knowledge;
- if the knowledge gathered is affecting the students thinking skills to start planning;
- if the students care to address issues related to GW mitigation;
- if their course of study is influencing the students to reflect on green energy initiatives; and
- whether their target job of the future would reflect the need to consider GW.

For example, construction students indirectly tackle GW issues by considering how to design structures that are energy efficient in all aspects, such as orientation to the sun to reduce lighting from inside, insulation to decrease heat transfer, number and size of windows to increase the light from outside, ventilation to reduce the humidity from inside, and collection of rainwater to reduce water consumption (this in turn will reduce the amount of water pumped from the reverse osmosis thus reducing energy demands). All this is usually considered during the design stage of a project but is also influenced by the client's decisions. The knowledge gathered during their studies could aid students to give better information about building net zero-carbon emission houses and, at the same time, satisfy the clients' needs. This would mean that the students' future job will aid towards mitigation of GW effects.

Besides, this research analysed and assessed insights on the social, economic, personal, and environmental impacts that affect the students' life-style information. Regarding social impact, the research will highlight if the students already know that they are being affected by GW due to the decisions taken by policy-makers, such as decisions taken regarding the prices of electrical and water supply. Economically speaking, the research will show if students are willing to pay more for an energy-efficient appliance just to aid the cause or rather to spend according to their budget and leave it to others to take care of nature. However, at the same time the research will also show if this can also provide an opportunity for new jobs in this sector. Ideas such as what type of car should one buy. If the choice falls on an electrical car, then what else does one need to consider? It could be a hybrid car, but then, what does it involve. For example: charging, maintenance, annual insurance, and road licence. Is the student aware of government initiatives to combat CC? All this will start to become personal. Finally, the environmental impact will be tackled to find out if students are already feeling the effects of CC on the environment such as, due to the rise in temperature, less food being produced; trees burning, increasing desertification, and, flooding all around the world: war between countries which will in turn cause migration towards other countries. This study will also show if students know which of these are already directly causing changes to their lifestyle and which indirectly they feel that might be a problem for their future.

The Research Question

From the literature review studied, it was noticed that the research always pointed towards three concepts, namely:

1. The meaning of GW and CC and related concepts;
2. The causes and effects of GW; and
3. The actions that can be taken to mitigate GW.

The literature was important because it helped identify the three main concepts that can contribute towards understanding to what extent the students could contribute to lessen the effects of GW.

The main objective of this research study was to make a hypothesis and verify it by collecting data through a questionnaire utilizing a quantitative approach. This would in fact become the basis for the entire study. The hypothesis is:

There is a correlation between knowledge gathered through the course of study and contributing to mitigate GW.

Based on the findings, guidance could be provided to curriculum development in the various departments.

Literature Review

Literature Map

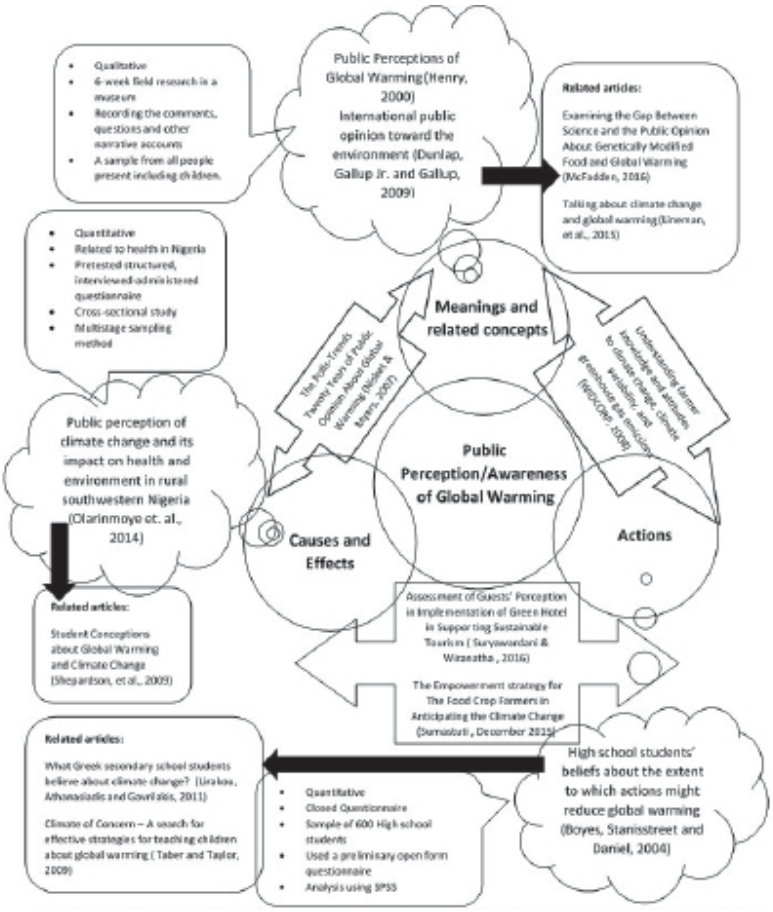


Figure 1: *Literature map: A visual summary based on three main concepts derived from four main articles and various other related articles*

The Concept Derived from the Literature

Mankind has been facing GW for the last few decades. Some think that GW is just a natural phenomenon caused by the effects of CC and is the way how nature behaves, while others think that humans are causing this rapid change in climate with average temperatures rising all over the world. Even scientists do not agree whether this phenomenon is caused by the human intervention or not. Research carried out by Nisbet *et. al* (2007) found that public opinion about GW during the past twenty years was always divided: 68% believed that GW was real in 1992, yet it dropped to 57% two years later owing to strategic communication efforts of conservative thinking but then rose to more than 70% after 2002. The film *Before the Flood* (2016) documents the significant effects this phenomenon has on CC while also discussing mankind's potential to reverse them. This film was an inspiration to embark in this research since it reflected on the three basic concepts in the literature map, that is, meanings and related concepts; causes and effect and actions that every researcher has tried so far to understand and analyse to further knowledge on this subject; and how each person views the concept of GW in one's own way. Some of the effects of GW are noticeable in the Mediterranean region. CC projections for the region, derived from global climate model, indicate an increase in temperature of 1.5 to 3.6^{o} C and a decrease of 10–20% in precipitation by 2030 (Giorgi *et al.* 2008). Being in the Mediterranean, Malta will suffer greatly if this scenario does occurs and nothing is done during this period to try to maintain a balance.

Reducing the effects of GW is not going to be an easy task and, the more time passes, the more difficult will it become to tackle the problem. It will require all the international leaders to cooperate at one level and to engage the rest of humanity on the other level. However, to understand all the effects and implications that GW is causing year after year, knowledge about it must be reinforced especially from a young age. Boyes and Stanisstreet (1993) have concluded that school and college students' understanding about GW is severely limited and embedded with several glaring misconceptions.

The literature map shows the three main concepts that were derived from several researches done by various authors. Some of them discuss only one concept, while others tried to analyse two concepts based on a particular subject, such as the 'Assessment of guests' Perception in Implementation of Green Hotel in Supporting Sustainable Tourism'. Suryawardani *et al.* (2016) not only addressed the causes and effects that GW might have on tourism but also researched what particular actions can be taken to sustain tourism in a green environment way. Although this might not be directly linked to the research being carried here, it is still valuable to notice that this could indirectly be an insight to hotel architects and students following courses in construction engineering which might be the most that can be influenced by this research. The literature map also shows the methodology adopted by the three main articles, namely the philosophy adopted, the method of enquiry, and the method of interpretation. All the three researchers adopted different but ultimately convincing methodologies according to the research question being analysed. The three main concepts shown in the literature map were also analysed by various other authors in this way.

Meanings and Related Concepts

Perhaps one of the important researches covered in relation to GW issues was carried out by Dunlap *et al.* (1993) who focused on whether concern for the environment was only limited to citizens of wealthy industrialized nations or concerned the entire world population. This research is a rather old one amongst all the researches read so far to compile this literature review, but it gives a general idea that all the world had already some awareness of environmental deterioration and effects that where resurfacing in 1992. This research was also important because the researchers collected a sample from all the world; thus, the results reflected the opinion of all countries rather than examining only a selective group like what McFadden (2016) did in his research work, where he only addressed US citizens. Still McFadden's research was focused on one aspect, namely checking what people thought of genetically modified food and GW and if there was a relation between the two subjects. The main findings showed that people mainly think that GW is not being caused by humans and that eating genetically modified food is not a problem; however, this statement was only true for individuals with greater perceived knowledge. This statement provides an important point which implicates that if people are knowledgeable enough, one could have better insights on the problems associated about GW and genetically modified food and thus people might be able to start taking actions about these problems.

Interestingly McFadden was one of the researchers who tackled persons with a higher intellect and within a small age group of the median age of 26. This could have been a strategy by the researcher, since such persons can be more reliable in the answers they give in the questionnaire and at the same time are young enough to start influencing the world towards greener initiatives from their current jobs. This concept is also being adopted in this research where even younger persons were selected, the majority of being between 19 and 21 ears of age and knowledgeable enough to be able to address the questions in the questionnaire.

Henry (2000) adopted a different strategy to tackle the public perception of GW. His aim was to see if the public at least knows the differences between GW and CC, that is he focused on the meaning and related concepts of the words. This time the respondents were even more selective since Henry only addressed those who attended a Smithsonian Institution exhibit on GW. The researcher collected 150 observations in six weeks of field research. The method of enquiring data was rather constructivist where the researcher aimed mainly to build the theory from what the people attending the exhibition thought about GW and its related concepts. The researcher constructed three patterns, one of them being an increase in knowledge between average citizens and those who were more engaged in the exhibition. Just like McFadden, this research concludes that knowledge on such subject gives better results. Henry also pointed out that most of the visitors attending the exhibition might also have been those who are already knowledgeable about the subject since, in general, one visits a museum if there is something that attracts him. Thus, the data might be only interpreted as relevant only for knowledgeable people and does not reflect what the entire population believes.

Lineman *et al.* (2015), carried out something similar but mainly focused on checking if awareness of GW and CC was being influenced by publicity on the internet. This time the method of enquiry was to collect information from Twitter and Google Trends on various words associated with GW and CC. One aspect of the research focused on how much the words GW and CC are researched on the internet. Their findings indicated that the search has decreased since 2010 onwards (See Figure 2). Lineman *et al*. did not identify

the cause of decline in relative search volume (RSV) but they clearly indicated that peaks occurred when there was press exposure events, such as a Nobel Prize. Lineman *et al.* (2015) also focused on the sentiment being generated by these two phenomena where CC was seen in a more positive frame than GW.

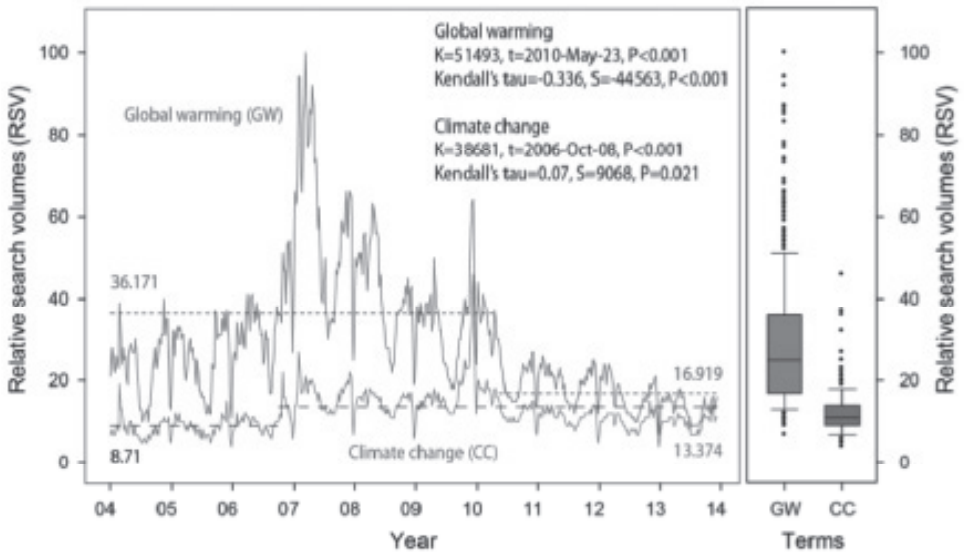


Figure 2: *Change in relative search volume (RSV) for GW and CC as search terms (2007–2013); dash line represents the mean for the RSV for each period (Lineman et al. 2015)*

As seen from the four literature reviews, every researcher indicated an aspect of GW, mainly assessing the knowledge perceived so far by the respondents. All four researchers adopted different methods of enquiry but mainly a general point that comes out from all of them is that knowledge is very important to start addressing the problems associated with GW and, more than that, sentiment could be a potential aspect of how to address GW concepts.

Causes and Effects

The second concept being examined in relation to GW is what causes GW and what are its effects. The research by Olarinmoye *et al.* (2014) on 'Public perception of climate change and its impact on health and environment in rural south-western Nigeria', found out that the people are not quite knowledgeable about what could be the causes of GW but are quite knowledgeable on the effects of GW in their part of the country, especially in relation to health issues. To accredit their research, the researchers made sure that the respondents knew the definition of GW. The main findings indicated that, due to low educational status, some related the causes of CC to God's work and to the sins of men. In terms of effects, the people interviewed knew a great deal about these effects, with some clearly indicating a reduction in food supply, more illnesses, and lack of water resources.

Olarinmoye *et al.* (2014) also focused on health issues in a poor country. This does not mean that their research is not valuable for the current conditions in Malta where health issues are different. However, even in Malta, carbon emissions from cars and power stations and the illnesses that result from these emissions are part of everyday talk.

Shepardson *et al.* (2009) took a different strategy to examine the issue of GW by tackling directly the knowledge being delivered at school level in the American Midwest. Again, this is a selective group and does not reflect the entire world population, but at least this time the researchers aimed to acquire sufficient information related to what is being taught in schools and what the students are actually managing to grasp; from the results, the researchers were going to use the information gathered to influence the curricula to address the student studies towards issues associated with GW. Interestingly the researchers chose to use four open-response items and one draw-and-explain item. This method was chosen to analyse directly the content rather than to check right or wrong responses. The main findings indicated that many students do not believe that GW and CC will have a major impact on people and society, but they also believe that people will find ways to adjust to the environmental changes caused by GW. Students also noticed some causes and effects that might occur due to GW such as, an increase in human deaths, more flooding, rises in temperature, and lack of drinking water, some of which were caused by an increase in atmospheric carbon dioxide levels from vehicles and factories. The researchers also pointed out that students were mainly being influenced by the illustrations related to GW issues in science books. Since some of the books were published a long time ago, it does not necessarily mean that they reflect present knowledge.

The two articles reviewed in this section, although tackled from different perspectives and different ethnicity, mainly pointed out the importance of knowing about the causes and effects of GW. If such information is collected, actions could be formulated to start engaging in ways to mitigate GW. In these two articles, no one discussed this aspect which is also significantly very important to consider.

Actions

One of the articles that mostly reflect the objectives of this research was written by Boyes et al. (2004) who used closed-ended questionnaire to find out the extent to which students believe that various actions might help in reducing GW. The questions for the closed questionnaire were built up by previously asking Grade 6 and 8 students to write about 'what one can do to stop the Earth from warming up by GW (the greenhouse effect)', 'things that people can do themselves', and 'things that government and industry can do to reduce global warming'. Findings indicated that misconceptions about this subject tend to decrease as the age increases. Students also realized that using alternative sources of energy can reduce GW while using less coal and reducing vehicle emission could also contribute to its reduction.

The results lead the researchers to propose to education entities to embed more knowledge-related topics in the course content to empower students to take daily actions, no matter how minimal they may be, that can contribute to alleviate the problem. While Boyes, Stanisstreet and Daniel (2004) focused on public schools in the north-west of the UK, Liarakou, Athanasiadis, and Gavrilakis (2011) performed similar research in Greek schools where they also tried to discover whether there was any difference in knowledge on GW among different age groups. The findings indicated that eleventh graders were

much more knowledgeable than eight graders and that misconceptions reported in the literature, such as the cause-effect relationship between the greenhouse effect and ozone layer depletion, persists, according to Boyes and Stanisstreet (1993).

However, a gap in the literature remains. So far no one has tackled the question whether students' belief that they will have the ability to make a positive impact in relation to GW and CC. Taber and Taylor (2009) tried to find out in a survey they carried out in schools in Australia. They adopted a mixed-method approach where, at first, they interviewed a selected group of students to acquire the concepts from where to start off. Secondly, a new unit was written based on the findings of the first survey. The second part of the research assessed any changes in knowledge by means of a questionnaire which categorized correct responses. The questionnaire was given before the lectures were covered and afterwards. Results showed an increase in knowledge but still some misconceptions remained. Since the lectures were covered in a short amount of time, the results were quite positive. This research indicated that improving knowledge about GW issues and problems is important, particularly at early ages. Considering that all the three articles mentioned in this section were covered in the schools, it also stresses how influential it is if such concerns started to be tackled in school at early ages.

