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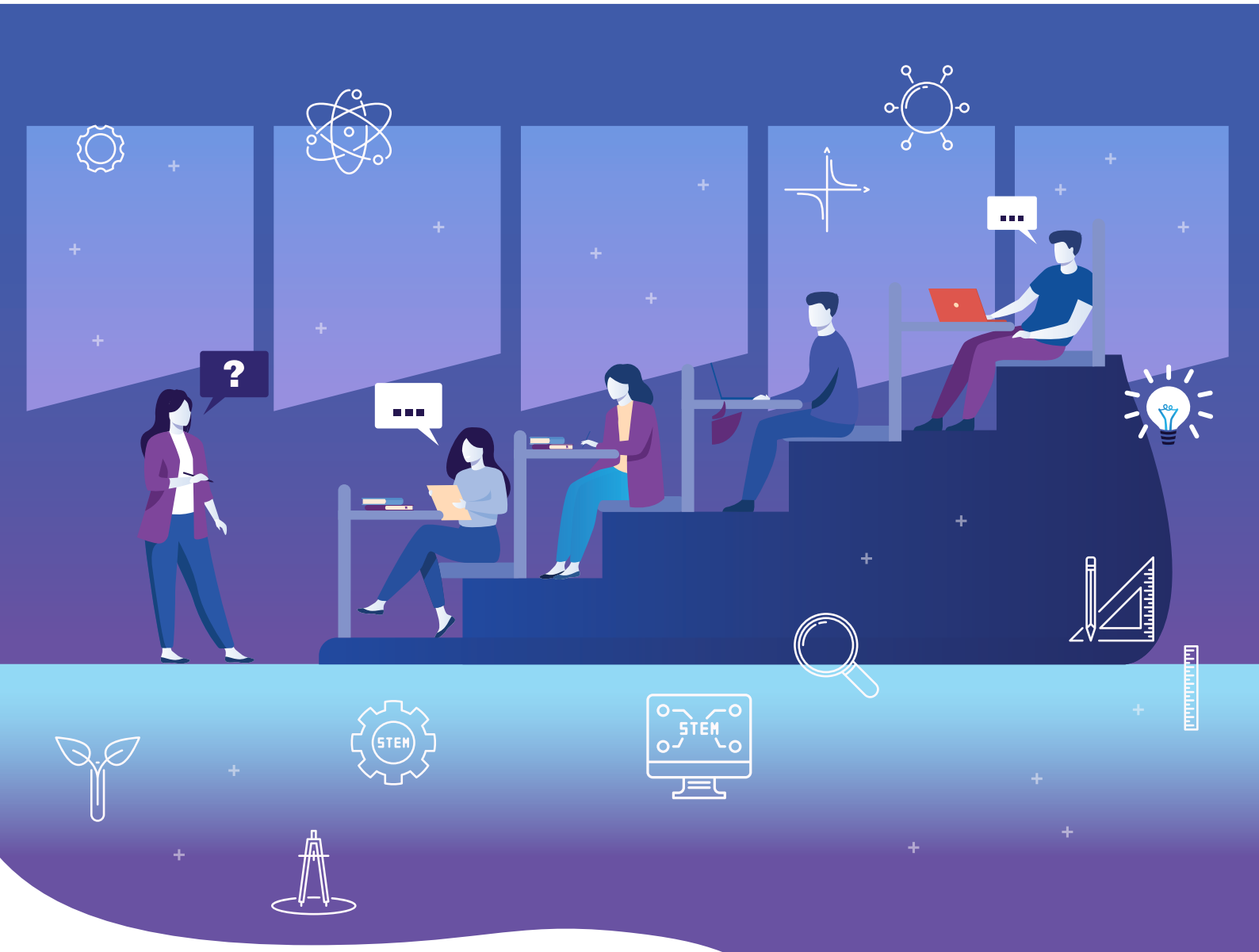

GENDER GAP IN THE STEM FIELDS AND PROPOSED INTERVENTION PROGRAMMES

REPORT

Authors: **PhD Nermin Đapo,** Faculty of Philosophy - Department of Psychology; **MSc. Ivona Čelebičić,** proMENTE social research;**Lamija Spahić, MA**, proMENTE social research; **Rachel Binder-Hathaway, M.P.A., B.A., B.S.**, Behavioral Science Specialist, UN Women - STEM & Inclusive Economic Growth Specialist, UNDP HQ

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REPORT

1 INTRODUCTION

Available statistics indicate that there are gender differences in terms of involvement in the STEM (Science, Technology, Engineering and Mathematics) fields and this theoretical background served as the basis for explaining these differences in a study conducted with the overall aim to examine the level of interest among male and female pupils in STEM. The study researches the barriers women face in traditionally male dominated fields, examines at what age gender differences emerge in education and career preferences and sampled teaching staff in order to examine gender stereotypes and the role they play in defining the education and career goals of pupils and students.

The results obtained can serve as the basis for designing intervention programmes aimed at narrowing the gender gap in the aforementioned fields of education and in terms of career choice. The underlying theoretical framework of the methodological design included primarily the impact that the socialisation process has on the formation of attitudes in children in relation to their expectations concerning their social roles, competencies and education and career opportunities. The patriarchal model of family and social relationships wherein women are naturally predisposed to take care of the household and men to care about finance was applied to education and labour. Namely, the biological differences between men and women result in the emergence of social differences and differences between occupations perceived as 'female' or 'male'. It was presumed that children internalise stereotypical messages about the distribution of roles and consequently the classification of occupations according to biological differences and generally accepted norms pertaining to the suitability of occupations with regard to gender.

Studies show that women prefer more supporting professions, while men prefer more those occupations that allow for the financial well-being status (Dasgupta and Stout, 2014; Petersen and Hyde, 2014 and Bešlagić, 2017). On a cognitive level, such socialisation practices can affect the development of spatial abilities. Studies show that men achieve higher results on spatial ability measures and that successful performance in such tasks in childhood foretells future performance in STEM fields (Hedges and Nowell, 1995; Shea and associates, 2001, and Hyde, 2005).

Moreover, uncertainty related to affiliation with a particular academic or career environment caused by negative cultural stereotypes is common among girls and women and expressed explicitly and implicitly in the STEM fields. This sense of not belonging can demotivate pupils and prevent them from pursuing or advancing in a field. Therefore, the lack of motivation among girls to pursue education or careers in the STEM fields can be linked to the theory of social belonging.

Studies have also shown how those women who achieve success in traditionally male fields face punishment by society arising from the belief that women who are successful in 'male' jobs do not pay enough attention to their community and family, which may lead them to abandon their career in STEM (Heilman and Okimoto, 2007).

The Ajzen and Fishbein model (1980) explains the sense of demotivation among girls to pursue education and careers in the STEM fields. According to the model, social pressures cause girls and women to accept the subjective norms and beliefs that society should and does not approve of their involvement in male dominated career domains. This causes them to develop a negative attitude toward STEM and incorporate the belief that they do not possess the capacities required for success in these fields. The consequence of this superimposed belief system is a loss of self-belief and unwillingness to become involved in the STEM fields.

Although the Lubinski and Benbow model (2019) is primarily a talent development model it can also be utilised to explain differences in career orientation with regard to gender. According to this model, orientation in terms of education and profession depends on matching competence and satisfaction. Competence is determined by the level of compatibility between the abilities of an individual and the environment or job requirements, while the sense of fulfilment is determined by the personal needs and requirements of the individual and the rewards and incentives provided by the job and the working environment.

The competence of an individual to perform a specific job and the sense of satisfaction the job provides are the main criteria for adaptation to the working environment. Therefore, the ideal environment is one that corresponds to their personal attributes.

Optimal development and pursuit of interests occur when the job meets the needs of an individual and the working environment stimulates the individual through the provision of support, challenges and opportunities for adequate professional growth and development.

Self-efficacy represents a central construct within Bandura's (2006) social cognitive theory and a lack of support for women to engage in the STEM fields potentially results in low self-esteem in relation to efficacy in the fields of technology and engineering.

Bandura defines it as a person's belief in his or her own ability to achieve specific goals. Accordingly, if a person's perception of his/her self-efficacy in the STEM fields is high then he/she will be prone to involvement in various activities related to these fields and consequently this will lead to an improvement in the individual's abilities and skills.

On the contrary, if the perception of self-efficacy is low then the person will avoid involvement in such activities and ultimately limit his/her ability to learn new skills (Bandura, 2006; Juretić, 2008). The sources of self-efficacy are **personal experience** (prior experience of performing various tasks), **vicarious experience** (learning by observing others, e.g. parents or teachers), **verbal persuasion** (the judgement, feedback and support we get from others) and **physiological reactions** (interpretation of emotional and physical states aimed at identifying the beliefs about self-efficacy) (Britner and Pajeras, 2005).

Eccles' expectancy-value model can also be referred to in order to explain gender differences in the STEM fields in terms of whether career choices are the result of a combination of expectancy of success and the subjective values of a specific career domain. Persons will therefore prefer those activities that they appreciate and where they expect a positive outcome, i.e. success. The subjective value of a specific activity is shaped by a combination of personal characteristics (abilities, prior experience, goals, beliefs and the self-concept) and environment factors (the cultural milieu and beliefs stemming from socialisation sources). The expectancy of success relates to the valuation of activities, affecting future performance and educational and career choices (Eccles and Wigfield, 2002).

Expectancy of failure among girls and women in relation to the STEM fields can be a consequence of their beliefs centred on the nature of intelligence. Those that view intelligence as unchangeable are prone to avoid challenges and attribute failure to a lack of ability. On the other hand, those that view intelligence as changeable perceive errors as a learning opportunity, attribute failure to a lack of effort and demonstrate an aptitude for facing challenges.

Accordingly, those girls or women who believe that mathematical ability is a consequence of innate intelligence and that men are more intelligent compared to women struggle to cope with mathematical tasks and are more susceptible to stereotypes compared to the girls or women who view intelligence as a changeable characteristic (Dweck, 2015).

The theory of preference purports that the gender gap in STEM is a product of the life tendencies or priorities that men and women have when it comes to family and career. Namely, professional segregation can be explained by the diversity of choice between the genders in relation to their interpretation of their way of life. Studies show that women are more willing to sacrifice their career for the family and that children can affect their productivity because women mainly assume the responsibility of childcare (Stack, 2004).

Gender differences in terms of life priorities usually emerge in adulthood when a person experiences important life changing events such as marriage and parenthood. STEM fields require time, commitment and continual professional development and therefore women face significant hurdles related to balancing their family and professional lives. Consequently, commitment to family obligations potentially leads to a decrease in their productivity and competitiveness in the labour market (Jacobs and Winslow, 2004; Ceci and Williams, 2011).

Considering the importance of the participation of girls and women in STEM and the insufficient amount of empirical research into the gender gap in this field within the territory of Bosnia and Herzegovina, an empirical study was designed to focus on examining the underrepresentation of women in STEM in this country.

2

METHODOLOGY

2.1 RESEARCH PROBLEM

1. Examine the gender differences in the STEM fields with regard to the described variables: the attitudes toward these fields, the level of self-efficacy and self-concept, the sense of belonging to the STEM fields, stereotypes and vulnerability to the inherent threats associated with stereotyping, the expectancies in terms of success and the tasks value, the way intelligence is perceived as either a changeable or unchangeable attribute, family and career orientation, as well as other factors.

2. Examine the factors affecting the choice of career in the STEM fields.

3. Identify the barriers faced by women in traditionally male dominated career domains.

4. Examine the gender stereotypes and the role that teaching staff play in defining the education and career goals of pupils.

2.2 SAMPLE

2.2.1 PRIMARY SCHOOLS

A total of 215 eighth grade (N=112) and ninth grade (N=102) primary school pupils participated in the quantitative part of the research of which 114 were girls and 101 boys. The average age of the participants was M=13.76 (SD=0.69). The average performance of the boys at the end of the previous grade was M=4.21 (SD=0.90) and that of the girls was M=4.36 (SD=0.77).

Tables 1 and 2 below show the sample of pupils with regard to their place of residence and school attended.

Table 1. Sample of pupils by place of residence

	Frequency	Percentage
Sarajevo	69	32.1
Banja Luka	38	17.7
Mostar	62	28.8
Foča	45	20.9
Hrenovica	1	0.5
Total	**215**	**100.0%**

Table 2. Sample of pupils by school

	Boys		Girls	
	Frequency	**Percentage**	**Frequency**	**Percentage**
Vrhbosna	20	19.8	15	13.2
Zmaj Jova Jovanović	14	13.9	24	21.1
Antuna Branka Šimića	9	8.9	18	15.8
Sveti Sava Foča	26	25.7	19	16.7
Mustafa Ejubović-Šeih Jujo	18	17.8.	17	14.9
Osman Nakaš	14	13.9	21	18.4
Total	**101**	**100.0**	**114**	**100.0**

The highest percentage of the respondents reported that their parents had completed an associate/higher school or university (mother 50.7% and father 43.7%), followed by secondary school (mother 37.2% and father 43.3%).

Table 3. Level of education of the parents

Level of education of the parents	Mother		Father	
	Frequency	Percentage	Frequency	Percentage
Completed primary school	0	0.0	0	0.0
Completed secondary school	80	38.8	93	45.1
Completed associate/higher school or university	109	52.9	94	45.6
I do not know	17	8.3	19	9.2
Total	**206**	**100.0**	**215**	**100.0**

The highest percentage of the respondents planned to enrol in an academic secondary school after completing their primary education (boys 36.7% and girls 54.5%). It is interesting to note that no girls reported their intention to enrol in a secondary school of electrical engineering.

Table 4. Planned secondary school

Planned secondary school	Boys		Girls	
	Frequency	Percentage	Frequency	Percentage
Secondary school of electrical engineering	7	23.3	0	0.0
Academic Secondary School	11	36.7	24	54.5
Secondary school of medicine	1	3.3	3	6.8
Secondary school of dental technology	1	3.3	5	11.4
Secondary school of veterinary medicine	1	3.3	0	0.0
Secondary school of hospitality and tourism	4	13.3	2	4.5
Secondary school of transport and communications	3	10.0	1	2.3
Secondary school of civil engineering and geodesy	1	3.3	1	2.3
Secondary school for textile, leather and design	1	3.3	0	0.0
Secondary school of economics	0	0.0	6	13.6
Secondary school of business, commerce and trade	0	0.0	1	2.3
Secondary school of applied arts	0	0.0	1	2.3
Total	**30**	**100.0**	**44**	**100.0**

2.2.2 SECONDARY SCHOOL

A total of 234 pupils participated in the quantitative part of the research of whom 129 were boys and 91 were girls, while 14 pupils did not report their gender. Of the total number, 106 pupils attended the first grade of secondary school, 121 pupils attend the fourth grade of secondary school and 7 pupils did not report the grade they were attending. The average age of the participants was M=16.72 (SD=1.61). The average performance of the boys at the end of the previous grade was M=4.23 (SD=0.73), while that of the girls was M=4.60 (SD=0.63).

Tables 5 and 6 show below show the sample of pupils with regard to their place of residence and the type of school attended by them.

Table 5. Sample of pupils by place of residence

	Frequency	Percentage
Sarajevo	86	37.9
Mostar	70	30.8
Foča	35	15.4
Banja Luka	26	11.5
Čapljina	2	0.9
Jablanica	3	1.3
Bijelo Polje	2	0.9
Stolac	1	0.4
Trn-Laktaši	1	0.4
Gradiška	1	0.4
Total	**227**	**100.0**

It is evident based on Table 6 that a higher percentage of girls preferred academic secondary school education, while boys had a higher affinity for vocational and technical secondary schools.

