



# Pupils' Views Towards Design and Technology in Singapore

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## Abstract

Design and Technology (D&T) is a relatively new subject in Singapore secondary schools. The subject is not yet well-received and the reasons have not been investigated systematically. Therefore, to understand pupils' views of D&T analytically, a survey was conducted in November 2002. A total of 982 responses to a two-page questionnaire from cohorts of secondary 1 to 3 pupils from 16 different schools were collected and analysed. In the questionnaire, pupils were asked to rate 20 statements relating to D&T delivery in secondary schools against a Likert scale. In addition, there were four short questions to allow pupils to express their views and perceptions of D&T in their own words. Pupils' views were collected, categorised and compared with their academic levels, academic ability streams, and genders as well as schools. Overall, the responses consistently indicated a positive attitude towards D&T. This paper highlights some of the preliminary research findings of pupils' perceptions in D&T.

## Key words

attitudes, survey, design and technology, D&T, Singapore

## Background

Design and Technology (D&T) was launched in secondary schools in Singapore in 1990. Prior to the establishment of D&T, there were many technical subjects such as metalwork, woodwork, plastics and technical drawing that were taught in schools, however they were meant for technically-inclined pupils. Now D&T has replaced the individual technical subjects and integrated all these subjects with additional components. It has become a compulsory subject for both boys and girls in almost all secondary schools in Singapore at lower secondary levels (secondary 1 and 2, ages 13 to 14) and it is an elective subject for upper secondary levels (secondary 3, 4 and 5, ages 15 to 17). As D&T is a relatively new subject with

technical components, its value and usefulness have not been fully appreciated by the pupils and their parents. For some reasons, D&T is not a popular subject among the academically inclined pupils. The number of pupils selecting this subject is relatively low, only about 20% of the cohort.

For years, there has been a common perspective among D&T teachers that pupils in Singapore do not like workshop classes. Pupils seem to feel that D&T work would dirty their hands, and operation of the tools and machines is dangerous and tiring. Furthermore, pupils equate the D&T course with technical training for craftsmen and technicians and thus do not have a positive impression of it. Gender preferences seem to be quite obvious as girls generally do not select this subject during their course selection exercises at the end of secondary 2. For some schools, D&T pupils in upper secondary levels were stereotyped to be of lower academic ability. In general, D&T teachers feel that pupils were not adequately motivated in either the theory or practice components of the subject and the subject has not yet been well-received.

This might not be the real situation in Singapore schools, as there has been no formal recording or research published. There have been quite a few papers, surveys and studies on D&T carried out in the Singapore context. Chan (1993) performed a survey of about 300 principals, head of departments and D&T teachers to arrive at a fuller understanding of D&T in the first few years of its implementation. Tan (1996) described and explored some issues in the design process in the delivery of D&T. Yau (2000, 2002a, 2002b) also discussed some aspects of portfolios in the practice of D&T and electronics as well as the relevance of D&T to the engineering and design courses in polytechnics. However, there is no published record regarding pupils' perceptions. Hendley's (1996) work in investigating pupils' perceptions of D&T in South Wales inspired the researchers<sup>1</sup> to carry out a similar survey in Singapore. In the

<sup>1</sup>The researchers consist of a trainer and trainee in D&T in the National Institute of Education, the sole teacher training institute in Singapore.





## Pupils' Views Towards Design and Technology in Singapore

researchers' opinion, information about learners' feedback is essential for any kind of curriculum review. Thus, the researchers initiated this research in the hope that this will bring up some discussions about the different levels of emphasis in the current D&T curriculum.

### Questionnaire Design

Yau's (2000, 2002a) questionnaire was used as a basis for this research. A number of statements from his questionnaire on pupil's perceptions of the subject as well as their attitudes and motivations in D&T were modified. Additional statements relating to the subject components were included. There were a total of 20 statements for pupils to respond to on a 4-point Likert scale. Respondents were given an additional option of selecting "No Comment" to each statement. The questionnaire testing was piloted with 62 secondary 1 pupil and 47 D&T teacher trainees to check and fine-tune its design. Figure 1 shows the questionnaire used for the study.

Some of the statements are listed below.

### Some Statements Directly Relating to Attitude and Motivation:

- I don't like to attend D&T classes.
- D&T is a useful subject.
- D&T theory is too dry and difficult.

### Some Statements Indirectly Relating to Attitude and Motivation:

- D&T is just a craft and skill course.
- Boys are better in both D&T theory and practical.
- D&T stresses design.
- D&T integrates with various skills and knowledge.
- Creativity is practiced in D&T design and artefacts making.

From the data collected (final sample size is 982), it was confirmed that there was a clear positive or negative statistical correlation ( $p > 0.85$ ) between any pair of the statements.