From the literature covered so far, no one asked if the students are already doing any actions towards mitigating GW and/or if they have the intent to do so in the future. Taber and Taylor (2009) found out that after the new unit was introduced more students believed they could be able to make a positive impact on the environment, although there was also an increase in level of concern.

Mixed Concepts

So far, the literature covered always addressed one concept and, in some minor case, while knowledge claim was the main focus of the research, some causes, effects, and actions were considered, mainly to assess the knowledge gathered. Other research, such as that covered by Sumastuti (2015), focused on the causes and effects of GW that influence food crop farmers and what strategies can be implemented to anticipate CC, which is the direct cause of GW. The results showed that, to anticipate CC, four aspects must be considered: human resources, technology, institutional, and production, by involving various social groups such as academics, business/private sectors, government, and community of food crop farmers. Although this research was specifically addressed to the needs of farming, it is rather important since it emphasizes the importance of school and curricula to aid this sector. MCAST has an institution related to agribusiness which offers courses that consider these aspects. However, one needs to find out how many students attending this institute do really consider the changes that are occurring due to GW as a threat and hence assess whether the students are considering what strategies can be implemented to cope with these changes.

The Water in Drylands Collaborative Research Program (WINDCORP) group carried out a similar research to understand the gaps between the knowledge-needs of farmers, such as CC policies, common characteristics among and practices by farmers, perception of CC, knowledge acquisition and its transfer, and actions they would take to cope with CC. All this research is relevant and of importance even to Malta's food production; more than that this research showed that some farmers do consider and implement ways how to become net zero-carbon emitters as well as ways how to reduce nitrogen fertilizers. Some are pushed by the government to do so since they see a benefit coming from

the government rather than seeing a benefit for themselves in the future. However, actions are being implemented and the knowledge gathered is being transferred to other farmers to start to cope with this issue. The research carried out in these two articles is important since, as mentioned in the film *Before the Flood*, one of the high contributors that influences GW and CC is the farming sector. Addressing issues such as how to cope with CC in the farming industry and how farmers can aid to mitigate GW is of high importance to start actions in every country.

Conclusion

The literature covered reflects different aspects of GW. The literature review helped to categorize these aspects and to mainly find out gaps in the review itself. One gap relates to the fact that almost no one tried to assess how many of the actions known so far are really being implemented and if they are really influencing the GW rate of change. At least the research carried out by WIDCORP reflected on actions being implemented by farmers. Research carried out in schools tends to focus mainly on the knowledge of the students about GW and CC and only few tried to also focus on knowledge associated to causes, effects, and actions. Only Taber and Taylor (2009) gave an insight whether the knowledge gathered in schools might influence students in developing strategies and actions in the future, since some students believed at the end of the unit being delivered that they could make a positive impact on the environment. All this clearly indicates that research can be covered to discover whether students have the potential and the necessary tools to deal with actions that mitigate GW consequences.

Research Methodology

The Knowledge Claim

The research methodology adopted in this paper is that of a positivist way of thinking where one can in fact verify a theory based on the hypothesis and the target audience. The target audience could have been all students studying at a post-secondary and higher levels in Malta which would have generated different yet relevant results from what resulted in this research. Yet, the target audience was all students that attend at MCAST Technical and University College. As seen from the literature review, one possible way to examine this research is to go for a qualitative approach and conduct a case study; however, in this case a survey questionnaire with a five-point Likert rating scale was used since it was better to gather the opinions of many students despite the fact that surveys tend to generate black-or-white answers rather than actually seeing a broader image that can be gathered from a qualitative research. Moreover, this research has adopted a positivist approach since the researcher is more scientifically driven and was already influenced by the literature review. The researcher wanted to study the causes that influence the outcome of this research. Besides, by using this approach, it is also possible to reduce the variables that constitute the hypothesis and research questions into a small, discrete number of ideas to test by changing the five-point Likert-scale into numerical data.

Figure 3 shows a visual representation of the interconnection of worldviews and research methodology adopted in this research.

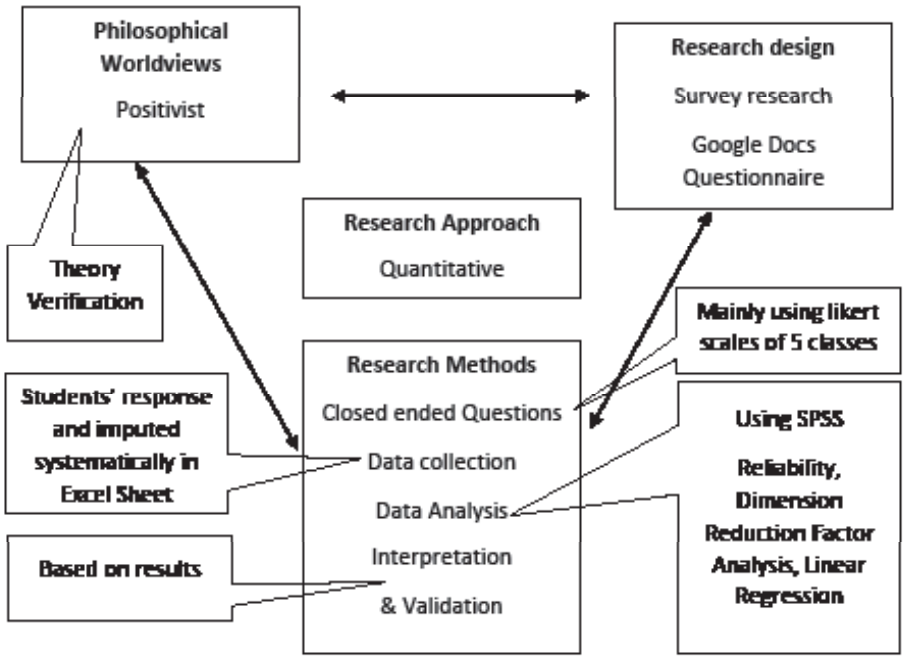


Figure 3: *The interconnection of worldviews and research methodology*

The Build-Up of the Research Questionnaire

The research question was divided into two sections. The first section covered some descriptor variables such as age, gender, academy level, and type of academy, that is, whether they were engineering students or not. The second part covers 27 different variables five of which are considered as dependent variables, while the rest are considered independent variables. All the independent variables were created to reflect the three concepts described in the literature review, that is, meanings and related concept, causes and effects of GW, and actions that can be taken to mitigate GW. For simplicity's sake, all the variables were numbered from V1 to V27, and this acronym will be used in the rest of the research. Some of the variables were taken from articles already been mentioned in the literature review. The following table shows these variables and reference, where applicable. These variables will further confirm whether what other researchers found in their research reflects what MCAST students think about this phenomenon.

No.	Question	Reference
V1	GW is inevitable because of the way society works.	
V2	We can all do our part to reduce the effects of GW.	
V3	Students should be taught how to mitigate GW in their course of study.	
V4	GW will increase the jobs on the Maltese islands.	
V5	GW does not affect the way we are living.	
V6	The government should provide incentives to mitigate GW issues.	
V7	There is nothing that can be done to reduce the rise in global temperatures.	
V8	GW is not caused by human intervention; rather, it's just the cycle of the earth.	(Leiserowitz *et al.* 2008)
V9	Students are not interested in studying about the causes and effects of GW.	
V10	Developing countries should take most of the blame for GW issues.	
V11	If I come across information related to alternative sources of energy, I tend to read it.	
V12	Most of the knowledge related to GW and mitigation solutions comes from school.	
V13	The government should increase the electrical and water consumption rates to force people to consume less.	
V14	I will choose my future car depending on type of fuel and lowest consumption rate and not based on money value.	
V15	The amount of rain will increase if global temperatures continue to rise.	
V16	There are no alternatives as to how one can reduce carbon emissions from cars, industries, powers stations, etc.	
V17	For the most part, the government is doing its part to reduce GW.	
V18	I feel a moral duty to do something about GW.	
V19	If my future job will cause environmental problems, I'd rather be unemployed than carrying on causing them.	
V20	Deforestation is increasing due to rise in global temperatures.	(Taber and Taylor 2009)
V21	GW is an opportunity for the people to increase working demand due to new technology aimed at mitigating GW.	(Boyes, Stanisstreet, and Daniel 2004)
V22	I am convinced that GW is happening.	(Leiserowitz *et al.* 2008)
V23	Owners of existing and new developing buildings should make their buildings more energy efficient.	(Leiserowitz *et al.* 2008)
V24	A reduction in industrial and vehicle emissions could mitigate GW.	(Boyes, Stanisstreet, and Daniel 2004)
V25	An increase in renewable resources of energy could mitigate GW.	(Boyes, Stanisstreet, and Daniel 2004)
V26	GWwill cause a rise of illnesses.	(Olarinmoye *et al.* 2014)
V27	An increase in knowledge will result in an overall increase in students' belief about their ability to make a positive impact in relation to GW.	(Taber and Taylor 2009)

Table 1: *Independent and dependent variables*

All the rest of the variables were created to reflect the three concepts as shown in the following figure. As can be observed there are some variables that reflect more than one concept. The independent variables not taken directly from other researchers were created after gathering sufficient knowledge from the literature review.

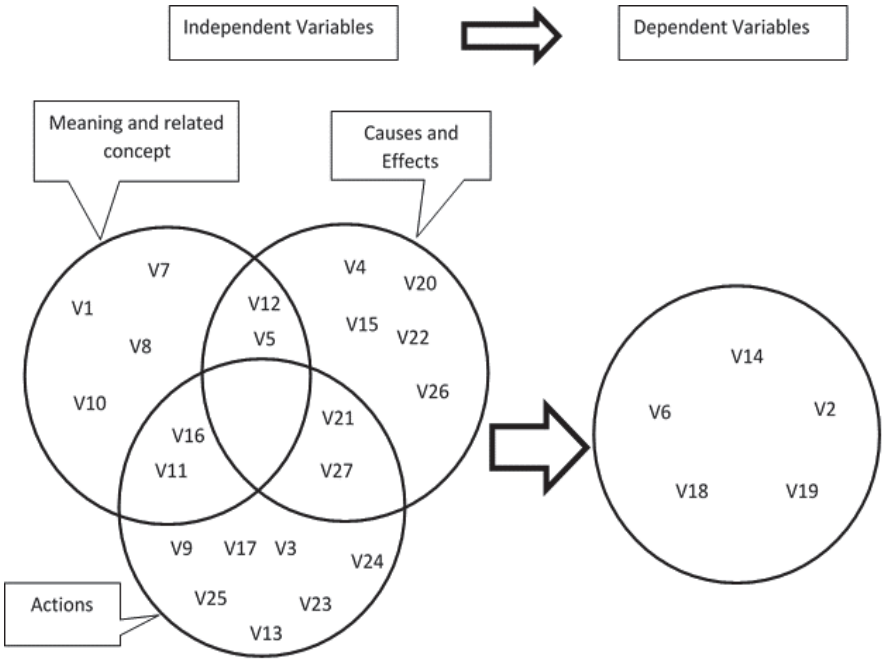


Figure 4: *Mapping of independet and dependent variables*

Enquiring and interpreting the Data

The data was collected from all the students attending MCAST Technical and University Colleges in the 2017–18 scholastic year. In total there were approximately 4,800 students registered in these two colleges in this academic year. The study was considered a cross-sectional study since the findings only represented the results obtained for this academic year. This can be considered as true since such facts tend to change every year, especially when propaganda, politics, and advertisements reinforce these issues. Moreover, the results could also change in future since courses offered at MCAST tend to change periodically depending on the requirement and needs of society. The outcomes of this research could be one possibility why courses could change and thus alter the thinking of future students.

A sample size calculator (Creative Research Systems 1982) from the internet was used to determine the sample size needed for collecting data that reflected all the students within a confidence level of 95% and a margin of error of 10%. The results show that at least 94 respondents needed to be collected to validate the results within the confidence level and margin of error chosen.

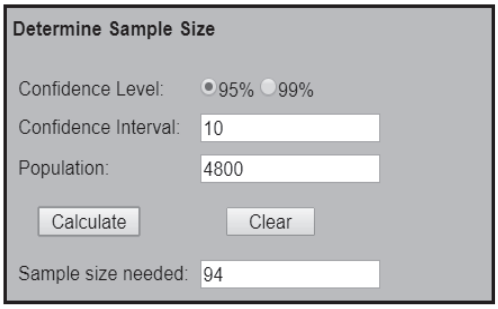


Figure 5: *Sample size calculator (Creative Research Systems 1982)*

The questionnaire was structured by using a 5-point Likert scale to measure the variables. An online survey software program (Google forms) was used to create and disseminate the questionnaire. This software was used due to its advantages, such as a statistical analysis after every respondent uploaded information. All the respondent results can also be downloaded in an Excel spreadsheet. Another advantage is that all the variables are reshuffled before every respondent starts to answer the questions. This guarantees randomness in the variables and avoids any structure in the questionnaire.

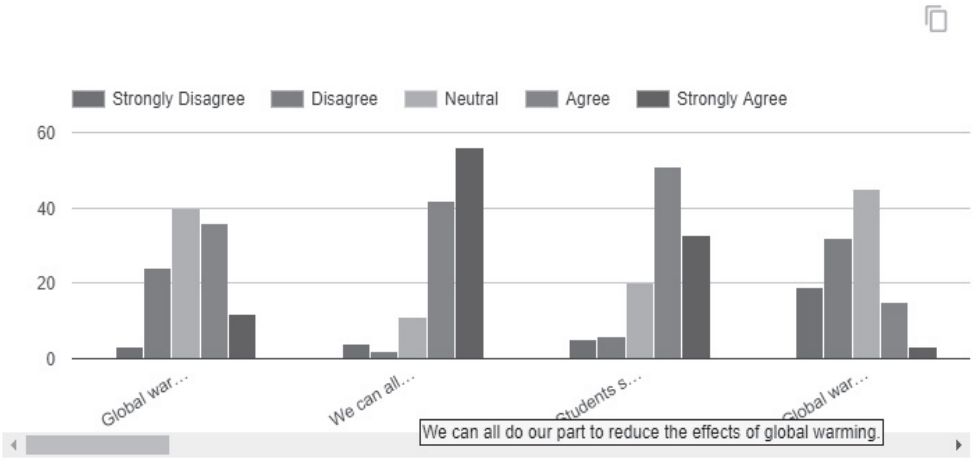


Figure 6: *Visual representation for results created by Google Docs. Questionnaire*

In total 113 respondents were collected within seven days between 21 and 27 July 2018. The first 110 respondents were used to carry out the research work. This reduced the margin of error to 9.4%, thus improving the outcome of the results. To check whether the data changed over time, the first 30 responses were analysed and compared with the last 30 responses. Reliability analysis showed that the last 30 respondents had a Cronbach's Alpha value slightly better than the first 30 respondents. Due to the high consistency of 0.874 and 0.901 respectively, it was decided to accept all 110 readings and continue to develop the analysis further.

Upon starting to analyse the data, it was found that three respondents had a high concentration of unanswered values. It was decided to remove these three samples completely and change them with the next three submitted readings. There was some missing data which was considered as missed at random (MAR) cases. As a result, it was decided to substitute the MAR data with the mean of the variables. IBM SPSS Statistics data editor can perform this task.

The data analysis and interpretation was gathered through an exploratory analysis approach where, by using dimension reduction factor analysis, it was possible to identify the separate dimensions of the structure and then determine the extent to which each variable was explained by each dimension. An exploratory perspective view was considered since using this method one can search for a structure within the set of independent variables. This method served to reduce the variables within the data. The R-Type factor analysis was used in this case. By using scree test criterion, it was possible to find out the number of factors extracted. This technique was used to express the set of variables within few factors. By rotating factors, one can redistribute the variance upon the number of factors chosen. The Varimax approach was used to create a new variable that described a group of common variables. All variables loading high on a factor were combined and their average was taken to represent the new factor. This procedure was used to reduce errors in the original data since all variables were averaged out into one converging factor. Within this analysis, certain variables were dropped to improve the amount of accumulated variance within the first few components.

The last step of the analysis involved linear regression analysis to analyse the relationship between a single dependent variable derived from the average of five variables (see Figure 4) with factors derived from the dimension reduction factor analysis. The reason was to predict which component or components affect highly the dependent variable. The linear regression analysis was used to address the research question as to whether there was a correlation between the data or not.

Analysis of Research Findings

As described in the methodology chapter, the target was to assess the reliability of the data and if it was possible to reduce the number of independent variables by using factor analysis into components that still explain most of the data. After covering some preliminary calculations, it was noticed that results would improve if V10, V12, V15, and V16 are removed from the analysis. The reason behind this was not because such variables do not give reliable information but because all the other variables explain better the data collected. This decision reflected positively in the total amount of variance extracted from the factor analysis. After the four variables were removed, the following results were extracted.