Table 6. Sample of pupils by type of school

School	Boys		Girls	
	Frequency	Percentage	Frequency	Percentage
The Third Academic Secondary School in Sarajevo	14	10.9	31	34.1
The Secondary School of Mechanical Engineering and Transport in Sarajevo	47	36.7	8	8.8
The Secondary School of Electrical Engineering in Sarajevo	31	24.2	9	9.9
The Secondary School Centre in Foča	15	11.7	8	8.8
The Academic Secondary School in Mostar	10	7.8	18	19.8
The Catholic School Centre	11	8.6	17	18.7
Total	**128**	**100.0**	**91**	**100.0**

According to the results shown in Table 7, it is evident that the highest percentage of boys attended computer science and informatics as their major course of study (25.4%) whereas the highest percentage of girls attended a general course of study (38.5%).

Table 7. Major course of study at secondary school

Major course of study	Boys		Girls	
	Frequency	Percentage	Frequency	Percentage
General course of study	21	17.2	35	38.5
Major course of study in natural sciences	4	3.3	16	17.6
Major course of study in mathematics and informatics	10	8.2	15	16.5
Computer science and informatics	31	25.4	9	9.9
Computer design	24	19.7	8	8.8
Mechatronics	12	9.8	2	2.2
CNC machine programming	18	14.8	6	6.6
Robotics	2	1.6	0	0
Total	**122**	**100.0**	**91**	**100.0**

Tables 8 and 9 below show the faculties and the major courses of study at the faculties in which the pupils intended to enrol. It is evident based on the obtained results that the highest percentage of both girls (19.0%) and boys (29.0%) planned to enrol in a faculty of electrical engineering. The highest percentage of girls (50.0%) and boys (88.6%) planned to enrol in computer science and informatics as their major course of study.

Table 8. Planned faculty

		Boys	Girls	Total
Faculty of electrical engineering	N %	27 29.0%	15 19.0%	42 24.4%
Faculty of mechanical engineering	N %	22 23.7%	7 8.9%	29 16.9%
Faculty of civil engineering	N %	0 0.0%	2 2.5%	2 1.2%
Faculty of medicine	N %	3 3.2%	12 15.2%	15 8.7%
Faculty of pharmacy	N %	1 1.1%	1 1.3%	2 1.2%
Faculty of dentistry	N %	0 0.0%	2 2.5%	2 1.2%
Faculty of veterinary medicine	N %	0 0.0%	1 1.3%	1 0.6%
Faculty of criminalistics, criminology and security studies	N %	3 3.2%	3 3.8%	6 3.5%
Faculty of architecture	N %	10 10.8%	4 5.1%	14 8.1%
Faculty of natural sciences and mathematics (PMF)	N %	3 3.2%	5 6.3%	8 4.7%
Faculty of philosophy	N %	2 2.2%	7 8.9%	9 5.2%
Faculty of economics	N %	1 1.1%	2 2.5%	3 1.7%
Faculty of law	N %	1 1.1%	1 1.3%	2 1.2%
Faculty of information technology (FIT)	N %	11 11.8%	6 7.6%	17 9.9%
I do not plan to enrol	N %	1 1.1%	0 0.0%	1 0.6%
Faculty of sport and physical education (DIF)	N %	2 2.2%	0 0.0%	2 1.2%
Academy of performing arts	N %	0 0.0%	3 3.8%	3 1.7%
Academy of fine arts	N %	1 1.1%	4 5.1%	5 2.9%
Sarajevo School of Science and Technology (SSST)	N %	1 1.1%	0 0.0%	1 0.6%
International Burch University (IBU)	N %	4 4.3%	2 2.5%	6 3.5%
Faculty of transport	N %	0 0.0%	2 2.5%	2 1.2%
I do not plan to enrol	N %	1 1.1%	0 0.0%	1 0.6%
Total	**N** **%**	**93** **100.0%**	**79** **100.0%**	**172** **100.0%**

Table 9. Faculty and major course of study

		Boys	Girls	Total
Graphic design	N %	1 2.9%	3 8.3%	4 5.6%
Management	N %	0 0.0%	2 5.6%	2 2.8%
General	N %	2 5.7%	3 8.3%	5 7.0%
Computer science and informatics	N %	31 88.6%	18 50.0%	49 69.0%
Energetics	N %	0 0.0%	2 5.6%	2 2.8%
Acting	N %	0 0.0%	1 2.8%	1 1.4%
Painting	N %	0 0.0%	3 8.3%	3 4.2%
Psychology	N %	0 0.0%	2 5.6%	2 2.8%
Dramatic arts	N %	1 2.9%	0 0.0%	1 1.4%
Animation/Fine art	N %	0 0.0%	1 2.8%	1 1.4%
Mathematics and informatics	N %	0 0.0%	1 2.8%	1 1.4%
Total	**N** **%**	35 100.0%	36 100.0%	71 100.0%

The highest percentage of the respondents reported that their parents had completed secondary education (mother 49.5% and father 53.8%), followed by higher education (mother 41.9% and father 42.5%).

Table 10. Level of education of the parents

Level of education of the parents	Mother		Father	
	Frequency	**Percentage**	**Frequency**	**Percentage**
Completed primary school	11	5.2	3	1.4
Completed secondary school	104	49.5	114	53.8
Completed associate/higher school or university	88	41.9	90	42.5
I do not know	7	3.3	5	2.4
Total	**210**	**100.0**	**212**	**100.0**

2.2.3 STUDENTS

A total of 525 students from the liberal arts, humanities and the STEM faculties participated in the quantitative part of the research of which 168 were men, 318 were women and 39 students who did not report their gender. Moreover, 302 students attended the first year of university, 13 attended the second year, 49 the third and 123 the fourth year. The average score on preparedness for study after secondary school was M=2.71 (SD=1.37), while the highest percentage of respondents (59.5% male students and 70.7% female students) had an academic secondary school education.

Table 11. Completed secondary school

Completed secondary school	Male pupils		Female pupils	
	Frequency	Percentage	Frequency	Percentage
Academic Secondary School	100	59.5	222	70.7
Four-year vocational school	58	34.5	82	26.1
Religious school	1	0.6	4	1.3
Other	9	5.4	6	1.9
Total	**168**	**100.0**	**314**	**100.0**

Tables 12 and 13 below show the sample of male and female students according to their faculty and major course of study. It is evident based on the obtained results that the highest percentage of men studied at the Department of Computer Science and Informatics (53.0%), while the highest percentage of women studied at the Department of Psychology (43.1%), followed by the Department of Computer Science and Informatics (24.8%).

Table 12. Faculty

Faculty	Male pupils		Female pupils	
	Frequency	Percentage	Frequency	Percentage
Faculty of Electrical Engineering in Lukavica	19	11.3	3	0.9
Faculty of Electrical Engineering in Banja Luka	54	32.1	46	14.5
Faculty of Electrical Engineering in Sarajevo	44	26.2	43	13.5
Faculty of Philosophy in Pale	8	4.8	34	10.7
Faculty of Philosophy in Sarajevo	18	10.7	88	27.7
Faculty of Philosophy in Mostar	17	10.1	92	28.9
Faculty of Computer Science, Mechanical and Electrical Engineering in Mostar	7	4.2	12	3.8
Faculty of Medicine in Sarajevo	1	0.6	0	0.0
Total	**168**	**100.0**	**318**	**100.0**

Table 13. Department

Department		Male students	Female students	Total
Computer science and informatics	N %	87 53.0%	77 24.8%	164 34.5%
Psychology	N %	24 14.6%	134 43.1%	158 33.3%
Pedagogy	N %	2 1.2%	26 8.4%	28 5.9%
Journalism	N %	0 0.0%	6 1.9%	6 1.3%
Political science and international relations	N %	3 1.8%	8 2.6%	11 2.3%
Electric power engineering	N %	9 5.5%	1 0.3%	10 2.1%
Logopaedics	N %	0 0.0%	5 1.6%	5 1.1%

Energetics and automatic control	N %	14 8.5%	13 4.2%	27 5.7%
Electronics and telecommunications	N %	9 5.5%	6 1.9%	15 3.2%
Oriental philology	N %	1 0.6%	0 0.0%	1 0.2%
Romance studies	N %	0 0.0%	1 0.3%	1 0.2%
Oriental studies; philosophy	N %	0 0.0%	1 0.3%	1 0.2%
English language and literature	N %	2 1.2%	9 2.9%	11 2.3%
German language and literature	N %	0 0.0%	4 1.3%	4 0.8%
Croatian language and literature	N %	0 0.0%	1 0.3%	1 0.2%
German language and literature; Latin language and Roman literature	N %	1 0.6%	0 0.0%	1 0.2%
Croatian language and literature; journalism	N %	0 0.0%	1 0.3%	1 0.2%
History; information sciences	N %	1 0.6%	0 0.0%	1 0.2%
Russian language and literature; information sciences	N %	0 0.0%	1 0.3%	1 0.2%
Italian language and literature; information sciences	N %	0 0.0%	3 1.0%	3 0.6%
Journalism; information sciences	N %	1 0.6%	0 0.0%	1 0.2%
English language and literature; Italian language and literature	N %	0 0.0%	1 0.3%	1 0.2%
Croatian language and literature; English language and literature	N %	0 0.0%	1 0.3%	1 0.2%
German language and literature; English language and literature	N %	0 0.0%	1 0.3%	1 0.2%
English language and literature; Italian language and literature	N %	0 0.0%	1 0.3%	1 0.2%
English language and literature; information sciences	N %	2 1.2%	1 0.3%	3 0.6%
German language and literature; Italian language and literature	N %	0 0.0%	1 0.3%	1 0.2%
Latin language and Roman literature; information sciences	N %	1 0.6%	0 0.0%	1 0.2%
History of art; Russian language and literature	N %	0 0.0%	1 0.3%	1 0.2%
Philosophy; Russian language and literature	N %	0 0.0%	1 0.3%	1 0.2%
Italian language and literature; Russian language and literature	N %	0 0.0%	1 0.3%	1 0.2%
History; German language and literature	N %	1 0.6%	0 0.0%	1 0.2%
History	N %	1 0.6%	0 0.0%	1 0.2%
History; journalism	N %	1 0.6%	0 0.0%	1 0.2%

English language and literature; Russian language and literature	N %	0 0.0%	1 0.3%	1 0.2%
Philosophy; Croatian language and literature	N %	1 0.6%	0 0.0%	1 0.2%
Mechanical engineering	N %	1 0.6%	0 0.0%	1 0.2%
General	N %	1 0.6%	0 0.0%	1 0.2%
Department of electrical engineering	N %	1 0.6%	4 1.3%	5 1.1%
Total	**N %**	**164 100.0%**	**311 100.0%**	**475 100.0%**

The average performance at the end of the previous semester for the sample of male students was M=7.98 (SD=1.03), while the sample of female students was M=7.73 (SD=0.76). The highest percentage of respondents that reported regular class attendance was (76.7%). The highest percentage of respondents had the status of full-time student (78.3%).

Table 14. Class attendance

	Frequency	Percentage
Rarely	7	1.5
Occasionally	16	3.3
Frequently	89	18.5
Regularly	368	76.7
Total	**480**	**100.0**

Table 15. Student status

	Frequency	Percentage
Full-time	357	78.3
Part-time	3	0.7
Self-funded	96	21.1
Total	**456**	**100.0**

2.2.4 TEACHERS

A total of 171 respondent teachers participated in the research of which 107 were women, 19 were men and 45 respondents who did not report their gender. The average age of the participants was M=43.82 (SD=8.2). The highest percentage of the respondents that had completed the first cycle of education was (31.0%).

Table 16. Completed level of education

	Frequency	Percentage
Graduate (pre-Bologna system of education)	39	31.0
University Degree (Baccalaureate)	30	23.8
University Degree (Professional Master)	35	27.8
Master of Science	15	11.9
Doctor of Science (PhD)	7	5.6
Total	**126**	**100.0**

The highest percentage of the respondents had completed the faculty of philosophy (30.8%).

Table 17. University education of the teaching staff

	Frequency	Percentage
Faculty of pedagogy	29	24.2
Faculty of philosophy	37	30.8
Faculty of natural sciences and mathematics	18	15.0
Academy of fine arts	1	0.8
Academy of music	1	0.8
Faculty of economics	3	2.5
Faculty of humanities	3	2.5
Faculty of agriculture and food sciences	2	1.7
Carleton University (Psychology)	1	0.8
Faculty of Education and Rehabilitation	2	1.7
Faculty of philology	1	0.8
Faculty of electrical engineering	5	4.2
Faculty of sport	1	0.8
Faculty of tourism and hospitality	1	0.8
Faculty of mechanical engineering	2	1.7
Faculty of information technology	1	0.8
Tuzla University, European University Kallos	1	0.8
Faculty of teacher education	6	5.0
Faculty of dentistry	1	0.8
Faculty of health studies	1	0.8
Faculty of theology	1	0.8
Faculty of natural sciences, mathematics and education	2	1.7
Total	**120**	**100.0**

More than half of the respondents teach to students attending primary school (60.2%), and 32.4% of respondents teach to students attending secondary school.

Tabele 18. The institutions where the participants taught

	Frequency	Percentage
Preschool	4	3.7
Primary school	65	60.2
Secondary school	35	32.4
Faculty	2	1.9
Primary and secondary school	1	0.9
Secondary school and faculty	1	0.9
Total	**108**	**100. 0**

Table 19.Subjects taught by the respondent teachers

	Frequency	Percentage
Croatian language and literature; English language	1	0.9
Physics	4	3.6
Bosnian language and literature	15	13.5
Subjects for pupils from first to fourth grade	28	25.2
Mathematics	8	7.2
Arabic language	1	0.9
Chemistry, culture of living, democracy and human rights	1	0.9
English language	9	8.1
Music culture	1	0.9
History	2	1.8
Group of economics subjects	2	1.8
Psychology	2	1.8
Solfeggio with music theory	1	0.9
Mathematics and physics	2	1.8
Chemistry	2	1.8
Defectology (special education)	1	0.9
Serbian language and literature	2	1.8
Electrical engineering basics	1	0.9
Physical and health education	1	0.9
Gastronomy	1	0.9
Mechanical engineering subjects	1	0.9
Informatics and technical culture	1	0.9
Informatics	5	4.5
Informatics and mathematics	4	3.6
Mathematics, physics and informatics	1	0.9
Geography	1	0.9
Art	1	0.9
Mechanics technique, machine elements, processing technology, manufacturing automation, hydraulics and pneumatics	1	0.9
Technical subjects in the field of computer science	1	0.9
Art and democracy and human rights	1	0.9
Medical biochemistry and chemistry	1	0.9
Group of liberal arts subjects	1	0.9
History and Latin language	1	0.9
Social medicine; Hygiene and health protection	1	0.9
Technical subjects in the field of food sciences	1	0.9
Religious education	1	0.9
Pedagogical subjects	1	0.9
Biology	1	0.9
Physics and informatics	1	0.9
Total	**111**	**100.0**

2.3 PROCESS

Approval to conduct the study from the competent ministries in the education sector within the territory of Bosnia and Herzegovina preceded the realisation of the research. Prior to the conduct of the research, a pilot study was also realised in order to verify the validity and comprehensibility of the designed toolbox and to define the timeframe required to apply the tests. Then, in the final study, paper and pencil questionnaires for primary and secondary school pupils and for liberal arts, humanities and STEM faculty students were completed. The purpose of the research was explained to the pupils and students and their voluntary consent to participate in the research was requested. In addition, approval was requested from the parents of the sample of primary and secondary school pupils prior to the application of the questionnaires. The questionnaire for the student sample was applied online as was the online survey of the teaching staff.

Moreover, the study also included focus group research on the sample of pupils and students, teaching staff and persons employed in the ICT sector. The focus group research was realised with the voluntary consent of the participants, which was preceded by an explanation of the purpose of the research.

