Chapter 18
Italian Female and Male Students' Choices: STEM Studies and Motivations

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Introduction: Young People and Their Study Paths

Research has pointed to some differences in the priorities of males and females choosing higher education (Blickenstaff 2005; Brotman and Moore 2008). Published studies on this topic offer numerous explanations and adopt various methodological approaches, but the factors taken into consideration are common to all of them: the social, economic, and ethnic context; the family context; gender issues; the influence of the school and the quality of teaching; and interest in and aptitude for the sciences (Scantlebury and Baker 2007; Brotman and Moore 2008).

The literature in this field has highlighted the influence of the family context on the development of educational motivation and student progress, and the importance of positive parent-child relationships for the creation of adaptive capacity in the educational context (Ryan et al. 1995; James 2002; Wildhagen 2009; Munk 2011). Data from the IRIS survey conducted in Italy confirm the influence of the family on orienting students towards scientific studies, and they point out a considerable gender difference: one quarter of females have parents coming from a university background while seven out of ten males are the first in their family to study at university.

The Italian survey also shows that students enrolling in Engineering and Computer Science faculties come from families with a lower level of tertiary education, and they attend courses where there is a large male presence. Biology courses, on the other hand, receive a high level of female enrolment coming from families with high "science capital" (see Chap. 6); it is therefore more often the case that a female student enjoys support for her choice from university-educated parents. One might infer from this that families with a higher "science capital" help female students overcome cultural pressures aimed at orienting them towards traditional gender

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roles and behavioural models, and assist them in overcoming the obstacles in their future professions that arise when they are at the university (Blickenstaff 2005).

On the other hand, as we will further describe, a large proportion of male students enrolled in Engineering and Computer Science courses comes from technical institutes which in Italy are male-dominated secondary school contexts, traditionally oriented to work after school rather than academic education. This is a crucial factor since it suggests that parental role models also have a central influence on these male students, but not tied to educational and cultural priorities, but more focussed on work improvement (Allegrini 2004).

An analysis of pre-university study shows that males mainly come from secondary schools which are similar to their current course of study, while female students have more often attended schools of other kinds; the largest share of students continuing with their previous studies are enrolled in Computer Science and Biology. These data confirm what has been shown by various studies on women's preferences for biological, bio-medical and care-giving studies: this is a tendency which explains the greater presence of women in Biology courses (Osborne and Collins 2000). Male students, on the other hand, more often come from technical secondary schools. Normally, the majority of female students attend Biology or Biotechnology courses in higher education, and come from humanities and science-based secondary schools.

Method

Four open questions proposed to Italian students in the Iris survey enabled us to investigate the factors which encourage students to choose science studies, and allowed us to verify gender differences, and differences between the various degree courses, through a qualitative analysis of 2,192 open responses to the following questions:

- Q 9. Describe how you came to choose this course.
- Q 13. If someone you know was thinking about enrolling on your course and asked you about it, what would you say to her or him?
- Q 15. Do you attend a course where one gender is over-represented? If so, why do you think this is the case?
- Q 16. Do you see any reason why the situation described above should be changed – and if so, what do you think could be done to change it?

Using the Atlas.ti programme package for qualitative analysis, the research team used an open-inductive coding process to identify central concepts appearing in the students' responses. Responses were then categorised (Strauss and Corbin 1990) to reduce the complexity of the corpus. This analysis resulted in seven conceptual dimensions: five taken from Eccles' achievement-related choices model (Eccles 1994;

Eccles and Wigfield 2002, see Chap. 2), and two developed inductively from the data material. The seven dimensions used for the analysis were:

- *intrinsic value*: all the elements of interest in, and enjoyment of, a subject;
- *attainment value*: statements about personal attainment, identification with the task and social role of scientists;
- *utility value*: aspects of individual utility in relation to a project for personal growth;
- *perceived cost*: perceptions of the costs required to complete a course of study;
- *expectation of success*: the expectation of success, including self-perception and self-assessment of the student's abilities (Rosenberg 1979, 1986);
- *cultural features*: scholastic and educational factors (the role of the teachers, the educational background, and previous experiences), and also factors such as the role and expectations of family and friends, as well as influences outside the school environment;
- *natural features*: beliefs that a certain aptitude and predisposition for scientific subjects are connected with, and necessary for, academic success.

