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**GENDER DIFFERENCES IN PREFERENCE OF SCIENTIFIC AREAS
- A CASE STUDY OF A MIDDLE EASTERS SOCIETY**

BY

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INTRODUCTION AND BACKGROUND

Many studies have documented the fact that there are differences between the number of males and females who major in science, with former leading the latter. Further, a polarisation of preference in scientific areas, was found between males and females who go into science. Females tend to prefer biological sciences, and males prefer physical sciences (Harding & Sutoris, 1985).

When it comes to the applications of science, there appears to be a gender related gap too. Girls seem to be more interested in the aspects of physics related to medicine and biology, while boys display more interest than girls in electronics and in the technical parts of the equipments. (Jones and Krik, 1990).

Some scholars attribute these empirical gender related differences to nature, while others think that they are due to the process of specialisation (Jones & Wheatley, 1990), depending on the "ideology" of the researcher (Born, Bleichrodt, and Flier, 1987). Other researchers suggest that some differences, commonly thought of as having biological bases, such as mathematical abilities, and careers aspirations, are also influenced by the process of socialisation (Czujko & Bernstein, 1989).

Cross-cultural studies can provide clues about the plausibility of either of these interpretations. If some differences appear to be true in many cultures, then this would support the existence of a biological factor in this

respect. However, some caution should be used to interpret the data of cross-cultural studies. Some biological factors may become effective in some societies due to the presence of some particular conditions in those societies (Born, Bleichrodt, & Flier, 1987).

Public schools in Bahrain are separated according to gender. Students are taught by teachers of the same gender all along their schooling. Some elementary schools in Bahrain, (29% in the year 1990-1991), assign female teachers to teach male students in the first four years of elementary education. Some co-educational private schools exist on the island.

Students study general education upto the ninth grade. In the tenth grade, they, start to branch off into different sections according to grades, abilities and interests. These branches are mainly scientific, literary and vocational. The latter is only open for males. Further, science students branch off in the eleventh grade into Chemistry-Biology (CB) section, or Physics-Mathematics (PM) section. Students begin to specialise in different fields of science according to the section chosen.

In general, the number of students, joining the CM branch is more than that of students joining the PM branch regardless of gender.

Table 1 reflects the number of male and female students in the CB branch, and in the PM branch, in public schools in Bahrain for the past nine years.

TABLE 1

Numbers of Females (F) and males (M) students in PM & CB Branches*

| PM BRANCH | | | CB BRANCH | | | |
|-----------|-------|-------|-----------|-------|-------|-------|
| YEA R | F | M | TOTAL | F | M | TOTAL |
| | NO(%) | NO(%) | | NO(%) | NO(%) | |

| | | | | | | |
|-------|---------|---------|-----|----------|---------|------|
| 82-83 | 124(38) | 201(62) | 325 | 463(67) | 231(33) | 694 |
| 83-84 | 114(32) | 238(68) | 352 | 507(62) | 312(38) | 819 |
| 84-85 | 171(43) | 229(57) | 400 | 633(65) | 334(35) | 967 |
| 85-86 | 162(42) | 227(58) | 389 | 637(66) | 331(34) | 968 |
| 86-87 | 182(41) | 264(59) | 446 | 691(66) | 362(34) | 1053 |
| 87-88 | 149(41) | 212(59) | 361 | 673(62) | 408(38) | 1081 |
| 88-89 | 148(45) | 179(55) | 327 | 782(64) | 443(36) | 1225 |
| 89-90 | 136(35) | 248(65) | 384 | 1293(65) | 682(36) | 1975 |
| 90-91 | 171(40) | 254(60) | 425 | 1091(64) | 618(36) | 1709 |
| 91-92 | 144(40) | 214(60) | 358 | 1035(62) | 642(38) | 1677 |
| 92-93 | 130(43) | 173(57) | 303 | 1011(58) | 733(42) | 1744 |

*Source: Statistics Department, Ministry of Education, Bahrain.

This table indicate that the number of males in the PM branch exceeded that of the females. The opposite is true for the CB branch.

PURPOSE

The purpose of this study was to identify and anlyse gender related differences in a Middle Eastern Society, with a special group of students. The sample was taken from the population of twelvth grade science students in public schools in bahrain. These students are of special interest here since they have committed themselves to the poles of the scientific subjects forming the famous difference in selection between the two sexes. They were enrolled in

either a Physics–Mathematics branch, or a Chemistry–Biology one. Gender related differences were analysed according to:

1- The number of students of each gender joining each branch, for the last nine years.