The content of the focus groups was recorded using a voice recorder with the prior consent to record the discussions requested from the participants. The questionnaires required 45 minutes and the focus groups lasted for 60 minutes.

2.4 TOOLBOX

Quantitative (application of the questionnaires) and qualitative research (focus group research) approaches were applied in order to provide answers to the posed research problems. The toolbox applied to this research is described below.

2.4.1 QUESTIONNAIRE FOR PRIMARY SCHOOL PUPILS

The A and B versions of a 15-module questionnaire were designed for primary school eighth and ninth grade pupils. Module I examined the education and career interests and goals of the pupils. Module II was intended to examine the level of interest among the pupils in STEM subjects. Module II contained a list of subjects that did not fall within the target group in order to eliminate the possibility of the pupils identifying the purpose of the research process.

The general attitude of the pupils toward STEM subjects was measured through module III, which included three Likert type scales: mathematics (6 items), natural sciences (8 items) and informatics (6 items). Module IV included three items whereby the expectancy of the success construct was measured and three items where the task value construct based on the previously described Eccles' expectancy of success and task value model were measured (Eccles and Wigfield, 2002). Module IV also included a scale designed to examine the extent to which the pupils' intended to pursue STEM fields in the near and distant future (3 items). Module V included 18 items intended to examine the pupils' self-concept in relation to STEM subjects.

Module VI used 7 items to measure the strength of the pupils' attitudes in relation to social desirability. Module VII included 12 items intended to examine the pupils' perceptions of scientists, science and technology. Module VIII contained 10 items that examined the pupils' preferences in terms of specific activities relevant to the STEM fields, such as understanding how things are constructed. Module IX examined the pupils' interests in relation to occupations and careers linked to STEM. In this regard, Module XIII offered a list of occupations where the pupils were asked to assess whether men or women were better in specific occupations. Module IX offered the pupils a vignette aimed at examining gender stereotypes.

A situation was described wherein a person was offered a job as an engineer. The respondents had to decide whether the person should accept the job or accept a less demanding job. The main character in Version A of the scenario was a woman whereas in version B the main character was a man.

A total of 107 pupils completed version A and 108 completed version B. Moreover, Module XI was designed to examine their perceptions in terms of the support provided by the environment and how this affected their choice of study within the STEM fields (4 questions).

Module XII was designed to examine the effect of gender stereotypes that potentially exist in their immediate and broader environment (3 questions in version A and 4 questions in version B). The question that distinguished the aforementioned versions from one another was "Should girls be supported to study a field belonging to the STEM domains."

Module XIV included theories implicit to the intelligence scale, a measure to assess one's own intellectual abilities (8 items) and to assess one's abilities in relation to different careers and fields. Module XV asked the pupils to specify which secondary school they intended to enrol in and what occupation they believed that secondary school would afford them.

Lastly, the pupils were asked to complete a questionnaire on sociodemographic characteristics containing questions related to their gender, age, the school they attended, their place of residence, average school performance at the end of the previous grade and the highest level of education attained by their parents.

2.4.2 THE QUESTIONNAIRE FOR THE SECONDARY SCHOOL PUPILS

The questionnaire for the secondary school pupils was similar to the previously described questionnaire. The education and career interests and goals of secondary school pupils were examined through 15 modules, followed by their interest in different school subjects and general attitude toward STEM subjects. Their 'expectancy of success' and 'task value' constructs were also measured as were their intentions to engage in the STEM fields in the near and distant future. Moreover, their interests in specific activities relevant to the STEM fields and their perception of jobs and careers in the fields of natural sciences, technology, engineering and mathematics as well as their perception of their expectancy of success in the occupations associated with these fields were examined. The questionnaire was also used to measure their strength of attitude and their views on social desirability.

The gender differences within the STEM fields and the associated gender stereotypes were measured through the application of the previously described vignettes wherein a scenario was offered where the main character in version A was a woman and the main character in version B was a man, followed by a 16-item scale. A total of 120 pupils completed version A and 114 completed version B. At the same time, the pupils were offered different fields of human activity and asked to assess who (men or women) are more capable in these fields and whether men and women are equally capable.

The questionnaire for secondary school pupils also included measures designed to assess their perception of the support provided by their environment and their perception of the presence or absence of gender stereotypes in their immediate and extended environment. Moreover, the questionnaire included theories implicit to the intelligence scale. The pupils were also asked to assess their intelligence quotient and to estimate their own abilities in relation to several careers and fields. Lastly, the pupils completed a questionnaire on sociodemographic characteristics including questions related to their gender, age, school and their major course of study, their grade, place of residence, average performance at the end of the previous grade and the faculty and major course of study in which they intended to enrol as well as the level of education that their parents had attained.

2.4.3 THE QUESTIONNAIRE FOR THE STUDENTS

A questionnaire on the sociodemographic characteristics of the sample of students included questions related to their gender, the secondary school they had attended and to what extent they were prepared after their secondary education for higher education. The students were asked to specify their faculty and department, their year of study, their student status, class attendance and average performance at the end of the previous semester.

The questionnaire for students also included 15 modules. Module I examined the education and career interests and goals of the students. Module II (7 items) examined the students' reasons for enrolling in their chosen faculty. Module III (11 items) examined the students' general attitudes toward their studies. Module IV was intended to examine the self-concept in relation to the STEM fields (18 items), while the scale within Module V (17 items) was intended to examine their sense of belonging to the studies and departments they had chosen. Module VI was intended to examine their career intentions within their chosen profession and science (12 items), while the subjective norms were examined through Module VII (3 items). Module VIII represented a measure to assess the strength of their attitudes and views on social desirability (7 items).

Module IX (21 items) included an abridged vulnerability to stereotype threat scale. Module X (16 items) was intended to examine their values orientation toward family and career. Module XI examined their perceptions on gender roles/differences in the STEM fields as well as their perception of the differences in ability in relation to gender within the STEM fields, which included a scale (11 items) and a section where the respondents were provided with a list of careers and fields. Through this list, the respondents were asked to assess who (men or women) are more capable in a specific field.

The previously described scenario was also used to examine gender differences in the STEM fields. In Module XII, 261 students completed version A and 264 completed version B. Module XIII measured their perceptions of the level of support provided by the environment in relation to their choice of study in the STEM fields. Module XIV included a survey on their perceptions of the gender stereotypes present in the environment. Module XV included theories implicit to the intelligence scale (8 items) and the respondents were asked to assess their own intelligence quotient and abilities in relation to several career fields, such as natural sciences and engineering.

2.4.4 THE QUESTIONNAIRE FOR THE TEACHERS

The questionnaire for teachers included a sociodemographic section related to their gender, age, years of work experience in education, questions on the institution where they taught, the faculty they had attended, and the level of education and subjects taught by them. In addition to the previously described scenario (versions A and B), an additional questionnaire for teaching staff included 8 modules. In both versions of the questionnaire, the first module examined the intentions of the teaching staff to engage in defining the education and career goals of their pupils.

The respondents were also asked to assess the relevance of the individual component within the evaluation and the recommendations given to pupils on their further education. At the same time, the teachers were asked within this module to assess the level of interest in science among their pupils, to comment on factors that could potentially contribute to the reduced representation of girls/women in the STEM fields and their opinions on social norms related to the involvement of men and women in these fields. Module II contained two versions of the questionnaire (A and B) as well as a list of adjectives. In version A the respondents were asked to assess the skills and attitudes demonstrated by their female pupils/female students in the subject taught by them. In version B, the respondents had to assess the skills and attitudes demonstrated by their male pupils in the subjects taught by them. A total of 90 teachers completed version A of the questionnaire and 81 teachers completed version B.

Module III included a vignette wherein the main character in version A of the scenario was a woman, while the main character in version B was a man. The respondent teachers had to propose the career field that the person should pursue and to give their reasons for their proposal based on the described scenario.

Module IV contained a similar scenario wherein a person was offered a job as a neurosurgeon and had to decide whether to accept or refuse the job offer in favour of a less demanding job. The main character in version A was a man and in version B a woman. Module V was the same in both versions of the questionnaire.

A scenario was described wherein the parents could not afford higher education for their twins who had completed secondary education (a girl and a boy). To examine the gender stereotypes, the respondents were asked five questions.
Module VI was the same in both versions of the questionnaire. It examined gender stereotypes by asking the respondent teachers to distribute household chores to each member of a four-member family (father, mother, son and daughter) and to specify who was responsible for different household chores in their own household.
Module VII also examined gender stereotypes. It used two versions of the same scenario wherein the parents of a woman aged 21 (version A) and a man aged 21 (version B) had to prioritise their daughter/son getting married or accepting a challenging career. The respondents had to respond to a series of questions related to their level of agreement with the decision made by the parents in the scenario and, among others, what they would do if they were in the situation of the main characters.

Module VIII included a scale whereby the presence/absence of gender stereotypes was examined (20 items). There were two versions of the questionnaire (A and B) that differed with regard to the following: "Girls/boys should have more education in order to be able to find better husbands/wives", "For women/men, their job is more important than their education", "Shy/withdrawn behaviour makes a woman/man more eligible for marriage" and "At what age would you like your sister/female cousin or brother/male cousin to get married?"

2.4.5 GUIDES FOR THE RESEARCH INVOLVING FOCUS GROUPS

Five research protocols were designed for the focus groups for the purposes of this research:

- A Guide to Focus Group Research on a Sample of Primary School Pupils
- A Guide to Focus Group Research on a Sample of Secondary School Pupils
- A Guide to Focus Group Research on a Sample of Humanities and STEM Faculty Students
- A Guide to Focus Group Research on a Sample of Teachers/Lecturers
- A Guide to Focus Group Research on a Sample of Persons Employed in the IT Sector

3

RESULTS

3.1 PRIMARY SCHOOL

3.1.1 FAVOURITE SCHOOL SUBJECTS AND PREFERRED SCIENTIFIC FIELD AND OCCUPATION

According to the obtained results, it is evident that the boys mostly preferred the following subjects: physical and health education (41.6%), informatics (11.9%) and geography (8.9%). On the other hand, girls mostly preferred the following subjects: biology (17.5%), mathematics (12.3%) and physical and health education (10.5%).

Table 20. First choice of favourite subject

		Gender		
		Male	Female	Total
Mother tongue	N	4	6	10
	%	4.0%	5.3%	4.7%
Mathematics	N	6	14	20
	%	5.9%	12.3%	9.3%
Physics	N	3	9	12
	%	3.0%	7.9%	5.6%
Chemistry	N	4	8	12
	%	4.0%	7.0%	5.6%
Biology	N	4	20	24
	%	4.0%	17.5%	11.2%
Geography	N	9	10	19
	%	8.9%	8.8%	8.8%
Informatics	N	12	4	16
	%	11.9%	3.5%	7.4%
Foreign language	N	7	10	17
	%	6.9%	8.8%	7.9%
Art/Music	N	4	11	15
	%	4.0%	9.6%	7.0%
History	N	3	7	10
	%	3.0%	6.1%	4.7%
Physical education and Health education	N	42	12	54
	%	41.6%	10.5%	25.1%
Religious education	N	0	1	1
	%	0.0%	0.9%	0.5%
Technical culture	N	3	2	5
	%	3.0%	1.8%	2.3%
Total	**N**	**101**	**114**	**215**
	%	**100.0%**	**100.0%**	**100.0%**

The top second choices of favourite subject in the sample of male pupils were physical and health education (12.0%), biology (14.0%) and informatics (14.0%), while those in the sample of female pupils were biology (19.8%), geography (12.6%) and chemistry (10.8%).

Table 21. Second choice of favourite subject

		Gender		
		Male	Female	Total
Mother tongue	N	3	5	8
	%	3.0%	4.5%	3.8%
Mathematics	N	7	6	13
	%	7.0%	5.4%	6.2%
Physics	N	4	9	13
	%	4.0%	8.1%	6.2%
Chemistry	N	1	12	13
	%	1.0%	10.8%	6.2%
Biology	N	14	22	36
	%	14.0%	19.8%	17.1%
Geography	N	10	14	24
	%	10.0%	12.6%	11.4%
Informatics	N	14	6	20
	%	14.0%	5.4%	9.5%
Foreign language	N	8	11	19
	%	8.0%	9.9%	9.0%
Art/Music	N	10	8	18
	%	10.0%	7.2%	8.5%
History	N	10	8	18
	%	10.0%	7.2%	8.5%
Physical education and Health education	N	12	9	21
	%	12.0%	8.1%	10.0%
Religious education	N	5	1	6
	%	5.0%	0.9%	2.8%
Technical culture	N	2	0	2
	%	2.0%	0.0%	0.9%
Total	**N**	**100**	**111**	**211**
	%	**100.0%**	**100.0%**	**100.0%**

The boys mostly preferred the scientific fields of informatics (22.5%), medicine (13.8%) and natural sciences (11.3%), while the girls mostly preferred natural sciences (22.4%) and medicine (17.3%).

Table 22. Choice of scientific field

		Gender		
		Male	Female	Total
Natural sciences	N	9	22	31
	%	11.3%	22.4%	17.4%
Medicine	N	11	17	28
	%	13.8%	17.3%	15.7%
Technical sciences	N	7	2	9
	%	8.8%	2.0%	5.1%
Informatics	N	18	6	24
	%	22.5%	6.1%	13.5%
Arts	N	0	5	5
	%	0.0%	5.1%	2.8%
Sport	N	2	2	4
	%	2.5%	2.0%	2.2%
Law	N	1	2	3
	%	1.3%	2.0%	1.7%

Veterinary medicine	N %	3 3.8%	7 7.1%	10 5.6%
Architecture	N %	2 2.5%	2 2.0%	4 2.2%
Pharmacy	N %	0 0.0%	3 3.1%	3 1.7%
Economics	N %	1 1.3%	4 4.1%	5 2.8%
Mathematics	N %	2 2.5%	3 3.1%	5 2.8%
Psychology/Pedagogy	N %	3 3.8%	4 4.1%	7 3.9%
Teacher	N %	1 1.3%	3 3.1%	4 2.2%
Nutritionist	N %	0 0.0%	2 2.0%	2 1.1%
Criminalistics/Security	N %	3 3.8%	3 3.1%	6 3.4%
Languages	N %	0 0.0%	1 1.0%	1 0.6%
History	N %	3 3.8%	1 1.0%	4 2.2%
Faculty of sports and physical education (FASTO)	N %	0 0.0%	1 1.0%	1 0.6%
Military academy	N %	2 2.5%	0 0.0%	2 1.1%
Does not see themselves attending a faculty	N %	12 15.0%	8 8.2%	20 11.2%
Total	N %	**100** **100.0%**	**111** **100.0%**	**211** **100.0%**

When it came to the first choice of occupation, the male pupils mostly preferred sport (18.4%), medical (14.9%), security services (14.9%) and information technology (12.6%). The girls showed most interest in medicine (34.5%), working in education (11.8%) and the field of art and design (8.2%).