These last two interpretative dimensions have been evaluated as consistent with, and relevant to, a gender issues analysis, most of all in the light of qualitative outcomes collected through the open questions. Further details can be found in Chap. 4 for general perspectives and in Chap. 20 for traditional and non-traditional aspects that underpin gender and science representations. In this chapter, we focused our attention on priorities and values, as discussed in Chap. 9 for the data sets from Denmark, Norway and England.

Results: The Motivations Which Lead Young People Towards Science

Intrinsic Value

The first open-ended question – Describe how you came to choose this course – allowed students to track the aspects which had encouraged them to undertake a scientific course of study. In their short accounts, we frequently found words such as "interest", "passion" and "pleasure", which are notable for the emotional connotation given to the main motivation expressed by students: an interest in scientific subjects. The intrinsic value dimension showed two clearly distinct response tendencies: one is personal, but still more rational and well-considered, connected with interest in and attraction to the subject:

> Since I was a small child, I have been very interested in mechanics, especially in motor engineering (male, Mechanical Engineering)

The other tendency is more emotional and emotive, an affective response couched in terms such as love, appeal, enthusiasm, magic, passion, and pleasure:

> After careful reflection, I eliminated the subjects which did not excite me. Chemistry was what I loved most, and it is what I still love; I like to know how something happens, and what lies at the bottom of the phenomena which surround me (female, Chemical Engineering)

A high level of correspondence between one's interests and the environment to which one belongs leads to greater satisfaction, better performance in the field, and therefore a greater determination to carry on with one's decisions (Ackerman et al. 2001; Eccles and Wigfield 2002; Schiefele et al. 1992):

> I chose this degree course because of my passion for it, and because it involved scientific subjects, and because I wanted to be an engineer (male, Electrical Engineering)

An academic interest in a particular subject is therefore correlated with success in it (Ackerman 1996), and vice versa. This was evident in the answers provided by many students – as can be inferred in the texts from the number of times that terms communicating intrinsic value were used together with words which referred to a sense of satisfaction, achievement, and success:

> I was very attracted by ecology, and I was doing very well at secondary school (male, Biology)

Aspects of pleasure, interest, and real passion for the subject, or for certain specific features of it, were common to both men and women in the intrinsic and interest value dimension. Certain differences are worth noting, however, especially with regard to different disciplinary areas. Students enrolled on different tracks in Engineering often emphasized a specific interest in the world of machines, both mechanical and electronic, while women's interest was more often described as a generic "interest in or leaning towards scientific subjects". Numerous responses emphasized the former aspect:

> A strong propensity for Physics, Mathematics, and other scientific subjects, as they apply to the real world and to their social and technical function (male, Mechanical Engineering)

> I chose engineering because of my passion for scientific subjects and I hope to gain a passion for the more technical subjects I will be coming across in my course (male, Mechanical Engineering)

Among the replies provided by women, on the other hand, we have:

> Interest in the course subjects (female, Mechanical Engineering)

> The course subjects fascinate me (female, Mechanical Engineering)

In other words, the interest expressed by men attending engineering faculties was especially in technical aspects and technological subjects, whilst women's interest was generically defined in terms of an interest in scientific subjects, science, or the techno-scientific field. Male students' experiences could also be related to their childhood experiences with technology (electronics, vehicles etc.), thus giving males a stronger sense of "ownership" of technical aspects of STEM (Sjøberg 2000; Jones et al. 2000).