Reliability Statistics Test

After removing four variables, the coefficient of reliability resulted to be a value of 0.781 which is a high Cronbach's Alpha measure. This value does not imply that the measure is unidimensional. It just means that there is a high internal consistency between the variables.

Reliability Statistics

Cronbach's Alpha	N of Items
.781	18

Table 2: *Reliability Statistics table with 4 independent variables removed*

The second step involved performing dimensional reduction factor analysis, to check whether it was possible to reduce the variables into a fewer number of dimensions. It was decided to extract exactly five components instead of relying on eigenvalues greater than 1. Upon performing factor analysis, various tables are displayed. The first table (Table 3) includes the communalities. Communalities indicate the common variance shared by the factors with given variables. Higher communalities indicate that a larger amount of the variance in the variable has been extracted by the factor analysis. In the preliminary calculations, it was noticed that four variables scored lower than 0.5. This time only one variable scored lower than 0.5. This time it was decided not to remove this variable since this variable scored high in the preliminary results; the reason why this time the score is lower is that, out of the remaining 18 variables, this was the least variance amount in the variable to be extracted by the factor analysis that reflected the entire data. The second table (Table 4) refers to how the variance can be explained with fewer components. This test indicates that all the 18 variables can be explained within five components with an eigenvalue greater than one. Together they account for 65.32% of the variability in the original variables.

Communalities

	Initial	Extraction
VAR00001	1.000	.636
VAR00003	1.000	.633
VAR00004	1.000	.663
VAR00005	1.000	.651
VAR00007	1.000	.698
VAR00008	1.000	.679
VAR00009	1.000	.733
VAR00011	1.000	.674
VAR00013	1.000	.556
VAR00017	1.000	.717
VAR00020	1.000	.416
VAR00021	1.000	.543
VAR00022	1.000	.742
VAR00023	1.000	.718
VAR00024	1.000	.788
VAR00025	1.000	.638
VAR00026	1.000	.588
VAR00027	1.000	.686

Extraction Method: Principal Component Analysis.

Table 3: *Table of Communalities with 4 independent variables removed. Yellow cells indicate variables with low communality*

The middle section of Table 4 shows the variance explained by the extracted factors before rotation. The cumulative variability explained by these five components in the extracted solution remained the same from the initial solution. Thus, nothing was lost from the original data. The third section of Table 4 shows the variance explained by the extracted factors after rotation. The rotated factor model makes some adjustments within the first four components, but the last component is left unchanged.

Total Variance Explained

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	5.444	30.247	30.247	5.444	30.247	30.247	5.165	28.693	28.693
2	2.370	13.166	43.413	2.370	13.166	43.413	1.900	10.554	39.247
3	1.577	8.760	52.173	1.577	8.760	52.173	1.693	9.408	48.655
4	1.207	6.705	58.878	1.207	6.705	58.878	1.563	8.686	57.341
5	1.159	6.442	65.320	1.159	6.442	65.320	1.436	7.978	65.320
6	0.998	5.545	70.865						
7	0.741	4.118	74.983						
8	0.694	3.857	78.840						
9	0.632	3.512	82.353						
10	0.579	3.218	85.571						
11	0.503	2.795	88.366						
12	0.470	2.612	90.978						
13	0.356	1.978	92.956						
14	0.325	1.804	94.759						
15	0.303	1.684	96.444						
16	0.287	1.595	98.038						
17	0.184	1.022	99.060						
18	0.169	0.940	100.000						

Extraction Method: Principal Component Analysis.

Table 4: *Total variance explained when four variables were removed within five components*

Figure 7 represents the scree plot of the data. The sharp drop indicates the part where the major components are relevant. In this case, the first four components show a sudden drop from one another. All the rest are in a plateau region. This gives us a better understanding that describing the variables within five components would be enough.

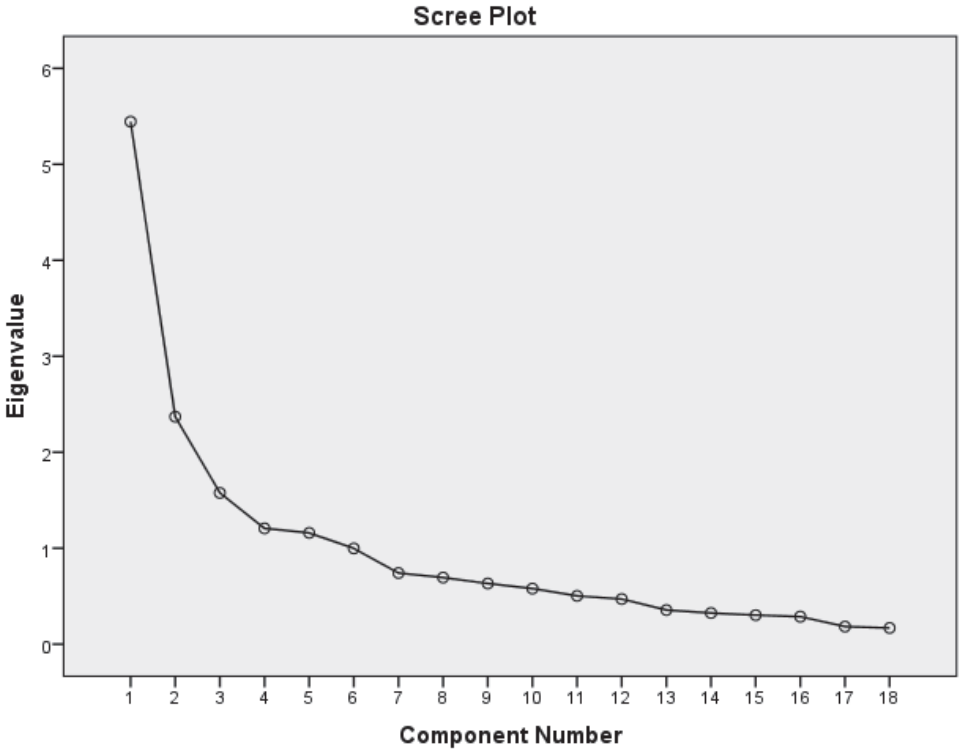


Figure 7: *Scree Plot when four independent variables were removed*

Perhaps the most important table that explains with what the components are correlated is the Rotated Component Matrix (Table 5). The largest number in every row indicates with what the variable is correlated from the components. After four independent variables were removed, the following results showed up. There are eight variables which are correlated with component one. The least uncorrelated here is V11. There are other three variables correlated with the second component of which V20 is the least correlated. Other three variables are correlated with component three of which V8 is the least correlated, two more variables are highly correlated with component four and other two more variables highly correlated with component five. Those who are the least correlated will affect little the results and the general components. Thus, a title given for each component will be related with those who are highly correlated with the variables.

Rotated Component Matrix[a]					
	Component				
	1	2	3	4	5
VAR00023	0.835	0.017	0.128	0.068	-0.004
VAR00022	0.830	0.017	-0.137	0.119	0.141
VAR00027	0.800	-0.031	-0.088	0.180	-0.071
VAR00003	0.752	0.217	0.030	-0.135	-0.043
VAR00026	0.730	0.158	-0.139	0.096	-0.023
VAR00025	0.725	0.090	0.091	-0.160	0.266
VAR00024	0.666	0.400	0.092	-0.397	-0.133
VAR00011	0.551	0.416	-0.070	0.159	-0.409
VAR00004	-0.037	0.697	0.056	0.088	0.407
VAR00021	0.244	0.680	-0.025	0.145	-0.007
VAR00020	0.430	0.449	0.098	-0.136	-0.034
VAR00007	-0.157	0.002	0.815	0.074	0.065
VAR00001	0.375	-0.023	0.688	-0.100	0.108
VAR00008	-0.353	0.421	0.493	0.360	-0.068
VAR00017	0.127	-0.036	0.209	0.810	0.009
VAR00013	0.021	0.359	-0.174	0.629	0.043
VAR00009	0.232	0.087	0.028	-0.001	0.819
VAR00005	-0.404	0.148	0.375	0.178	0.542
Extraction Method: Principal Component Analysis. Rotation Method: Varimax with Kaiser Normalization.					
a. Rotation converged in 6 iterations.					

Table 5: *Rotated component matric when four independent variables were removed. Yellow cells indicate which components are mostly correlated with each variable*

Linear Regression Analysis

Factor analysis gave the opportunity to group the independent variables into five components. The following picture shows how the independent variables were grouped and the name given to each component. For simplicity's sake, the components were marked from F1 to F5. All the dependent variables were also grouped into one component named DV. The name of the component was given according to those variables which had a high contribution for the component. For example, V11 was not really taken into consideration to name the first component.

Grouping enables the averaging of all the independent variables into one component. In fact, every outcome of each component was calculated as the average of the independent variables that contributed to the component.

Now with all the data set as one dependent variable versus five components, it was possible to compute linear regression analysis and to check which out of the five components most influenced the dependent variable.

The main target is to assess the following four assumptions:

- If the data is linear;
- If the data has a normal distribution;
- If there is a low level of multi-collinearity; and
- If there is an adequate level of homoscedasticity.

Satisfying all these four components would mean that the hypothesis is correct.

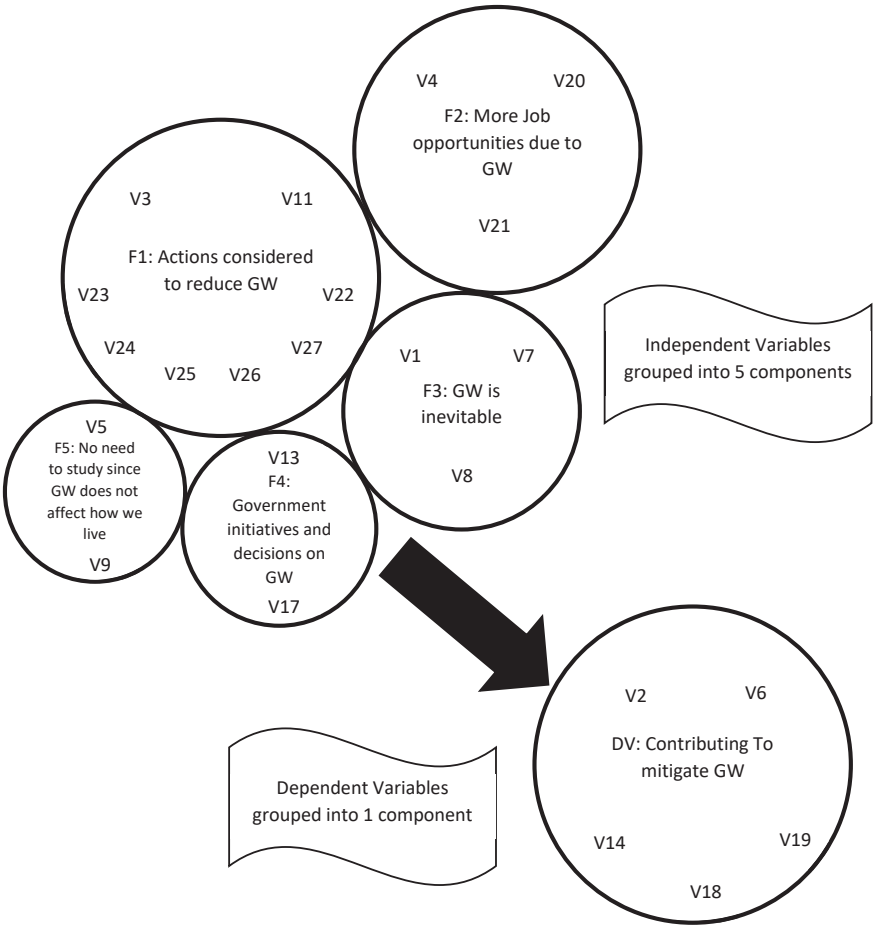


Figure 8: *Independent and dependent variables grouped into components*

Upon running the test all these tables are displayed.

ANOVA[a]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	39.799	5	7.960	46.906	0.000[b]
	Residual	17.648	104	0.170		
	Total	57.448	109			

a. Dependent Variable: DV

b. Predictors: (Constant), F5, F4, F1, F3, F2

Table 6: *Linear Regression ANOVA*

The ANOVA table reports a significant F statistic, indicating that the model is 46.9 times better than if the averages of the independent variables had only been compared to the average of the dependent variable.

Model Summary[b]

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate	Change Statistics				
					R Square Change	F Change	df1	df2	Sig. F Change
1	0.832[a]	0.693	0.678	0.41194	0.693	46.906	5	104	0.000

a. Predictors: (Constant), F5, F4, F1, F3, F2

b. Dependent Variable: DV

Table 7: *Linear Regression Model Summary*

The regression does a good job of modelling the contribution to mitigating GW. 83% of the variation in contributing to mitigate GW is explained by the model. An R-Square value of 0.693 means that approximately 69% of contributing to mitigate GW is explained by all the independent variables together.

The Significance F Change result means that the chance that this answer happened by chance is 0. Thus, the relationship is 100% there.

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.	Correlations			Collinearity Statistics	
		B	Std. Error	Beta			Zero-order	Partial	Part	Tolerance	VIF
a.	(Constant)	0.101	0.282		0.358	0.721					
	F1	0.785	0.060	0.815	13.150	0.000	0.809	0.790	0.715	0.768	1.301
	F2	-0.048	0.061	-0.051	-0.788	0.432	0.361	-0.077	-0.043	0.706	1.416
	F3	0.046	0.059	0.046	0.775	0.440	0.025	0.076	0.042	0.855	1.169
	F4	0.164	0.048	0.193	3.397	0.001	0.254	0.316	0.185	0.911	1.098
	F5	-0.017	0.054	-0.019	-0.323	0.747	-0.077	-0.032	-0.018	0.851	1.176

a. Dependent Variable: DV

Table 8: *Linear Regression Coefficients*

Looking at the coefficients table one can notice that F1 has a high Beta and high t and the significance is 0%. This component is the one that is mostly affecting the dependent variable. The next one close to him is F4 but then it has low Beta and a significance of 0.1%. This means that F1 is the one which contributes the most for the model because it has the largest absolute standardized coefficient.

The second section of the coefficients table shows that there are no problems with multicollinearity. For most predictors, the values of the partial and part correlations are almost identical to the zero-order correlation. This means that the variance in contributing to mitigate GW, which is mostly explained by the actions considered to reduce GW, is not explained by the other variables.

The last section in Table 8 explains the collinearity statistics of the data. The tolerance is the percentage of the variance in a given component that cannot be explained by the other predictors. The results show that approximately 70%–86% of the variance in a given component cannot be explained by the other components. This also shows that there is a very low multicollinearity in the variables. A variance inflation factor (VIF) greater than two is usually considered problematic. In this case all components have a VIF smaller than two.

Collinearity Diagnostics[a]

Model	Eigenvalue	Condition Index	Variance Proportions (Constant)	F1	F2	F3	F4	F5
1	5.727	1.000	0.00	0.00	0.00	0.00	0.00	0.00
2	0.098	7.661	0.00	0.03	0.03	0.08	0.14	0.50
3	0.071	9.003	0.01	0.08	0.08	0.04	0.73	0.00
4	0.058	9.908	0.00	0.00	0.01	0.78	0.08	0.40
5	0.034	12.967	0.12	0.12	0.80	0.03	0.00	0.00
6	0.013	21.126	0.87	0.77	0.09	0.07	0.04	0.10

a. Dependent Variable: DV

Table 9: *Linear Regression Collinearity Diagnostics*

The collinearity diagnostics table confirms that there are no serious problems with multicollinearity. Only one eigenvalue is close to zero, indicating that the predictors are not intercorrelated between them. The condition indices also conclude that there are no serious problems in the results since usually a number greater than 30 indicates serious problems. None of the results displayed are greater than 30.

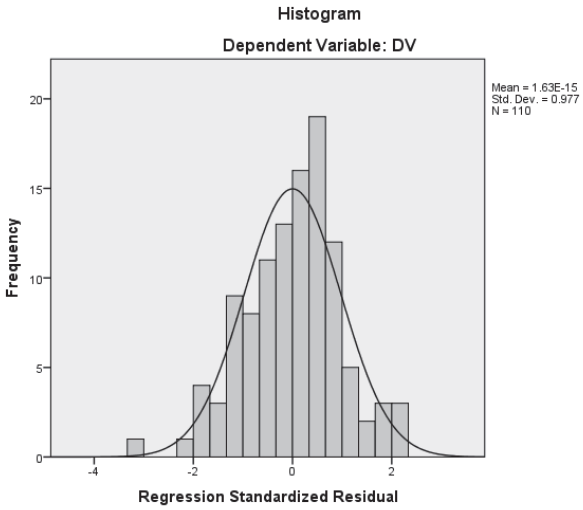


Figure 9: *Linear Regression Histogram Chart*

The histogram follows the shape of a normal curve which means that the data is normally distributed as well. The final assumption to be checked is the normality of the error term of the variate by visually examining the normal probability plots of the residuals. Figure 10 shows the values fall along the diagonal with no substantial or systematic departures; thus, the residuals are considered to represent a normal distribution. The regression variate is found to meet the assumption of normality.