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### Design & Technology Questionnaire

*Hi, I believe you have gone through D&T programs in the last two or three years. Do you like it? I would like to have your feedback and opinion for a research project.*

Assistant Professor Yau Che Ming November 2002

**Please tell me a bit about yourself.**

Name (optional) \_\_\_\_\_ Class \_\_\_\_\_ Sex \_\_\_\_\_  
 School \_\_\_\_\_

**How would you rate the following statements relating to D & T program? Please just circle the best option you think fit. (1: strongly agree 4: strongly disagree NC: no comment)**

| Statements   | Responses  |
|--|------------|
| 1. I don't like to attend D&T classes.                         | 1 2 3 4 NC |
| 2. I am good at practical work in D&T.                         | 1 2 3 4 NC |
| 3. D&T is a useful subject.                                    | 1 2 3 4 NC |
| 4. D&T is just a craft and skill course.                       | 1 2 3 4 NC |
| 5. Boys are better in both D&T theory and practical.           | 1 2 3 4 NC |
| 6. Sketching skill in D&T is important.                        | 1 2 3 4 NC |
| 7. D&T emphasizes on Design.                                   | 1 2 3 4 NC |
| 8. The portfolio in D&T is interesting and fun.                | 1 2 3 4 NC |
| 9. I am glad to do well in my D&T projects.                    | 1 2 3 4 NC |
| 10. I hate to dirty my hands in D&T workshops.                 | 1 2 3 4 NC |
| 11. D&T will help in my future study.                          | 1 2 3 4 NC |
| 12. D&T teachers demonstrate skills and creativity to me.      | 1 2 3 4 NC |
| 13. D&T is an outdated subject.                                | 1 2 3 4 NC |
| 14. D&T integrates with various skills and knowledge.          | 1 2 3 4 NC |
| 15. Girls are not good in D&T programs.                        | 1 2 3 4 NC |
| 16. Creativity is practiced in D&T design and artefact making. | 1 2 3 4 NC |
| 17. Team working in D&T program is essential.                  | 1 2 3 4 NC |
| 18. D&T theory is too dry and difficult.                       | 1 2 3 4 NC |
| 19. The key part of D&T is for the technology education.       | 1 2 3 4 NC |
| 20. D&T teachers are boring and strict.                        | 1 2 3 4 NC |

With regard of the nature of D & T subject, please indicate your personal feeling in the following questions with explanation. Please circle the choice and write down your reasons.

1. D & T is a subject welcomed by most students. YES/NO  
 Why? \_\_\_\_\_

2. D&T is a time consuming subject in completing assignments and projects. YES/NO  
 Why? \_\_\_\_\_

3. D&T should be compulsory for all students in all levels. YES/NO  
 Why? \_\_\_\_\_

**Overall, what is your own perception of D&T? Which pictures below most match your ideas? Please circle one and explain why you think so. Alternatively, you can choose to draw an "object" in the empty box and explain your answer.**



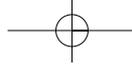



Explanation: \_\_\_\_\_

**Thank you very much your cooperation and contribution**

Fig.1 Questionnaire





## Pupils' Views Towards Design and Technology in Singapore

Although pupils were given an option to choose "No comment" for every statement, there were 83% valid responses. Therefore, the set of statements should be consistent and sufficient in describing pupils' perceptions of D&T.

Furthermore, in order to validate pupils' views in their own words, pupils were asked to express their opinions concerning the following three free-response questions: whether D&T is a subject favoured by most pupils or not? whether D&T is a time consuming subject in completing assignments and projects or not? and finally, whether D&T should be compulsory for all pupils at all levels or not?. Interestingly, the result of the findings showed about 95% pupils willingly wrote an average of about 15 words for the discussion of each statement.

In the last part of the questionnaire, there was an overall perception description of D&T, which was expressed pictorially. Pupils were asked to choose one out of four given pictures or they could choose to draw their own "object" or "symbolic figure" to match their perception of D&T. In all cases, pupils were requested to give an explanation for their choice in their own words. This was another form of triangulation of findings. The different "pictures/ objects" options were selected quite evenly by the pupils and they have written an average of about 20 words to elaborate their choices.

The intention of the questionnaires was to have a wide range of findings about pupils' perception in D&T including the selection of pre-set answers as well as their choices of representative pictures and their own explanations.

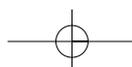
### Survey Sampling

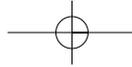
In order to have a wide and fair response of pupils' views towards D&T, out of some 140 secondary schools in Singapore, 16 schools were chosen based on an even academic achievement distribution and a geographically "proportioned" location distribution in Singapore. In Singapore (as at year 2002), an annual ranking list for the top 50 secondary schools is published, from which the researchers drew some of their selections. Secondary schools in Singapore are segmented into four major regions: namely North, Central, East and West, but the schools are not evenly distributed among these regions, i.e. with fewer schools in the Central and more schools in the East. As mentioned earlier, D&T is a compulsory subject for all secondary 1 and 2 pupils while it was optional in secondary 3, 4 and 5 levels. Taking into account that all secondary 1 pupils did not have significant exposure in D&T and all secondary 4 and 5 pupils were expected to be unavailable during the period in which the questionnaire was being distributed, therefore a higher percentage of secondary 2 pupils was chosen to better reflect the overall pupils' views. The selection of schools in the aspects of schools' location and ranking is shown in Table 1.