Table 23. First choice of occupation

		Gender		
		Male	Female	Total
Medicine/Healthcare	N %	13 14.9%	38 34.5%	51 25.9%
Art/Design	N %	3 3.4%	9 8.2%	12 6.1%
Liberal arts	N %	0 0.0%	5 4.5%	5 2.5%
Entertainment	N %	1 1.1%	4 3.6%	5 2.5%
Communications/Media	N %	1 1.1%	0 0.0%	1 0.5%
Physical/Life sciences	N %	2 2.3%	5 4.5%	7 3.6%
Community/Social services	N %	2 2.3%	5 4.5%	7 3.6%

Education	N %	4 4.6%	13 11.8%	17 8.6%
Business/Finance	N %	3 3.4%	4 3.6%	7 3.6%
Law	N %	0 0.0%	7 6.4%	7 3.6%
Engineering	N %	4 4.6%	4 3.6%	8 4.1%
Architecture	N %	2 2.3%	3 2.7%	5 2.5%
Computer science/Information technology	N %	11 12.6%	6 5.5%	17 8.6%
Software development	N %	1 1.1%	0 0.0%	1 0.5%
Security services	N %	13 14.9%	2 1.8%	15 7.6%
Manufacturing/Production	N %	1 1.1%	0 0.0%	1 0.5%
Armed forces	N %	4 4.6%	1 0.9%	5 2.5%
Construction/Installation/Maintenance/Repair	N %	5 5.7%	0 0.0%	5 2.5%
Sport	N %	16 18.4%	3 2.7%	19 9.6%
Science	N %	1 1.1%	1 0.9%	2 1.0%
Total	**N %**	**87 100.0%**	**110 100.0%**	**197 100.0%**

When it came to the second choice of occupation, the male pupils mostly preferred the fields of sport (10.8%), security services (10.8%), working in a service for social work (10.8%) and the girls preferred medicine (27.3%), working in a service for social work (11.1%) and working in education (9.1%).

Table 24. Second choice of occupation

		Gender		
		Male	Female	Total
Medicine/Healthcare	N %	7 8.4%	27 27.3%	34 18.7%
Art/Design	N %	3 3.6%	7 7.1%	10 5.5%
Liberal arts	N %	3 3.6%	4 4.0%	7 3.8%
Entertainment	N %	1 1.2%	3 3.0%	4 2.2%
Communications/Media	N %	0 0.0%	1 1.0%	1 0.5%
Physical/Life sciences	N %	3 3.6%	8 8.1%	11 6.0%
Community/Social services	N %	9 10.8%	11 11.1%	20 11.0%
Education	N %	6 7.2%	9 9.1%	15 8.2%
Business/Finance	N %	7 8.4%	5 5.1%	12 6.6%

Law	N %	0 0.0%	3 3.0%	3 1.6%
Engineering	N %	6 7.2%	2 2.0%	8 4.4%
Mathematics	N %	2 2.4%	0 0.0%	2 1.1%
Architecture	N %	5 6.0%	4 4.0%	9 4.9%
Computer science/Information technology	N %	5 6.0%	5 5.1%	10 5.5%
Software development	N %	1 1.2%	0 0.0%	1 0.5%
Security services	N %	9 10.8%	5 5.1%	14 7.7%
Manufacturing/Production	N %	1 1.2%	0 0.0%	1 0.5%
Armed forces	N %	3 3.6%	0 0.0%	3 1.6%
Construction/Installation/Maintenance/Repair	N %	2 2.4%	0 0.0%	2 1.1%
Sport	N %	9 10.8%	5 5.1%	14 7.7%
Science	N %	1 1.2%	0 0.0%	1 0.5%
Total	**N %**	**83 100.0%**	**99 100.0%**	**182 100.0%**

The level of education that the pupils wanted to achieve was associate/higher school or university (male pupils 69.4% and female pupils 84.1%).

Table 25. The level of education that the primary school pupils intended to achieve

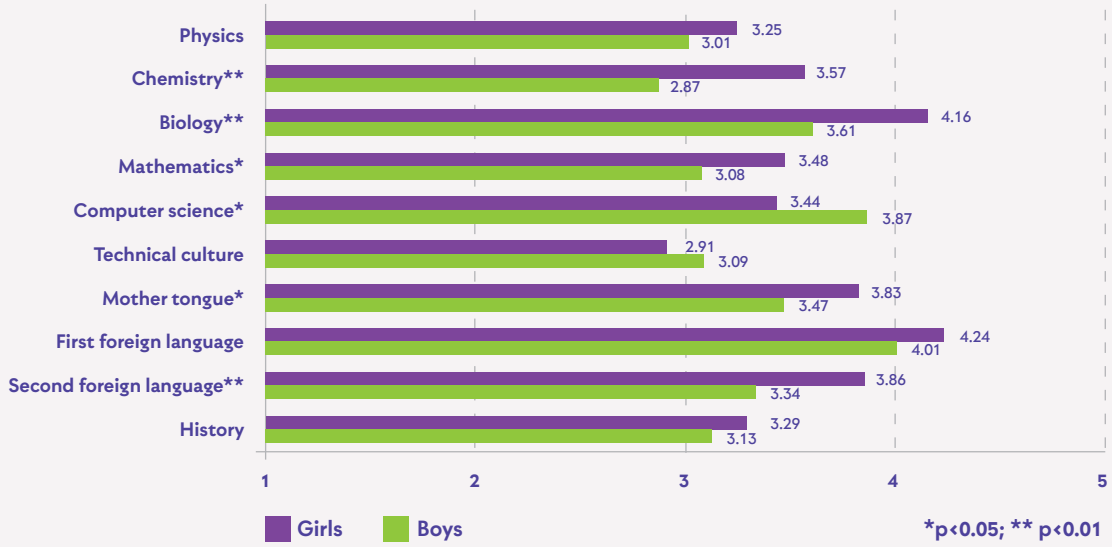
Level of education	Boys		Girls	
	Frequency	**Percentage**	**Frequency**	**Percentage**
Completed secondary school	20	20.4	9	8.0
Completed associate/higher school or university	68	69.4	95	84.1
I do not know	10	10.2	9	8.0
Total	**101**	**100.0**	**114**	**100.0**

3.1.2 INTEREST IN AND GENERAL ATTITUDE TOWARD STEM SUBJECTS

Figure 1 below shows the average values of the assessments of the level of interest among male and female pupils in the specified subjects. It is evident from Figure 1 that the female pupils reported greater interest than the male pupils in subjects in the STEM fields (chemistry, biology and mathematics) save for the subject of informatics in which the male pupils showed greater interest. The female pupils also showed more interest in a second foreign language compared to the boys.

The general attitudes among the pupils toward the subjects in the STEM fields were determined through the scales designed for mathematics (6 items), natural sciences (8 items) and informatics (6 items). To verify the validity of the construct, an analysis of the main components was performed for each scale.

Figure 1. Interest in STEM subjects

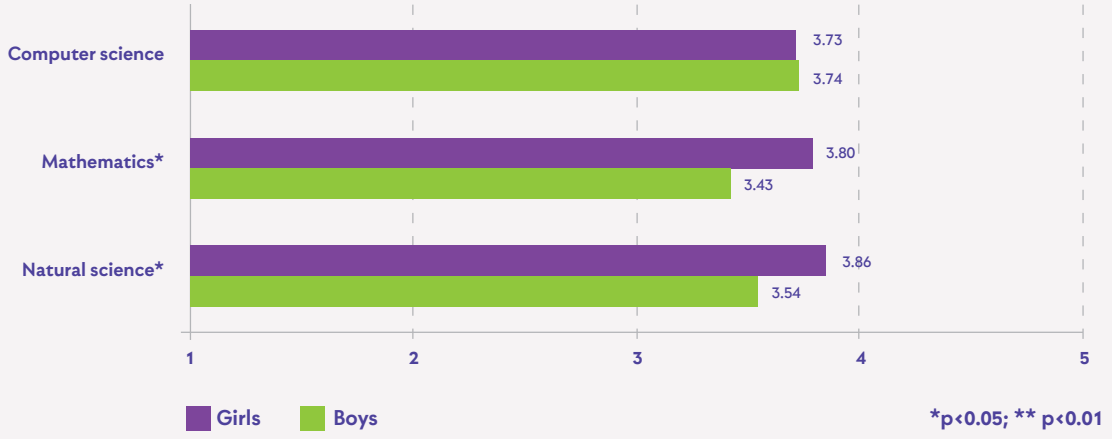


One component was identified for each scale and consisted of four identical items that by their content reflected a positive attitude toward the STEM subjects at school. For example, the scale on their attitudes toward natural science subjects: 'The things I learn in the natural science subjects will help me in my further schooling', 'We learn interesting things in the natural science subjects', 'Learning natural sciences is useful for getting a good job in the future' and 'The things I learn in the natural science subjects will help me in my day-to-day life'.

The components explain the 64.62 per cent results variance for the scale on attitudes toward mathematics, 69.3 per cent for the scale on attitudes toward natural science subjects and 67.84 per cent of the results variance for the scale on attitudes toward the subject of informatics. Satisfactory values of the internal reliability coefficients were determined for the scales on attitudes toward natural sciences, mathematics and informatics (α=0.817; α=0.850; α=0.836 respectively).

Figure 2 below shows the average values determined for the scales on attitudes toward natural sciences, mathematics and informatics with regard to gender. It is evident from Figure 2 that the female pupils reported more positive attitudes toward mathematics and natural science subjects than the male pupils did. No statistically significant differences were found in the attitudes toward informatics.

Figure 2. Attitudes towards STEM subjects



3.1.3 SELF-CONCEPT IN SUBJECTS IN THE STEM FIELDS

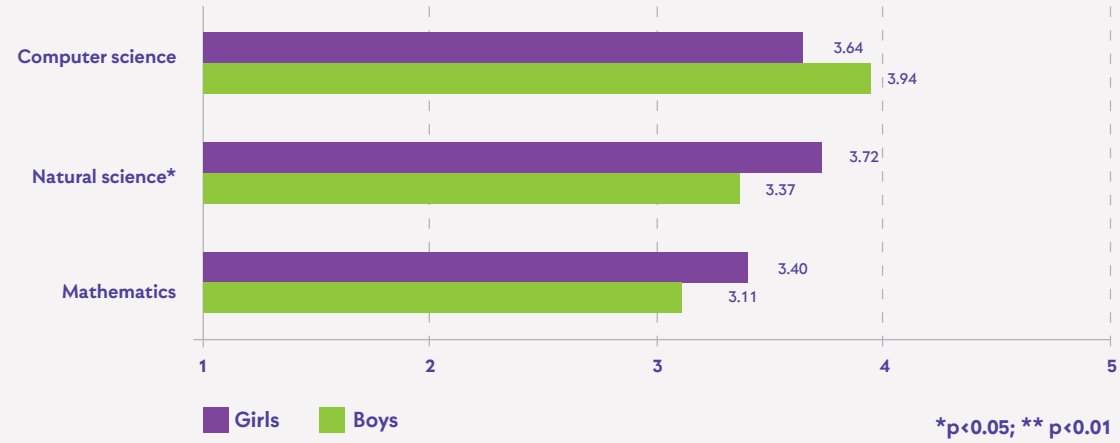
The self-concept in relation to the STEM fields reflects a pupil's general self-perception in relation to a field related to STEM. The self-concept of pupils in relation to STEM was determined through a scale designed for the purposes of this research. The scale consisted of 18 items related to different aspects of the self-concept in relation to mathematics, natural sciences and informatics. To verify the validity of the construct an analysis of the main components was performed.

The analysis of the main components identified three interpretable components that by their content corresponded to the self-concept in relation to mathematics (four items, 'Mathematics is interesting to me', 'I can quickly master things in mathematics', 'It is important to me to be good in mathematics' and 'I can achieve excellent results in mathematics'), natural sciences (four items, 'I quickly grasp concepts and theories in natural sciences', 'It is important to me to know as many things as possible in natural sciences', 'Knowledge of natural sciences will benefit me in the future' and 'I can become a successful scientist') and informatics (four items, 'I quickly master things in informatics', 'It is important to me to be good in informatics', 'Knowledge of informatics will benefit me in the future' and 'I can become a successful programmer').

The first component, the self-concept in relation to mathematics, explains the 27.18 per cent results variance, the second component and the self-concept in relation to natural sciences, explains the 24.0 per cent results variance, while the third component, the self-concept in relation to informatics, explains the 22.4 per cent results variance. High values for the internal reliability coefficients were determined for the self-concept in relation to mathematics, natural sciences and informatics (α=0.913; α= 0.825; α=0.857 respectively).

Figure 3 below shows the average values determined by the scales on the self-concept in relation to mathematics, natural sciences and informatics with regard to gender. Compared to the male pupils the female pupils recorded a higher self-concept in natural sciences. When it came to informatics, the ratio reversed with the male pupils recording a higher self-concept. No statistically significant differences were found in the self-concept in relation to mathematics.

Figure 3. Self-concept in subjects in the STEM fields



3.1.4 EXPECTANCY OF SUCCESS AND THE TASKS VALUES

Expectancies and tasks values represent motivational beliefs defined within the Eccles and Wigfield social cognitive model (Eccles, 1983), which is one of the most commonly used expectancy-value models in the field of education. The value reflects our goals, values and interests ('Why am I doing this task?'), while the construct of expectancies refers to actual beliefs about future success ('Am I able to perform this task?'). Items developed by Eccles and her associates (Eccles et al., 1984) were used to measure the constructs of expectancy and the tasks values.

Figure 4. Tasks values

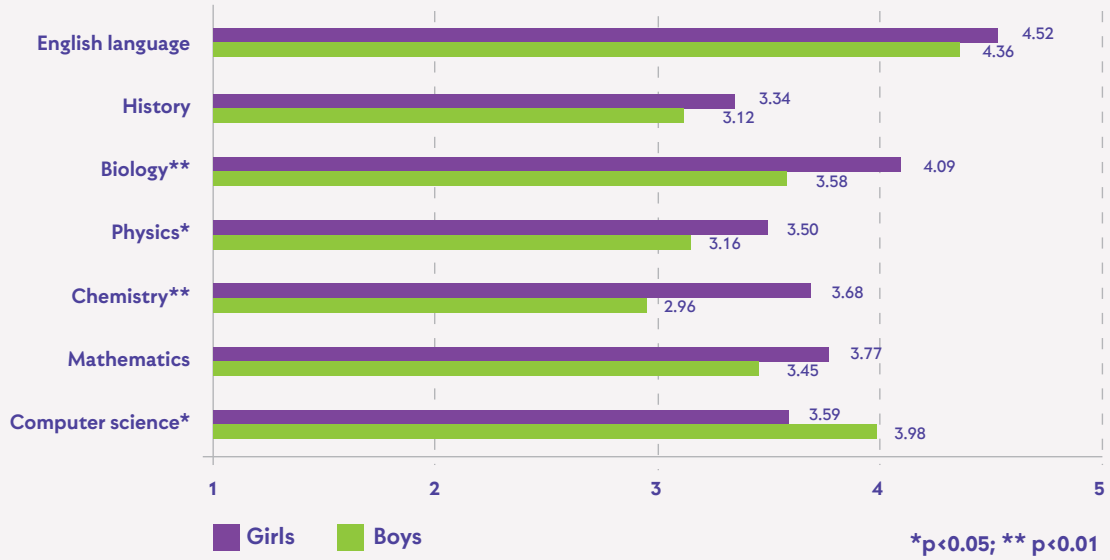
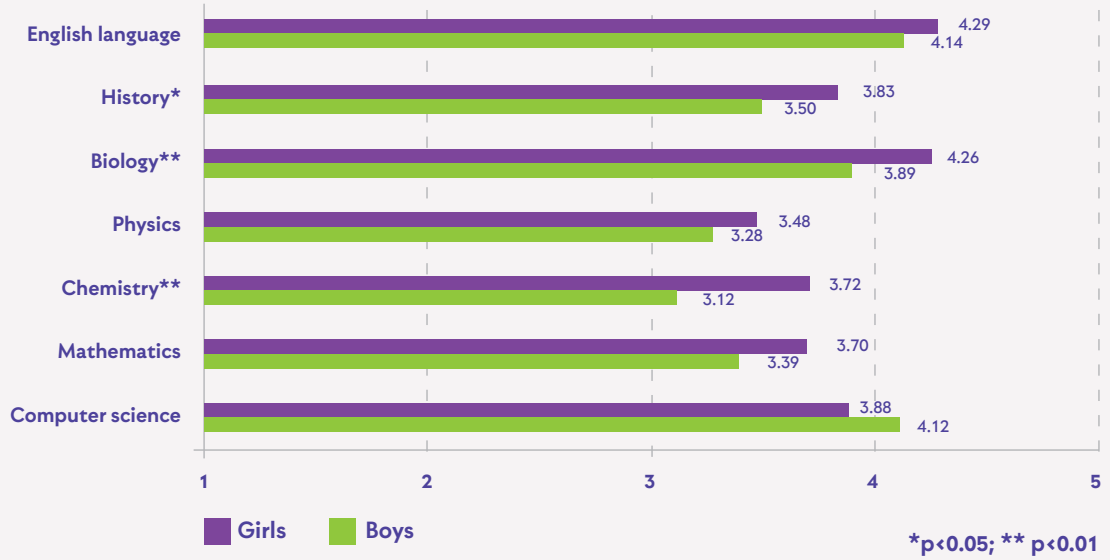


Figure 5. Expectancy of success



Three items were used to measure expectancy ('How successful would you be in occupations requiring knowledge and competency in the subjects provided below?', 'How important is it to you to achieve the best possible performance in the subjects provided below in the next school year?' and 'Imagine yourself in the future'). Respondents were also asked to specify 'to what extent do you believe that you would successfully fulfil the tasks related to the careers provided below'.

