Maltese Girls' Attitudes to Physics

Lilian Said

Why Physics?

It has been argued by Kelly (1987) and others (Harding, 1979: Klainin and Fensham, 1987) that science is a male domain. A masculine image is attributed to physics. In fact polarization of subjects exists where the three sciences (physics, chemistry and biology) are optional. Girls tend to choose biology while few opt for physics. Boys prefer physics to biology and there is evidence that this applies in the Maltese situation as well as elsewhere (Darmanin, 1991; Ventura, 1991). Chemistry seems not to carry differential gender images (Johnson and Murphy, 1986: Johnson and Bell, 1987).

The polarization of subjects is of great concern to those who seek to make education equally accessible to everyone. If girls avoid studying physics they would be putting themselves in a disadvantageous position. They would be limiting themselves in scientific careers and career opportunities.

> Physics is a crucial qualification without which women are barred from many careers... Being scientifically illiterate in a highly technological society can only lead to a feeling of inadequacy.
>
> Duxbury, 1984,p.649

In Malta physics is now compulsory for entry to the State sixth form and so both girls and boys learn the subject. However attitudes towards the subject vary considerably (Ventura,1991).It is the aim of this small - scale study to identify the attitude that Maltese girls have towards physics.

Method of Investigation

To fully understand girls' attitudes to physics in their own words and with their own definitions, an Interview was held with ten (10) fourth form girls in one Junior Lyceum (grammar school). Although all from the same class, the girls were chosen at random. Pseudonyms have been used throughout. A set of ten questions (see below) had been prepared beforehand, and these were based on the items relating to subject orientation identified by Kelly (1987).The interviews were therefore structured. The pupils could answer in either English or Maltese according to their preference.

General attitudes towards physics

The first two questions of the interview 'What do you think physics is about?' and "Do you like physics ?' were designed to elicit general comments regarding the girls' understanding of the subject and their attitudes towards it. Half of the girls (5) considered physics as related to things that happen around us. Physics involves going into detail about things, carrying out experiments and studying formulae by heart (memory) according to two thirds of these girls.

> Brenda: Fil-physics nidħlu f'dettalji irqaq ta' affarijiet li niltaqgħu magħhom fil-ħajja ta' kuljum.
>
> Helga: Għalija il-physics huwa suġġett fejn wieħed jkun jista' jesperimenta t-teorija. Fih ċerti formuli li teħtieġ titgħallimhom bl-amment.

One girl sees physics as an integral part of our technological age.

> Ethel: Il-physics huwa suġġet li jitratta fuq it-teknoloġija. Naħseb li hu tajjeb fil-ħajja tal-lum, iktar u iktar il-quddiem, meta id-dinja tagħna qegħda dejjem tiżvillupa.

Two girls considered physics as a subject related to machinery and engineering. One commented that physics is 'boring' and 'confusing' while another girl said that it is difficult. Although most of the girls considered physics to be related to everyday happenings, they did not seem to note any connection between physics and human experience. This tallies with Weinreich-Haste's (1981 cited in Kelly, 1987, p 127) finding that

> science was associated with factors such as difficulty, hard rather than soft, things rather than people and thinking rather than feeling, all of which are part of the cultural stereotype of masculinity.

Asked whether they like physics and if so, why ? half (5) the girls answered that they did like the subject whilst four (4) said they do not like it.

Catherine took a neutral position. Her answer is typical of the ambivalence many girls feel towards the subject. She likes it both when it involves mathematics and when it is based on experiments, but she qualifies the liking by referring to difficulty and learning problems.

> Catherine: Jiddependi, xi kultant jogħġobni, xi kultant le. Jogħġobni l-aktar meta nagħmlu l-esperimenti, u meta ikun fih ħafna maths, dan is-suġġett huwa l-favurit tiegħi...iva, l-maths jiġifieri. Minn naħa l-oħra iddejjaqni l-physics, meta isir tqil ħafna, nibda nitħawwad u niddejjaq fil-lezzjoni.

Helga's answer is typical of those who did like physics

> Helga: Jien inħobbu għax fih nitgħallmu ħafna affarijiet li fil-ħajja ta' kuljum nistgħu niltqgħu magħhom.

Those like Ina, who disliked the subject linked it to difficulty in understanding

> Ina: Ma tantx, għax għalija huwa suġġett tqil u 'boring' u diffiċli biex tifhmu.