In the Singapore education system, there are different academic streams, namely Special, Express, Normal (Academic) and Normal (Technical), where pupils are grouped according to their learning ability and performance. Normal (Technical) streams pupils took a similar subject, Technical Studies, and were therefore excluded from this survey and data analysis. The pupils from the Express stream represent approximately 60% of the

| School Ranking       | North | Central | East | West | Total |
|----------------------|-------|---------|------|------|-------|
| Academically Good    | 1     | 0       | 2    | 2    | 5     |
| Academically Average | 2     | 1       | 1    | 1    | 5     |
| Academically Weak    | 0     | 1       | 4    | 1    | 6     |
| Total                | 3     | 2       | 7    | 4    | 16    |

**Table 1: Distribution of academic ranking of schools in the survey sample**





## Pupils' Views Towards Design and Technology in Singapore

| Pupils' Academic Ability | Secondary 1      | Secondary 2      | Secondary 3      | Total (%)         |
|--------------------------|------------------|------------------|------------------|-------------------|
| Special                  | 31               | 37               | 0                | 68 (7%)           |
| Express                  | 194              | 384              | 35               | 613 (62%)         |
| Normal (Academic)        | 33               | 109              | 159              | 301 (31%)         |
| <b>Total (%)</b>         | <b>258 (26%)</b> | <b>530 (54%)</b> | <b>194 (20%)</b> | <b>982 (100%)</b> |

**Table 2: Distribution of pupils' academic ability streams in the survey sample**

overall pupil population, and thus more pupils from this stream were chosen to provide a better representation of their views. The distribution of the survey is depicted in Table 2. The distribution among schools and different academic ability streams was postulated to be fair, consistent and representative. The ratio of the genders for this sampling was fairly equal. The gender ratio was taken in a fairly evenly distributed sampling of 51:49 (girl:boy) out of 982 pupils.

### Pupils' Attitudes in D&T

The data for twenty, 4-point Likert statement responses were analysed in the categories as whole sample, gender, level, and academic ability stream and school academic type. Instead of performing factor analysis, and, with the inspiration of Weiner's (1992) book on human motivation, an attempt to compute an attitude and motivation index was performed from the response ratings to some selected statements. Those statements were chosen by eliminating statements considered to relate mainly to content, subject and gender. They were further filtered by only accepting those with correlation coefficients at the value of 0.95 or above. In the end, seven statements were selected to compute the index, which was then to be compared and discussed. After readjustment of the calculation formula, results of three (out of the selected seven) statements, as well as the overall "attitude index" (for the selected seven statements) was shown in Table 3.

### Notes:

#### 9Y, 14<sup>5</sup>, 16<sup>7</sup> Statements

- 9Y I am glad to do well in my D&T projects.
- 14<sup>5</sup> D&T integrates with various skills and knowledge
- 16<sup>7</sup> Creativity is practiced in D&T design and artifact making.

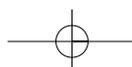
### Classification of Schools

Criteria: Based on Secondary Schools Ranking 2002 (Mean L1B5 and PSLE Entry Score)

- School Group A# : Academically Good
- School Group B#: Academically Average
- School Group C#: Academically Weak.

| Responses       | Mean              |                 |                 | Attitude Index |
|-----------------|-------------------|-----------------|-----------------|----------------|
|                 | Statements Number |                 |                 |                |
|                 | 9 <sup>y</sup>    | 14 <sup>5</sup> | 16 <sup>7</sup> |                |
| All Pupils      | 1.98              | 2.00            | 1.83            | 15.77          |
| Boys            | 1.93              | 1.89            | 1.84            | 15.12          |
| Girls           | 1.99              | 2.08            | 1.82            | 16.24          |
| Secondary 1     | 1.99              | 2.07            | 1.83            | 16.04          |
| Secondary 2     | 1.99              | 2.02            | 1.84            | 16.09          |
| Secondary 3     | 1.93              | 1.87            | 1.80            | 14.55          |
| Special         | 1.79              | 2.06            | 1.78            | 17.08          |
| Express         | 2.02              | 2.06            | 1.86            | 15.87          |
| Normal (A)      | 1.96              | 1.89            | 1.81            | 15.23          |
| School Group A# | 1.97              | 2.10            | 1.86            | 16.51          |
| School Group B# | 1.91              | 1.93            | 1.82            | 15.20          |
| School Group C# | 2.01              | 1.97            | 1.81            | 15.56          |
| School A1 North | 1.78              | 2.04            | 1.74            | 17.06          |
| School A2 East  | 1.83              | 2.15            | 1.86            | 16.72          |
| School A3 East  | 1.94              | 1.97            | 1.75            | 15.13          |
| School A4 West  | 2.39              | 2.29            | 2.17            | 17.01          |
| School A5 West  | 2.07              | 2.11            | 1.89            | 16.86          |
| School B1 North | 1.82              | 1.72            | 1.91            | 14.58          |
| School B2 North | 2.11              | 2.14            | 2.01            | 15.35          |
| School B3 South | 1.86              | 2.04            | 1.65            | 15.46          |
| School B4 East  | 1.88              | 1.90            | 1.63            | 15.78          |
| School B5 West  | 1.76              | 1.79            | 1.70            | 15.02          |
| School C1 South | 2.15              | 1.92            | 1.81            | 15.14          |
| School C2 East  | 2.24              | 2.10            | 1.90            | 15.45          |
| School C3 East  | 1.89              | 1.98            | 1.73            | 15.53          |
| School C4 East  | 1.93              | 1.80            | 1.73            | 15.43          |
| School C5 East  | 1.94              | 2.00            | 1.81            | 15.17          |
| School C6 West  | 2.10              | 2.14            | 1.94            | 16.64          |

**Table 3: Means of three, 4-point Likert scale statements and overall "Attitude Index"**





## Pupils' Views Towards Design and Technology in Singapore

### "Mean" Ranges from 1 to 4

1: Strongly agree; 4: Strongly disagree  
(A value of 2.5 or less indicates in favour of the question statement.)