Three items were also used to measure tasks values: 'To what extent are you interested in what is learned in the specified subjects?', 'How important is it to you to learn in this grade as many things as possible in the subjects provided below?' and 'How important will the knowledge and competencies in the subjects provided below be in your future?'

Composites of the results expressed as average values for all three items were created for both constructs. The expectancies and tasks values were determined for the following subjects: mathematics, informatics, physics, chemistry, biology, history and English language.

Figures 4 and 5 above show the average values of the tasks and expectancy of success for individual subjects with regard to gender. Statistically significant differences were found in the tasks values for the subjects of biology, physics, chemistry and informatics. Namely, the female pupils considered biology, physics and chemistry to be more valuable compared to the male pupils and the male pupils considered informatics to be more valuable compared to the female pupils. Moreover, statistically significant differences were found in the expectancy of success for the subjects of history, biology and chemistry; the female pupils had higher expectancy of success in these subjects compared to the male pupils.

3.1.5 PERCEPTIONS OF SCIENTISTS AND OF SCIENCE AND TECHNOLOGY

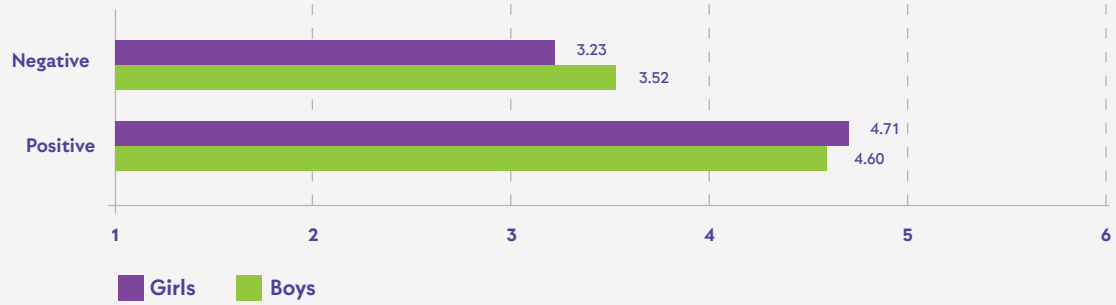
The respondents' perceptions of scientists and science and technology were determined through a scale that consisted of 12 items designed to measure positive images of scientists, the stereotypical view of scientists and the level of belief in the importance of science. Seven items referred to the perception of scientists, (e.g. 'Scientists are strange') while the other five items referred to the beliefs about science and technology (e.g. 'Science does more harm than good'). The items were taken over from the ASPIRES and SAS projects. A Likert type scale with 6 notches ranging from 1 'I strongly agree' up to 6 'I strongly disagree' was utilised.

Figure 6. Perceptions of scientists and of science and technology

An analysis of the main components was performed for the seven items that measured the positive image of scientists and the stereotypical view of scientists. After excluding one item ('We should always believe what scientists claim'), two components were identified that when combined explained the 61.3 per cent of variance in the results. After applying a Varimax rotation, the first component explained the 34.9 per cent of variance whereas the second component explained the 26.4 per cent results variance. The first component referred to the positive image of scientists (scientists are intelligent, talented researchers and earn a lot of money) whereas the second component referred to the stereotypical view of scientists (scientists are strange, lonely and boring). The internal consistency reliability, expressed through the Cronbach α coefficient, was 0.751 for the positive image of scientists and 0.546 for the negative image of scientists.

Figure 7 below shows the average values of the positive and negative image of scientists with regard to gender. No statistically significant differences were found, which indicates that the perceptions of scientists were equal among the male and female pupils.

Figure 7. Positive and negative image of scientists



3.1.6 INTEREST IN OCCUPATIONS AND CAREERS RELATED TO STEM

A scale designed for the purposes of this research was used to examine the extent of interest in occupations related to STEM. The pupils were asked to assess to what extent they would like to pursue some of the offered occupations when they grow up using a scale ranging from 1 'not at all' to 5 'yes, definitely'. Figure 8 below shows the average results determined for the male and female pupils. According to the results obtained, the male pupils preferred to pursue the occupations of programmer, mechanical engineer, civil engineer or electrical engineer. On the contrary, the female pupils mostly preferred the occupations of doctor, psychologist or journalist. No statistically significant differences were found for the other occupations.

In addition to the preferences expressed toward specific occupations, the preferences toward specific activities relevant to STEM occupations were examined such as 'solving mathematical problems', 'understanding how things are built' and 'work on finding a new cure'. The pupils were asked to assess to what extent they would like to pursue specified activities using a scale ranging from 1 'Does not apply to me at all' to 5 'Completely applies to me'. Figure 9 below shows the average values determined for the male and female pupils. As can be seen from Figure 9, the female pupils showed greater interest in activities that entail 'work on finding a new cure' and the male pupils showed greater interest in activities aimed at creating computer applications or designing video games. No statistically significant differences were found for the other activities.

Figure 8. Interests in STEM occupations

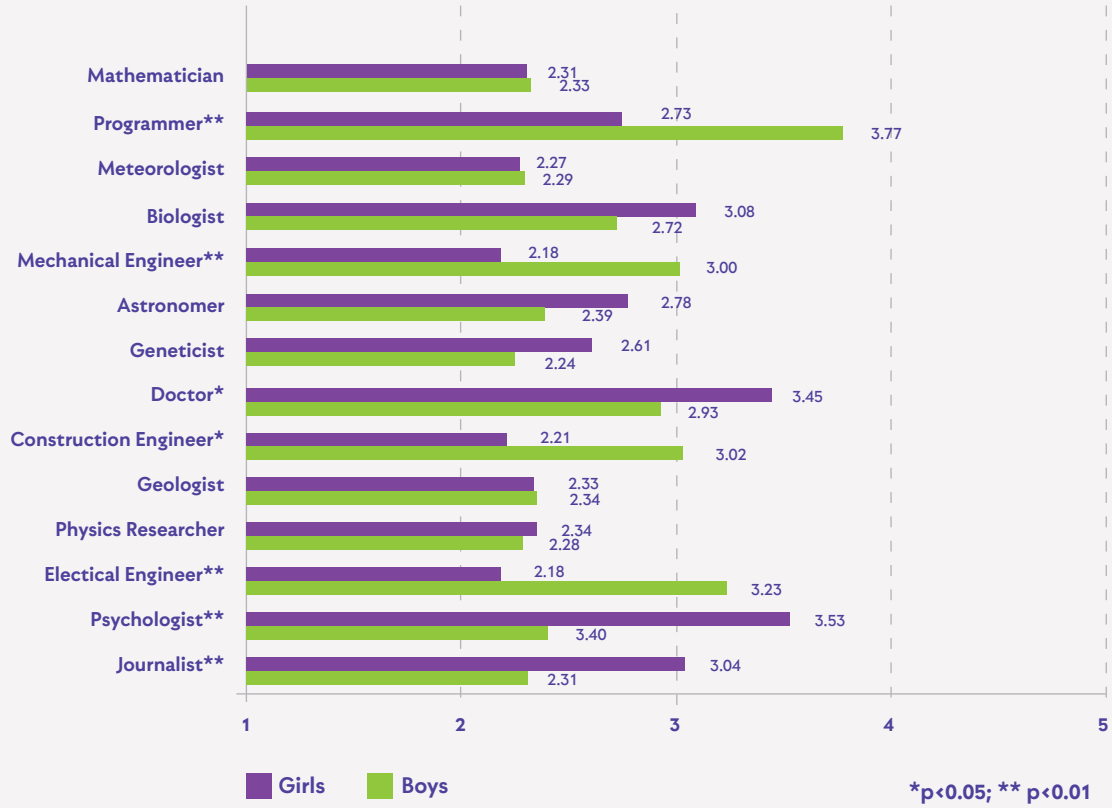
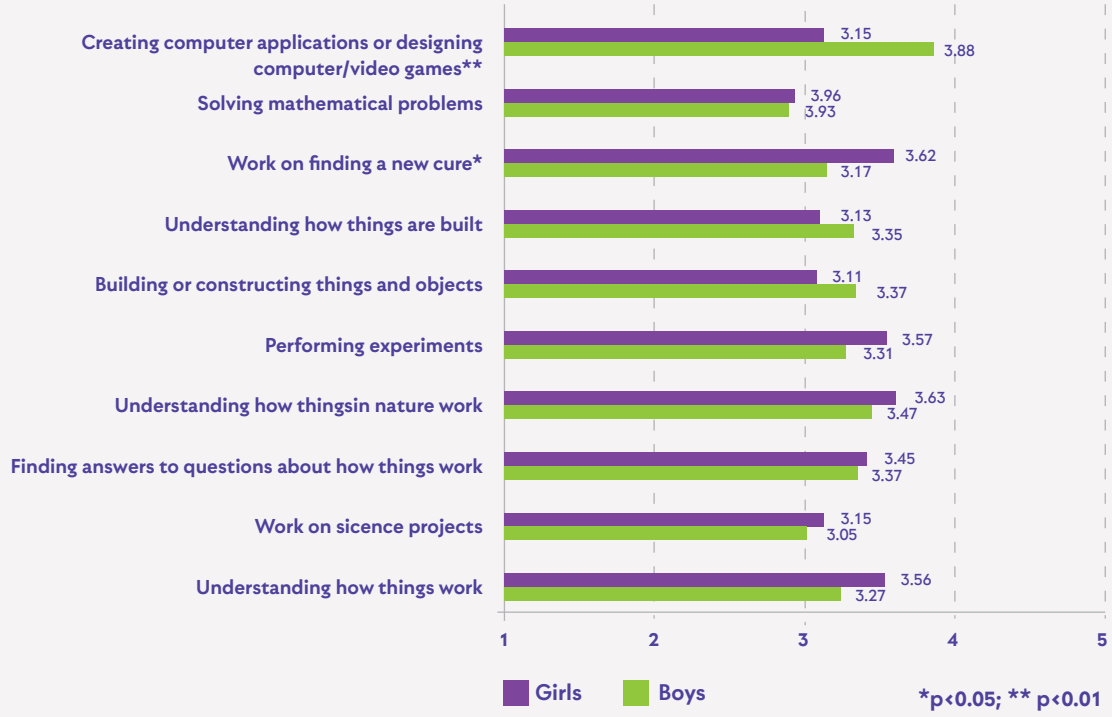


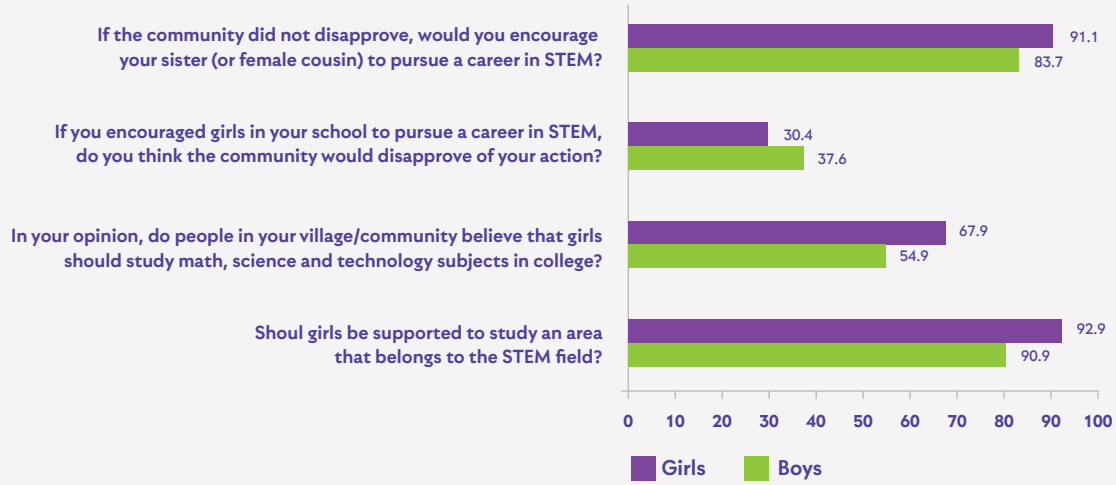
Figure 9. Preferences activities relavant to STEM occupations



3.1.7 PERCEPTION OF GENDER DIFFERENCES IN THE STEM FIELDS

Three tools were used to examine the respondents' perception of gender differences in the STEM fields. The pupils were asked to respond to four questions examining the gender stereotypes that potentially exist in their immediate and broader environment such as 'Do people in your environment believe that girls should take up university studies in a field belonging to STEM domains?' The pupils were asked to respond to the question by circling 'yes' or 'no' answers. Figure 10 below shows the percentages determined from the affirmative answers given by the male and female pupils.

Figure 10. Percentage of 'YES' answers



As can be seen from Figure 10, the majority of the male pupils believed that girls should be supported in taking up university studies in a field belonging to the STEM domains. However, somewhat fewer boys (80.8%) compared to the girls (92.9%) responded affirmatively to this question. Similar results were also determined for the question of whether they would support their sister or female cousin in building a career in a field belonging to the STEM domains. Out of the total number of girls, 91.1 per cent responded affirmatively, while 83.7 per cent of the boys responded affirmatively. Somewhat fewer boys (54.9%) compared to girls (67.9%) responded affirmatively to the question of whether people in their environment believed that girls should take up university studies in a field belonging to the STEM domains.

Out of the total number of boys, 37.6 per cent reported that people in their environment would oppose supporting girls at their school in building a STEM career whereas 30.4 per cent of the girls responded affirmatively to this question. It is noteworthy that the determined differences were not statistically significant.

The pupils were also asked to give their opinion on whether men or women are better in specific occupations. The pupils were provided with a list of occupations. Figure 11 below shows the results determined for the boys and girls. The pupils, irrespective of their gender, believed that men make better programmers, mechanical engineers, astronomers, civil engineers and electrical engineers and that women make better psychologists and journalists. Statistically significant differences were found in their opinions with regard to gender.

Namely, compared to the girls the boys believed that men make better programmers, mechanical engineers, civil engineers and electrical engineers. On the other hand, the girls believed that women make better doctors and journalists.