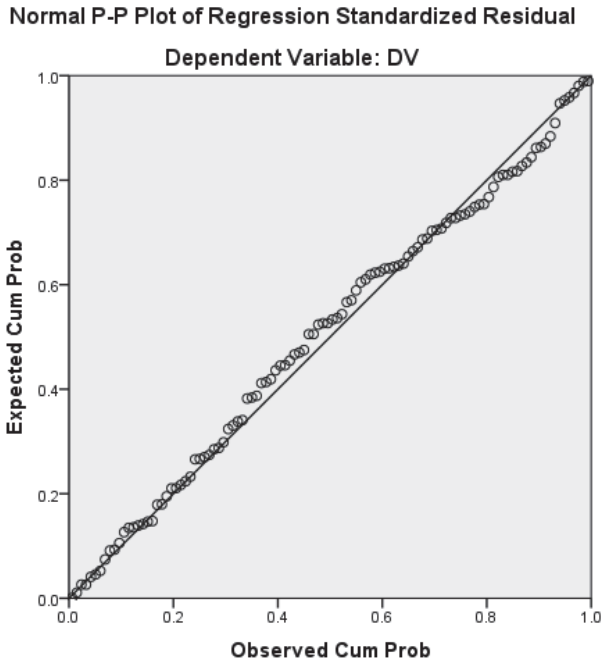


Figure 10: *Linear Regression: Normal Probability Plot Standardized Residuals*

Since component F1 had a high correlation with the dependent variable DV, it was decided to plot the graph between these two components to check the linear regression between them. As clearly shown in Figure 33, the R-Square value obtained means that approximately 65% of contributing towards mitigating GW is explained by the actions considered to reduce GW. The gradient also shows that the dependent variable is directly proportional to the independent variable.

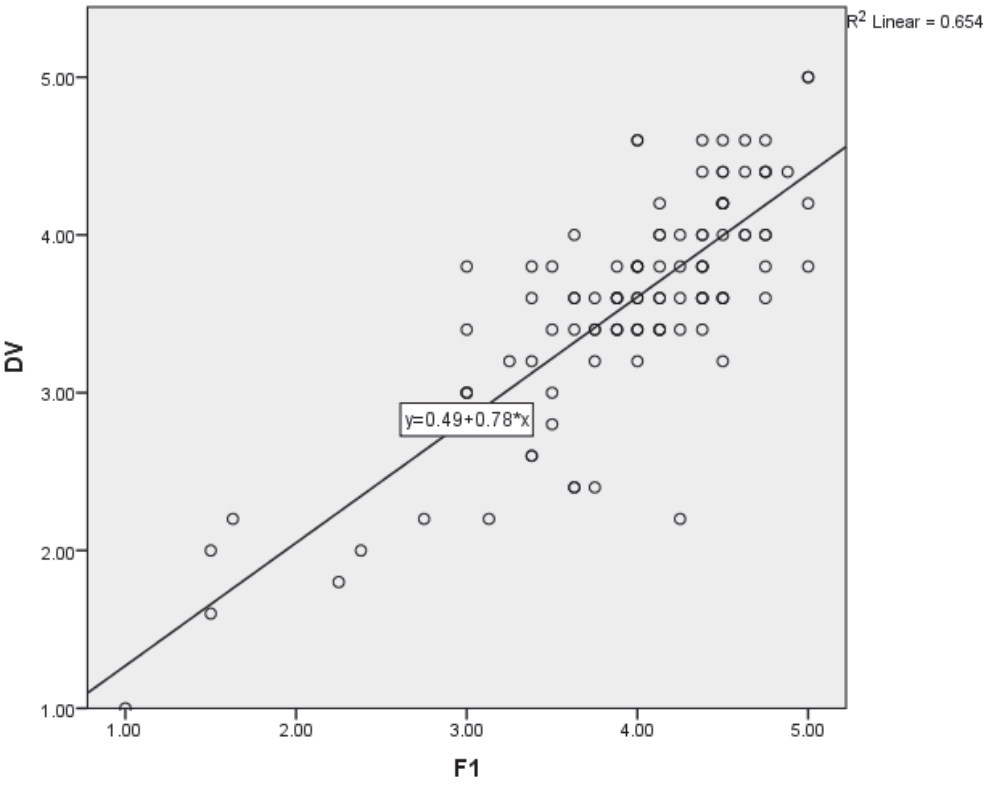


Figure 11: *Graph of Actions Considered vs Contribution to mitigate GW*

All these outcomes show that there is a high correlation between the knowledge obtained through the course of study with respect to contributing to mitigating GW. The knowledge is mostly being addressed by the actions that the respondents wish to pursue; one respondent thinks that owners of existing and new buildings should make their buildings more energy efficient. There is a strong belief that, if knowledge in relation to GW is increased, the respondents would be in a better position to make a positive impact.

Conclusion and Observations

Malta, like many other countries, is vulnerable to the adverse effects of GW. Being a small country and surrounded by the Mediterranean Sea, and at an approximate longitude of 36° North, it has a temperate climate mostly influenced by the hot climate coming from the desert to the south and a mild winter which is mainly influenced by shorter days. GW is affecting Malta's way of life. This result was clear and supported by the respondents in this research. That is why knowledge is so important at this stage: so that the necessary means will be acquired to help the climate or at least try to cope with CC.

Exploratory Analysis

This research clearly evidenced the fact that there is a strong correlation between knowledge obtained through the course of study with respect to contributing to mitigate GW. In trying to understand which knowledge the respondents think that might influence them most, multivariate techniques had to be used, first to identify the main components of the variables by using factor analysis and then, after grouping, by using linear regression analysis to check which component mostly influences the decision to contribute to mitigate GW. This had to be done because from the literature reviews it was found that knowledge was described as having three different aspects, namely, meaning and related concepts, causes and effect, and type of actions. This does not necessarily mean that the respondents still need to learn all these. Rather, it could only be one aspect that the respondents are interested in gathering more knowledge about. This was, in fact, what the results showed in the exploratory analysis. As seen in Figure 8 and hence in all the calculations covered afterwards, the part which mostly affect the contribution towards mitigating global warming was the actions that can be considered to reduce GW. In total there were eight variables addressing this component, of which six were already addressed as being related to actions in the literature review. Four out of these six were already tested by other researchers as well. Basically, these six variables concern what the respondents would like, such as talking how to mitigate GW in their course of study, reading article-related subjects, seeing more owners of existing or new buildings making their houses more efficient, and sharing a belief that reducing carbon emissions, increasing renewable sources of energy, and studying on GW-related subjects will all make a positive impact towards reducing the effects of GW. All this clearly indicates that there is a positive approach to contributing to mitigating global warming.

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The Broken Rainbow: Same-Sex Intimate Partner Violence

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Abstract: This paper focuses on same-sex intimate partner violence (SSIPV), the effects on the victim within a same-sex relationship, the services available locally for LGB victims, and the barriers encountered by the victims within the services. It explores whether the services offering aid to lesbian, gay, and bisexual (LGB) victims of same-sex intimate partner relationships are effective, since locally there is not a service that offers specific SSIPV support yet. It inquires if the services are gay-affirmative by implementing gay-affirmative strategies, policies, and procedures. It aims to create awareness that same-sex intimate partner violence takes place so as to break the silence in relation to this matter locally. The paper also outlines the importance of having both LGBTIQ services and DV services for the victims to turn to, services they feel comfortable with and can disclose to.

Keywords: Same-sex intimate partner violence (SSIPV), domestic violence victims, domestic violence services, awareness, Gay-affirmative theory, LGBTIQ community, LGBTIQ Services.

Abbreviations:

- **SSIPV** – Same-sex Intimate Partner Violence
- **IPV** – Intimate Partner Violence
- **DV** – Domestic Violence
- **LGBTIQ** – Lesbian, Gay, Bisexual, Trans, Intersex, Queer
- **LGB** – Lesbian, Gay, Bisexual
- **LB** – Lesbian, Bisexual
- **GAT** – Gay-affirmative theory/ therapy or LGBTIQ affirmative therapy
- **GSDT** – Gender and Sexual Diversity Therapy

SSIPV is defined as a 'pattern of violent or coercive behaviours whereby a lesbian or gay man seeks to control the thoughts, beliefs, or conduct of an intimate partner or to punish the intimate for resisting the perpetrator's control' (Hart 1986 as cited by J. Potoczniak *et al*. 2003: 261).

Insight of SSIPV

About fifty years ago, same-sex relationships were not included when researchers and feminist activists focused on IPV because the issue of IPV or DV was viewed as 'wife

abuse' in both patriarchal and hetero-normative marriage and society. At the time LGB individuals were mostly closeted since same-sex attraction was viewed as a pathological and deviant behaviour, sinful, and/or a mental disorder or sickness; prior to the 1970s same-sex relationships were illegal in most countries (Potoczniak *et al.* 2003: 252–9).

The first book regarding lesbian violence was first published in 1986, while in relation to gay men and abuse, the process was slower and started in the 90s. Even today, since SSIPV is not particularly visible and spoken about, society does not give it its due importance and it remains a topic which still needs to be explored further, even though it is a growing issue within the LGB community (Baker *et al*. 2012: 12). One possible reason may be that society upholds the myth that only men are perpetrators, women are victims, and violence is only likely to take place in heterosexual relationships. SSIPV also removes gender-based assumptions in relation to manifestations of IPV, its cultural narratives, and stereotypes (ibid.). Society tends to view same-sex violence as not a common issue or that it takes place at a lower rate when compared to heterosexual IPV. Locally, it is still a silent topic and is not well addressed and researched (ibid.).

The Law within The Local Context

The Gender-Based Violence and Domestic Violence Act 2017 which was enacted in April 2018 was a breakthrough as it does not focus only on DV but also on gender-based DV. This legislation reduces the chance of loopholes within systems owing to its accuracy in definitions. SSIPV victims are now also further protected as any other family and victim within society, irrespective of gender (Caruana 2017: 1). The Act protects the rights of victims without discrimination on grounds such as association with a minority; gender expression or gender identity; sex or sex characteristics; and sexual orientation (Services 2016: 3–4).

The Gay-Affirmative Theory (GAT)

The GAT which is also known as LGBTIQ affirmative therapy 'affirms LGB identities as an equally positive human experience and expression to heterosexual identity' was published by Davies (1990) who aimed to rectify the discriminatory psychotherapeutic practice LGBTIQ individuals face and have faced in previous years (Davies & Neal 2000: 2). Offering an effective service provision within the health and social care field is one of the most important factors. When working with SSIPV victims, a good service provision is highly important as clients have usually experienced trauma which may have been ongoing for various years and it may have been difficult for them to talk about abuse (Ruckle 2013: 4). GAT can be carried out by implementing strategies within the DV service provision or/and with professionals who are willing to perform in line with such strategies (Davies & Neal 2000: 2).

Literature

Prevalence

Modern studies indicate that SSIPV seems to be increasing. Some studies affirm that it is even more likely to take place and in even higher numbers than amongst heterosexual couples (Banks & Fedewa 2012: 194–205). It affects one-quarter to nearly three-quarters of LGB individuals; 25% to 33% of LGB individuals are abused by their partners. This data is comparable to reported rates of IPV occurring in abusive heterosexual relationships; still data is at best only an estimate of the phenomenon (ibid.)

Studies show that, amongst the LGB community, bisexual female women seem to be at more at risk, both in heterosexual and lesbian relationships, owing to the role that jealousy plays in IPV which may lead to more frequent triggers of violence (Banks & Fedewa 2012: 196). Banks and Fedewa suggest that further studies need to be carried out to gain a better understanding of the dynamics (ibid.). Recent studies of IPV amongst gay men suggest that abuse among gay men has doubled (Duke & Davidson 2009: 796–816). A reason for this may be that gay men might find themselves torn between the dichotomy of affirming a positive gay identity and adhering to society's masculine norms; as a result, one of the individuals within the relationship has the same probability of becoming a batterer.

Research shows that the studies about IPV need consider the following aspects. In most studies about IPV respondents are not asked about their sexual orientation; as a result, the gender of the partner is assumed and most of the time grouped with opposite-sex IPV (Stiles-Shields 2015: 201). Furthermore, even though visibility and acceptance of LGB individuals and same-sex relationships has increased, some individuals may not feel comfortable disclosing their identity. Fluidity also affects the survey, as individuals marking male or female may not actually fit in those binary boxes. Another aspect to be taken in consideration when researching SSIPV is that not everyone who engages in same-sex relationships, identifies as gay[1] and the gender of a current partner may not reflect the gender of previous partners (ibid).

Myths

Existing myths about the LGB community and SSIPV cause further damage for same-sex victims as they may create barriers against receiving and providing adequate service and aid (Duke & Davidson 2009: 798–9). One myth about lesbian relationships is that these relationships are a Lesbian Utopia or that relationships between women constitute ideal egalitarian relationships. A lesbian couple can be considered to project a false sense of safety (ibid.). The idea of an abusive lesbian relationship may not be seriously considered, as it challenges the notion of a 'safe lifestyle' among women; another myth is that women cannot be raped by other women (Stiles-Shields 2015: 205).

1 Research up to date is impacted by how the researcher defines sexual orientation. One might be involved in same-sex relationships but does not necessarily identify as LGB (Stiles-Shields & Carroll 2014: 205), might be still questioning, or is Bi or is MSM (Duke & Davidson 2009: 796 & Danica et al. 2006: 798).

Furthermore, women fighting with other women and men fighting with other men is considered mutual, since society believes that LGB individuals cannot be in 'real' abusive relationships. The fact that one rarely hears about SSIPV leads to the assumption that SSIPV does not occur (Duke & Davidson 2009: 796–9). The stereotype that gay men are effeminate and caring also leads to the myth which minimizes the public perception that gay men can also be violent and abusive (ibid.).

Male Hegemony

According to Connell and Messerschmidt (2005), 'hegemonic masculinity can be best understood as a way for men to practise continued domination over women through not only a set of perceived expectations for what is necessary to be masculine, but also actions taken on others to assert power'. Therefore, men within society are 'expected' to fight back, including within a relationship, as both of the individuals were brought up with that culture message. Hence two men fighting may not be seen as abusive but rather something that they would do. In addition, the myth of hypersexuality also creates a false impression that sexual abuse is not present between men, since there is the perception that man always want or are willing to participate in sexual activities (Duke & Davidson 2009: 797).

Obstacles in seeking Help

Research regarding aid, in relation to service providers and professionals that can offer assistance within this field, remains scarce (Banks & Fedewa 2012: 194–205). Research states that services and professionals have different attitudes towards SSIPV when compared to heterosexual IPV; professionals tend to view SSIPV as being more negative and harmful. Such views or lack of support may be due to a heteronormative society, stigma, lack of knowledge regarding strategies and preventive care, prejudice, and/or homophobia (Madera & Toro-Alfonso 2005: 73). Some research also shows that professionals perceive SSIPV as less serious and not likely to get worse and such an attitude may influence the delivery of the service providers and act as a barrier for LGB victims (Banks & Fedewa 2012: 194–205). Other studies also state that lesbian and bisexual women within shelters tend to be referred to as, and are verbally harassed as, 'the battered women', masculinized butches, or 'cat fights'. Gay male victims are viewed as the feminized gay male partner, which tends to 'minimize' the violence occurred, or the relationship is degraded by insinuating that they are promiscuous when compared to heterosexual relationships or marriages (Younglove et al. 2002: 761–72). Intersectionality is a further potential barrier to receiving the needed help and leads to multiple oppressions (Duke & Davidson 2009: 797). LGB victims may not seek help or disclose the negative aspects of their relationship as they may fear that it will have a negative impact on their community (Baker *et al*. 2012: 3–4). Additionally, victims hold back because of heteronormative societal perceptions of a same-sex relationships, which are held as negative. Furthermore, poor media representation is a barrier which serves to restrict individuals from gaining information about same-sex relationships and support (Fisher *et al.* 2007: 167–75).

LGB victims may find it harder to leave, owing to the perpetrators threatening to expose their sexual orientation, if it is unknown, to family, friends, and even work colleagues, thereby affecting job security and family dynamics/relationships (Peterman & Dixon 2003: 9). Whilst same-sex couples deal with the further stress of being part of a sexual minority, because of the stigma attached, they find it difficult to open up about the abuse as

society may perpetuate the stereotype that homosexuality is a disease or because same-sex relationships are viewed as not 'natural' or are referred to as 'dysfunctional'(ibid.). Victims may also find it difficult to open up with their friends about the abuse due to the sharing of mutual friends within the LGB community where disclosure may lead to embarrassment, abandonment, and fear of ending up without a relationship and friends (The Gender Centre 2015: 1). Furthermore, the victim's friends may have been the perpetrator's friends first and the only support the victim has acquired. The victims may also find it difficult to convince their friends that their partner is a perpetrator, as they might be old, trusted friends of the perpetrator (Duke & Davidson 2009: 790–800).