### "Attitude Index" Ranges from 7 to 28

7: Strongly agree; 28: Strongly disagree  
(A value of 17.5 or less indicates good attitude and more motivated.)

In general, as shown in the Table 3, all three perception statements were well supported by pupils as all means obtained were well below 2.5 and their "attitude indices" were far below 17.5. Similar results were obtained for the rest of the 20 perception statements in the questionnaire. Therefore, there was sufficient evidence to claim that pupils, in general and without gender bias, perceive D&T positively and like the subject.

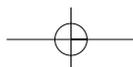
For statement No.14, in particular, the data was further analysed to confirm that there was clearly a statistically significant difference (by analysis of variance, one-way ANOVA, F-test values) between groups of responses from boys and girls ( $F=12.90$  at 0.000 level), from different levels ( $F=3.66$  at 0.026 level), from different schools ( $F=3.26$  at 0.039 level), and from different academic ability groups ( $F=2.53$  at 0.039 level). As a result, concerning whether D&T integrates the various skills and knowledge, a possible conclusion could be drawn that: 1) boys favour the subject more than girls; 2) pupils in senior levels liked the subject more than pupils in junior levels; 3) pupils of the normal stream favour the subject more than those in special and express streams; 4) pupils from schools of lesser academic achievement favour the subject more than those of schools with higher academic achievement. Hence, a possible generalisation could be drawn that pupils who performed well academically were more convinced that D&T was a subject that taught various skills and knowledge. This finding was found to be similar for almost all the other 19 statements' responses, with variation of degree of confidence level.

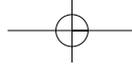
Also, among the 20 statements, there were two gender related statements. Pupils were asked whether they agree that "Boys are better in both D&T theory and practical" with mean response at 2.55:2.94 for boys:girls, and "Girls are not good in D&T programs" with mean response at 2.86:3.34 respectively. Consistently, pupils were not in favour of the statements, although to a different extent. There were substantial statistically significant differences ( $F=25.27$  and  $45.45$  respectively, both at 0.000 level) between girls' and boys' response to these two statements. Therefore, more girls than boys firmly believed that girls were performing as well as boys. Also, as is consistent with other findings in this survey, gender bias in D&T was not obvious in pupils' views in Singapore schools. However, the gender bias in D&T as a subject was still an issue to be investigated separately.

For the "attitude index" analysis, the difference of index value with respect to gender, levels, schools and academic ability groups were also found statistically significant ( $F=2.82$ ,  $13.83$ ,  $3.01$  and  $4.83$  respectively, all at 0.000 level) and the trend of change of index follows closely with each of the seven contributing statements. So, this leads to the interesting research assertion: *In Singapore, pupils who performed less well academically perceive D&T better.* However, this would not deny the preferences of D&T in other groups of pupils.

As a whole, the 20 statements received different degrees of support or opposition. By rephrasing the statements, most pupils, regardless of gender, level, school and ability streams, essentially expressed their views as below:

- *"We like to attend D&T classes. Some of us are not necessarily good at practical work in D&T though boys always believe they are better in workshop practice. In fact, boys are not necessarily better in D&T theory and practical. And, we believe girls are also good in D&T programmes. Somehow, all of us consider ourselves glad to do well in our D&T projects."*





## Pupils' Views Towards Design and Technology in Singapore

- No doubt, D&T is a useful subject and it is not just a craft and skill-based course. And, it stresses design and it therefore is obvious that sketching skill is important in D&T. Basically, portfolios are interesting and fun as shared by some of our senior pupils.
- We do not hate to dirty our hands in D&T workshops. D&T should be able to help us in our future study. Our D&T teachers are good at demonstrating skills and creativity to us but, some of their teachings are boring and strict.
- Certainly, D&T is not an outdated subject and it actually integrates various skills and knowledge. Also, creativity is practiced in D&T design and artefact making. Somehow, we are quite divided in judging whether D&T theory is too dry and difficult or not.

*Boys tend to think so while girls do not agree in general. Nevertheless, we all feel it is obvious that the key part of D&T is for technology education."*

Those pupils in higher levels and from lower academic streams usually gave a stronger preference, and sometimes boys gave a stronger indication.

### Pupils' Evaluation of D&T

In the survey, there were three debatable statements for pupils to indicate their opinions: YES or NO, as well as to express their views in their own words. Once again, as shown in Table 4, their YES/NO option data was analysed for the whole sample, gender, levels, school and academic ability streams, as well as to test their statistical significance in the difference among groups. However, quite differently from the findings found for pupils' attitudes, there was no statistically significant difference from the option ratio among genders, levels, and academic ability streams. Yet, it was obvious that the responses' percentage ranged significantly differently among schools. The only obvious gender difference was observed for the question relating to whether D&T was welcomed by most pupils.

### Notes:

#### 1 Y, 2 5, 3 3 Statements

1 Y D&T is a subject welcomed by most pupils

2 5 D&T is a time consuming subject in completing assignment and projects

3 3 D&T should be compulsory for all pupils in all levels.

### Classification of Schools.

Criteria: Based on Secondary Schools Ranking 2002 (Mean L1B5 and PSLE Entry Score).