Figure 11. Assessing the performance of women and men in different occupations

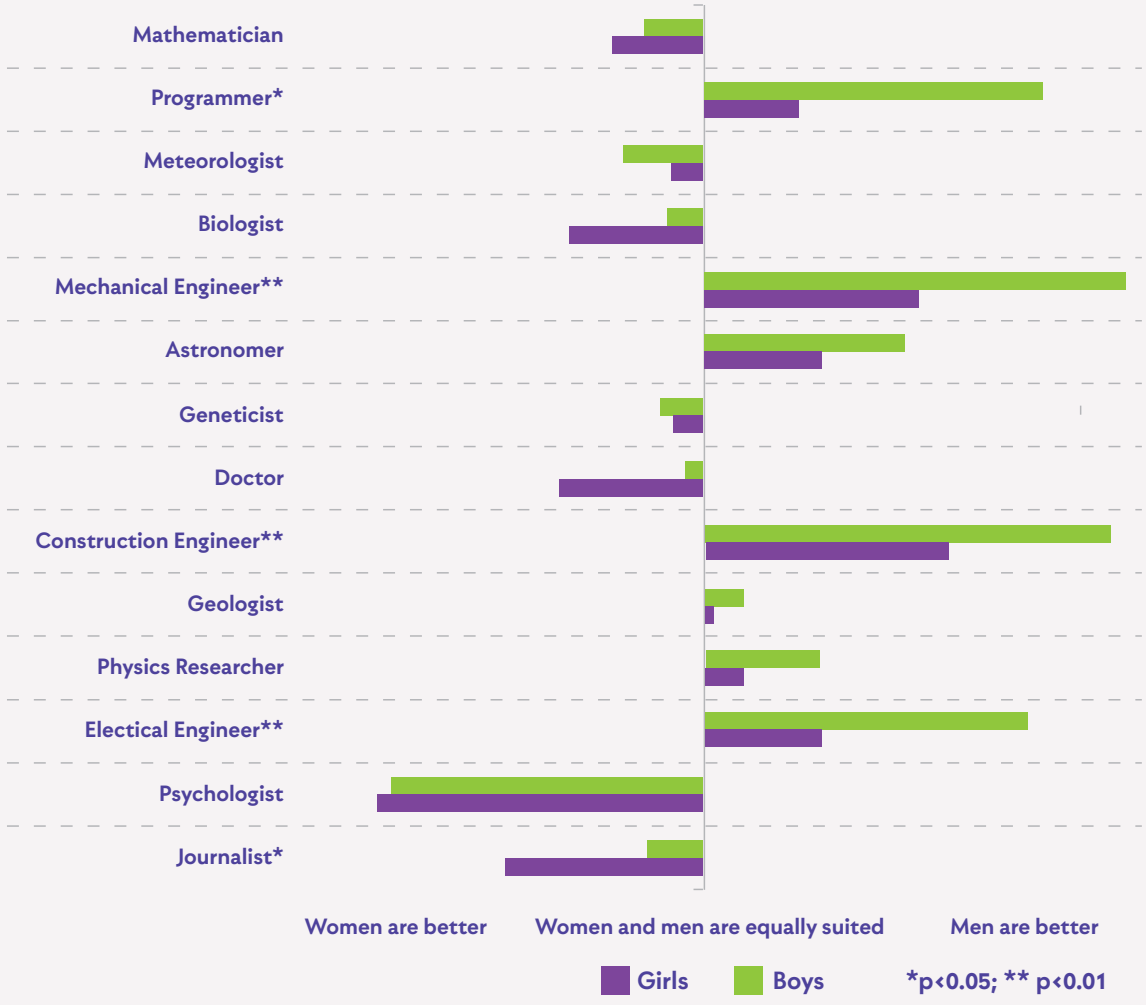
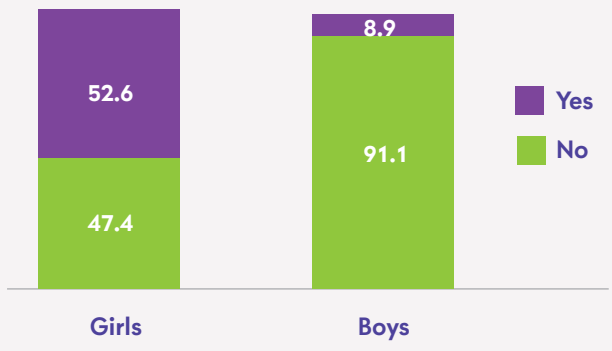


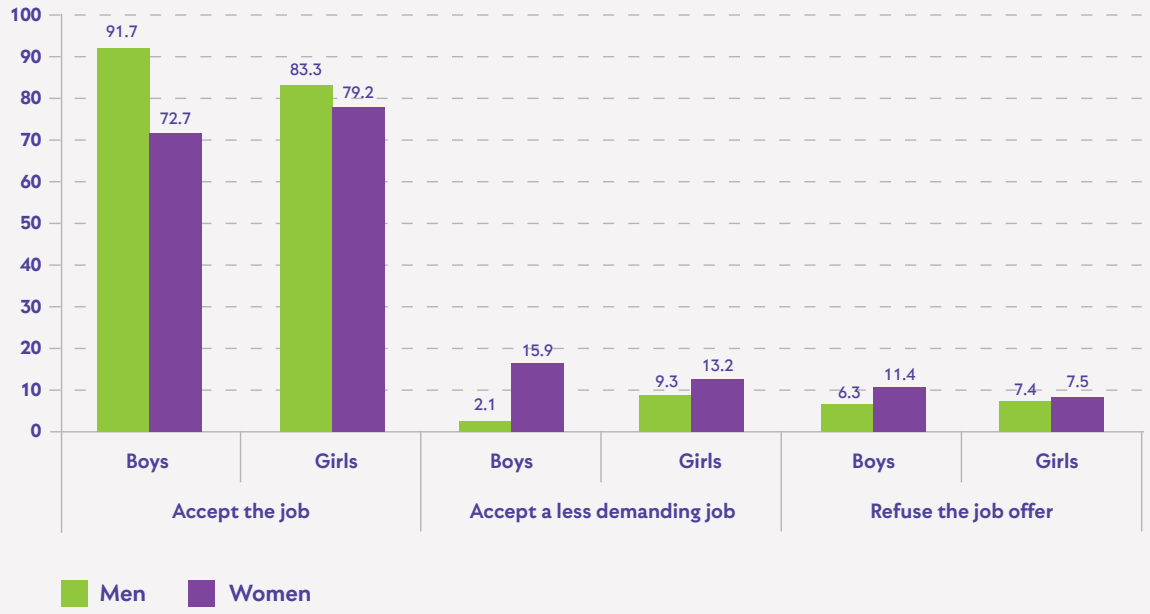
Figure 12 below shows that as much as 52.6 per cent of the boys responded affirmatively to the assertion that it was more appropriate for men to have a developed career, while just 8.9 per cent of the girls responded affirmatively to this assertion.

Figure 12. It is more appropriate for men to have developed careers than for women.



Gender stereotypes were examined further using a vignette wherein a person had to decide whether to accept a job as an engineer. There were two versions of the scenario with the main character as a woman or as a man. After reading the vignette, the pupils were supposed to decide what the main character in the story should do by circling one of the three offered answers ('accept the job', 'do a less demanding job' or 'refuse the offer and be at home in order to take care of his/her family'). Figure 13 below shows the responses given by the pupils in percentages based on gender.

Figure 13. Results achieved on a vignette created for the purpose of examining gender stereotypes



It is evident from the Figure 13 that the majority of pupils chose the answer according to which the main character in the story (irrespective of gender) should accept the job. A significantly lower percentage of the pupils chose the second or third offered answer. However, some differences were evident in the percentages with regard to the gender of both the pupils and the main characters in the story. Although these differences are not statistically significant, it is noticeable that a lower percentage of the boys chose the option to 'accept the job' where the main character was a woman compared to a man (91.7% and 72.7% respectively). The difference was significantly lower for the girls (83.3% and 79.2% respectively). The sample size was relatively small in terms of achieving a satisfactory statistical result and therefore a degree of caution should be exercised when interpreting the obtained results.

3.1.8 INFLUENCE OF THE ENVIRONMENT ON THE CHOICE OF STUDY IN STEM FIELDS

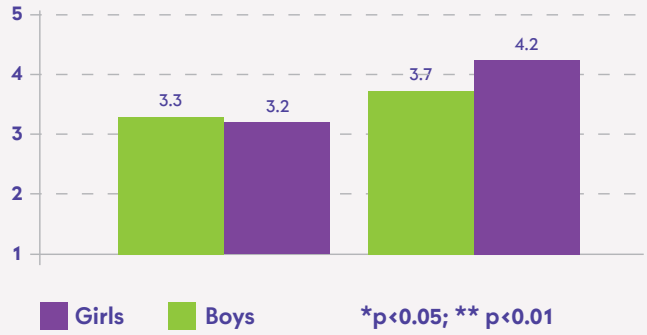
Table 26 below shows the affirmative answers to the questions based on family support in relation to studying. The majority of pupils had discussed their goals in terms of education with members of their family. According to the obtained results, a greater percentage of female pupils reported that their family would encourage them to take up university studies in a field belonging to the STEM domains.

Table 26. Environmental support in the choice of STEM faculties

	Gender							
	Boys				Girls			
	Yes		No		Yes		No	
	N	%	N	%	N	%	N	%
Have you ever discussed your goals in education with your family?	88	88.9	11	11.1	107	94.7	6	5.3
Would your family encourage you to take up university studies in fields like history, the arts or foreign languages?	43	43.9	55	56.1	67	60.4	44	39.6
Would your family encourage you to take up university studies in a field belonging to the STEM domains?	54	55.1	44	44.9	74	66.7	37	33.3

3.1.9 IMPLICIT THEORIES OF INTELLIGENCE

Figure 14. Implicit theories of intelligence



According to the obtained results, the girls assessed intelligence more as a changeable attribute.

The pupils assessed their own abilities for different STEM and non-STEM fields on a scale ranging from 1 'below average' to 5 'above average'. The boys rated their abilities in the fields of engineering and informatics more highly than the girls did. Figure 15 below shows the average values determined for the boys and girls.

3.1.10 FUTURE PLANS

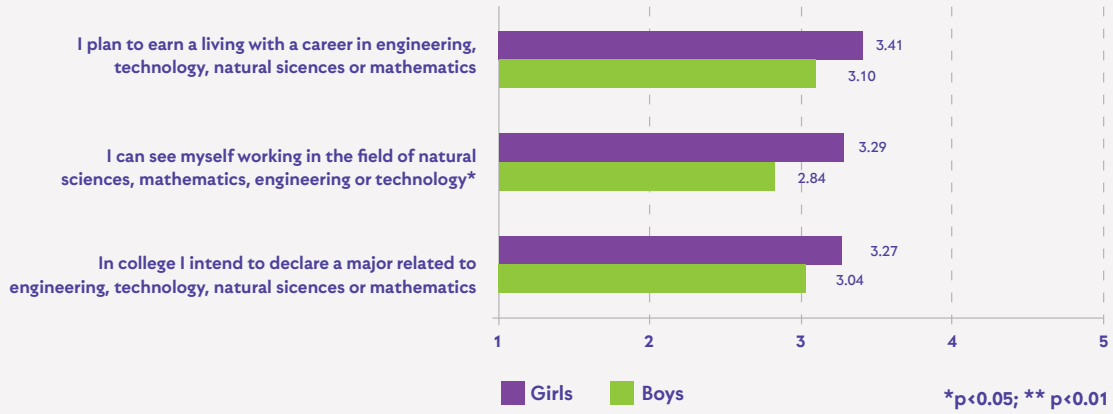
A scale consisting of three assertions was applied to examine the future plans of the pupils in relation to the STEM fields. The pupils assessed the likelihood of each assertion on a scale ranging from 1 'very unlikely' to 5 'very likely'. Notch 3 denoted an undecided view. Figure 16 below shows the average values determined for the boys and girls. As can be seen from Figure 16, the pupils were on average undecided when it came to their plans and goals in the STEM fields. Yet unlike the boys, the girls more easily saw themselves working in the STEM fields.

The Pearson correlation coefficient was determined in order to examine the relationship between the plans and goals of the pupils in relation to the STEM fields as well as other relevant variables included in the research. The correlation coefficient was determined between the plans and goals in the STEM fields on the one hand and the following variables on the other: 1) the level of education of the father and the mother', 2) general attitudes toward mathematics, informatics and natural sciences; 3) the self-concept in mathematics, informatics and natural sciences, 4) task values for the STEM subjects (determined as the average value for STEM subjects), 5) expectancy of success in the STEM fields (determined as the average value of expectancy of success in the STEM subjects), 6) positive image of scientists, 7) the level of interest in occupations linked to STEM (determined as the average value of interest in individual occupations linked to STEM), 8) perceptions of gender differences (determined as the average value of the perception of the abilities of men and women in relation to individual occupations linked to STEM) and 9) mindset (fixed or growth). A complete matrix of the correlation is provided in annex.

Table 53 shows the coefficients of correlation of the variables with the STEM plans. As can be seen from the Table 53, moderately high correlation coefficients were determined between the STEM plans and the expectation of success in the STEM field variables ($r=0.501$, $p<0.01$), followed by self-concept in relation to natural sciences ($r=0.472$, $p<0.01$), family support ($r=0.463$, $p<0.01$), STEM task values ($r=0.438$, $p<0.01$) and the self-concept in relation to mathematics ($r=0.427$, $p<0.01$) and informatics ($r=0.422$, $p<0.01$).

Somewhat lower correlation coefficients were determined between the STEM plans and the level of interest in the STEM fields ($r=0.327$, $p<0.01$), followed by general attitudes toward informatics ($r=0.325$, $p<0.01$), mathematics ($r=0.263$, $p<0.01$), the positive image of scientists ($r=0.242$, $p<0.05$) and general attitudes toward natural sciences ($r=0.238$. $p<0.05$). No statistically significant relationship with the plans in the STEM fields was determined for the other variables.

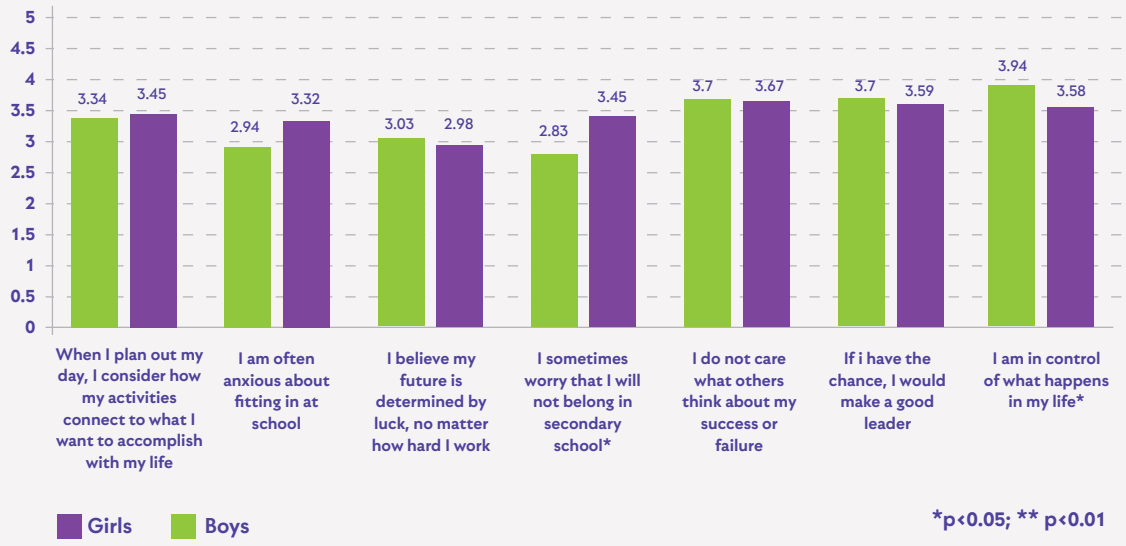
Figure 16. Future plans



3.1.11 EMPOWERMENT OF ATTITUDES

The Figure below shows the average ratings with regard to each assertion within the scale related to the empowerment of attitudes. The results show that the girls were statistically significantly more concerned about whether they would be accepted into secondary school (p=0.002; p<0.05), while more boys believed that what happens in their lives is within their control (p=0.04; p<0.05).