This same trend was apparent when we compared the responses of men and women studying Computer Science and Technological and Computer Sciences, where a passion for electronics and computers was a factor strongly orienting males, and less the females, who, except in one case ("Electronics fascinate me" –

female, Computer Science), gave a reason for their choice based on a generic interest in techno-scientific subjects. Among the men's replies were:

> Electronics have always interested me (male, Technological and Electronic Sciences)
>
> I've always been interested in electronics and computers in general (male, Electronics)

Women's responses included:

> Because I'm interested in techno-scientific subjects (female, Electronics)
>
> Because of an interest in techno-scientific subjects (female, Electronics)

Among students of Mathematics, Statistics, and Computer Science, a specific interest in, predisposition or inclination – a true passion, in some cases – towards the study of mathematics constituted a major orienting factor from primary school onwards. There were numerous responses similar to the following:

> My passion for mathematics developed as early as middle school, but it was only thanks to the support of my mathematics teacher in my final year of high school that I decided to take this uphill path (female, Mathematics)
>
> I've been interested in mathematics since primary school. As time passed, this interest was confirmed, and now I've chosen the course I was most interested in (male, Mathematics)

Finally, in all courses, the word "passion" – one of the terms most frequently used by male and female respondents, together with "interest" – was often accompanied by other terms such as "expectations", "aspirations", and "ambitions" in male cases:

> I carefully evaluated my knowledge and abilities in many areas, but above all in those which interested me the most, and concluded that this faculty could offer me what would best reflect my expectations (male, Information Engineering)

In the case of females, the purer and less tangible aspects were emphasized, and the stress was placed on a speculative interest in knowledge not tied directly to concrete results:

> I felt myself particularly attracted by "conceptual" scientific subjects, at the end of High School, (not for calculation purposes)! (female, Biology)

Attainment Value

Both male and female students cited various elements in their responses which explained orientation towards science courses in terms of life-choice. This concerns the personal self-fulfilment which is attained by the idea of becoming a scientist, thereby satisfying particular aspirations: challenging oneself to attain a career goal, and pursue what is perceived to be a socially important career.

We often encountered phrases such as "I've always wanted to do this", "since I was a boy", which are expressions referred to a deep-rooted conviction behind a life choice. It was apparent that the "vocational" aspect, and the desire for attainment,

generated and supported the choice of a university course. There were also references to various images: dreams, future aspirations and desires, expressed in their "purest" and most open form, frequently unconnected with the tangible and practical relevance of the course:

> I chose it so that I could fulfil my secret dream (female, Physics)

The vocational element was mainly present when students talked about their choice of beginning a path of personal growth or the definition of their passions and aspirations, and when they underlined the opportunity for self-fulfilment that their educational choices gave them. Those who mentioned the vocational side revealed a sort of 'calling' to perform a certain role. An example of that was the reply given by a female Mathematics student:

> I would like to become a teacher, and I know that society needs teachers (female, Mathematics)

As regards public impact, various responses suggested the desire and responsibility to change and improve society with the aid of scientific research:

> I chose it because it is my wish to help my neighbours, and research seems to me to be the best area to express my passion (female, Biology)

Although these responses were equally significant for men and women, an analysis of the texts from a gender perspective showed some differences, mainly in the kind of language used and the content proposed; and these acquired further – and specific – meaning when they were related to a certain disciplinary area.

Social relevance aspects, for example, were cited by female and male students with different meanings. The former offered reasons which more closely concerned mankind, the environment, and nature, with a specific connotation of "taking care of others", while male students mentioned issues concerning the exploitation of science and technology for the betterment and development of society, which were often described in general and abstract terms. Female students' orientation towards aspects of life tended to shift their university choices to the so-called life sciences (Biology, Biological Sciences, Chemistry, or Biotechnology). The prevalently male orientation towards technical and technological aspects was most evident in technological faculties, especially Engineering.