School Group A#: Academically Good

School Group B#: Academically Average

School Group C#: Academically Weak.

| Responses       | YES %           |    |    |
|-----------------|-----------------|----|----|
|                 | Question Number |    |    |
|                 | 1Y              | 25 | 33 |
| All Pupils      | 52              | 71 | 23 |
| Boys            | 62              | 73 | 25 |
| Girls           | 44              | 70 | 22 |
| Secondary 1     | 51              | 61 | 34 |
| Secondary 2     | 46              | 72 | 15 |
| Secondary 3     | 71              | 83 | 31 |
| Special         | 54              | 69 | 17 |
| Express         | 45              | 70 | 24 |
| Normal (A)      | 62              | 76 | 24 |
| School Group A# | 51              | 75 | 16 |
| School Group B# | 54              | 71 | 26 |
| School Group C# | 53              | 69 | 28 |
| School A1 North | 47              | 78 | 12 |
| School A2 East  | 49              | 72 | 20 |
| School A3 East  | 49              | 80 | 36 |
| School A4 West  | 71              | 70 | 11 |
| School A5 West  | 39              | 74 | 9  |
| School B1 North | 58              | 62 | 12 |
| School B2 North | 47              | 68 | 23 |
| School B3 South | 43              | 72 | 21 |
| School B4 East  | 73              | 86 | 24 |
| School B5 West  | 49              | 64 | 35 |
| School C1 South | 53              | 80 | 35 |
| School C2 East  | 61              | 82 | 12 |
| School C3 East  | 49              | 60 | 14 |
| School C4 East  | 47              | 80 | 17 |
| School C5 East  | 41              | 70 | 44 |
| School C6 West  | 68              | 52 | 38 |

**Table 4: Percentage of Yes for three free-response statements**



## Pupils' Views Towards Design and Technology in Singapore

### "YES %" Ranges 0 to 100

0: Totally disagree 100: Totally agree  
(A value of 50 or more indicates in favour of the question.)

There is a range of 0 to 4% giving invalid or no response.

Pupils also elaborated on their choices for YES or NO for three statements. After carefully examination of their responses, a preliminary grouping criterion with six different items was designed to group the key descriptive words in the pupils' writing. Three teams of a total of 25 coders were trained and performed the grouping independently. Regardless of slight deviations of the variables between the groups, the percentage distribution was quite consistent among the three teams' results. The grouping exercise was further sub-divided by sets of YES options and NO options. The result of the average grouping from the teams is shown in Table 5.

|                     |       | A  | B  | C  | D  | E  | F | Total |
|---------------------|-------|----|----|----|----|----|---|-------|
| Statement 1 average | "YES" | 47 | 12 | 13 | 19 | 0  | 9 | 100   |
|                     | "NO"  | 60 | 3  | 16 | 6  | 7  | 8 |       |
| %                   | ALL   | 52 | 8  | 14 | 14 | 3  | 9 |       |
| Statement 2 average | "YES" | 11 | 8  | 3  | 14 | 58 | 6 | 100   |
|                     | "NO"  | 20 | 14 | 18 | 19 | 28 | 1 |       |
| %                   | ALL   | 13 | 9  | 7  | 15 | 51 | 5 |       |
| Statement 3 average | "YES" | 28 | 18 | 25 | 20 | 2  | 7 | 100   |
|                     | "NO"  | 58 | 6  | 13 | 4  | 10 | 9 |       |
| %                   | ALL   | 49 | 9  | 17 | 9  | 8  | 8 |       |

**Table 5: Average grouping result (from three teams of coders) of three free-responses statements**

**Statement 1:** D&T is a subject welcomed by most pupils. Yes or No?

**Statement 2:** D&T is a time consuming subject in completing assignment and projects. Yes or No?

**Statement 3:** D&T should be compulsory for all pupils in all levels. Yes or No?

### GROUPING CRITERIA AND RULES

#### Criteria:

A ----- statements/reasons involving words as of personal and emotional judgment and preference (e.g. *fun, interesting, like, hate, good, useful, weak...*)

B ----- statements/reasons involving words relating to the subject (D&T) design, creativity and innovation (e.g. *design, creative, drawing, sketching, portfolio...*)

C ----- statements/reasons involving words relating to the subject ( D&T) theory, teaching and examination (e.g. *lesson, boring teachers, exam, GCE, marks...*)

D ----- statements/reasons involving words relating to the subject ( D&T) practical, workshops and artefacts (e.g. *projects, skills, handwork, construct, planning...*)

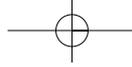
E ----- statements/reasons involving words relating to time (e.g. *time-consuming, time, wasting time...*)

F ----- others not classified as above.

#### Rules:

1. Try best to judge for either class A to E, if not, put to F.
2. When there are more than one key word/idea found in the response, firstly, select the class type with repeated/similar word/idea. (E.g. "*It is quite a confusing topic and there is a need to memorise a lot of things. D&T needs creativity; those who are not very creative will have problems doing the project.*" Many ideas and key words, but repeating on "*creativity*" so 'B').

If not possible, select the first word/idea that appeared. (E.g. "*It is because D&T is a fun and creative subject to learning*". Two key words found, but "*fun*" is the first word found, so 'A')



## Pupils' Views Towards Design and Technology in Singapore

The grouping criteria were fairly valid for most pupils' response statements. Evidently, the criteria may not be matching statement 2 in particular, which related to the issue of time in the statement itself. Rightfully, each statement should deserve its own grouping criteria. However, the item distribution might give some clear and distinct message while the small discrepancy situation could simply be ignored.