Figure 17. Empowerment attitudes



3.2 SECONDARY SCHOOL

3.2.1 FAVOURITE SCHOOL SUBJECTS AND PREFERRED SCIENTIFIC FIELDS AND OCCUPATIONS

Tables 27 and 28 show the school subjects that the boys and girls specified as their favourite school subjects. The girls' favourite subjects were mother tongue (15.6%) and biology (15.6%), followed by mathematics (14.4%) with physics coming in fourth place (12.2%). As for the second choice, the girls' first three second favourite subjects were foreign language (15.9%), informatics (13.6%) and biology (11.4%). The boys' favourite subjects were physical and health education (25.8%), informatics (15.6%) and mathematics (12.5%). The boys reported their second-choice favourite subjects as informatics (20.8%) and physical and health education (13.6%).

Table 27. First choice of favourite subject

		Gender		
		Male	Female	Total
Mother tongue	N %	7 5.5%	14 15.6%	21 9.6%
Mathematics	N %	16 12.5%	13 14.4%	29 13.3%
Physics	N %	9 7.0%	11 12.2%	20 9.2%
Chemistry	N %	1 0.8%	2 2.2%	3 1.4%
Biology	N %	1 0.8%	14 15.6%	15 6.9%
Geography	N %	0 0.0%	1 1.1%	1 0.5%
Informatics	N %	20 15.6%	7 7.8%	27 12.4%
Foreign language	N %	10 7.8%	9 10.0%	19 8.7%
Art/Music	N %	1 0.8%	5 5.6%	6 2.8%
History	N %	3 2.3%	1 1.1%	4 1.8%
Physical education and Health education	N %	33 25.8%	5 5.6%	38 17.4%
Religious education	N %	4 3.1%	0 0.0%	4 1.8%
Technical drawing with descriptive geometry	N %	3 2.3%	4 4.4%	7 3.2%
Phylosophy	N %	1 0.8%	0 0.0%	1 0.5%
Computer aided manufacturing	N %	1 0.8%	0 0.0%	1 0.5%
Mechanics	N %	1 0.8%	1 1.1%	2 0.9%
Sensorics	N %	1 0.8%	0 0.0%	1 0.5%
Automation and robotics	N %	1 0.8%	0 0.0%	1 0.5%
Electrical engineering and Electronics basis	N %	4 3.1%	0 0.0%	4 1.8%
Descriptive geometry	N %	1 0.8%	1 1.1%	2 0.9%
Laboratory work	N %	2 1.6%	0 0.0%	2 0.9%
Practical classes	N %	4 3.1%	1 1.1%	5 2.3%
Electrical circuits	N %	1 0.8%	1 1.1%	2 0.9%
Engineering materials	N %	1 0.8%	0 0.0%	1 0.5%
Digital computing machines	N %	2 1.6%	0 0.0%	2 0.9%
Total	**N** **%**	**128** **100.0%**	**90** **100.0%**	**218** **100.0%**

Table 28. Second choice of favourite subject

		Gender		
		Male	Female	Total
Mother tongue	N	5	4	9
	%	4.0%	4.5%	4.2%
Mathematics	N	12	5	17
	%	9.6%	5.7%	8.0%
Physics	N	9	5	14
	%	7.2%	5.7%	6.6%
Chemistry	N	6	9	15
	%	4.8%	10.2%	7.0%
Biology	N	2	10	12
	%	1.6%	11.4%	5.6%
Geography	N	1	4	5
	%	0.8%	4.5%	2.3%
Informatics	N	26	12	38
	%	20.8%	13.6%	17.8%
Foreign language	N	10	14	24
	%	8.0%	15.9%	11.3%
Art/Music	N	0	3	3
	%	0.0%	3.4%	1.4%
History	N	2	6	8
	%	1.6%	6.8%	3.8%
Physical education and Health education	N	17	9	26
	%	13.6%	10.2%	12.2%
Religious education	N	3	0	3
	%	2.4%	0.0%	1.4%
Psychology	N	1	1	2
	%	0.8%	1.1%	0.9%
Sociology	N	5	0	5
	%	4.0%	0.0%	2.3%
Control and regulation	N	1	0	1
	%	0.8%	0.0%	0.5%
Electronics	N	2	0	2
	%	1.6%	0.0%	0.9%
CAD/RAM technology	N	0	1	1
	%	0.0%	1.1%	0.5%
Robotics	N	2	0	2
	%	1.6%	0.0%	0.9%
Mechatronic system maintenance	N	1	0	1
	%	0.8%	0.0%	0.5%
Descriptive geometry	N	0	3	3
	%	0.0%	3.4%	1.4%
Electrical engineering basics	N	6	0	6
	%	4.8%	0.0%	2.8%
Laboratory work	N	2	0	2
	%	1.6%	0.0%	0.9%
Practical classes	N	7	0	7
	%	5.6%	0.0%	3.3%
Electrical circuits	N	2	1	3
	%	1.6%	1.1%	1.4%
Digital computing machines	N	2	0	2
	%	1.6%	0.0%	0.9%
Engineering materials	N	1	1	2
	%	0.8%	1.1%	0.9%
Total	**N**	**125**	**88**	**213**
	%	**100.0%**	**100.0%**	**100.0%**

When it came to the choice of scientific fields, the boys preferred the following fields: informatics (36.8%), technical sciences (16.7%) and natural sciences (10.5%) whereas the girls preferred informatics (22.8%), medical field (16.5%) and natural sciences (15.2%).

Table 29. Choice of scientific field

		Gender		
		Male	Female	Total
Mother tongue	N %	12 10.5%	12 15.2%	24 12.4%
Medicine	N %	6 5.3%	13 16.5%	19 9.8%
Liberal arts	N %	1 0.9%	1 1.3%	2 1.0%
Technical sciences	N %	19 16.7%	4 5.1%	23 11.9%
Informatics	N %	42 36.8%	18 22.8%	60 31.1%
Arts	N %	0 0.0%	2 2.5%	2 1.0%
Sport	N %	4 3.5%	0 0.0%	4 2.1%
Law	N %	2 1.8%	1 1.3%	3 1.6%
Architecture	N %	1 0.9%	2 2.5%	3 1.6%
Economics	N %	2 1.8%	2 2.5%	4 2.1%
Mathematics	N %	8 7.0%	7 8.9%	15 7.8%
Psychology	N %	2 1.8%	8 10.1%	10 5.2%
Teacher/Lecturer	N %	1 0.9%	1 1.3%	2 1.0%
Criminalistics/Security	N %	1 0.9%	1 1.3%	2 1.0%
Languages	N %	0 0.0%	1 1.3%	1 0.5%
Faculty of sport and physical education (FASTO)	N %	1 0.9%	0 0.0%	1 0.5%
Graphic design	N %	2 1.8%	1 1.3%	3 1.6%
Dentistry	N %	0 0.0%	2 2.5%	2 1.0%
Does not know the answer	N %	1 0.9%	1 1.3%	2 1.0%
Does not see themself as attending a faculty	N %	9 7.9%	2 2.5%	11 5.7%
Total	**N %**	**114 100.0%**	**79 100.0%**	**193 100.0%**

Tables 30 and 31 offer the first and second choice occupations of the sample of boys and girls. When it came to the first choice of occupation, the boys preferred the field of computer sciences (30.8%), the field of design/installation/repair (13.1%) and business sector/finance (11.2%). The second top choices of occupation for the

sample of boys were computer sciences (21.3%), engineering (13.5%) and business sector/finance (9.0%).

When it came to the first choice of occupation of the girls they preferred computer sciences (23.8%), medicine (21.4%) and art and design (10.7%). The top second choice occupation for the girls was medicine (21.1%).

Table 30. First choice of occupation

		Gender		
		Male	Female	Total
Medicine/Healthcare	N	6	18	24
	%	5.6%	21.4%	12.6%
Art/Design	N	3	9	12
	%	2.8%	10.7%	6.3%
Liberal arts	N	3	7	10
	%	2.8%	8.3%	5.2%
Entertainment	N	1	0	1
	%	0.9%	0.0%	0.5%
Physical/Life sciences	N	0	4	4
	%	0.0%	4.8%	2.1%
Community/Social services	N	5	2	7
	%	4.7%	2.4%	3.7%
Education	N	2	2	4
	%	1.9%	2.4%	2.1%
Business/Finance	N	12	4	16
	%	11.2%	4.8%	8.4%
Law	N	1	2	3
	%	0.9%	2.4%	1.6%
Engineering	N	4	4	8
	%	3.7%	4.8%	4.2%
Architecture	N	1	8	9
	%	0.9%	9.5%	4.7%
Computer science/Information technology	N	33	20	53
	%	30.8%	23.8%	27.7%
Software development	N	1	0	1
	%	0.9%	0.0%	0.5%
Manufacturing/Production	N	0	1	1
	%	0.0%	1.2%	0.5%
Armed forces	N	7	2	9
	%	6.5%	2.4%	4.7%
Design/Installation/Maintenance/Repairs	N	14	1	15
	%	13.1%	1.2%	7.9%
Sport	N	11	0	11
	%	10.3%	0.0%	5.8%
Politics	N	2	0	2
	%	1.9%	0.0%	1.0%
Science	N	1	0	1
	%	0.9%	0.0%	0.5%
Total	**N**	**107**	**84**	**191**
	%	**100.0%**	**100.0%**	**100.0%**

Table 31. Second choice of occupation

		Gender		
		Male	Female	Total
Medicine/Healthcare	N %	3 3.4%	16 21.1%	19 11.5%
Art/Design	N %	1 1.1%	4 5.3%	5 3.0%
Liberal arts	N %	2 2.2%	4 5.3%	6 3.6%
Entertainment	N %	2 2.2%	4 5.3%	6 3.6%
Communications/Media	N %	1 1.1%	3 3.9%	4 2.4%
Physical/Life sciences	N %	1 1.1%	8 10.5%	9 5.5%
Community/Social services	N %	2 2.2%	4 5.3%	6 3.6%
Education	N %	5 5.6%	6 7.9%	11 6.7%
Business/Finance	N %	8 9.0%	6 7.9%	14 8.5%
Law	N %	0 0.0%	1 1.3%	1 0.6%
Engineering	N %	12 13.5%	2 2.6%	14 8.5%
Mathematics	N %	1 1.1%	0 0.0%	1 0.6%
Architecture	N %	2 2.2%	3 3.9%	5 3.0%
Computer science/Information technology	N %	19 21.3%	6 7.9%	25 15.2%
Security services	N %	4 4.5%	2 2.6%	6 3.6%
Security services	N %	5 5.6%	1 1.3%	6 3.6%
Manufacturing/Production	N %	7 7.9%	2 2.6%	9 5.5%
Armed forces	N %	2 2.2%	2 2.6%	4 2.4%
Design/Installation/Maintenance/Repairs	N %	5 5.6%	2 2.6%	7 4.2%
Sport	N %	4 4.5%	0 0.0%	4 2.4%
Politics	N %	3 3.4%	0 0.0%	3 1.8%
Total	**N %**	**89 100.0%**	**76 100.0%**	**165 100.0%**

The highest percentage of the pupils wanted to complete an associate/higher school or university (boys 79.4% and girls 96.6%).

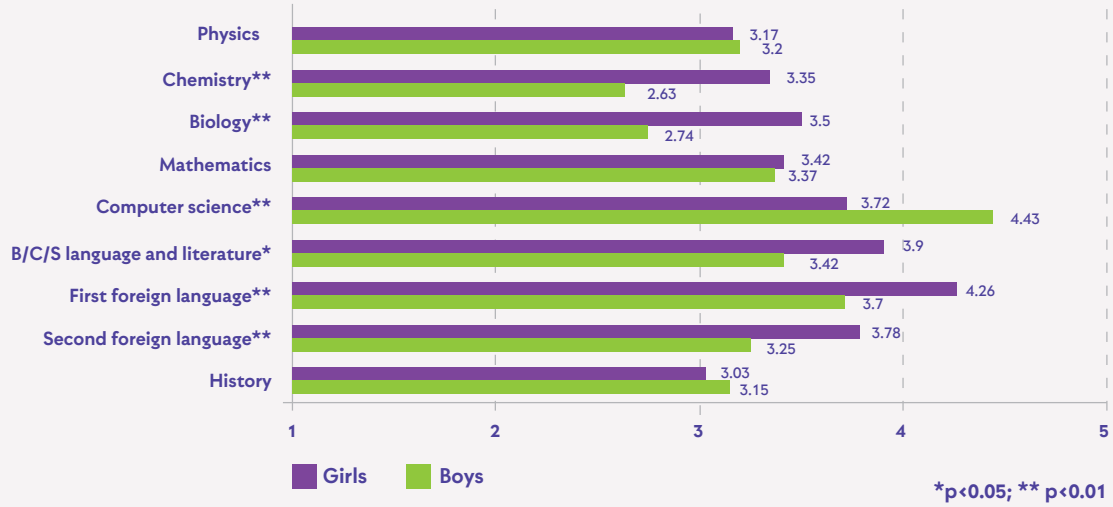
Table 32. The level of education that the secondary school pupils wanted to achieve

Level of education	Boys		Girls	
	Frequency	Percentage	Frequency	Percentage
Completed secondary school	11	8.7	1	1.1
Completed associate/higher school or university	100	79.4	86	96.6
I do not know	15	11.9	2	2.2
Total	**126**	**100.0**	**89**	**100.0**

3.2.2 INTEREST AND GENERAL ATTITUDE TOWARD STEM SUBJECTS

Figure 18 below shows the average values of the male and female pupils' assessment of their interest in the specified subjects. It is evident from Figure 18 that the female pupils reported greater interest in the subjects of chemistry and biology as well as mother tongue and foreign language, while the male pupils reported greater interest in the subject of informatics.

Figure 18. Interest in STEM subjects



As with the sample of primary school pupils, the scales designed for mathematics (6 items), natural sciences (8 items) and informatics (6 items) were used to determine the general attitudes of the secondary school pupils toward subjects within the STEM fields.

An analysis of the main components was conducted to examine the validity of the construct of the scales. One component was identified for each scale, consisting of four identical items. By their content they reflected positive attitudes toward STEM subjects at school. The items on the scale on attitudes toward natural science subjects were 'The things I learn in the natural science subjects will help me in my further schooling', 'We learn interesting things in the natural science subjects', 'Learning natural sciences is useful for getting a good job in the future' and 'The things I learn in the natural science subjects will help me in my day-to-day life'.

The components explain the 62.768 per cent results variance for the scale on attitudes toward mathematics, the 64.378 per cent variance for the scale on attitudes toward natural science subjects and the 63.6 per cent results variance for the scale on attitudes toward the subject of informatics.

Satisfactory values of the internal reliability coefficients were determined for the scales on attitudes toward natural sciences, mathematics and informatics (α=0.832; α= 0.814; α=0.866 respectively).

