

# STEM to STEAM – Is Art the way forward?

## Introduction:

The aim of our project was to investigate the effectiveness of the STEM to STEAM campaign. This is a campaign which was initiated by Rhode Island School of Design. It is the addition of Art to the STEM subjects (Science, Technology, Engineering and Maths) to make STEAM. Educators at RISD believe that this change of STEM to STEAM will result in more innovative students. We wanted to determine if Art could improve students' abilities in the 3 STEM subjects **Science, Maths and Technology**.

## Sampling:

We used Stratified Sampling and Simple Random Sampling. Stratified Sampling refers to having pre-defined groups from which a randomly chosen population is obtained.

## Experimental Group:

TY students who studied HL Science and Art for Junior Certificate

A

TY students who studied HL Maths and Art for Junior Certificate

B

TY students who studied HL Technology and Art for Junior Certificate

C

## Control Group:

TY students who studied HL Science but not Art for Junior Certificate

D

TY students who studied HL Maths but not Art for Junior Certificate

E

TY students who studied HL Technology but not Art for Junior Certificate

F

## Testing:

### (1) Ability in Science:

We gave higher Level Science mock papers to students in groups A and D (40 students). These were at Junior Cert level.

### (2) Ability in Maths:

We gave higher Level Maths mock papers to students in groups B and E (40 students). These were at Junior Cert level.

### (3) Ability in Technology:

We gave higher Level Technology mock papers to students in groups C and F (40 students). These were at Junior Cert level.

### (4) Aptitude and Cognitive Test:

We gave MALT 14 aptitude tests to 30 students who studied Art and 30 students who did not study Art.



## Surveys:

### (5) Perception Survey:

This survey was used to assess the perception of Art as a subject that improves overall ability.

### (6) Subject Choice Survey:

This survey was used to determine the popularity of Art as a subject choice for the Leaving Cert.

## Results and Analysis:

### T-TEST:

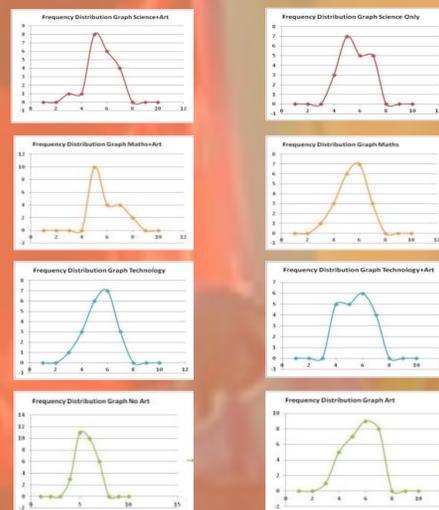
We used a t-test to examine if there was a statistical difference between the test results of students who studied Art with STEM subjects and students who did not study Art with STEM subjects. The alpha value is usually set at 0.05. A value less than 0.05 is taken to show that the difference is not due to chance and is significant. **The averages of students who studied Art with Science, Maths and Technology were higher than students who did not study Art with these subjects. This was also the case with the MALT 14 aptitude tests.**

Subject	T-Test:P-Value
Science	0.00508
Maths	0.001467
Technology	0.790435
MALT-14	0.000262

All p-values were below 0.05 except for the Technology results. This meant that difference between the results of students in each category was statistically significant except in the case of Technology results, which were not significant.

### Frequency Distribution Graphs:

In order to use T-Test to analyse the data we had to ensure that the data was normally distributed, otherwise the T-Test results would not have been accurate. As the T-Test formula uses the mean of the data, any extreme values would have a large effect on the results. Non-normal distribution of our data was a large possibility due the small sample size (20 pupils). Thus, we created Frequency Distribution Graphs with our data on Excel and checked if a bell-curve was present.

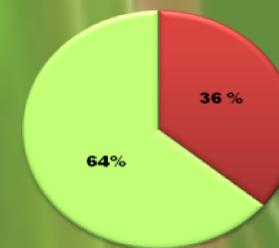


### Perception Survey:



- ❖ The pie chart above shows the difficulty ratings students chose for the tests:
- ❖ 8% of Art students rated the tests Very Easy but no non-Art students rated the test Very Easy.
- ❖ 13% of Art students rated the tests Easy but only 6% of non-Art students rated the test Easy.
- ❖ 13% of Art students rated the tests Average but 37% of non-Art students rated the tests Average.
- ❖ 8% of Art students rated the tests Hard but 15% of non-Art students rated the tests Hard.
- ❖ 26% of students thought that Art does help their ability in Science, Technology and Maths.
- ❖ 74% of students thought that Art does help their ability in Science, Technology and Maths.
- ❖ This revealed that Art is seen as a subject that causes a hindrance in the study of STEM subjects by the majority of the students in our school.

### Subject Choice Survey:



- ❖ 64% students who obtained A/B in Junior Certificate Higher Level Art did not pick it for their Leaving Certificate.
- ❖ 36% students who obtained A/B in Junior Certificate Higher Level Art did pick it for their Leaving Certificate.
- ❖ These results revealed that Art is not a very popular subject choice for the Leaving Certificate in our school, despite the high grades in the subject.
- ❖ The main reason was that students believe that Art would result in their study of the STEM subjects being compromised. This had been outlined in our Perception Survey results.

## Conclusions:

- ❖ On analysing the results, we found that students who studied Art along with Science or Maths performed better in the tests than those who did not study Art. This was also seen with the MATL14 test results, which gave a p-value of 0.000262. There was no significant difference between the results of students who studied Technology with Art and Technology Only (p-value of 0.790435).
- ❖ From our Perception Survey, more students who studied Art found the tests (curriculum and aptitude) easier than those who did not study Art. We had expected this because students who studied Art performed better in the tests than students who did not study Art, therefore logically, they should have found the tests easier. More students who did not study Art found the tests harder than those who did study Art.
- ❖ From our Subject Choice survey results, we found our original thoughts to be true. 64% of students who attained higher level A/B grades in Art for the Junior Certificate did not pick it for the Leaving Certificate despite their high grades.



## Recommendations:

- ❖ Two areas that could be affected positively due to the STEM to STEAM campaign are Dyslexia and the prevalent gender imbalance in the STEM sector.
- ❖ We believe that this new campaign could hugely benefit Dyslexic students who find themselves struggling in the classroom. They see words, numbers, lectures and formulae as complex challenges that are difficult to overcome, however, many dyslexic students are talented artists and can view images with more detail and accuracy than a person without dyslexia can. In this way STEAM would prove to be extremely beneficial for dyslexic students as it will involve images and pictures being a more central part of the education system and the way students are taught.
- ❖ An issue that should be considered in relation to STEM to STEAM is gender imbalance in the STEM sector. More efforts than ever are being made to encourage women to enter STEM careers. Widening interest areas in the STEM sector would undoubtedly make it a more appealing area to work in and hence, it will attract more women as well as men.