From the item distribution in the sets of YES and NO options, it was clear that the emphasis was different in most cases. Pupils defended or supported the same statement by relating to different experiences and reasons. It was shown that most of the reasons listed were true but different emphases were placed on them by those who had positive or negative attitude towards the statement. Furthermore, they had related quite differently on their choices of YES/NO options. Once again, this suggested that their thinking was different in terms of their attitudes towards D&T in particular. From the average and item distribution of all three statements 1, 2 and 3, Item A on personal and emotional expression and Item E on time factors were most mentioned in general.

As a whole, pupils expressed and debated their views, either by using their own words or by extracting some of the 20 stated statements in the questionnaire, to support or to defend the open-ended questions. The questionnaire was to be completed in a short time and the overall aim was to collect their immediate responses and perceptions. Consequently, it was partly an issue of pupils' attitude towards D&T in general. Overall, pupils' expressions were basically concerning attitudes towards the implication and delivery of D&T, and, in particular, the length of subject delivery time was an issue not to be overlooked in D&T.

### **Q.1: D&T is a subject welcomed by most pupils: Yes at 52%**

Pupils were slightly in favour of the statement but there was an obvious contrast of opinion for boys and girls, where boys agreed and girls did not. This was consistent with the earlier findings of a higher value of attitude index for

boys. Gender bias seems to exist, though not to a great and alarming extent. As expected, pupils in upper levels showed a much clearer indication of their preference. This might be explained by the presumption that: 'the more they know and learn about D&T, the more they like the subject'. However, this was simply a guess demanding evaluation.

Schools were quite divided in favouring or rejecting the statement. Their YES indications vary from 39% to 73% and from a rejection to a support situation. However, it was not statistically significant to see a difference among school clusters. It was possible that there were more reasons to contribute to the possible differences regarding the schools' culture, and emphasis on D&T, but not necessarily their academic performance.

For the various reasons written by pupils, as observed from the grouping analysis, it was interesting to note that the emphasis on item C and D was simply the opposite in the YES and NO sets of pupils. In other words, the pupils who welcomed D&T related to the practical part more than the theoretical part, while those pupils who did not welcome D&T gave the excuse that theory was more critical than practical. Therefore, in brief, it is postulated that all pupils liked the practical work in D&T regardless of whether they welcomed D&T or not.

Consistently for all different teams' grouping results, pupils related more to their emotional and personal perception towards the statement. Those who liked and those who did not like the subject expressed their personal judgment and feeling without many details and reasons being disclosed. When they mentioned other reasons, interestingly they did not talk much about the time factor but rather described more the theoretical and examination related issues. Hence, it was quite clear that in pupils' minds, whether they welcomed the subject of D&T or not, it was a question of attitude on how they perceived the subject, and the time factor was not the crucial issue here. This was true for secondary 1, 2 and





## Pupils' Views Towards Design and Technology in Singapore

3 pupils before they, advance to secondary 4 and 5, and getting into the hard work of preparing the artefacts and portfolios up to the standards of the GCE Ordinary Level examination.

### **Q.2: D&T is a time-consuming subject in completing assignments and projects: Yes at 71%**

For most pupils, with no gender difference, they were strongly in favour of the statement. Again, the analysis disclosed that those in the lower secondary levels were quite neutral towards learning D&T while secondary 3 pupils showed a much clearer support to the statement. Some pupils in lower academic ability groups show a greater support.

All schools were in favour of the statement that fell in the range of YES at 52% to 85%. Pupils from most schools, though with quite a significant difference in the degree of favour, strongly believed that D&T was a time consuming subject when completing assignments and projects, regardless of the academic type of individual school.

From the grouping analysis, as expected, Item E dominated as time consumption was a reality for all pupils regardless of their option of YES or NO. However, surprisingly, in both YES and NO sets of pupils, item D was rarely identified, though the statement relates to practical work. Item D consisted of less than 20% of the total response. This could be explained as pupils thinking that it was too obvious and there was no need to mention it. Pupils supporting or rejecting this statement referred mostly to the time factor which was so obvious and certain in D&T. In particular, for those who did not support the statement, they tried hard to relate to many other factors to defend their choice. Pupils expressed other positive points of the D&T programme rather than the time factor. Again, these pupils might simply articulating according to their emotional perceptions.

Pupils referred consistently to time when they agreed that D&T was really a time-consuming

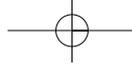
subject. This was well expected before the delivery of the survey. However, for those pupils who were not in favour of the statement, they related to their positive sentiments about D&T, intending to overwrite the time factor issue. Most of them did not take into consideration the fact that D&T was indeed a time-consuming subject. Furthermore, the distribution of the reasons listed for not supporting the statement was not consistently identified among different teams. It could be partly explained as pupils were trying very hard to relate to many other reasons and were confused with the pre-set grouping criteria. If this was the case, it would mean that those pupils were so eager to defend the statement that D&T, that though it might be time-consuming, the positive points outweighed the deficiencies. So, it was apparent to all pupils, and it was clear that D&T was really a time-consuming subject.

### **Q.3: D&T should be compulsory for all pupils in all levels: Yes at 23%**

Most pupils (regardless of level, ability and gender) were strongly against this statement. They did not support the idea that D&T should be a compulsory subject for all pupils in all levels. Similarly, all schools, despite their academic performance and individual culture, were strongly against the statement. This result should not be considered as contrary to the viewpoint that D&T was a subject welcomed by pupils. The statement included three key words: "compulsory", "all pupils" and "all levels", that, to a certain extent, brought up various judgments on different grounds.