2- The ranking of preference, of each gender in each branch, to pursue their studies in different areas of science. Some of these areas are purely scientific, while others are interdisciplinary or represent applications of science.

METHOD

SUBJECT

Subjects were 199 twelfth grade science students in public schools in Bahrain. The sample consisted of 102 males and 97 females in 6 randomly selected schools. Further, each of the PM and CB branches was represented by 3 classes. The number of students in the PM branch was 94, and in the CB branch was 105.

PROCEDURE

Students were asked to rank order 9 scientific areas according to their preference to specialise in them.

DATA ANALYSIS

Crosstabulation was done for each sub-area of science along with gender and branch. Further analysis of the responses was done for the areas of science which received the highest and the lowest ranking.

RESULTS AND CONCLUSIONS

Table 2 displays rank ordering of female and male students in the CB branch of different scientific areas, according to preference.

TABLE 2
Rank Order of Scientific Areas by Gender, CB Branch

| Scientific Areas | Rank Order | | | | | | | | | Total |
|----------------------------|------------|-----|-----|------|------|------|------|------|------|-------|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | |
| 1- Physics | | | | | | | | | | |
| Females | - | 1 | - | - | 2 | 2 | 9 | 18 | 24 | 56 |
| Males | 4 | - | 4 | 3 | 1 | 6 | 11 | 8 | 12 | 49 |
| Total | 4 | 1 | 4 | 3 | 3 | 8 | 20 | 26 | 36 | 105 |
| % | 3.8 | 1.0 | 3.8 | 2.9 | 2.9 | 7.6 | 19.0 | 24.8 | 34.3 | 100.0 |
| 2- Marine Sciences | | | | | | | | | | |
| Females | 5 | 6 | 6 | 9 | 7 | 12 | 4 | 3 | 4 | 56 |
| Males | 9 | 4 | 4 | 10 | 7 | 2 | 8 | 2 | 3 | 49 |
| Total | 14 | 10 | 10 | 19 | 14 | 14 | 12 | 5 | 7 | 105 |
| % | 13.3 | 9.5 | 9.5 | 18.1 | 13.3 | 13.3 | 11.4 | 4.8 | 6.7 | 100.0 |
| 3- Medical Sciences | | | | | | | | | | |
| Females | 14 | 16 | 1 | 5 | 9 | 6 | 5 | - | - | 56 |
| Males | 14 | 4 | 5 | 4 | 3 | 6 | 6 | 5 | 2 | 49 |

| | | | | | | | | | | |
|-------|------|------|-----|-----|------|------|------|-----|-----|-------|
| Total | 28 | 20 | 6 | 9 | 12 | 12 | 11 | 5 | 2 | 105 |
| % | 26.7 | 19.0 | 5.7 | 8.6 | 11.4 | 11.4 | 10.5 | 4.8 | 1.9 | 100.0 |

4- Zoology

| | | | | | | | | | | |
|---------|-----|------|------|------|------|-----|-----|-----|-----|-------|
| Females | 6 | 10 | 14 | 9 | 5 | 4 | 4 | 2 | 2 | 56 |
| Males | 4 | 13 | 10 | 6 | 7 | 2 | 2 | 5 | - | 49 |
| Total | 10 | 23 | 24 | 15 | 12 | 6 | 6 | 7 | 2 | 105 |
| % | 9.5 | 21.9 | 22.9 | 14.3 | 11.4 | 5.7 | 5.7 | 6.7 | 1.9 | 100.0 |

5- Environmental Science

| | | | | | | | | | | |
|---------|------|-----|------|------|------|------|-----|------|-----|-------|
| Females | 7 | 3 | 6 | 12 | 16 | 4 | 4 | 4 | - | 56 |
| Males | 4 | 2 | 5 | 6 | 8 | 8 | 5 | 8 | 3 | 49 |
| Total | 11 | 5 | 11 | 18 | 24 | 12 | 9 | 12 | 3 | 105 |
| % | 10.5 | 4.8 | 10.5 | 17.1 | 22.9 | 11.4 | 8.6 | 11.4 | 2.9 | 100.0 |

6- Astronomy

| | | | | | | | | | | |
|---------|-----|-----|-----|------|-----|------|------|------|------|-------|
| Females | - | - | 4 | 6 | 3 | 7 | 10 | 16 | 10 | 56 |
| Males | 5 | 7 | 6 | 5 | 5 | 7 | 2 | 5 | 7 | 49 |
| Total | 5 | 7 | 10 | 11 | 8 | 14 | 12 | 21 | 17 | 105 |
| % | 4.8 | 6.7 | 9.5 | 10.5 | 7.6 | 13.3 | 11.4 | 20.0 | 16.2 | 100.0 |