> I've chosen this course because my desire is to help others, and research seems to me to be the best area for expressing my passion (female, Biology)

> I have always dreamed of being an inventor. Although it may seem stupid, the thing which is likely to get closest to this is mechanical engineering. And finally because I want to be able to build machines which can improve life and also increase the development of society (male, Mechanical Engineering)

References to social relevance, such as helping others, were most frequent among respondents attending faculties mainly chosen by women, such as biological sciences; and they were also common in the case of biotechnology, where female students emphasized the bio-medical aspects of care-giving, despite the technological nature of the degree course. As also emphasised in Chap. 20, the technological

aspects typical of the biotechnology faculty, were related to the care dimension enriched by a future-oriented attitude. In fact, "future" is a word which appeared in many responses: "the future of mankind", "the society of the future", "the future of incurable diseases", as suggested by certain female Biotechnology students:

> The world of research fascinated me, the study of diseases and experimental techniques for healing the sick, and I chose the faculty which I thought came closest to my expectations (female, Biotechnology)

> I followed my passion for science. The future will be increasingly based on biotechnology (female, Biotechnology)

Utility Value

A sense of utility and future career prospects were important motivating factors: male and female students showed that they were very attentive to, and aware of, job opportunities when they completed their studies. Students stated that they were studying sciences in order to earn high salaries, and attain their career and job objectives (see also Chap. 9). This concerns career objectives and lifestyles, but also the social role which the students intended to perform:

> I chose this university course because of the enormous range of job opportunities it provides (male, Electronic Engineering)

> Good job prospects (female, Mathematics)

> I tried to combine my passion for scientific subjects with the chance to attain ambitious goals in the workplace (male, Chemical Engineering)

A considerable amount of research into the future emerged from the answers:

> Initially, I was undecided between humanities and chemistry, but I chose the latter because it was more likely to offer a future with greater opportunities (male, Chemistry)

This search was linked with the perception, or certainty, that scientific training offers rapid entry into the labour market and certain career prospects, due to opportunities for the practical use of knowledge acquired at university:

> I believe it is fundamental to do courses which have real utility in life, which are not just 'hot air' but provide good job opportunities at the end of the course. I also wanted to plan and carry out something concrete (male, Computer Science)

Another utility factor was the significance of the study area: students showed a desire to undertake degree courses in order to do something of note:

> I chose this course because the future is increasingly linked to technology, so you need to understand it and have a solid base (male, Computer Science)

> To try to understand the future, and I'm convinced that scientific subjects are the only way to do this, and I also think that they are the only subjects which give you the hope of getting a job (female, Biology)

Job prospects in research provided a powerful motivation, and enabled students to formulate their objectives as far as academic success and self-confidence are concerned:

> I like being active in the field of research. It's an environment which opens doors to many professions (male, Biology)

> I made my choice mainly by thinking about the job I would like to have one day, and so I thought that Physics might open a lot of doors in the research field (female, Physics)

An analysis of the responses from a gender perspective shows that male and female students attach great importance to their future employment and professional opportunities. In the case of men, this significance was more frequently expressed in terms of remuneration and, in some cases, the social role – in the sense of public image – which the course allowed them to occupy. This was especially the case for the "applied" sciences – Biotechnology, and most of all the various Engineering disciplines.

> My cousin was doing Chemical Engineering, but quit, and we decided that we'd attend Biotechnology together. Prospects of becoming important people (male, Biotechnology)

> It seemed to me the course which would give me the best chance to get on in the labour market in the future, and it was the nearest one to my passion (male, Mechanical Engineering)

> I looked at which path would give me good training and an excellent income at the same time. To make an impact on society, be someone, and make money (male, Mechanical Engineering)

To a lesser extent, men – in contrast to women – also cited aspects of utility in the "pure science" faculties (Mathematics, Mathematical Sciences, and Physics), whereas women attached more significance to a passion for knowledge or an interest in the subject. The following are examples of responses given by males enrolled in these faculties:

> I looked at all the choices I would need to make, what I would like to do, and finally the employment opportunities I would have once I would complete my studies (male, Mathematics)

> Looking at course programmes for the various faculties, and choosing the one which gave me the most job opportunities and which I liked the best (male, Mathematics)

In the case of women enrolled in Engineering, this dimension was an important element in making their decisions. More than one female student who enrolled in Mechanical Engineering replied:

> I made my choice on account of the opportunities I would have in the future if I chose this course;
>
> I chose my university course because of my interest in scientific subjects and the future opportunities it could offer me

Finally, there were some noteworthy differences among the replies regarding a career in research. Women, above all, expressed a specific motivation to engage in scientific research, in particular Biology and Biotechnology students. They

considered the social relevance of a research career both in laboratories and in biomedical clinics.