Inconsistent results were observed in grouping analysis. For the YES set of pupils, there was no consistent and agreeable dominating item found in three teams' results. Also, there was big contrast between Items E and F identified in all teams' results. One explanation might be that the scope of discussion, and reasons relating to time and many other unknown factors, were too wide, and that has confused coders in arriving at the grouping results. Pupils who supported this statement, were generally associated with all issues relating to their personal perception and





## Pupils' Views Towards Design and Technology in Singapore

feelings, and other factors, but they did not mention much about the factor of time used in D&T. On the other hand, for the 'NO' set of pupils, Item A dominates and pupils related more to personal and emotional factors without disclosing the reasons explicitly. Pupils did not mention much about the factor of workshop practice and time spent in D&T.

Overall, the question resulted in too broad a spectrum to discuss easily. "Compulsory" could mean for secondary 3, 4 and 5 for both genders, or it might refer to "Advanced level subjects". Pupils might find insufficient time, materials, references and knowledge to share about whether D&T should be compulsory at all levels. Pupils who supported the statement defended the statement by giving reasons from personal perception to theory and practical issues. On the other hand, pupils who did not support the statement were more giving emotional expressions without details and, they did not say much about the issue of time. So, as a result, most pupils related to their subjective judgments only.

### Pupils' Perceptions of D&T

The researchers wanted to find out what were pupils' overall pictorial perceptions of D&T. Pupils were asked to choose a pictorial representation and to explain for their choice, in an average of 20 words. Pupils' choice was listed in the Table 6.

Most pupils related their perceptions of D&T to tools and workshop practice. Design and robotics were also selected to a significant proportion. The least number of pupils related D&T to books, which was a good sign as the overall perception of D&T was not a subject of book-based knowledge alone. There were still distinctive differences for choice percentages

between different schools. However, the choice percentage difference among groups by gender, level and academic ability was not significant.

Regardless of the emphasis or bias over the different choices, pupils' written explanation, by and large, will give their overall experience of the subject D&T. The following paragraphs would therefore be a brief "non-grounded" collection and description of D&T delivery in Singapore schools.

### D&T = "Books" (9% of responses)

Some pupils perceived D&T as a theoretical subject and most of the teaching time was spent on learning theories. Pupils were concerned more about the theory because it was vital for their examinations, whereas practical would only enable them to fabricate good pieces of work. In any case, pupils felt that they just had to memorise the notes on the equipment, tools and materials, their functions and properties from a book in order to do well in D&T theory. Furthermore, some pupils considered books a most useful resource as there was a need for research when studying D&T.

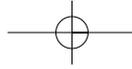
On the other hand, some pupils thought books were boring and hence suited D&T most as D&T was boring, time consuming and lacks room for creativity. Also, they thought D&T theory was difficult to grasp as there were so many books to read and memorise. Some pupils also shared the viewpoint that their teachers have been teaching the theory badly, thus pupils had to find their own reference books to study.

"The books are needed for our knowledge of the subject which makes us more intelligent and therefore could come up with a creative idea in making a product." Secondary 3 boy in Express stream.

| Choice        |  |  |  |  | Pupils' Own Drawings | No response |
|---------------|---|---|---|--|----------------------|-------------|
| Responses (%) | 9   | 39  | 19  | 22   | 7                    | 4           |

Table 6: The distribution of the choices in overall perception of D&T





## Pupils' Views Towards Design and Technology in Singapore

### D&T = "Tools" (39% of responses)

Many pupils considered D&T to be wholly concerned with workshop practice with tools. They needed to know the tools before learning how to make the basic things. Without tools, pupils thought that there would not be any man-made things which they used daily. Yet, few pupils thought D&T was a topic based mostly on how pupils make artefacts and carpentry work using the tools. In another aspect, they found that the process of making projects and artefact was very interesting and appreciated it very much. Furthermore, D&T pupils mostly depended on practical components to pass the subject.

On the contrary, a few pupils thought D&T was all about using tools to make products and therefore the subject delivery was boring and "repeated" and "standardised". They also preferred the practice than the theory and drawing as they don't like to memorise facts nor draft detailed diagrams.

"D&T is a topic based mostly on how we make artefacts and carpentering work. It requires a lot of tools so therefore my perception of D&T is Tools and other materials." Secondary 3 girl in Normal stream.

### D&T= "Design" (19% of responses)

Some pupils related D&T to design with creativity and that the emphasis was more on the design process. They think that without proper design and preparation a lot of products would not be realised. It was believed that D&T would cultivate pupils' creativity, through teaching them how to design, and through carrying out projects and assignments. Pupils used both intelligence and creativity which was taught during D&T lessons. Some pupils also related further to design, planning and research. They felt that planning was an important part of D&T.

Viewing the issues differently and with a different emphasis, some pupils just related D&T designing to drawing and sketching only as they felt that D&T was full of drawing and sketching in class. Yet, they thought that the

drawing and sketching skills were very important in D&T. Pupils needed the sketching in making their work piece.

"I think that planning and sketching are the most important processes in making an object as it ensures the stability, usefulness... of the object." Secondary 2 girl in Special stream.