The girls' attitudes towards a subject are important because they are 'both a determinant and a consequence of learning' (White, 1988, p.100). Positive attitudes generate willingness to learn, while negative attitudes destroy it. It is quite encouraging that half of the girls interviewed like physics though it is equally of concern that the other half did not, especially since many of the comments suggest that with different methods and materials there could be a change in attitudes.

Physics-a compulsory subject?

Since most of the research on girls' attitudes to physics comes from Britain (Kelly, 1982) and Australia (Parker, 1984) where physics is an optional subject it is difficult to compare the findings with the Maltese situation, where for girls aspiring to State Sixth Form, it is a compulsory entry requirement. Whether a subject should be compulsory or not is debatable. Harding et al (1988, p.189) argue that

> The inclusion of choice is seen to be a liberalizing move which caters for a wide range of interests and encourages the development of decision-making skills. On the other hand, whenever choice is offered stereotyped assumptions may operate, restricting real freedom to choose.

Since physics has become compulsory in Maltese schools both Darmanin (1991) and Ventura(1991) have found that uptake has increased considerably and that girls are entering more science related courses, especially in the medical sciences (with 50% female medical students). However engineering remains undersubscribed (Darmanin,1991) and attitudes towards the subject have not yet changed significantly (Ventura, 1991).

With question 10, 'If physics were no longer a compulsory subject, would you then take it as one of your options?' I wanted to explore the issue further. The majority (7 out of 10 girls) answered that they would not have chosen it, with five (5) of the seven giving the reason that physics was unrelated to their future job choice. Johnson and Bell (1987, p.273) have also found that

> Interest in a subject and perceived usefulness for jobs were both the most frequently selected reasons for the pupils' subject choices.

Despite liking the subject, many of the girls would have been glad to drop physics.

The relevance of physics

Question 3 (a) was directed at eliciting exactly how relevant the subject was considered in terms of future jobs and careers.It was found that six (6) girls thought it was related to their future career whilst four (4) did not.

> Doreen: Iva, għax naħseb li se jkolli bżonnu biex nsir tabiba.

> Ethel: Għall-'job' li nixtieq ikolli 'l quddiem, il-physics huwa bżonnjuż ħafna. Inkella mingħajru ma nistax inwettaq ix-xewqa tiegħi. Jien nixtieq nsir 'sailor' u l-physics allura għandi bżonnu. Jekk imbagħad ma nsirx 'sailor', naħseb li xorta waħda għandi bżonnu għal jobs oħra. Barra minn hekk billi fl-iskola jkollna nitgħallmuh bilfors irridu jew ma rridux, jien naħseb li hemm raġuni għalfejn, u din hija li 'l quddiem ser ikollna bżonnu.

In all, the girls showed an acute awareness of occupational entry requirements and even of labour market processes as Darmanin (1992) has

found with larger samples. Amongst those who felt it was not relevant were answers such as Ina's (below) which show a single minded movement towards a career in teaching of specific subjects (though not physics). Other answers such as Joyce's also show a instrumentalist approach to the subject. Joyce wants to be a nurse, a profession in which in the broader understanding of it would benefit from a strong science background. Joyce doubts that physics is indeed useful and goes on to add that it is not an entry requirement for the course.

Ina:Le għax għall-għalliema ta' l-istorja ta' Malta jew xi suġġett ieħor bħall-lingwi, ma jidħolx physics.

Joyce: Le, ma naħsibx li jkolli bżonnu fix-xogħol tiegħi ta' nurse u lanqas ma naħseb li għandi bżonnu biex nidħol fil-kors.

Question 3b asked whether the girls thought they needed physics to help them understand and control the world around them. Here again the majority (6) did think physics was useful in this regard whilst the remaining four did not. Some, like Catherine, qualified their answer by referring to the theoretical relevance of physics but doubting its practical applicability.

Catherine:Jiddependi...bħal issa qed jiġini ġo moħħi l-eletriku fid-dar. Hawn żgur li jidħol l-physics. Iżda l-physics mhux dejjem tista' tassoċjah mal-ħajja tagħna ta' kuljum.

Others like Doreen gave a wider interpretation to the relevance that could be derived from the subject and her answer indicates that if teachers need to find ways of 'marketing' the subject they might do well to consider these commonsense constructions of relevance.