7- Botany

| | | | | | | | | | | |
|---------|-----|------|------|------|------|------|-----|-----|-----|-------|
| Females | 1 | 10 | 12 | 8 | 10 | 11 | 3 | - | 1 | 56 |
| Males | 2 | 4 | 8 | 9 | 11 | 6 | 3 | 2 | 4 | 49 |
| Total | 3 | 14 | 20 | 17 | 21 | 17 | 6 | 2 | 5 | 105 |
| % | 2.9 | 13.3 | 19.0 | 16.2 | 20.0 | 16.2 | 5.7 | 1.9 | 4.8 | 100.0 |

8- Geology

| | | | | | | | | | | |
|---------|---|---|---|---|---|---|----|----|----|----|
| Females | 3 | 4 | 5 | 3 | 1 | 5 | 13 | 10 | 12 | 56 |
| Males | 1 | 6 | 4 | 4 | 2 | 4 | 7 | 8 | 13 | 49 |

| | | | | | | | | | | |
|-------|-----|-----|-----|-----|-----|-----|------|------|------|-------|
| Total | 4 | 10 | 9 | 7 | 3 | 9 | 20 | 18 | 25 | 105 |
| % | 3.8 | 9.5 | 8.6 | 6.7 | 2.9 | 8.6 | 19.0 | 17.1 | 23.8 | 100.0 |

9- Chemistry

| | | | | | | | | | | |
|---------|------|------|------|-----|-----|------|-----|-----|-----|-------|
| Females | 20 | 6 | 8 | 4 | 4 | 5 | 4 | 3 | 2 | 56 |
| Males | 6 | 8 | 4 | 2 | 5 | 8 | 5 | 6 | 5 | 49 |
| Total | 26 | 14 | 12 | 6 | 9 | 13 | 9 | 9 | 7 | 105 |
| % | 24.8 | 13.3 | 11.4 | 5.7 | 8.6 | 12.4 | 8.6 | 8.6 | 6.7 | 100.0 |

Further analysis was done of the responses of Table 2, concerning the three areas of science which received the highest and the lowest preference. Some areas received equal scores. The highest and the lowest three or four areas of science are presented below.

I- The areas of science which received the highest preference were respectively:

1. Zoology, medical sciences and chemistry, by all the CB branch students.
2. Chemistry, medical sciences and zoology by females in the CB branch.
3. Zoology, medical sciences, astronomy and Chemistry by males in the CB branch.

II- The least preferred areas of science by students in the CB branch were respectively:

1. Physics, geology and astronomy, by all the students.
2. Physics, astronomy and geology, by females.
3. Physics, geology, environmental science and chemistry by males.

Table 3 represents rank order of scientific subjects by students in the physics-Mathematics branch.

TABLE 3

The following results were drawn from Table 3:

I- The areas of science which received the highest preference were respectively:

1. Physics, medical sciences and marine sciences by all students in the PM branch.
2. Physics, medical sciences, astronomy and marine sciences, by females in the PM branch.

II- The areas of science which received the lowest preference were respectively:

1. Chemistry, geology, botany and zoology by all students.
2. Geology, chemistry and zoology by females.
3. Chemistry, environmental sciences and geology by males.

DISCUSSION AND EDUCATIONAL IMPLICATIONS

The findings of this study suggest the existence of the following patterns:

1. More males than females are attracted to the Physics-Mathematics branch, while more females are attracted to the Chemistry-Biology branch.
2. Females in both branches gave a high preference to medical sciences.
3. Males in both branches declared high preference to astronomy.

4. Environmental sciences was given low preference by males in both branches.
5. Females in the C-B branch gave zoology a high preference, while those in the P-M branch gave it a low preference.
6. Geology received low preference from both genders in the two branches.

The present study adds to the growing research on gender differences in science education, by identifying gender differences of a special group of students in a Middle Eastern society. Some results agree with those arrived at in other parts of the world, mainly that girls favour medical sciences, and more boys than girls are attracted towards physics. The other results could be culture specific.

Several educators have come up with suggestions to attract more women to study physics (Clewell, 1987; Ramsden, 1990; and Scott & Heller, 1991). These suggestions include, providing role models, designing intervention programs, reconsidering how the nature of science is being portrayed to students, presenting science in a non masculine fashion, and making the study of physics relevant to the daily life.