### D&T = "Robotics" (22% of responses)

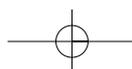
Many pupils found that it was exciting to make projects involving robotics and electronics in D&T classes. They liked to make gadgets which could be useful in daily lives. They believed D&T would help them to create electronic objects while the robot manufactures the end product of what D&T was able to execute. Hence the D&T subject would be able to improve our standards of living. D&T was the only subject in secondary schools which has projects like designing and making a useful robot, although few pupils related D&T to car manufacture. Some pupils preferred robotics as they saw them as creative products in D&T.

However, few pupils related robotics to those machines (lathes, CNC, drilling machines, etc) used in the D&T workshops as those pupils simply liked to do machinery work. Pupils used machines to help to do their project.

"D&T involves designing the product and making it work by applying technology to it. This robot is designed to be able to work and it can work efficiently with the aid of technology." Secondary 2 girl in Express stream.

### D&T = "Others?" (7% of responses)

These pupils preferred to do their own drawing and emphasis on the subject D&T. A few pupils drew "brain" and related D&T to thinking and creativity. They believed it was necessary to use their intellect capacity (brains) most of the time to think of creative designs and to do brainstorming. They claimed that the brain was needed for them to do the assignment properly and to work with the tools in the process of making artefacts. Some pupils drew "light bulbs" and explained that D&T ideas came like the light of the bulb when they had ideas and





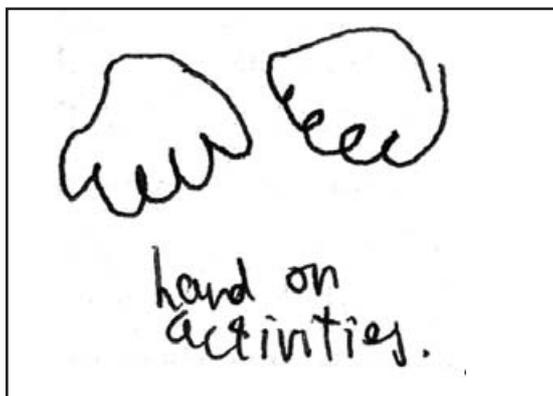
## Pupils' Views Towards Design and Technology in Singapore

the light bulb would brighten them to design more things.

Some pupils drew a piece of wood and related D&T as a 'free and easy' subject; that coupled with simple efforts, the wooden work piece could be carved, filed and painted into something of great beauty. They considered D&T as an interesting, creative and useful subject. They shared their views that D&T was an easy, relaxing, fun, interesting, creative, useful and enjoyable subject that allowed them to show their ideas and creativity in doing projects, giving them a sense of achievement. A few pupils drew a picture of class teaching, with everyone smiling as they think a D&T lesson was a time for enjoyment, relaxation, fun and laughter.

There are some negative feedbacks as well. Quite a number of pupils drew fans and stated that D&T workshops are hot, boring and dull. They claimed the projects pupils have done, the syllabus and the teacher's teaching were all very boring and D&T classes usually made them sleepy thus they did not learn anything in the end. Some drew and shared their views that D&T was troublesome, difficult, and time-consuming and somehow lacking creativity. Some even complained that they did not want to work technically, learning D&T was a waste of time.

*"Everything in D&T lesson are learnt with hand on activities experience are gained through hands on activities."* Secondary 3 boy in Express stream.



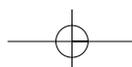
### Conclusion

For the survey conducted, the researchers were well aware of the limitations. The sample size of 982 pupils, which was about 1% of whole D&T cohort, was relatively small and not holistically representative. The whole spectrum of schools type, academic ability streams and levels was not fully reflected in the sample. Due to a lack of research funding, it was not feasible to conduct a nationwide questionnaire survey or to arrange selective interviews scheduled immediately after the survey to validate the findings. Nevertheless, it was believed that these preliminary findings were worth generally noting and that some further investigations could be conducted to complete the overall picture of D&T delivery in Singapore.

Inspired further by Spector's (1991) work, it was suggested that a grounded theory approach could be applied for the analysis of the three free-responses statements. In view of the huge number of responses, the time for the data analysis would be very substantial. Together with the detailed factor analysis of the full set of 20 statements, it was expected to come up with a 'complete picture' of how pupils perceive and evaluate D&T. The result will be reported in a future publication.

Furthermore, with reference to Chan's (1993) work, it was suggested that a similar mass survey could be conducted with D&T teachers but with a different set of questionnaires, and it would then be possible to compare the data with the pupils' views and to analyse and comment on any possible differences between their perceptions.

Lastly, there were two key issues raised from this survey, which require further investigation. One issue was that D&T was widely considered to be a time-consuming subject. It was necessary to clarify this common misunderstanding and to check out the real situation as well as to propose any possible remedial solution. The second issue was the misconception of the core of D&T. A comprehensive research project would be needed to review and analyse the current situation and whether D&T delivery in



## Pupils' Views Towards Design and Technology in Singapore

Singapore was being dominated by design or technology or a good integration of both.

Overall, among the findings yet to be discussed, it was very clear and the evidence confirmed that:

1. In general, D&T pupils bore a positive attitude and were motivated in D&T. Boys, pupils with lower academic ability and pupils in upper levels showed consistently stronger favour towards D&T.
2. Most pupils believed that D&T was a time-consuming subject, especially in completing assignments and projects. However, pupils were divided in considering whether this was a good or bad point.
3. In D&T subject delivery, pupils considered design work as the most interesting activity and creativity was clearly identified in the projects' development. However, some related D&T more to working with tools in the workshops than other subject component.

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