Doreen: Iva, għaliex jekk jinqala ' xi ħaġa fid-dar tkun taf timmaniġja. Anke, ngħidu aħna, la tkun taf dwar il-'greenhouse effect' tkun tista tieħu passi biex tgħin l-ambjent.

Physics as a male domain

Kelly's (1987,p.127) dictum that 'science is masculine' is well-known. In order to find out how these Maltese girls felt about this two questions were put to them in this regard. Question 5 asked if they thought that boys achieved better in physics than girls did. Half thought that boys did do better whilst the other half were divided in their response.Of those who thought boys did have more success the answer was often explained in terms of the boys' opportunities to practice the subject in their everyday life.

Ethel:Il-ġuvintur jifhmuh iktar għax fil-ħajja ta' kuljum huma jipprattikawh iktar mit-tfajliet.

Two of the girls did not agree that boys did better whilst another two conceded that boys sometimes did better but this was because they needed it for their careers.Interestingly, among the two who thought that girls did achieve as well as the boys was Angela who had herself had difficulties with the subject and disliked it. It would be misleading with this sample to claim that the single -sex setting of Maltese secondary schools might in part produce a less stereotyped attitude to the ability of girls than mixed schools, but it is noticeable that some difference in attitude between these girls and other reported studies (Kelly,1987) do exist. For example, Brenda agrees that often it is boys who do achieve in physics but she also makes it clear that firstly she is not sure why this is so, and that one reason may be that the boys have more opportunities for practice. Secondly she reminds us that girls are intelligent too and could achieve well. Without actually saying it Brenda implies that take-up of the subject might be the real problem for girls.

Brenda: Iva, naħseb li jmorru (is-subien) aħjar fil-physics bħala suġġett, għalkemm hemm ukoll ħafna tfajliet li huma intelliġenti u li jifhmu l-physics. Iżda xorta jibqa' l-fatt li l-maġġoranza ta' dawk li jifhmu l-physics huma ġuvintur... Eżattament għalfejn ma nafx, forsi huma (is-subien) jippratikawh iktar fil-ħajja tagħhom ta' kuljum.

Ethel also links the difference in achievement to different lived experiences and specifically mentions Malta as a country in which boys and girls are given different jobs to do and therefore different learning situations. Finally, Felicity demonstrates the type of protection that is afforded by the single-sex system. She answers that she cannot give an answer because she has never discussed physics with boys, the implication being that she does not consider their performance and attitudes as relevant to her own experiences.

Indeed when it came to answering question 7 which asked whether the girls thought that physics was a boys' subject, most of the girls (7) disagreed with this suggestion. Angela answers quite dogmatically

Angela: Le, għax kulħadd kemm bniet, kemm subien jistgħu jagħmlu karriera bil-physics.

Brenda is equally clear about her objections to the insinuation that physics is a boys' subject. For her, women's participation in waged labour means that they should have the same educational opportunities. The same position was shared by Doreen who spoke also of equal rights and by Ethel who stressed that girls could and should be able to have the same jobs as boys. Ethel feels that girls should be able to choose any field in the labour market.

Brenda: Le, jiena ma naqbilx li il-physics huwa aktar suġġett tas-subien. Illum il-ġurnata ix-xogħolijiet tal-ġuvintur huma bħal tat-tfajliet u allura jekk f'ċertu xogħol hemm bżonn il-physics, anki 'l-bniet għandhom bżonn jitgħalmuh biex ikunu jistgħu jagħmlu dak ix-xogħol.

Though she felt that physics was not a boys' subject, Ina was not confident that girls and women would with take-up be able to enter the same jobs as men. She gives engineering as an example. The students who thought that it was a boys' subject qualified their answer by referring to the fact that boys take up the subject more than girls. None of them gave ability as an explanatory variable.

Self Image

Much of the work on girls and physics has explored the idea of self-image. Kelly (1987) gives the story of Jean to make her point. Duxbury (1984, p.652) points out that

The self-image of girls is poor. Girls tend to attribute success more to luck than to judgement.

In the interviews a series of questions were asked to try to understand the girls' personal self -image, especially in relation to their achievement in physics. Three girls said they did badly in physics because they never liked the subject. A typical answer was Angela's who started off by locating the problem in poor teaching but then went on to say that possibly she was not studying enough. Later this was explained as a consequence of difficulty, in that she had become disheartened (in the Maltese 'I lost heart') and gave up trying to understand

Angela: Le, ma tantx għax xi kultant ma nifhem assolutament xejn.