> My choice for this type of course was conditioned by the fact that it allows me to work in scientific research and to have a certain level of responsibility on advancing scientific and technological development (female, Biotechnology)

> Because I like researching, finding vaccines for diseases or finding something better than what already exists (female, Biotechnology)

It should also be noted that, in cases where the importance of income was cited, most of the responses came from students enrolled on Engineering courses, in particular Mechanical Engineering, which is probably the course that provides the most professional type of training.

> I chose this course because I think it guarantees that I'll find a good job and it will be well paid (male, Mechanical Engineering)

> To achieve my goals, which are to have a good job which I like and a high income (female, Mechanical Engineering)

Perceived Cost

Both male and female students attached particular importance to the difficulties which had to be faced on their courses: the workload to be managed, the length of the course, and the difficulty of the degree course.

> I had to choose between veterinary science and biotechnology, but the number of years you have to study for medicine and veterinary science scared me, so I chose biotechnology (male, Biotechnology)

Here, the heavy financial burden of university fees, the ongoing economic commitment, the cost of university services, and the need to adapt to a new city and to a university environment emerge.

> Reasons: personal propensity for studying technical subjects. Best relationship between the quality of the courses and the cost of the university: the most beneficial and effective (male, Mechanical Engineering)

Opinions relating to academic organizations were closely connected with the previous evaluations. Administrative efficiency, effective management of teaching, and lack of overcrowding were other factors appreciated by students who selected the university to attend with special care.

> I chose only on the basis of possible job opportunities and because other "interesting" faculties were overcrowded, so there was less chance of "excelling" (male, Computer Science)

Other students performed a cost-benefit calculation of the available resources, and found it impossible to move to a university outside their home town: this meant excluding faculties a long way from home. Apparent in these cases was the

significance attached to a graduate career, regardless of the career itself, in order to gain access to a profession:

> In today's labour market, you are supposed to have a degree (male, Computer Science)

From a gender perspective, there are no marked differences among the overall responses within the 'perceived cost' category. Evaluations of the difficulties to be faced were common to men and women attending different faculties and courses. Nonetheless, it is interesting to note that the choice process of some female engineering students was more problematic than in the case of their male counterparts or female students of other faculties:

> The choice of my university degree course was not targeted, but was one of the three possibilities or preferences which I had the chance to take (female, Automotive Engineering)

> The choice wasn't easy. I had to choose from among very different faculties and appealing courses, including the non-scientific ones. I chose electronic engineering because it fascinated me more than any other faculty, it had the courses I liked the best, and would lead to a very interesting profession, from my point of view (female, Electronic Engineering)

These data demonstrate a more specific choice-making method than the one used by males, and also raises the issue of the influence by various people in the selection process. A large number of responses emphasized the importance of certain key figures (as mentioned in Chaps. 9 and 11), in the following order: teachers who had encouraged and supported the student, parents with degrees, tutors (where a mentoring service operated), and friends. The support of the teachers was mentioned especially by female students, who appeared to be more influenced by gender stereotypes attached to scientific or engineering professions as mentioned by a student:

> In my course it is predominantly men. I guess this is so because the figure of the engineer in society is still male-dominated (female, Electronic Engineering)

Expectation of Success

Self-image and the evaluation of one's abilities are connected with the chances of success (see Chap. 2). Hence, past experiences and future prospects were expressly cited by the respondents. The more students felt that they had acquired knowledge of a subject during their schooling years, the more probable it was that they would choose it as their subject:

> Because I acquired a basis at high school, and I like electronics (female, Mechanical Engineering)

These reasons were cited by a small number of students, but they exhibited a particular combination of elements closely connected with the other dimensions that we have examined above.