Lesbians tend to develop trust issues during and after the abuse and strive more to make their partner happy in the hope that the perpetrator will change (Evans 2006: 2–4). Gay perpetrators may blackmail an HIV-positive victim and hide his medication (Strudwick 2016: 1–2). Whilst gay victims struggle because of the stigma related to masculinity and social expectation, they may, in turn, be labelled further for not defending themselves. A lack of policies to safeguard them also serves as an obstacle (Dunne 2014: 2–5). Bisexual individuals carry a 'double marginality' owing to the ideology of the LGB community which may not include them as equal members within the community, whilst the heterosexual community stigmatize bisexuals due to their experiencing same-sex attraction (Duke & Davidson 2009: 790–800). Additionally, victims who have children within the relationship may decide to stay on due to a reluctance to raise the children alone or leave them behind (Short *et al*. 2000: 7–10). Researchers state that the stigma attached to LGB couples can increase SSIPV (Baker *et al*. 2012: 12).

These factors can all act as a barrier when it comes to aiding LGB victims and perpetrators; they can affect the vital role of reporting or referring to services owing to fear of accusations of discrimination, maltreatment, or blame or, indeed, a professional 'outing' the client without asking (King 2014: 2–3). SSIPV victims who are not 'out' as yet might feel as if they are living in a 'double closet' since, when seeking aid, they have to state that they identify themselves as LGB and that they are in an abusive relationship, which may increase isolation, helplessness, and shame (Duke & Davidson 2009: 780). 'This phenomenon needs to be brought out of the closet too' (Potoczniak *et al*. 2003).

Lack of Services for Male Victims

Locally there are no shelters that specifically target male victims of abuse; similarly although the Domestic Violence Unit does not only work with women, its campaigns most of the time target and portray females as victims (Scicluna 2015: 74). Having said that, the DVU does offer help to male victims when needed. However, male gay victims might struggle further owing to this overall lack (Peterman & Dixon 2003: 9).

GAT

GAT makes use of traditional psychotherapeutic methods whilst proceeding from a non-traditional perspective (Davies & Neal 2000: 4). Its aim is to achieve positive frameworks which are affirmative for LGB identities and should be implemented in practice to rectify discriminatory psychotherapeutic practices/oppression that LGBTIQ individuals may have faced in past years (Langdridge 2014: 160–73). This theory gives an insight into the client's shame and guilt, tackles the client's strength, and gets involved (ibid.), serving as a model to provide culturally competent services to LGB individuals. GAT does not

prescribe a particular method of practice but suggests certain principles as guides for practice. It can be used in any field or setting and with different client systems: individual, group, couple, and family treatment (Crisp & McCave 2007: 19).

Professionals making use of this theory are expected to affirm an LGB identity as positive although this does not mean pushing the individual towards it, as some myths state. LGBTIQ-affirmative practices are vital when working with SSIPV victims as it is common for such clients to receive an ineffective service due to discrimination (University of Nottingham, 1990: 3). Society frequently ignores the stressors that living in a heterosexist society brings and services may fail to cater for the needs of LGBTIQ individuals. If these needs and negative life experiences are not addressed, they may affect the client's present issues, add stigma, and result in poor mental health which may lead to depression (Langdridge 2014: 160–73.).

GAT & GSDT

Since 2012 GAT has moved towards change seeking a way forward to include everyone after it had been observed that it focused only on gay individuals; it transitioned to Gender and Sexual Diversity Therapy (GSDT). GSDT includes asexuality, polyamory, trans-individualism, and celibacy and therefore it focuses on all aspects of gender and sexual diversities (Cormier-Otaño & Davies 2012: 7–8). GAT and GSDT help individuals to better understand gender and sexual minorities, and the discrimination and stigma they may experience (Guay 2013: 1–2). It aids professionals to work through heteronormative biases/prejudices and, as a result, tackle these biases inherited by mainstream cultures, whilst gaining knowledge and ability to support all aspects and forms of gender and sexual diversities and thus perform effectively when working with LGB clients (Cormier-Otaño & Davies 2012: 7–8). LGBTIQ professionals themselves may have prejudices and stereotypes which may be a barrier to offering an affirmative service and are advised to work on their biases also (Wheeler 2006: 62–7).

GSDT Strategies that can be implemented to improve the Service-Provision

Policies

An equality policy requires team members to be ethically affirmative; this will ensure all service-users are treated in an equal and dignified way (Edinburgh 2013: 16). Professionals are to follow this policy by implementing it in their performance. Consequently service-users can be referred to by their preferred pronoun. This can serve as a protective factor and give a sense of belonging (Crisp & McCave 2007: 19). Further policies to conform to the introduction of the latest laws are also crucial. Monitoring by the manager is essential to see that professionals are abiding to these policies and who must take note of any malpractice.

Safe Space

Creating a safe space/environment for SSIPV victims within the shelter/service can easily be set up by identifying an area such as a living room and placing a sticker indicating 'safe space' along with a rainbow. Service-users will be able to safely discuss issues within the

setting, whilst being themselves. The management can also establish an agreement with an LGBT-affirmative therapist who can attend the setting-up and carrying-out an activity and have group discussion or one-to-one interactions with LGB clients to dig deeper into issues (Davies & Neal 2000: 4).

Training & seminars

Offering training is important, as employees will be able to reflect and become aware of the how culture affects their behaviour at work. Giving employees an awareness questionnaire during training will help them think and relate to their personal beliefs/ stereotypes (Ruckle 2013). Training can also aid teamwork between employees as they can assist one another to learn further about transphobia, homophobia, and gender identity. Training can also aid knowledge on sexual orientation issues and unique barriers LGB individuals face and eventually combat discrimination from other external professionals or service-users (Meyer & Bayer 2013: 6–8). Moreover, training and seminars help the team to become culturally competent. For this to happen, a knowledge base of attitudes, tools, and skills sets must become key elements; these can embrace terminology; diversity; community resources and services; coming out; and dynamics within SSIPV. This also aids awareness of the myths and barriers that exist about the LGBT community and should result in team members gaining a wider perspective (Crisp & McCave 2007: 19).

Gender-Neutral Bathrooms/Spaces

This will offer a safe facility for the service-users and prevent intimidating and unsafe situations. This may be a financial burden to implement and may put a burden on donors as they might not agree. Management should be prepared for such situations and plan ahead (Ard MD & MD 2010: 101–12).

Forms/Documents

In admission and any other forms, having a blank option in the preferred-gender section and asking for preferred pronoun is essential as it is the right of the service-user and adheres to the law which professionals will immediately become familiar with. The management should keep records of discriminatory cases by employees on the grounds of transphobia, biphobia, and homophobia which should be kept for future reference and as back-up (ibid.).

Collaboration

The management collaborating and networking with LGBTIQ groups, such as MGRM and the Rainbow Support Service, should turn to them for aid, material, and interventions. This will also help employees to get involved and get to know the spectrum further (MGRM 2016: 1). Cross-collaborations among DV services, LGBTIQ services, health-care settings, and the law enforcement agencies would be valuable.

Campaigns

It is necessary to identify ways how the organization can outreach victims of SSIPV and promote awareness about SSIPV by carrying out campaigns, including use of pictures of same-sex couples, inclusive messages, neutral vocabulary, and relevant information regarding SSIPV. These can be issued as posters, flyers, and business cards and distributed on their websites, on premises, and in public locations to aid awareness, acceptance, tolerance, and highlight outreach services (Duke & Davidson 2009: 796–800).

Monitoring

Carrying out monitoring by providing a questionnaire for LGB victims, who remain anonymous due to ethical reasons within shelters and services, to obtain their feedback about the service regarding LGBTIQ affirmative can also be implemented, whilst evaluating the inclusivity of the organization and/or practice (Pennant *et al.* 2009:1).

Inclusive Environment

Creating a more inclusive environment by eliminating the 'us versus them' mindset and by using more inclusive language and visuals, whilst encouraging other team members to become advocates and challenge stereotypes and heteronormative and cisnormative ideas would be a positive forward step (Duke & Davidson 2009: 796–800)**.**

The above strategies are important for the service provision as they do not only positively affect the LGB victims within the services but also the organization's reputation, which encourages ripple effects and helps prevent inequality amongst a particular group of clients (ibid.) .

Research Methodology

Owing to the lack of local literature in relation to SSIPV, one aim of the researcher was to explore whether the services offered locally are effective for LGB victims and how they can improve the strategies implemented. To explore this, the methodology below was used.

Research Design

The qualitative rather than quantitative research method was chosen as it aims to get a deeper meaning of particular human experiences and generate theoretically richer observations that are not easily reduced to numbers (Rubin & Babbie 2015: 204–8)*.* To be able to answer the research question, the researcher wanted to obtain an insight into the participants' experiences when working within the DV and/or LGBTQ field and to quantify the professional's opinions and attitudes whilst gathering local information regarding SSIPV.

Sampling Method

'Purposeful sampling is widely used in qualitative research for the identification and selection of information-rich cases related to the phenomenon of interest' (Palinkas *et al.*

2013: 3). Purposeful sampling was used for all the interviews with the professionals who had to work within a shelter/service with victims of DV and/or cases with SSIPV victims and were recruited according to the researcher's judgement regarding the elements of the participants and the main aim of the study (Rubin & Babbie 2015: 204–8). This was also used with the social worker from the specific LGBTIQ service chosen, enabling the researcher to get information-rich cases in relation to the phenomenon of SSIPV (ibid.: 3).

Data Collection

The researcher's main tool to carry out the data collection was face-to-face semi-structured interviews which were selected owing to their planned structure, enabling the researcher to the interview-guide to make sure all the outcomes were tackled (Gill *et al.* 2008: 403–4). Furthermore, such interviews lead the researcher to dig deeper and get in-depth direct information. This method enabled flexibility responses from the professionals interviewed, whilst allowing them to freely state their experience in a conversational manner.

Six interviews were carried out with different settings who offer support to individuals experiencing IPV and to service providers who work with LGBTIQ service users. During the interviews the researcher inquired about the experience the interviewees had when working with SSIPV victims, if they had ever worked with clients who experienced SSIPV, and if they had ever training regarding the GAT theory, SSIPV, or LGBT terminologies, as well as the way forward as a setting. Since there are not any shelters for male DV victims as yet, an interview with a local service that offers aid to such victims was carried out, to understand the process involved better.

Data Analysis

Thematic analysis was used to analyse the data, as it is a categorizing strategy for qualitative researches, whilst it best fits the researcher's aims as the data would be provided in an organised way (Boyatzis 1998: 5). Moreover, the results found regarding the services could be compared when using this method (Braun & Clarke 2006: 6–9). Thematic analysis required the audio-recorded responses to be transcribed, coded, and transformed into themes whilst also made it possible for the researcher to compare the evidence found (Alhojailan 2012: 14–17). The transcripts were essential, as they are a crucial step to initiate the data analysis (King & Horrocks 2010: 10–14).

The researcher also used exploration as one of the main aims of the study to explore the services offered to SSIPV victims locally. Evaluation was also used as another aim of this research is to obtain an insight into the effectiveness of training within the DV services and shelters in relation to SSIPV and LGB knowledge-based training.

Results & Data Analysis

The main emergent themes include:

Collaborating with Other Services, Organizations, & Shelters

All of the services collaborate with Appoġġ or have collaborated with each other at one point or another when tackling different cases. It was implied that further networking and collaboration is needed the services, especially between the LGBTIQ support service and the DV shelters and services to work further on SSIPV. The LGBTIQ support service has the knowledge and expertise regarding the LGB community, whilst the DV services and shelters have the expertise on DV dynamics. Therefore, further collaboration can build a bridge between both regarding SSIPV.

Knowledge about SSIPV

Professionals' knowledge in relation to SSIPV is mostly lacking and they believe that SSIPV will still to be an issue in the future. On the contrary, knowledgeable professionals remarked that SSIPV is different when compared to IPV, owing to different dynamics within the relationship (homophobia, invisibility, lack of awareness). This was in line with the literature studied and shows that lack of knowledge about SSIPV can affect LGB victims who might not be receiving adequate aid from the services and shelters.

The Service Provision & SSIPV

Some of the services had worked with SSIPV victims, whilst others never encountered SSIPV cases. None of the shelters and services interviewed have different arrangements or practices when working with SSIPV victims. Failing at providing an affirmative practice can lead to further stressors caused by a heterosexist society, stigma, discrimination, depression, and poor mental health. It resulted that while one of the participants stated that SSIPV victims are treated equally, as any other service-user, they then contradicted this by stating these victims had a 'condition'. This sets doubt on whether they really offer an equal service. Furthermore, referring to sexual orientation as a 'condition' nowadays, especially within the health and social care field, is unacceptable. This continued to reveal that knowledge and training are needed, even when talking about LGBTIQ terminologies, let alone SSIPV.

Barriers faced by SSIPV Victims

There are barriers within the shelters, as LGB victims come last, with priority being first given to heterosexual women and their children. Managers tend to try their utmost to overcome the barriers encountered by LGB victims and other service users who might who discriminate against them. This might help to make SSIPV victims feel protected and valued since the professionals try to face the barriers encountered on a micro-level. On the other hand, the results also show that, on a macro-level, the primary barriers include a heteronormative society, lack of awareness and campaigns, as well as the double closet for SSIPV victims; they must face society, 'come out' and, then, state that they are also in an abusive relationship.

Training regarding LGBTIQ Individuals & Knowledge regarding GAT

Training is offered by the LGBTIQ support service and demand for such training has been increasing rapidly with professionals and educators. The training focuses on LGBTIQ terminologies and effective GAT practices and strategies. It seems that SSIPV is also mentioned, depending on the context of the training given. However, there is a lack of training within services and shelters with most participants not being aware of GAT. From the results gathered, it was also evident that none of the DV services nor shelters are implementing GAT strategies within their practice and management systems.

The Way Forward

The management of the services and shelters, with the exception of one service, do not have a specific plan as a way forward regarding SSIPV. The reasoning behind this is apparently because they have encountered only a few cases.

Main Overall Finding

The findings of the study do not only show the importance of the awareness and knowledge needed to work to reach the goal that proves that SSIPV does exist, but also envisage why LGB victims do not turn to services, which was a common finding amongst all the participants. Therefore, if SSIPV takes place in Malta, why aren't the victims coming forward to seek aid? According to Duke & Davidson (2009), one obstacle in seeking help was the lack of information and awareness about IPV within the LGBTIQ community. Participants felt that they lacked the language to describe the relationship and identify the abuse, which made them feel isolated and unprepared to handle the abuse they were facing, as well as experiencing 'invisibility, homophobia, and lack of understanding of the unique safety concerns in a close-knit community' (Peterman & Dixon 2003: 10–13) which could be the case on a local level.

Implications of the Study

Limitations within the Study

Lack of Local Research regarding SSIPV

A primary limitation included the lack of previous research carried out and available locally regarding SSIPV. This contributed to maintaining SSIPV as a silent topic (Duke & Davidson 2009: 796–800). To date only one research has been carried out by a social-work student at the University of Malta and that was back in 2014 (Mifsud 2014). This made it difficult for the researcher to refer to literature within a local context and to relate SSIPV and the LGB community in Malta.

Lack of Statistics

Since there have not been any local statistics specifically on SSIPV or LGB victims, the researcher was unable to include percentages. This identified the need for more research and further awareness regarding SSIPV in Malta. Since the prevalence rate of DV

is reported locally without defining one's sexual orientation, it is automatically assumed to be heterosexual IPV.

Lack of Insight into Gay Male Victims' Experiences & SSIPV

The researcher lacked an insight into gay male victims' experiences in relation to SSIPV. In Malta there is still no DV shelter that specifically targets male DV victims' needs. In accordance with Rubin and Babbie (2008: 204–8), the sample includes a gender bias as the findings might include an under-representation of male gay victims; most the professionals interviewed worked with female victims because the shelters target females. However, there were some of the interviewed professionals had worked with and had cases of gay male DV victims.

Participants lacking Clear Statements

Apart from two professionals, the participants did not make clear statements or did not finish their sentences; this may be because SSIPV is still considered a 'taboo' locally and they might have been extra attentive when discussing issues in relation to the LGBTIQ community. This was particularly apparent when a sentence included LGBTIQ terminologies. At times the researcher explained or continued the sentence to verify the participants' statements unintentionally, which could have affected their responses.

Lack of Knowledge on GAT and LGBTIQ Terminologies by Professionals

The lack of knowledge on GAT and LGBTIQ terminologies emerged, as some of the researcher's questions regarding GAT practices were not answered.

The Shelters are not Well-Prepared to cater for LGB Victims

Shelters are not well-prepared for catering for SSIPV victims; this was limiting as it made it hard for the researcher to get their perspective in relation to the dynamics, similarities, or differences between SSIPV and heterosexual IPV victims. Another limitation is non-generalizability since a small sample size was used which meant that not all of the local DV settings were represented.