Jista' jkun li jaffettwa l-fatt li min jagħllmek ma tantx ikun tajjeb għalhekk ma tagħtix każ. Jista' jkun ukoll minn naħa tiegħek għax ma tistudjax. Jista' jkun ukoll li is-suġġett tarah tqil, taqta' qalbek u ma tikkoperax biex tifhem aktar, kif qed jiġri lili.

Six of the ten girls interviewed said that their performance varied. They had to study hard to do well. They found that teaching methods also affected their performance.Physics, like mathematics (Fennema,1983) is seen to affect self-esteem and cause anxiety because even those girls like Brenda (below) who do very well in all other subjects find difficulty with physics.

Brenda: Ma tantx immur tajjeb, għalkemm ġieli nistudja. Naħseb li l-iktar li jitfawni lura huma dawk il-'problems' twal li dejjem kważi iħawduni. Fis-suġġetti l-oħra kważi dejjem immur tajjeb, minbarra l-physics, u għalhekk naħseb li din hi xi ħaġa ġejja minni. Infatti mill-bidu għidt li l-physics mhux se jogħġobni u hekk ħadtu fuq demm id-dars.

Brenda illustrates the problem of self-esteem because like many girls she is succeeding in other areas and yet she puts the blame for her failure to achieve in physics squarely at her own feet. Her expression 'and so I think it is something that has to do with me' is then followed by the observation that she immediately decided that she did not like the subject and found it barely tolerable. The Maltese expression 'ħaddtu fuq demm id-dars' is roughly translated as 'I was immediately put off by it' but carries more vigour in the original because it literally states 'it irritated the nerves of my teeth'.

Tinkering activities

The different socialization processes for girls and boys encourage them to develop traditional gender roles. Kelly (1987, p.129) argues that

Based on their toys and childhood hobbies boys have much greater experience than girls of tinkering activities.

With question 9 on present hobbies, past toys and early childhood games I wanted to see how many of these girls had any experience of tinkering activites.Only one of the girls had direct experience. Ethel was the only girl who said specifically that she used to play with her brother and dismantle and then fix cars. Her interview shows that she has a positive attitude to the

physics, though she thinks that boys are more likely to do well.

Her hobbies now include reading, **helping her father in the garage,** watching television and swimming. Only one other girl also mentioned playing with boys, but this in pretend play games such as Zorro. The remaining eight (8) girls did not mention tinkering activities. Four used to play with dolls, whilst two others used to pretend they were teachers. Felicity made her own toys, for example cutting up vegetables and then pretending to be a vegetable seller.

Their adolescent activities centre around reading and watching television, with a high percentage of sport activities. Most of the girls invariably mentioned summer swimming, as well as other sport such as volleyball, dancing, skating,long walks including night hikes (Helga), karate (Catherine), jogging, tennis and netball. Some also mentioned listening to music and collecting stickers and posters of their favourite pop stars.

Despite some gender-neutral sport activities it is apparent from these answers that the girls' leisure activities consolidate the modern version of stereotyped femininity. Whilst taking more care of fitness and health, they leave the male world unchallenged.

Experimenting in the physics lesson

Involvement in tinkering activities nourishes confidence in pupils' ability to cope with experiments.It has been found that in co-educational systems girls are afraid and reluctant to participate in experiments. Their lack of involvement in tinkering activities is thought to be a reason for this (Kelly, 1987; Duxbury, 1984). Asked whether they thought that experiments were important part of the physics lesson and whether they liked them (question four) all the girls answered in the affirmative and added that the experiments were essential because they aided understanding. Brenda finds that the process of verification through experiment helped one to understand the subject and avoided the usual monotony of note taking associated with physics lesson. Angela was somewhat contradictory in her answer. Initially her answer also puts emphasis on experiments as an aid to understanding through active participation. However when asked the follow-up question as to whether she liked carrying out experiments herself she answered that

> Angela: Ma tantx.Xi kultant ma nifhimx xi jkun qed jiġri, jekk mhux bis-saħħa ta' sħabi u tat-teacher.