Expectations of success were, in fact, linked with a future public image, particularly for male students in Biotechnology and Engineering faculties:

> It seemed to me the degree course which would give me the best chance of entering the labour market in the future, and which was the closest to my passions (male, Mechanical Engineering)

Finally, we consider interest issues and self-evaluation elements proposed by respondents who had selected their degree course on the basis of a search for success.

> Since I was a child I feel great interest towards mechanics, particularly for automotive engineer for which I think I will get good results (male, Mechanical Engineering)

> I chose my degree course purely and simply on the basis of the pleasure I feel in studying the subject and because of the good marks obtained in the secondary school (female, Biology)

Cultural Features

This dimension includes school and educational factors (the role of the teachers, the educational background, and previous experiences), and also external factors in general (the role and expectations of family, friends, and influences outside the school environment).

For many students, the linearity of their educational background, in the sense of a continuing link between university studies and the area of interest in their secondary school, was a determining factor in their choice (see Chaps. 2 and 9). Continuity between high school and university choices can be interpreted in two ways: the perception of having acquired the necessary knowledge and basis for studying the subject and, at the same time, the desire for consistency in continuing to develop a route which had already been selected:

> Having already experienced what chemistry is at high school, I confirmed this choice (male, Chemistry)

> The subjects I took at high school were very interesting and stimulating, so I decided to continue with the same subjects I started to study at school: biology, pathology, hygiene, and all the subjects connected with the medical-scientific environment (female, Biology)

These cultural features, according to the Eccles model, contribute to shape motivations and reinforce intrinsic values such as interest, attainment and utility.

Out of school experiences were also mentioned as having a special significance. Male and female students cited the importance of activities "in the field", such as the time spent in laboratories and guided visits to research centres or museums:

> I wanted a complete change. I went to a high school which specialized in languages. After a trip, I decided I wanted to do biology (female, Biology)

As stated earlier good performance levels at high school raised students' levels of self-esteem and satisfaction and directed them towards certain subjects, which made the selection process easier:

> My decision was influenced by the good results I obtained at school in similar subjects, and by the type of courses which I would like to do (male, Chemistry)

The positive influence exerted by teachers was also linked to good performance, owing both to their teaching methods and to the advice and help received in choosing the degree course:

> I had a good physics teacher in my second last year at high school, which made me understand how great the subject was (male, Chemistry)

Along with aspects belonging to the educational system, cultural factors such as family influences are also to be cited:

> I've been interested in mechanics since I was a boy, especially in automotive engineering. My family environment helped me cultivate this interest (male, Mechanical Engineering)

> My mother works for the environment, and I want to specialize in this area as well (female, Biology)

The emphasis placed by the respondents on the family environment confirms the results of a number of studies which highlight the influence of parents on school and university choices (Aschbacher et al. 2010; Sjaastad 2011). The students also attached a positive value to the family's cultural level, as mentioned in Chap. 6, recognizing the importance of having parents or siblings with degrees in scientific subjects:

> The profession of one of my parents has aroused my interest, since I was a young child (male, Mechanical Engineering)

> Thanks to my uncle, who also studied engineering at [. . .] University, and to my wish to carry on the family business with a higher educational qualification than my father had (male, Mechanical Engineering)

This shows signs that university courses perpetuate the same inequalities that exist among social groups (Cavalli and Argentin 2010).