Additional fundamental suggestions can be derived from other famous differences between the two genders. Studies have shown that girls have developmental advantage over boys in verbal and sensory aspects, while boys have the advantage in terms of number, spatial, and mechanical aspects (Born, Bleichrodt and Frlier, 1987). However, boys are not taught speech, reading, and writing later than girls. Society pushes them to learn these skills at the same rate as that of the girls. On the other hand, girls are not being taught spatial, mathematical, and mechanical aspects at an early age and in a rigorous manner (McGuinness, 1978, p.144).

In the light of this discussion, one can integrate these gender related studies in science education. By documenting gender differences, universal or culture specific programs can be designed to address them at early ages so as to compensate for what it seems to be "nature" related disadvantages for females.

Further studies are needed to:

1. Document gender differences of self images (Oseiran, 1989), and the stereotyping of physics and physicists. Some researchers suggest that students tend to choose the subject area which its stereotype characteristics fit their self image (Head, 1985, p. 38).
2. Identify factors affecting student's interests in different areas of science. One needs to analyse the roles of different socialisation agents at home, school, and media (Elkin, 1989), to account for these differences which seem to manifest themselves at early ages (Johnson & Patrecia, 1989).
3. Investigate the impact of doing fundamental changes in the physics curriculum, like introducing contemporary physics and its philosophical aspects, on women's enrollement in physics. Examples of such major revisions to physics courses are Introductory University Physics Program IUPP (Wilson, 1989), and University Foundation Course in Physics (UNESCO, 1991).

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TABLE 1

Numbers of Females (F) and males (M) students in PM & CB Branches*

| PM BRANCH | | | CB BRANCH | | | |
|-----------|-------|-------|-----------|-------|-------|-------|
| YEA R | F | M | TOTAL | F | M | TOTAL |
| | NO(%) | NO(%) | | NO(%) | NO(%) | |

| | | | | | | |
|-------|---------|---------|-----|----------|---------|------|
| 82-83 | 124(38) | 201(62) | 325 | 463(67) | 231(33) | 694 |
| 83-84 | 114(32) | 238(68) | 352 | 507(62) | 312(38) | 819 |
| 84-85 | 171(43) | 229(57) | 400 | 633(65) | 334(35) | 967 |
| 85-86 | 162(42) | 227(58) | 389 | 637(66) | 331(34) | 968 |
| 86-87 | 182(41) | 264(59) | 446 | 691(66) | 362(34) | 1053 |
| 87-88 | 149(41) | 212(59) | 361 | 673(62) | 408(38) | 1081 |
| 88-89 | 148(45) | 179(55) | 327 | 782(64) | 443(36) | 1225 |
| 89-90 | 136(35) | 248(65) | 384 | 1293(65) | 682(36) | 1975 |
| 90-91 | 171(40) | 254(60) | 425 | 1091(64) | 618(36) | 1709 |
| 91-92 | 144(40) | 214(60) | 358 | 1035(62) | 642(38) | 1677 |
| 92-93 | 130(43) | 173(57) | 303 | 1011(58) | 733(42) | 1744 |

*Source: Statistics Department, Ministry of Education, Bahrain.

TABLE 2

Rank Order of Scientific Areas by Gender, CB Branch

| Scientific Areas | Rank Order | | | | | | | | | | |
|------------------|------------|-----|-----|-----|-----|-----|------|------|------|-------|--|
| | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | Total | |
| 1- Physics | | | | | | | | | | | |
| Females | - | 1 | - | - | 2 | 2 | 9 | 18 | 24 | 56 | |
| Males | 4 | - | 4 | 3 | 1 | 6 | 11 | 8 | 12 | 49 | |
| Total | 4 | 1 | 4 | 3 | 3 | 8 | 20 | 26 | 36 | 105 | |
| % | 3.8 | 1.0 | 3.8 | 2.9 | 2.9 | 7.6 | 19.0 | 24.8 | 34.3 | 100.0 | |

2- Marine Sciences

| | | | | | | | | | | |
|---------|------|-----|-----|------|------|------|------|-----|-----|-------|
| Females | 5 | 6 | 6 | 9 | 7 | 12 | 4 | 3 | 4 | 56 |
| Males | 9 | 4 | 4 | 10 | 7 | 2 | 8 | 2 | 3 | 49 |
| Total | 14 | 10 | 10 | 19 | 14 | 14 | 12 | 5 | 7 | 105 |
| % | 13.3 | 9.5 | 9.5 | 18.1 | 13.3 | 13.3 | 11.4 | 4.8 | 6.7 | 100.0 |