Social Desirability Bias

Social desirability bias could have also served as a limitation since the professionals may have replied to a question about the services 'differently' or not accurately. Some reasons may be:

- Not portraying a negative image of the services they manage or work within;
- Thinking the researcher would take further steps towards the service if they are discriminative or not inclusive;
- The researcher interpreting the service's provision as negative;
- Being cautious of how to reply to the question, as they may have been assuming or envisaging whether the researcher themselves identifies as lesbian or bisexual.

Lack of Interviews with SSIPV Victims

Failing to interview SSIPV victims could have served as a disadvantage for research purposes as this would have made it possible to get an insight into their experiences within shelters and when seeking aid from services, e.g. whether professionals could have missed or been mistaken about certain aspects such as barriers that the clients face, and clients' perspectives on the effectiveness of services (Rubin & Babbie 2015: 204–8).

Recommendations for Further Studies

Interviews could have been carried out with both the services and SSIPV victims to overcome non-generalizability based on the effectiveness stated only by the professionals of the services. Interviews would also gather further introspective insight in relation to male gay DV victims by interviewing survivors to outline if there were any differences between the aid gay male victims receive compared to lesbian victims within shelters and services.

Recommendations regarding the Services and Shelters to be Effective

Attending & Offering Further Training

Professionals and experts within the DV field would ideally benefit from training to gain the adequate knowledge and familiarity regarding LGBTIQ terminologies as well as GAT. This is imperative as it may aid managers to consider applying GAT strategies and practice within the shelters and services to create a safer, validating environment and a service provision that is accepting of SSIPV victims (Duke & Davidson 2009: 796–816).

In addition, the management is advised to provide training for the team of professionals who can then implement such GAT strategies effectively and rectify any discriminatory practices (Langdridge 2014: 6). Furthermore, training focusing on LGBTIQ terminologies is also beneficial and necessary in order to refer and use the appropriate language, such as pronouns, when working with LGBTIQ individuals. The results also outline this importance, since one professional referring to sexual orientation as a 'condition' in 2018 demonstrates that sexual orientation is still being referred to negatively, after supposedly not being viewed as a pathological behaviour since the 1970s by an adequate number of professionals (Baker et al. 2012: 12). The importance of training was strengthened by the findings; training helps to provide the necessary culturally competent service for sexual minority individuals and gives a better understanding of the stressors that play on an LGB individual's life. It is essential when working with an LGB individual within an abusive relationship (Carvalho et al. 2011: 501–9).

The LGBTIQ Support Service networking with the DV Field

The only local LGBTIQ support service should also consider further networking with services and organizations within the DV field to further professionals' knowledge regarding stressors faced by LGB individuals within a same-sex relationship. It should

also expand understanding of the dynamics and the stigma LGB individuals face as part of a minority group who battle homophobia frequently, because they are living in a heteronormative society (Brown & Groscup 2009: 10–14). As a result of networking, both the LGBTIQ-support-service professionals and the DV services' professionals will gain knowledge from the exchanged expertise and DV victims and the LGBTIQ community will benefit. The LGBTIQ support service should also have material including leaflets and a frequently asked questions (FAQ) section on the service's webpage and/or research to create awareness of SSIPV. This will aid awareness within society in general, as well as within the LGBTIQ community, which in turn may aid SSIPV victims to relate and seek aid within the LGBTIQ support service. Activists and professionals within the LGBTIQ community must give prominence to SSIPV since this has not always been the case.

Eliminating the Gender Gap in DV

DV services should also employ male professionals to eliminate the present gender gap in the field. Not every male victim may feel comfortable disclosing personal details to female workers. In this way the service is promoting a stereotype that gay male victims only feel comfortable confiding with women but it cannot assume that such victims feel comfortable opening up to female professionals. Heterosexual DV victims may not feel comfortable disclosing to female professionals either. This may also serve as a barrier preventing male DV victims from coming forward about the abuse to services and/or reporting it. There is always an opportunity for further research to be carried out regarding SSIPV which has not yet been conducted locally.

A final recommendation would be shelters and services following the suggested model of Advocacy Training by Duke and Davidson (2009: 796–816), in order to be more affirmative by:

- Gaining additional information about the LGB community;
- Learning more about SSIPV;
- Being aware of the tools of abuse and the unique barriers experienced by LGB individuals;
- Learning how to create a safe environment for survivors of SSIPV;
- Identifying ways how the organization or team of professionals can reach out to survivors of SSIPV and promote awareness about SSIPV (Lavrakas, 2008: 40-100).

Conclusion

Data shows that further knowledge, awareness, and training are needed regarding SSIPV locally as these may be lacking within DV shelters. The LGBTIQ support service feel the need to build a bridge and better network with other DV services to exchange the knowledge needed. They wish to make the LGBTIQ community and society at large further aware that SSIPV does take place locally and help LGBTIQ victims ask for aid, if they want. This outlines the importance of all the services. LGB individuals themselves may prefer to seek aid from a service which does not specifically focus on and aid LGB individuals.

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The Impact of Lecturers' Emotional Intelligence on Students

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Abstract: This paper examines how Lecturers' Emotional Intelligence (EI) can have a positive impact on students' lifes, both within the classroom and on the place of work. This research uses a grounded theory method as the findings are grounded in the data obtained from the participants. Through in-depth interviews and an interpretivist approach carried out with 4 lecturers working within an Institute at MCAST, the researcher explores and assesses the staff's perception of the importance of EI at the place of work, EI in the role of the lecturer, and EI in building trust between employees and students. It is hoped that the patterns that emerge from this research may be of benefit to both lecturers and students. This study provides a framework where lecturers may manage their students more effectively as disturbing emotions and impulses can be controlled, thus leading to more effective lesson delivery time. Moreover, EI may lead to further motivation to both staff and students. Consequently, more student retention and willingness to learn may lead to self-development and growth into the human beings' personal development.

Keywords: Emotional Intelligence, vocational education, grounded theory and emotions.

Emotional Intelligence

Emotional intelligence (EI) is important in today's workplace and community if one wants to relate well with others and achieve one's goal. The term emotional intelligence (EI) has gained international recognition thanks to Goleman (1995) after he stumbled on an article written by two psychologists Mayer and Salovey way back in the 1990s after they had initially developed the concept of EI. EI can be defined as the ability to identify, regulate, and manage emotions in oneself and in others. Moreover, Goleman states that emotional intelligence 'can be as powerful, and at times more powerful, than IQ …' This in turn, may have a positive impact on any organization as a whole, including educational settings. Positive impact extends to employees, clients, and the different industries concerned (Goleman 2006: 13).

The aim of this study is to show that lecturers having EI skills can impact positively on the student's life both in class and outside. EI helps to regulate disturbing emotions and impulses and understand from where these are coming so ultimately one can act to grow and self-develop into a full human being.

The main research questions addressed are:

- How do lecturers' EI impact on the level of excellence in education on MCAST students?
- Why is EI important for lecturers and students?
- How will EI provide a positive classroom experience for both lecturers and students?

The idea is to examine the impact of the lecturers' emotional intelligence on the way lecture content is delivered and, in turn, received by MCAST students. EI can also be of benefit within the educational sector as various studies have proved that EI is connected to performance (Sparrow and Knight 2006: 1–7). Lecturers have a key role to play in passing on knowledge to students in specific areas relating not only to academia, thus facilitating that knowledge to build a bridge between theory and practice but also for self-development and growth. To achieve this, students should be motivated and inspired by the teacher (Ramama 2013: 18). This can be achieved if emotional intelligence capabilities and skills are mastered so these can later be translated into one's job. According to Sparrow and Knight (2006: 197–217), 'tomorrow leaders', who could also be lecturers as they have to act as role models for their students and lead a class to attain and reach their potential, need to have a mix of skills and attitudes which are a crucial element of EI. 'EI is an attitude towards self and towards others of unconditional acceptance' (Ibid.: 197).

Through this study the participants have pointed out that they as lecturers have noticed that their roles are becoming quite ambiguous as it is not that of just lecturing, walking up and down the class, but they feel that they must intervene especially when they realize that something is wrong with the student. This is in line with studies and research that has been conducted in various and different areas of work which point out that the workplace is changing, resources are diminishing, and employees such as teachers end up covering various and ambiguous roles; therefore being flexible and adaptable are important. According to Sparrow and Knight (Ibid.: 252), some of the capabilities required fall under the umbrella of emotional intelligence and are needed to cope, work under pressure, and control stress that emerges owing to job demands and work environment. Studies have also shown that teaching tends to elicit more emotions than other occupations possibly due to the many challenges faced when lecturing different students who are individuals in their own right, as they have different cultural backgrounds, skills, abilities, as well as social and emotional and motivational needs (Nizielski *et al*.: 2012).

Furthermore, students will holistically be truly ready for the workplace not just by bridging the gap between theory and practice with regard to technical skills but also through their ability to use their emotions and emotional knowledge to enhance their thoughts throughout their academic studies and within the workplace. Their emotional and cognitive processes will help to augment interpersonal relationships.

Literature Review

D Goleman (1995) popularized the term EI but there may be a paucity of theoretical understanding and literature relating to EI in Malta. The literature for this research study is rather important as the researcher wants to compare the findings within this research to that which has already emerged and wants to expand further to understand the

impact EI has on student life in a vocational college. Furthermore, various studies across different work areas show that not all employees have the skills of emotional intelligence where one is capable of understanding one's own feelings and of those around them and processing this information so an informed decision can be taken to achieve what one wants (Sparrow and Knight 2006: 29; Mayer and Salovey: 1997; Goleman 1995,1998, 2000). MCAST is a vocational college and the employers in various industries state that they are not just looking for the academic abilities and technical skills when hiring and promoting employees who maybe students or ex-students from MCAST. They go a step further as employees need to have personal qualities, initiative, empathy, and an adaptability to change (Goleman 2000: 3–4).

History of EI

- 1930s: Edward Thorndike introduced the idea of social intelligence. Social intelligence is the ability to get along well with people; this can be achieved if one can understand oneself and others.
- 1940s: David Wechsler developed the concept of non-cognitive intelligence; 'the amalgamation of an individual to act purposefully, to think rationally, and to deal effectively with one's own environment'; according to Wechsler these factors are really important for success in life.
- 1950s: Abraham Maslow, a humanistic psychologist, amongst others focuses on the importance of emotional interactions and furthermore, a person can build emotional strength.
- 1975/83: Howard Gardner introduces the notion of 'multiple intelligence' in his book The Shattered Mind while in his book Frames of Mind he identifies 8 types of intelligence, two of these being interpersonal and intrapersonal intelligence. According to Gardner, these intelligences are as important as IQ.
- 1985: Wayne Payne used the words emotional intelligence in his doctoral thesis: 'A Study of Emotion: Developing Emotional Intelligence'.
- 1987: Keith Beasley used the term emotional quotient in Mensa Magazine. Emotional quotient is the score given to indicate one's emotional intelligence focusing solely on emotions. This test is like that of IQ.
- 1990: Peter Salovey and John Mayer, two leading psychologists, published their article 'Emotional Intelligence'.
- 1995: Daniel Goleman popularized the idea of EI with the publication of his book Emotional Intelligence: Why it Matters More than IQ (Dhani and Sharma 2016: 90).

Emotional Intelligence

Mayer's and Salovey's concept of EI is being encapsulated by four elements as opposed to that of Goleman that consists of five elements as he integrated motivation with the four elements:

SELF	SOCIAL
RECOGNITION ***Self-Awareness*** (you understand you) *Self-Confidence* Emotional Self-Awareness Accurate Self-Assessment	***Social-Awareness*** *Empathy* Organizational Awareness Understanding the Environment
Regulation Self-Management *Self-Control* Trustworthiness Conscientiousness Adaptability Dive and motivation Initiative	**Social Skills** *Influence* Inspirational leadership Developing others Influence Building bonds Team work and collaboration

Table 1

These four elements can definitely make teaching and learning a success as long as the lecturer possesses these competencies and is willing to incorporate them within the subject and its teaching. Each element has both a direct and indirect affect within the classroom as the lecturer would be alert to one's own feeling and that of others, thus managing the classroom environment. Furthermore, the lecturer would be able to tune in the student's feelings so facilitating motivation and interaction amongst all in the classroom. This will create a safe environment where teaching and learning will be enjoyable and stimulating to both students and lecturer (Chhabra 2010: 319; Sparrow and Knight 2006: 10).

EI helps to recognize, understand, and choose how one thinks, feels, and acts. According to Goleman, it helps to shape our interactions with others and our understanding of ourselves. As mentioned earlier, these are all-important qualities that are much needed in today's lecturers as they have to motivate students to successfully complete all units and keep the class together, while treating students as individuals to engage them in class in order to be in a position to play on their strengths. As this study seeks to explore EI links to education and how it impacts on the education of students, it is important to examine the concepts and theories related to EI and to a certain extent, the relationship between EI and leadership.

EI Theories

Prior to understanding EI, it is important to define the word 'emotion'. According to the *Oxford Dictionary* emotion is 'a strong feeling deriving from one's circumstances, mood or relationships with others'. Emotional Intelligence is the ability to monitor one's own and other people's emotions, to discriminate (recognize/differentiate) between the different emotions and label them appropriately, and to use EI to guide thinking and behaviour. EI is made-up of four abilities: perceiving, using, understanding, and managing emotions (Mayer and Salovey 1997: 10).

Lecturers as managers may directly influence the students' attitudes, interests, and behaviour towards their work/study commitment. Plato wrote 2,000 years ago that 'all learning has an emotional base'. Since then researchers have had conflicting ideas with regard to emotions: emotions have no place in intelligence as they stop people from thinking clearly and thus lose focus on what is important. Research continued to evolve and both psychologists and researchers have come to realize the importance of feelings whilst thinking (Salovey and Mayer 1990: 185). The researcher wants to examine EI from different angles to develop a comprehensive understanding of EI as far as possible. Furthermore, he wants to understand and learn how EI impacts on students in the classroom. As interaction takes place between lecturers and students on a daily basis, lecturers have noticed an increase in challenging behaviour in the classroom, a breakdown in lecturer– students relationship, and an increasing awareness of low self-esteem in students. These elements hinder and limit the knowledge received by the students and create stress and lack of motivation, while decreasing trust between lecturers and students. Furthermore, it negatively effects the performance of lecturers and students both in class and in their placements. Research and studies have suggested that emotional intelligence is a crucial component in the educational sector as it enhances one's health and wellbeing at the workplace and helps in job performance and work attitudes (Curci *et al*.: 2014; Gliebe 2012; Zeider 2012; Martin 2009; Lopez *et al*. 2006). Although many EI theories have been established, the most frequently used in empirical research and approved by the *Encyclopedia of Applied Psychology* are three. These three major models define EI:

1. The Mayer-Salovey model (ability model) which defines this construct as the ability to perceive, understand, manage, and use emotions to facilitate thinking. This model is a cognitive model. EI links cognition and affect by suggesting that emotions make the cognitive process more intelligent and that one thinks intelligently about emotions. EI connects two components: cognition (thought) and affect (feeling). Intelligence belongs to the cognitive component of the mind and refers to how well one engages in tasks pertaining to memory, reasoning, judgement, and abstract thought. On the other hand, emotions belong to the affective component that involves emotions themselves such as sadness, anger, fear, joy … (Rivers et al. 2011).
2. The Goleman model (mixed model) which views it as an assessment of emotional and social competencies that contribute to managerial performance and leadership.
3. The Bar-On model (mixed model non-cognitive) which describes EI as an array of inter-related emotional and social competencies, skills, and behaviour that impact intelligent behaviour.(Bar-On: 2013).

It is important to note that the above EI models share a common predisposition that is to recognize and regulate emotions both in ourselves and others. Furthermore, all models can measure the skills and behaviour one has relating to EI (Dhani and Sharma: 2016).

Different EI theories, namely the Mayer and Salovey, Goleman, and Bar-On theories will be taken into consideration for this research. The main areas of ability, perception, use, motivation, understanding, and regulating of emotions, can be assessed in the everyday life of lecturers as they will definitely help to understand how the lecturers' emotional intelligence impacts on the students' education. Ideally lecturers should already be equipped with EI skills if students are going to excel in both academic and technical competencies. Furthermore, it will also have an impact on their social and career success.

The main areas of EI will definitely help lecturers in class as EI fits with the role of the lecturer:

- The lecturer EI will help to recognize and identify the emotional state the lecturer and the student are in when a situation arises at the institute. This, in turn, will help the lecturer to control his emotional outburst.
- The lecturer will be able to understand how one's emotion can be used to generate enthusiasm and motivation for oneself and the students, for example, when delivering a lesson. Moreover, lecturers will be able to understand the students' feelings and thoughts better, so lessons can be pitched at their level, so that assimilation of information is achieved.
- The lecturers will be able to appreciate better a student state which can affect the whole class.
- EI can also be used as a tool to understand one's own strengths and weaknesses better, and recognize opportunities and threats that may be found in the institute and classrooms. EI can help lecturers to be proactive when situations arise, keeping stress and anxiety at a minimum.