There were some interesting gender differences concerning the influence of family as well as school experiences. Female students cited restrictive family ties – sometimes explicitly, sometimes more obliquely:

> I wanted to do an arts degree, but my parents 'warmly advised' me to do biology (female, Biology)

> My parents didn't let me choose the faculty I wanted. I chose the one which was closest to it so I could realize my dream one day (female, Mechanical Engineering)

A few students, mostly males, cited family expectations as crucial for their decisions. They are expressly oriented towards the prospect of a secure job after graduation:

> Family decisions, for a secure job in the future (male, Chemistry)

> Around the table with my parents, we discussed the job which would give the best employment guarantees, and we chose engineering (male, Electrical Engineering)

Once again in the case of the male respondents, work prospects after graduation were positively understood as the continuation of their parents' career, especially their father's:

> My choice is the consequence of work experiences I've had thanks to my father, and the many discussions with artisans and engineers in the sector (male, Automotive Engineering)

> With the help of my family, I've developed a liking for scientific subjects, and my father is a pharmacist (male, Biotechnology)

Interesting differences also emerge when disciplinary areas are taken into account. Among students of Biology, Chemistry, and Biotechnology, laboratory experience and practical activities on school curricula were recurring elements, especially among females:

> At high school, I took part in a series of Biotechnology laboratory classes, and I became very interested in this degree course (female, Biotechnology)

The various channels of scientific information were used by male and female students in different ways. Women have an interest in all degree courses, whilst among men there were more cases of physics students who attached significance to participation in science-related events, the reading of scientific magazines and books, and international mathematics and science games:

> I chose physics after I re-read some articles on particle physics. I'd always had an interest in science, but during the years I hesitated over my final decision for a long time (male, Physics)

> I chose it after an astrophysics conference on a subject I'd been fond of for some time (male, Physics)

Natural Features

Some of the students' accounts raise the issue of a predisposition for science and technology. This is a set of aptitudes believed to be innate and necessary for the choice of a university degree. Predisposition orients towards choosing which degree to take and, more particularly, it makes a person shape his/her own identity. A student's understanding that he or she has an innate ability in a subject will induce him or her to express a choice or, in some cases, a real preference:

> Since I was a small girl, I've always felt a propensity for and an interest in scientific subjects, which over the years turned into a true passion and a desire to undertake research in oncology (female, Biology)

The responses included expressions like "I've always had an aptitude", "since I was a small boy/girl, I've had an inclination", "I've always felt I had a talent". These expressions highlight the importance of factors relating to identity – rather

than to cultural aspects – as a part of the concept of self, self-perception and self-knowledge at an academic level (Bong and Skaalvik 2003). These factors reinforce the values which lead to a choice, as can be seen from these examples:

> I chose this degree course because I've always been curious about science, because I have a predisposition for Mathematics and Physics, and because of the satisfaction they gave me at high school (male, Chemistry)

> I chose this university course after evaluating what came closest to my aptitude, given that both Physics and Chemistry fascinated me (female, Chemistry)

Students made numerous references to beliefs and convictions supporting individual choices. These factors, when grouped together, enabled students to take their decisions, reinforce them gradually, and add value to the activity, with a view to success in their university careers:

> I chose a university course in computer science because I've always been very good with electronics, machinery, and above all with programming languages (male, Computer Science)

> I have a talent for mathematics and solving problems, so the choice was Electronic Engineering because it is the most scientific and I was most curious about it (male, Electronic Engineering)

Perception of one's innate abilities shows significant gender difference. This issue is referred to twice as often by males as by females. The differences reside above all in the content and the type of language used. Only in a few cases did female students motivate their choice exclusively on the basis of their aptitude, predisposition, or ability. Their responses frequently seemed complex: they included natural features combined with other evaluations relating to an interest in and a vocation for science or the various scientific subjects (attainment value), socio-cultural aspects, such as advice and orientation from teachers and parents (cultural features), and practical elements relating to future employment (utility value). These elements suggest that for female students the construct of identity is a composite process at the interface of individual personality, cultural context and social relationship. On the whole, a series of elements can be attributed to different dimensions:

> I have a great aptitude for science and I wanted to get a good preparation for the world of work (female, Electrical Engineering)

> I know that I am more inclined in scientific and practical subjects, but also I have the desire to enter in the Italian military police force (female, Chemistry)

Among the responses coming from male students, on the other hand, assertive elements were more frequent. They were distinct from other topics and more related to abilities and aptitudes for scientific subjects in general, or specific study subjects:

> I've always had a certain propensity for scientific subjects (male, Mechanical Engineering)

> I've always had a certain affinity for the subject (male, Computer Science)

Differences were also apparent in the language used to attribute abilities and aptitudes to scientific learning, which in some cases was a measure to distinguish awareness among students, their capacities, or their different levels of self-esteem.