3- Medical Sciences

| | | | | | | | | | | |
|---------|------|------|-----|-----|------|------|------|-----|-----|-------|
| Females | 14 | 16 | 1 | 5 | 9 | 6 | 5 | - | - | 56 |
| Males | 14 | 4 | 5 | 4 | 3 | 6 | 6 | 5 | 2 | 49 |
| Total | 28 | 20 | 6 | 9 | 12 | 12 | 11 | 5 | 2 | 105 |
| % | 26.7 | 19.0 | 5.7 | 8.6 | 11.4 | 11.4 | 10.5 | 4.8 | 1.9 | 100.0 |

4- Zoology

| | | | | | | | | | | |
|---------|-----|------|------|------|------|-----|-----|-----|-----|-------|
| Females | 6 | 10 | 14 | 9 | 5 | 4 | 4 | 2 | 2 | 56 |
| Males | 4 | 13 | 10 | 6 | 7 | 2 | 2 | 5 | - | 49 |
| Total | 10 | 23 | 24 | 15 | 12 | 6 | 6 | 7 | 2 | 105 |
| % | 9.5 | 21.9 | 22.9 | 14.3 | 11.4 | 5.7 | 5.7 | 6.7 | 1.9 | 100.0 |

5- Environmental Science

| | | | | | | | | | | |
|---------|------|-----|------|------|------|------|-----|------|-----|-------|
| Females | 7 | 3 | 6 | 12 | 16 | 4 | 4 | 4 | - | 56 |
| Males | 4 | 2 | 5 | 6 | 8 | 8 | 5 | 8 | 3 | 49 |
| Total | 11 | 5 | 11 | 18 | 24 | 12 | 9 | 12 | 3 | 105 |
| % | 10.5 | 4.8 | 10.5 | 17.1 | 22.9 | 11.4 | 8.6 | 11.4 | 2.9 | 100.0 |

6- Astronomy

| | | | | | | | | | | |
|---------|-----|-----|-----|------|-----|------|------|------|------|-------|
| Females | - | - | 4 | 6 | 3 | 7 | 10 | 16 | 10 | 56 |
| Males | 5 | 7 | 6 | 5 | 5 | 7 | 2 | 5 | 7 | 49 |
| Total | 5 | 7 | 10 | 11 | 8 | 14 | 12 | 21 | 17 | 105 |
| % | 4.8 | 6.7 | 9.5 | 10.5 | 7.6 | 13.3 | 11.4 | 20.0 | 16.2 | 100.0 |

7- Botany

| | | | | | | | | | | |
|---------|-----|------|------|------|------|------|-----|-----|-----|-------|
| Females | 1 | 10 | 12 | 8 | 10 | 11 | 3 | - | 1 | 56 |
| Males | 2 | 4 | 8 | 9 | 11 | 6 | 3 | 2 | 4 | 49 |
| Total | 3 | 14 | 20 | 17 | 21 | 17 | 6 | 2 | 5 | 105 |
| % | 2.9 | 13.3 | 19.0 | 16.2 | 20.0 | 16.2 | 5.7 | 1.9 | 4.8 | 100.0 |

8- Geology

| | | | | | | | | | | |
|---------|-----|-----|-----|-----|-----|-----|------|------|------|-------|
| Females | 3 | 4 | 5 | 3 | 1 | 5 | 13 | 10 | 12 | 56 |
| Males | 1 | 6 | 4 | 4 | 2 | 4 | 7 | 8 | 13 | 49 |
| Total | 4 | 10 | 9 | 7 | 3 | 9 | 20 | 18 | 25 | 105 |
| % | 3.8 | 9.5 | 8.6 | 6.7 | 2.9 | 8.6 | 19.0 | 17.1 | 23.8 | 100.0 |

9- Chemistry

| | | | | | | | | | | |
|---------|------|------|------|-----|-----|------|-----|-----|-----|-------|
| Females | 20 | 6 | 8 | 4 | 4 | 5 | 4 | 3 | 2 | 56 |
| Males | 6 | 8 | 4 | 2 | 5 | 8 | 5 | 6 | 5 | 49 |
| Total | 26 | 14 | 12 | 6 | 9 | 13 | 9 | 9 | 7 | 105 |
| % | 24.8 | 13.3 | 11.4 | 5.7 | 8.6 | 12.4 | 8.6 | 8.6 | 6.7 | 100.0 |