Lecturers these days cannot see students as disjointed human beings, attending class just to learn the academic bit but, they need to see them as fully whole rounded human beings where their whole selves needs to be developed. The delivery of the lesson, the dynamics in the classroom, and the service given to the students can be improved by empowering both lecturers and students through EI. Flexibility and creativity are keys in class as well as in the EI process to develop, motivate, and lead. Lecturers have the responsibility to perform so that students will be able to close units and achieve their grade. EI has been seen as linked to performance across many sectors, including education; so focusing on EI is of utter importance (Sparrow and Knight 2006).

Methodological Approach

The methodological strategy chosen for this paper is through grounded theory. Grounded Theory is a qualitative method that develops theory from observation, representing a structure that is both flexible and rigorous (Glaser and Strauss 1967). As a methodology, it is systematic to handle any biases and prejudices (Glaser and Strauss, 1967). It consists of a series of systematic and iterative steps for collecting data, coding themes, analysing, theoretical sampling**,** memo writing, creating conceptual properties, generating categories leading to theory construction. Grounded Theory is renowned for eliciting rich insights and for understanding the intricacies of organisational behaviour activities. Grounded Theory leads to the construction of reality that is grounded in data. Grounded theory fits best this study due to the approach that has been taken to collect data and analyse findings (Birks and Mills 2011). The researcher through a continuous process of analysis wants to construct reality by understanding the participants' views and extracting themes that are inherent in the in-depth interviews data collected. Through this data, areas that have not been yet explored would be thoroughly researched thanks to the inner experiences and perspectives of the participants who work in a vocational institution (Rubin and Rubin 2012; Birks and Mills 2011). This inductive method helped the researcher to build, from ground-up, the explanations gathered based on what is being discovered through the perspectives of the participants during the qualitative in-depth

interviews. Perspectives are built on the experience, knowledge, and expectations of the participants. This lead to thick and new insights which definitely helped to understand what is happening (Rubin & Rubin 2012: 15; Corbin and Strauss 2015) due to the ongoing comparison analysis.

The grounded theory methodology is used to investigate the process in relation to how EI impacts students and how the educators interact using their EI with students in both the class and the Institute. The researcher, through observation and open-ended questions that were focused on the process being used in class, could interpret and understand better the activities and actions being used between the educators and students (Creswell, 2009). Through the grounded theory approach, which is systematic and rigorous for collecting, coding, analysing qualitative data, memo-writing, and category generation (Corbin and Strauss 2015; Bryant and Charmaz 2007) the researcher ensures reliability and validity. Furthermore, this enabled the researcher to start constructing theory which is embedded in the data collected. Grounded theory has two main characteristics of design: constant comparison of data with emerging categories and theoretical sampling of different groups to maximize both similarities and difference in information until saturation point is achieved. This means that all major categories are fully developed, and no new information emerges from the data (Corbin and Strauss 2015: 135; Creswell 2009: 13). To help with the data gathered, the software package MAXQDA was used. This software helped to organize the coding system and memo-writing which in turn helped with the analyses; it was thus possible to understand the emerging construct better (Figure 1).

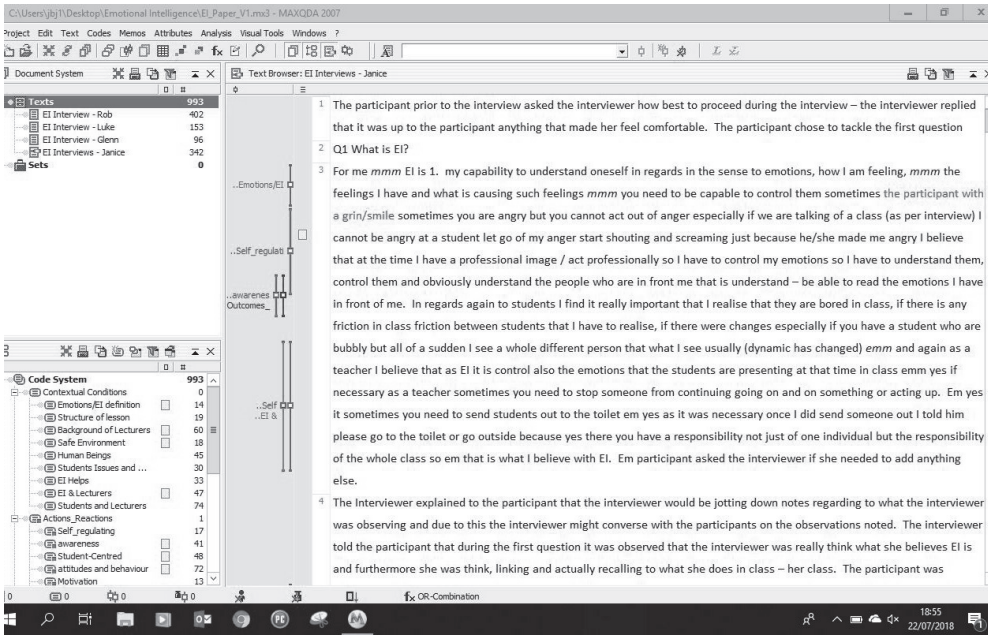


Figure 1

The researcher opted to review the literature prior to undertaking the research as it was felt that her professional and personal knowledge, gained through the plethora of literature, would help to guide and focus on what is really important for this particular study and so help to generate further interesting concepts and thoughts (Corbin and Strauss 2015; Creswell 2012; Charmaz 1990). The researcher kept an open mind and was sensitive to data being collected so as not to taint the data being collected through any preconceived ideas and thus hinder the emergence of grounded theory (Glazer and Struass 1967; Birks and Mills,2011).

Sampling and Selection Criteria

This study was conducted through convenience and purposeful sampling of lecturers within the Institute of Community Services. Through convenience sampling, participants are most easily accessible to participate in the study. Through purposeful sampling, participants are selected on the basis of knowledge relating to the researched topic. This study was a volunteer study; participation depended on the completion of 'The Quick EI Self-Assessment Test' attached. Lecturers who got the highest EI mark were eligible for qualitative interviewing using the responsive interviewing style. This style is flexible, and questions evolved depending on what the interviewees responded, thus always focusing on the experience and knowledge of the interviewee as an individual (Rubin & Rubin 2012; Creswell 2009; Corbin & Strauss 2015). The responsive interview is structured into three areas: main questions to provide a skeleton for the interview; follow-up questions to obtain depth and detail and clarify areas that are still hazy; and probes to help manage the interview/conversation. These three areas helped the interviewer cover the overall topic and research question (Rubin & Rubin 2012:116). As the researcher was seeking to obtain both depth and detail ,the best way forward was through semi-structured and responsive interviews. This type of interviewing allows flexibility to the interviewer who is the person managing the research study. Thus, if the interviewee mentions something new or the researcher did not fully understand the response, the researcher could either formulate new questions there and then or probe further to achieve a solid, deep understanding of the study through the perspectives and experience of the interviewees. Furthermore, the researcher could customise the questions to fit the participants experiences and knowledge (Rubin & Rubin 2012: 37). Standard procedures relating to how interviews were conducted were followed. The interviews were digitally recorded and a transcript was compiled. The researcher informed the participants and guaranteed both confidentiality and anonymity to safeguard both information and participants.

Data Analysis

Analysis helped the researcher to breakdown the raw data obtained from the interviews to clear and convincing answers to research question. According to Rubin and Rubin (2012), the analysis of responsive interviews is broken down into 7 steps; the researcher had to transcribe word for word the digitally recorded data and summarize the interviews in a separate file to be able to remember the key points. In the same file the researcher could also memo write one's one thoughts and ideas. Once this was done the researcher had to examine the interviews to code and define the relevant extracts such as concepts, themes, events, and examples in the text. This exercise had to be done across all interviews while constantly comparing and constructing the data. Furthermore, material with the same code had to be grouped together. Once the researcher found no new and relevant material towards this study the researcher was able to link and integrate the

material together to try and build a complete picture. This is done by comparing both concepts and themes to generate the researcher's own theory. Moreover, descriptions that have been extracted had to be explained. Finally, the researcher had to compare one's own picture to the interviews to ensure that the researcher was sensitive to the data gathered (Rubin & Rubin 2012: 190).

The above approach helped the researcher build concepts and themes that emerged from the data as the researcher was examining each passage sequentially, thus enabling the researcher to see new things and understand better what the data means. Qualitative analysis required the researcher to pay attention to detail, difference in emphasis, variations and nuance. This gave complexity and richness of data from the real world (Corbin and Strauss 2015; Rubin and Rubin 2012).

Findings and Analysis

This research was built after interviewing four lecturers from the same Institute within a vocational college in Malta. It provided a foundation for a process relating to the lecturers' perceptions on how EI impacts on students within a vocational college. The emerging construct link categories and sub-categories to each other as can be seen in Figure 2. These categories are formed by contextual conditions, actions and reactions, and consequences and outcomes whose main aim is to enhance the study and investigation according to, Corbin and Strauss (2015: 160)

Conditional and Consequential Matrix

Contextual conditions cover the area in which the research study is taking place primarily: a vocational teaching environment, including the characteristics of the lecturers themselves. Actions and reactions are the results of circumstances and the background of both lecturers and students. These may result either in a consequence or an outcome because of the use of EI with students by the lecturers. This, in turn, helps the student to evolve and develop, not just academically but also fully as human beings. Coding the data, grouping into categories and subcategories, and combining all the elements helped to form the emerging construct (idea).

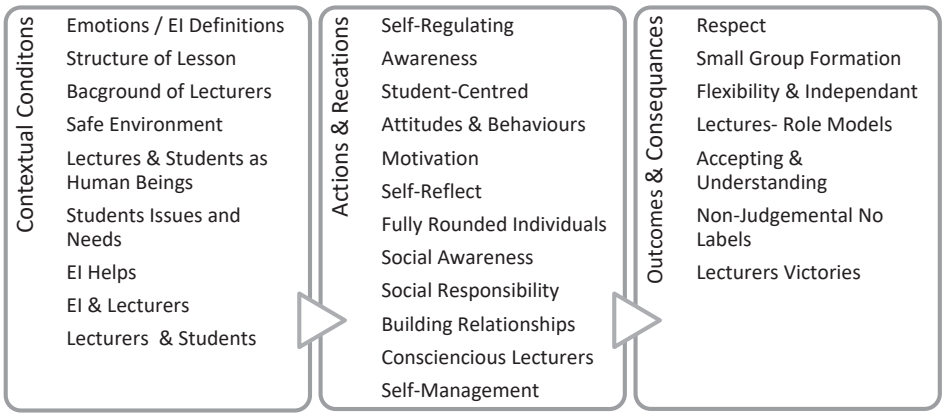
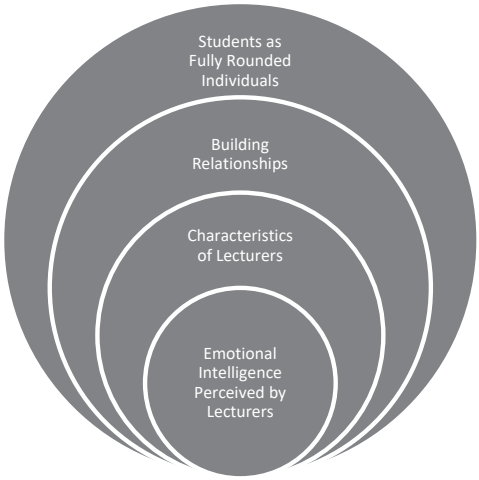
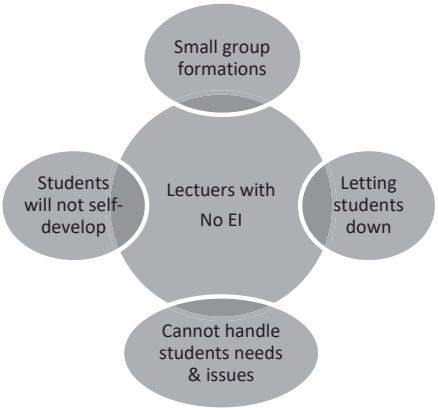


Figure 2



Perception of Lecturers EI Towards Students



Lecturers Perceived Risks

Figure 3

As per Figure 3, the idea that originates from the initial stages of grounded theory explains the various stages that a lecturer with EI skills goes through with his students. The initial idea shows that lecturers with specific characteristics start from the very beginning of the scholastic year working on their relationship with their students, so, at the end of scholastic year the students become fully human beings and succeeds academically. As demonstrated by this research, students carry baggage that creates barriers to learning and, according to the lecturers, if students are not helped through EI to break down these barriers, development and growth will not occur. It would be interesting to research how the students perceive this process and compare it to that of the lecturers.

The following basic information will help to explain who the participants were so that a context for their answer could be provided. This information was gathered through their responses during the interviews and observations made. The four participants, one female and three males all work in the same institute, lecturing in various areas and levels in care, sports, inclusion, etc. Two of the participants have counselling backgrounds; one has studied social emotional behaviour difficulties; while the other participant has a large and extensive experience in various work sectors as production manager, salesman, factory worker, builder, running a pub, and teaching in university at high levels. Figure 2 helps to understand that the participants are mainly conscientious and flexible in the way they deliver content and see students as unique respected human beings. These attributes could be due to the importance they attach to EI, their backgrounds, their attitudes and behaviour, as well as the way they perceive their role as conscientious lecturers using emotional competence (Sparrow and Knight 2006: 35–8). The researcher could understand how much EI means to them, as the participants explained in their own words and throughout the interview how they integrate EI in their class and unit, through their behaviour and strategies used with students (Goleman 2006: 24).

Perceived Emotional Intelligence

In fact, either because of their academic background or their experience in life, all participants have heard the term EI – Emotional Intelligence and all could explain what EI means to different degrees. Furthermore, throughout the interview the researcher could observe and gauge that the participants act with EI too. According to all participants, '*EI is the ability to understand your own thoughts, emotions, moods and of people you are with, acknowledge them, and use them which is the groundwork for EI*.' This is in line with how Salovey and Mayer (1990), Goleman (1995, 1998), and Bar-On (1997) defined and portray the term EI. Sparrow and Knight (2006) continues to depict the idea by relating it to intrapersonal and interpersonal intelligence. The four participants end up self-regulating and managing their emotions and moods prior to going to class as appropriate behaviour is necessary. They feel that their behaviour in class has to be that of a professional so as to set an example to their students. According to the participants, being aware of one's feelings is very important as it can affect their performance in class and their relationship with their students '*... on an average day whatever mood I am in, I adapt it so that I can approach my class*,' '*sometimes you are angry but you cannot act out of anger, especially if we are talking to a class*.' Goleman (2006: 55) explains that being aware of one's emotions and feelings is a skill that is very important in a teaching job as it involves students where ideally they need to achieve. EI helps the participants to facilitate learning, building relationships, and to be both proactive and reactive where they take charge of a situation and deal with it before it escalates. This is very much in line with Reuven Baron model of EI (2013) as they relate to people, they adapt and cope with their environment and dynamics in the classroom to be successful in dealing with the environment demands. In fact, all the participants, because they are conscientious, use EI in their class either to de-escalate situations and resolve conflicts, especially when they realize that small groups are forming in class which tends to divide the class or when they realize that a student has a problem that is creating a barrier to learning.

Characteristics of the Lecturers

Teachers EI

As emerged through this study, all participants believe strongly in EI especially as they are working with people who are vulnerable and sometimes students end up facing various challenges, social problems, and issues. According to the participants, the lecturer should be capable of identifying if there are any problems with the students. This can be achieved, as mentioned previously, if lecturers are present and aware of their surroundings and know their students. In fact, Mayer and Salovey (1997) and Salovey and Mayer (1990) refer to this as 'emotional intelligence'. All participants strongly believe that lecturers should be capable to stop and reflect why a student behaving in a particular way? Lecturers should learn not to take it personally but should be able to realize that there is something wrong and be socially aware. This is similar to Goleman (2006: 237) 'building emotional competence' where one should see things from the perspectives of others and try to understand before moving on. The participants feel that they are a link for these students who need help. All participants believe that investing time in the beginning of the year yields results, especially where relationships and trust come in. Trust in teaching and relationship building is important if collaboration must be generated. According to Christie *et al.* (2015) 'emotional intelligence is an important factor in processing the decision to trust.' Furthermore, two participants continue to add '*students allow you to*

teach them and to help them'. Participant 1 continues to state '*... we as lecturers are the link for them to seek out help; so if you do not show your students that you are there for them to listen ... that they can speak to you ... you will close another door for them*.'