Subjective statements were more common among female students ("I feel I have a talent for. . ."), whereas in the case of males, they were often couched in assertive terms ("I have a talent for. . ."):

> I have a talent for mathematics and solving problems, so the choice was Electronics Engineering because it is the most scientific one and I was most curious about it (male, Electronic Engineering)

Among female responses, we have:

> I analysed all the scientific subjects for which I felt I had a talent, and I chose the most interesting one, with the best job opportunities (female, Physics)

> I felt I had a talent for this type of subject (female, Biology)

Conclusions

The foregoing qualitative analysis enables us to make some assertions, starting from the most frequent to the less cited dimensions.

The key elements cited by male and female students were those which can be included in the intrinsic value category as proposed in Chap. 9: about half of the responses – mostly provided by women – showed passion for, pleasure in, and an attraction to the subject; those who enrolled in Biology, Biotechnology, Mathematics, Statistics, Physics, and Chemistry seemed more likely to choose their university career on the basis of intrinsic values than their male counterparts. These findings are also in line with the process of course selection an individual, personal and special choice (Holmegaard et al. 2012).

Secondly, we find numerous cultural elements cited in the list of priorities: the influence of the family context, of teachers at secondary school, and of the educational and school background. Just under half of the students – mainly males – cited cultural factors. Women's responses were nonetheless more related to elements such as the influence of their teachers, the average grade obtained at school, and support from the family. This consideration was linked – especially for female students – with the importance of identifying people who could be important points of reference along the path of choosing tertiary education, such as tutors or mentors. It is notable that those countries where this type of service has been instituted tend to have higher retention levels (Larose et al. 2011).

Males, above all those who enrolled in courses with a significant technical component (Electronic, Mechanical and Computer Engineering) cited educational background, such as the secondary school attended, among the cultural factors.

Utility values were cited less frequently than utility values and cultural elements among the motivations behind the subject choice. In this case there were gender differences within individual degree courses too: males enrolled in Engineering and Computer Science prioritized the opportunity for a satisfying career, also from an economic standpoint, professional success, and therefore a significant status. Utility aspects were equally important for male and female students, but the latter were

more oriented towards professional relevance, and only in very few cases (e.g. women doing very male-oriented courses) did students cite career, success, and income aspects.

Innate-type motivations were cited mostly by male students, which confirms a male propensity for attributing innate characteristics to the difference in interests between men and women. Although present in only a very small proportion of responses, vocational motivations (attainment values) were cited by students primarily from Biology, Biotechnology, Physics, Mathematics and Mechanical Engineering.

On the whole, we may say that, on account of our results, males are more attracted by the prospect of achieving status in the techno-scientific sphere, given that traditional socio-cultural models and the institutions are nearly always represented by male figures (see Chap. 20). A perception of science as a masculine environment is therefore reinforced in their representations. These elements of self-confidence are less present among female students, who mainly rely on an interest in and a passion for scientific studies, and less on aspects related to their role and institutional careers.

Given that identity and gender identity are central to choice of higher education in science and technology (see Chaps. 3 and 4), it is relevant to consider the ways in which students have described their choice process given that we found numerous references related to identity construction. It is clear that these young people are undergoing a crucial period for their individualization processes. Their search for meaning drives them to manifest their desire to be unique, but – for males, above all – to rely on pre-established roles, which in the case of science and technology are easily available and provide them with reassurance.

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