It appeared that unless the girls understood the experiments prior to entering the laboratory, they could be of questionable value. Catherine for example, points out that experiments are exciting but hard work which is made easier if everyone in the group helps. Another theme that emerged from the interviews was the satisfaction to be derived from getting your own results and also the special understanding associated with creating a process that works. Felicity puts it thus

> Felicity: Jien nħobb ngħamilhom għax meta l-oġġett tagħmlu int stess, tkun taf minn fejn ġew l-affarijiet.

The issue of self-directed learning and practice, and of control and verification of the theoretical work through experimentation was important to all the girls in this small sample. It is difficult to generalise from this small group but it would be fair to say that despite having diverse attitudes to the subject, all the respondents were clear that the need to control their own understanding of physics through experiments was of the essence. Indeed their stand could indicate that one of the problem that girls have with physics could be that they feel they have no control over it.

Conclusion

In this article I have tried to explain girls' attitudes to physics through their own commonsense understanding and experience of it. Some of the answers indicate sensitizing concepts that could be taken up in other research studies. Although the sample is small, the diversity and lucidity of the answers should already indicate possible areas for change to practising teacher. If we start by crediting the experiences of the pupils in our own classroom we might be a better position to improve the images of physics for all pupils.

Interview Questions

1. What do you think physics is about ?
2. Do you like physics ? Why ?
3. Do you think that you need physics

a. for your future job/career ?

b. to help you understand and control the world around you ?

4a. Do you think experiments are important in the physics lessons ?

b. Do you like doing them ?

5. Do you think that boys achieve better in physics than girls?

6. Do you personally achieve well in physics?
If yes, what do you think helps you to achieve well in the subject?
If no, what do you think hinders you from doing well in physics?

7. Do you agree that physics is a boys' subject (i.e. suitable / relevant for boys only?) Why?

8. Do you think that girls would do better if they were to learn physics with boys ?

9.a. What are your hobbies ?

b. What were your favourite toys and activities when you were a young child ?

10. If physics were no longer a compulsory subject would you then take it as one of your options?

Names of Respondents

Angela	Felicity
Brenda	Ina
Catherine	Joyce
Doreen	Georgette
Ethel	Helga

Acknowledgements

I would like to thank the Director of Education for permission to interview these Junior Lyceum students. I would especially like to thank the girls for their generous gift of time and for the interest they showed in the interview. I would also like to thank Dr Mary Darmanin for help with the data analysis and with the final draft.

References.

Darmanin, M. (1991) "Gender Differentials and Subject Choice in Maltese Secondary Schools", in Sultana, R. G. (Ed) Themes in *Education: A Maltese Reader*, Malta, Mireva Press

Darmanin, M. (1992) "The Labour Market of Schooling: Maltese Girls' Subject and Occupational Choice", *Gender and Education*, vol 4, no 1/2, pp 105-126

Duxbury, J. (1984) "Girls and Physics - the Role of a Head of Physics", *School Science Review*, June 1984

Fennema, E. "Success in Mathematics", in Marland, M. (Ed) *Sex Differentiation and Schooling*, London, Heinemann

Harding, J. (1980) "Sex Differentiation and Schooling", in *Education in Science*, September 1980

Harding, J. et al (1988) "Recent International Concerns in Gender and Science/Technology", in *Educational Review*, vol 4, no 2.

Johnson, S. and J.F. Bell (1987) "Gender Differences in Science", in *School Science Review*, December 1987

Johnson, S. and P. Murphy (1986) "Girls and Physics. Reflections on an APU survey findings"., D.E.S., London

Kelly, A. (1982) "Why girls don't do science", in *New Scientist*, May 1982

Kelly, A. (1987) "The Construction of Masculine Science", in Arnot, M. and G. Weiner (Eds), *Gender and the Politics of Schooling*, Open University Press, London

Kelly, A. (1988) "The customer is always right...girls' and boys' reactions to science lessons", in *School Review*, June 1988

Klainin, S. and P. J. Fensham (1987) "Learning achievement in upper secondary chemistry in Thailand: some remarkable sex reversals", in *International Journal of Science Education*, vol 9, no 2

Parker, L. (1984) "Difference in Access to Scientific Knowledge", in *The Australian Science Teachers' Journal*, vol 30, no 1

Ventura, F. (1991) "Gender and science in education", in Sultana, R. G. (Ed) *Themes in Education, A Maltese Reader*, Malta, Mireva Press

White, R.T. (1988) *Learning Science*, Oxford, Basil Blackwell