Using their EI capabilities, the participants carry out interventions as needed and in certain cases also recommended students to see a counsellor. In fact, the participants stated that one of the phrases that is used a lot in their class is '*Are you ok*.' If this is missed the student might be in a situation where suicide is committed, overdose, or just drops out of school. Various studies have been carried out using the ability-based model (Mayer and Salovey 1997) to actually prove the 'usefulness of EI amongst youth' and, as a result of these studies, it was noted that EI actually lowers the rate of disruptive behaviour and drug abuse while academic performance is achieved (Palomera 2008: 443). Participant 3 '*In my opinion you cannot work you cannot work with people and don't have EI ... how can you teach without EI*?' In fact, the studies by Ramana (2013), Chhabra (2010), and Palomera *et al.* (2008) show the importance and necessity of emotional capabilities of teachers if they want to obtain and carry out a '*teaching-learning process in the classroom*'. Furthermore, participant 1 says, '*educators should have EI as they should realise if something is wrong with the students – EI will help us*'. The researcher could see that the participants were really getting worked up at this question; this could be the result of their attitudes and feelings as EI is fused and merges with who they are as a whole person (Sparrow & Knight 2006: 35). They could not believe that educators/lecturers have no EI in such a profession. In fact, in one of the many studies EI has always been shown as a positive component for teaching owing to the various demands that are placed on the educators (Nizielski *et al.* 2012). Furthermore, Aritzeta *et al.* (2016) explains that 'emotional experience' is an important ingredient for both learning and success. EI helps the lecturer to be self-aware of one's emotions and limitations which in turn can help one being more aware of others in this case students (Mayer & Salovey 1997). Participant 1 sees it as very important because a lecturer must be a role model in the way one acts, '*If I am not able to control my own feelings in class, if I am not able to show empathy and what it really looks like, how can we expect our students to actually do it in class or at the place of work*?']. According to participant 2, EI can help the lecturer get the general feel of the class; it helps to create a positive environment as it can help with tolerance towards each other because each one of us is different and unique. Through EI one can understand oneself better; it does not make sense that one accepts oneself and not others. Participant 4 '*EI for me is vital*': he feels that EI helps him to interact with the students and, furthermore, helps him to motivate the students. Participant 4 uses the student's emotions to wake them up and to not give up. The participants who are also lecturers are seeing the students holistically as they are not helping them as students but also as persons. They are acting as good leaders and as well as role models; they have a goal which they want to achieve by the end of the scholastic year; that is for the students to become fully rounded human beings and achieve academically. According to, Goleman (2006: 32), having emotional competence is of the utter importance for leadership, especially if one need others to perform their jobs effectively. Moreover, Goleman in his famous book *Emotional Intelligence* which has been most cited, states that IQ contributes to just 20%; thus, on its own, it is rather negligible with regard to both achievement at work or in life (Goleman 2006:18, 34).

Building Relationships

Participants 3 and 4 strongly believe that it is important to learn who their students are during the first term by learning their names, getting an insight of who they are, and what they are all about. This is done so that when the lecturers deliver the lessons they can be

effective and '*students will build relationships and trust*' as they believe, like participants 1 and 2, that every student is an individual and unique. In fact, participant 4 said, '*I can say one thing to one student that I can't say to another*', while participant 3 suggests, '*… no student is alike even if they are brothers and sisters … everyone has one's own personality … obviously, this changes according to what is happening at home, relationships*'. The researcher sees all the participants doing their part to be socially responsible and building relationships with their students. In fact, participant 1 said '*… at the beginning until they come to know me*', while participant 2 offered the opinion that '*I think that the primary element is relationships, we are there as a class … even though we are individuals. A class is a small community.*' Taking an individual interest in the students, taking time to building relationships and trust, will help with the interaction in the classroom. As Nizielski *et al.* (2012) point out, the participants' EI 'might actually help to create good working relationships with the students which in turn helps the participants to focus on the students' needs. This helps the students to work in a more productive manner.' Furthermore, as per Mayer, Salovey, Caruso and Sitarenios (2001), Goleman (2006), and other researchers believe that having emotional intelligence and using it intelligently will promote meaningful relationships and so become an effective leader, which is truly important in class. Moreover, when one gets to know one's students, their interest, their likes, and dislikes, teaching becomes more effective. The participants take this knowledge and integrate it with their lesson to motivate them to learn '*to spark an interest*.' According to Goleman's (1998) motivational component 'learning inspires curiosity and promotes feelings of satisfaction, even joy, when students immerse themselves in the process of assimilating new information' (adapted from Goleman 1998, through University of Portland 2017). The researcher could observe that all four participants were re-calling their lessons in class from the beginning to the end of the scholastic year. All participants prepare a lesson plan so that they go to class with a structure of what they want to cover but all confessed that they do not always follow the lesson plan. The researcher sees them as using their EI competencies and being flexible and independent as they '*tend to follow what my students show me*' or '*… but my guide is the audience, the students*'. The participants know that they have a syllabus that they must follow and finish by the end of the scholastic year, but they leave space for their students to voice out both their concerns and opinions. This gives a direction for the lesson. This gives the participants, the flexibility and independence that they need if certain issues must be dealt with. In fact Goleman's (2006) ideas with regard to effective leadership can be attached to the above behaviour of the participants as they make learning a creative and meaningful experience.

The participants either, because of their background or because they are observant, are aware of their students' behaviour in class. Getting to know the students helps all participants to gauge if their students are passing through a rough time and '*if they are ok*' so they will act upon it as they become concerned. All participants strongly believe that their job as lecturers is diverse and not just teaching the academic aspect but also helping the student to evolve and progress in their self-development. The way the participants act and use their EI competencies to achieve their goals, which are also the student's goals, ties with Hernandez-Amoros and Urrea-Solano study (2016) that shows that EI is an important factor to humans especially in our ever-changing world. They want to help and intervene before the problems the students are facing get to a '*crisis point*'. All participants argued, as mentioned previously, that the academic element is secondary because the primary element is relationships, attitudes, and behaviour. '*As a lecturer, I believe that we do not teach; we teach nothing as lecturers; we only create an environment where learning can take place*.' Furthermore, participant 1 added '*… any topic can be learnt by just going on to Google research, reading about it, and you are done; I don't want to give them just material because that is something that they can do on their own. I want them*

to become critical, not believing everything that they read.' The participants, through their behaviour and attitudes and especially participant 4, '*believe that we can't learn without humour*' while participants 2 and 3 strongly believe that a '*positive learning environment can be created*'. This helps to create an area which is safe and leads to learning. Moreover, a student-centred approach is used by the four participants as they tend to pitch the lesson at the students' level, while including the students in their lessons through the different learning strategies used in class. These include discussions, gathering feedback from their students through questions, pushing the students to be critical and to think outside the box thus motivating the students to take interest in what is going on and to be part of learning. Being conscientious of who one is, who one's audience is, one's role, and what one wants to achieve can make learning an enjoyable experience for both student and participant (Dolev and Leshem 2016; Catalina 2014; Chhabra 2010).

All participants hope that the students leave college as fully rounded human beings and not with just a certificate to show that they have attained the grade. The participants aim for the students to be more confident and more self-aware but they also want the students to learn how to behave. The participants believe that the student should be able to reflect and learn from their own mistakes as they themselves, the participants, stop to reflect and learn. Moreover, the participants think that it is important for students to learn how to behave and respect others. In today's world, social skills and respect are of utter importance as one is dealing with people wherever one goes, be it at school or at work (Goleman 2006). Participant 4 '*I want them to understand the word and hear the word respect because they need to learn respect for everybody … because unless they respect themselves they won't respect anybody properly … and if they won't respect themselves they won't expect any for themselves, so lack of respect collates well with lack of expectations and self-expectations*'. In fact, Sparrow and Knight (2006: 38) place respect with 'unconditional acceptance of self and others' which can be hindered if one judges and 'categorizes as being worthy or not.' Furthermore, participant 3 ties respect with basic social skills, with the way one addresses and speaks to others and waiting for your turn to talk and listen which are of utter importance for both relationships and the workplace.

Participants 1 and 4 are very realistic and aware of being human, '*something else I think they accomplish in class is learning that you are not always right and that you can make mistakes. It is ok to make mistakes, apologize, compromise, and move on*'..Participants 2, 3, and 4 go on to say that it is important that one should stop to self-reflect to learn from mistakes. In fact, participants 1 and 2 continue to explain that '*students look at us as role models, in the sense that we are human beings*'. They look at us on how we treat and respond to students who can be tedious and take charge of the situation. In fact, the researcher notices that all participants realize that it is important that, in these situations, one must become aware of what one is feeling and to regulate one's feelings, so that one can manage the situation without causing discomfort to others. In class, there should be an environment where both students and lecturers can learn from each other no matter the background, race, culture, etc. In fact, all participants truly agree that as lecturers they can learn from their students too: 'co-teaching' in the sense that they make us more self-aware and thus make them reflect on their actions; strengths and weakness. According to participant 4, they, '*… look back and say what mistakes I've made*', while participant 2 asserts, '*Sharing my experiences, they see me as a role model; they see how I have acted before and they look at my reflections upon my actions now*.'

Lecturers' Attitudes and Behaviour

According to these participants, the role of the lecturer varies from that of facilitating knowledge to actually helping students self-develop and interact in a group as fully human beings, not just as students studying academic subjects. The researcher noticed that there was a predisposition amongst the participants in the way they see their role and relationship with their students, apart from being flexible in the way they teach, and what they teach; they enter the class with the aim of not letting the students down; in fact, they carry a fresh slate so as to avoid being judgmental towards the students. Sparrow and Knight (2006) explain that being non-judgemental makes one more aware and helps to understand better the students. Participant 2 explains '*that in psychology there is a theory called the self-fulfilling prophecy; so, if you label a person, with time if the person hears it enough the person m ends up believing that particular label even if you are not by nature so.*' According to the participants, labels never served anyone, unless they are positive labels; if the label is negative, the lecturer should be capable of helping that student do something about it. Labels hinder the process of learning and a lecturer is influential in a student's life, especially our students, '*as we can end up breaking them*.' It is important to note that our students enter MCAST, which is a vocational college and not a university which is just academic. Lecturers must keep in mind that these students have mixed abilities or else they would not have chosen our college. There is a probability that they did not function well in the previous schools, so one must keep in mind that, as lecturers, it is imperative to bridge the gap between theory and practice and try to understand why they did not function. The lecturer, according to participant 4, has to keep in mind that '*one size does not fit all*'. Moreover, the participants are willing to work with all, '*It is about them (students) also and they are learning not only how to do assignments they are learning how to work as a group how to be part of a class*.' Participants 2 and 4 continue to state that '*we are at their service, we are there to serve them*'. Furthermore, participant 1 has the same idea as participants 2, 3, and 4 and continues to explain that '*as a lecturer, yes we are in control but there should be equality and respect diversity there are various reasons for this* ...' The way that the participants work, apart from respecting and empowering the students, they also show that they are committed in their role to help their students achieve their certificates and also function at their place of work and with people outside school. This is done as all participants use their experience which was gained through the years of studying or through their industrial experience, '*This is something that requires a certain trust, trust, in the students that they will use this information for their own development and I think it is very important in my opinion*.' On the other hand, '*I like helping kids achieve ... I don't know why I do? I think possibly because of my own failures as a kid* ...' The participants are not afraid to show their students that they themselves are human and that using EI helped them both academically and also in their place of work to succeed (Bar-On 2010, Matthews *et al.* 2004).

Students Issues and Needs

All participants realize that the students have problems with curriculum which leads to low self-esteem when dealing with academic subjects,but they also see and feel other problems that students carry with them, '*I observe and I listen ... I don't miss a thing and I hear everything even in the hallway*.' Students' issues and needs vary from family issues to bereavement to abuse. According to the participants, these issues and needs cause barriers to the students' learning and hinder assimilation of information for example, '... *has a problem at home and student is really, really worried and student is in class it is not*

easy to concentrate' and furthermore, '*dis-function when in work placement as they carry their baggage' everywhere*,' *'we cannot disassociate ourselves from our baggage*.' If students are not aware of their problems and are not able to work on their problems,or not able to manage them, they end-up either re-traumatized (disturbed or distressed) or have transference issues (re-live the experience they passed from according to psychology today). As the participants are conscientious, flexible and independent, '*We aren't lecturers, I was a lecturer; walking up and down and sharing one's knowledge and inviting questions; this is way, way more in-depth and far more skilled*' and '*How can you relate to students*', they tend to intervene '*as they don't want to let anybody down*' especially when they observe that students are not acting normally as when one ' *notices that a student is very quiet*'. Participants, because of their social responsibility and because they are sensitive towards the students' issues and needs, discretely ask the student if they are ok, as the students '*allowed*' them to do so especially if the '*appropriate groundwork was done properly at the beginning of the year*'. This could be the result of the participants investing their time and energy in the beginning of the year to build relationships to create a safe environment based on trust and respect. The participants truly believe that EI helps in these situations (Bar-On 2010; Matthews *et al*. 2004). All participants feel that they cannot solve students' problems but EI empowers the students to be aware of their own feelings and emotions, of the situations they are in, and their stresses. EI equips them further to come up with ways to deal or tackle the problem at hand. Furthermore, the participants believe that, when they cannot help, further intervention should be sought through counsellors or other professionals. If lecturers have limited EI and view their students only at their academic level, or according to the label assigned to the students, if there is no relationship, no co-teaching, no empathy, the student may be '*lost*' as he has been let down many a time before. Moreover, all participants feel that the lecturer is in the wrong job, '*You cannot work with people and have no EI*.' These participants get involved with the students, they know what they like, how to motivate them, '*Teaching for me is not what you know but how you deliver it*'. In fact, this correlates well with Herandez-Amoros and Urrea-Solano (2017), Dolev and Leshem (2016) and Chhabra (2010), as they explain that just taking subject expertise to class, not aligning one's pedagogy to the needs of the students, and not incorporating EI, much is lost when relating it to knowledge and development of students.

EI Impacts on Students

All the participants showed that they are first and foremost human beings as they make mistakes, show compassion and understanding, and with the way they interact with the students at the beginning of the year. Furthermore, they invest their time and energy to get to know the students using various EI skills which each one has got with oneself and use it as part of the tools while they are in a class delivering a lesson. The participants believe that, as they are dealing with vulnerable human beings, it is imperative that they should be conscientious and that their behaviour reflects professionalism in the way they treat students.

The participants argued that students have a natural ability to perceive EI: when students see lecturers who are interested in who they are and in their well-being, and who care about them and give them attention over and above the attention to academics, they feel that they are valued human beings with their own dignity, '*Our actions speak for themselves*.' Furthermore, the participants believe that students also pick up on their change of moods. Therefore, seeing them getting angry is fine if they remain composed

and contain their feelings, as this is reality. The participants want the students to mimic this behaviour when they are in similar situations. Moreover, the participants believe that students need to develop a strong character, be present for others, and show empathy and understanding. Thus, it is imperative that as lecturers they portray this attitude and behaviour for the students so that they can '*take it on board*'. The participants truly believe that EI '*at the end makes us human as it helps us care for others not caring for others show that the lecturer is in the wrong job*.' In fact, participant 4 thinks that '*EI in educators is missing in a lot of lecturers and this is the missing piece that makes you truly a good teacher*.' Educators should be in a position to express their own emotions within boundaries especially if it is 'purposeful expression of feelings' one expresses feelings if it is going to help the audience (Biestek 1961) It is important that lecturers should be aware of how they perform and reflect on their actions as students show them if they have acted correctly or not.

The above can be encapsulated in the genuine desire of the participants' attitudes and behaviour to create an environment which is both safe and conductive to learning for the students by using their EI skills since education is an important aspect if we want students to become fully human beings (Turculet 2014; Catalina 2013; Ergur 2009; Proctor 2015).

Conclusion

As already discussed, lecturers who have EI skills tend to be human beings with their students as they invest both their time and energy to get to know them as unique individuals. Moreover, they are sensitive, observant, and good listeners capable of building relationships and creating a positive environment for both students and themselves. This setting helps students to break down their barriers to learning and it also helps them to grow and self-develop as fully rounded human beings. The initial stages of grounded theory research have helped to give an insight to the actions and outcomes of four participants who are lecturers within an institute at MCAST, showing the impact of their EI on their students. The researcher could get a hint of the process which is an important feature for analysis as one can understand the course undertaken by the lecturers with their students to grow and self-develop and also achieve academically (Corbin and Strauss, 2015: 175). This grounded theory research needs to be developed further to understand, as far as possible, the whole picture by integrating further the emerging constructs that shows a process in phases of both students and lecturers as per Corbin and Strauss (Ibid.). This research sets a very basic foundation for a more in-depth study where the views of the students and other lecturers should be investigated so that theoretical saturation can be achieved. From this research one can determine that lecturers with EI skills need to be flexible, independent, and conscientious towards their students.

Even though this research is still in the very early stages, it is being noted that lecturers within MCAST need to realize that students are vulnerable and need to develop both their acadlyemic skills and to grow as individuals. Understanding that a lecturer has to be social responsible and conscientious of one's role, can provide the support necessary for students to become fully rounded human beings. Having the necessary EI skills

can actually help them to achieve this, so that students will not just win in the area of academics but also self-develop to become role models for the community at large. Hence, it is important that lecturers understand that their emotional intelligence can impact on the level of excellence in education on MCAST students.

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