Figure 19. Attitudes towards STEM subjects

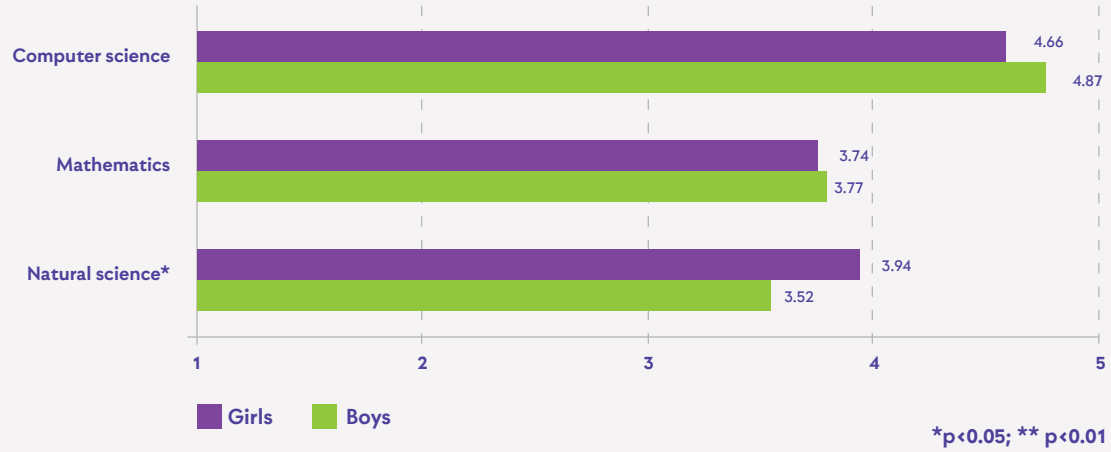
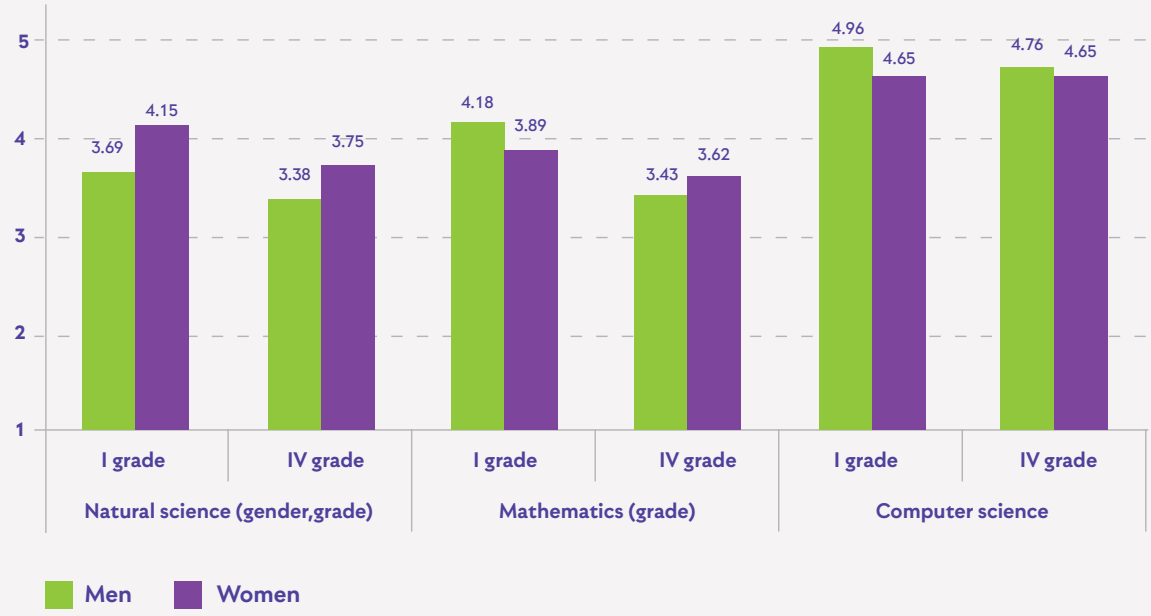


Figure 19 above shows the average values determined for the scales on general attitudes toward natural science subjects, mathematics and informatics with regard to gender. It is evident from Figure 19 that the female pupils had a more positive attitude toward natural science subjects. No statistically significant differences were found in the attitudes toward mathematics and informatics.

Statistically significant differences were found in the scales on attitudes toward natural science subjects and mathematics with regard to grade. Namely, lower average values were determined on both scales for the fourth-grade pupils. No statistically significant effects were found in terms of gender X grade interaction (see Figure 20 below).

Figure 20. Attitudes towards STEM subjects with regard to gender and grade



3.2.3 SELF-CONCEPT IN SUBJECTS IN THE STEM FIELDS

The self-concept among pupils in relation to subjects in the STEM fields was determined through a scale designed for the purposes of this research. The scale consists of 18 items related to the different aspects of the self-concept in mathematics, natural sciences and informatics. To verify the validity of the construct an analysis of the main components was performed.

The analysis of the main components identified three interpretable components that by their content corresponded to the self-concept in mathematics (four items, 'Mathematics is interesting to me', 'I can quickly master things in mathematics' 'It is important to me to be good in mathematics' and 'I can achieve excellent results in mathematics'), natural sciences (four items, 'I quickly grasp concepts and theories in natural sciences', 'It is important to me to know as many things as possible in natural sciences', 'Knowledge of natural sciences will benefit me in the future' and 'I can become a successful scientist') and informatics (four items, 'I quickly master things in informatics', 'It is important to me to be good in informatics', 'Knowledge of informatics will benefit me in the future' and 'I can become a successful programmer').

The first component, the self-concept in relation to mathematics, explains the 28.744 per cent results variance, the second component, the self-concept in relation to natural sciences, explains the 24.127 per cent variance and the third component, the self-concept in relation to informatics, explains the 22.839 per cent results variance. High values of the internal reliability coefficients were determined for the self-concept in relation to mathematics, natural sciences and informatics (α=0.920; α= 0.857; α=0.892 respectively).

Figure 21 below shows the average values determined for the scales on the self-concept in relation to mathematics, natural sciences and informatics with regard to gender and grade. Compared to the male pupils the female pupils showed a higher self-concept in relation to natural sciences. When it came to informatics, the ratio reversed wherein the male pupils showed a higher self-concept. No statistically significant differences were found in the self-concept in relation to mathematics with regard to gender and none for the self-concept with regard to grade or the effects of gender X grade interaction.

Figure 21. Self-concept in subjects in the STEM fields

3.2.4 EXPECTANCY OF SUCCESS AND THE TASKS VALUES

As with the sample of primary school pupils, three items were used to measure the expectancy of success among the secondary school pupils: 'How successful would you be in occupations requiring knowledge and competency in the subjects provided below?', 'How important is it to you to achieve the best possible performance in the subjects provided below in the next school year?' and 'Imagine yourself in the future. Specify below to what extent you believe that you would successfully fulfil the tasks related to the careers provided below'.

Three items were used to measure the tasks values: 'To what extent are you interested in what is learned in specified subjects?', 'How important is it to you to learn in this grade as many things as possible in the subjects provided below?' and 'How important will knowledge and competency in the subjects provided below be in your future?'

Figure 22. Tasks values

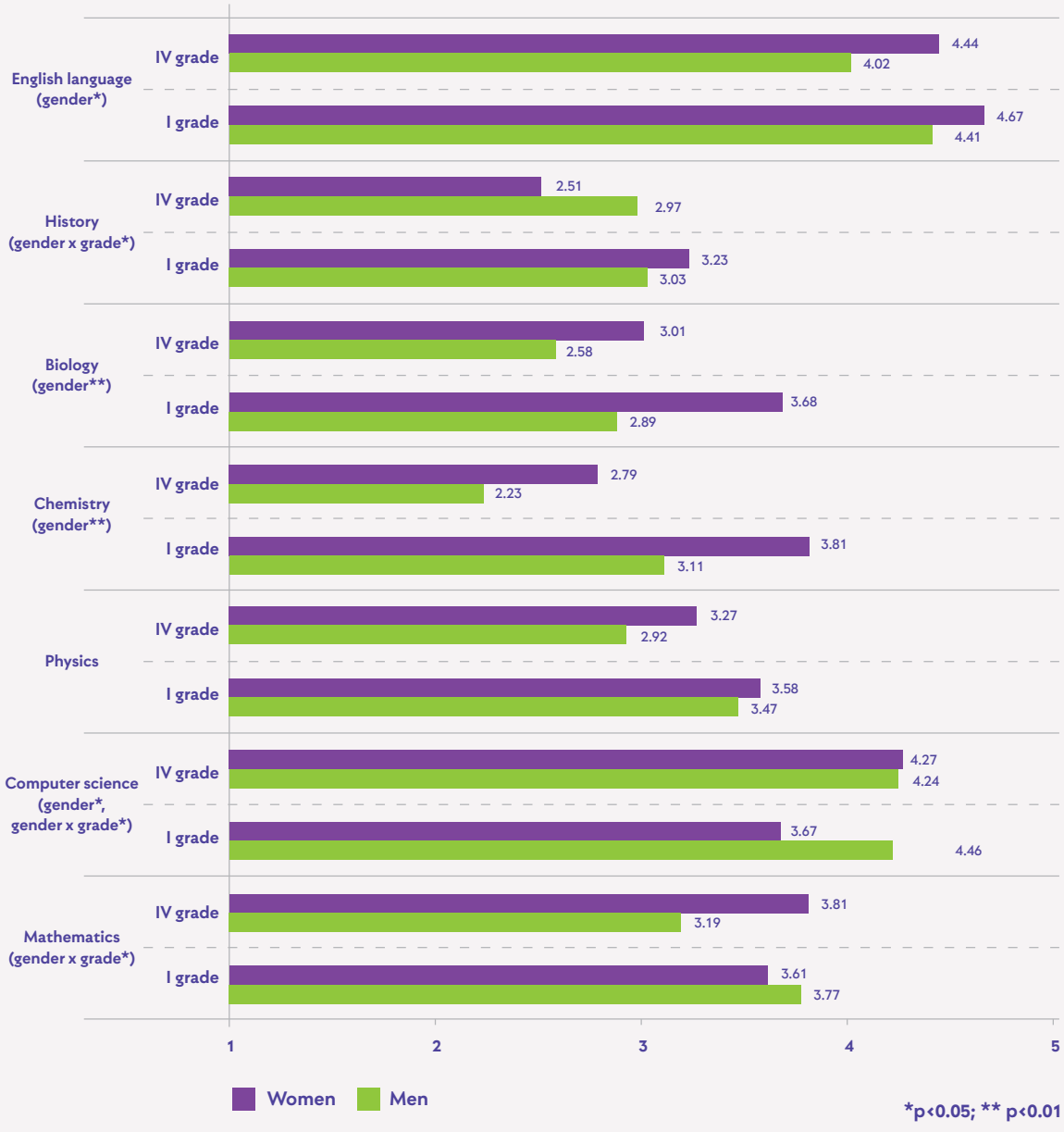
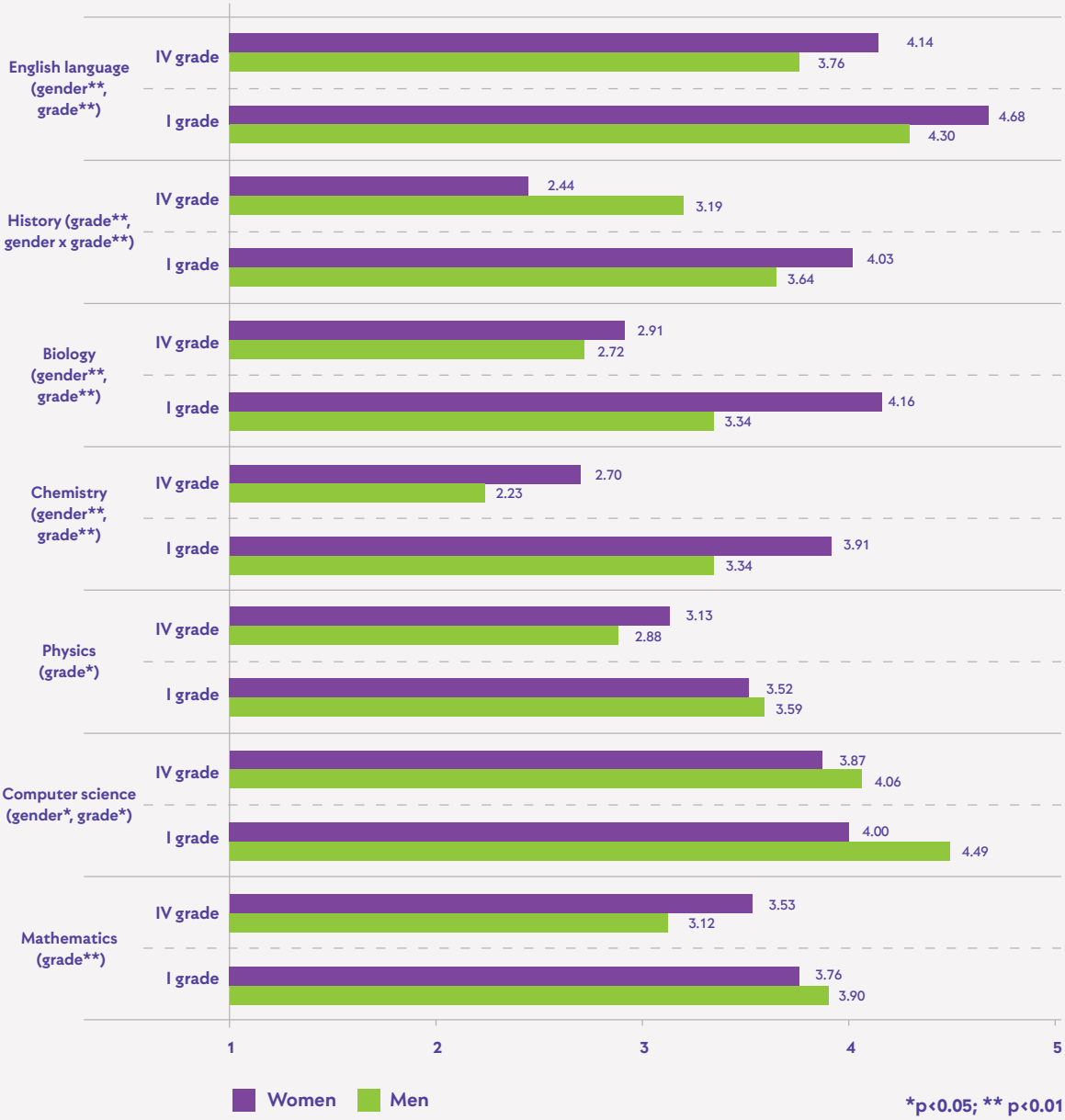


Figure 23. Expectancy of success



Composites of the results expressed as the average values of all three items were created for both constructs. The expectancy and tasks values were determined for the following subjects: mathematics, informatics, physics, chemistry, biology, history and English language.

Figures 22 and 23 above show the average tasks values and the expected successes for individual subjects with regard to gender and grade. Statistically significant differences were found in the tasks values for the subjects of biology, chemistry, English language, history and informatics with regard to gender. Namely, compared to the male pupils the female pupils considered biology, chemistry, English language and history to be more valuable whereas the male pupils considered the subject of informatics to be more valuable. No statistically significant differences were found in regard to grade.

Moreover, statistically significant effects of gender X grade interaction were found for the subjects of informatics and mathematics. Namely, the value that the female fourth grade pupils placed on informatics was equal to that of the same grade of male pupils. Yet this was not the case for both groups at the first-grade level, because compared to the female pupils the male pupils valued informatics significantly more. The ratio of the average tasks values for the subject of mathematics changed between the male pupils and the female pupils with regard to grade. Namely, compared to the same grade of male pupils the fourth-grade female pupils valued tasks in mathematics significantly more. The reverse occurred in relation to the average values of these two groups determined at the first grade.

Statistically significant differences were found in the level of expectancy of success for the subjects of biology, chemistry, English language and informatics with regard to gender. Compared to the male pupils the female pupils had higher expectancy of success in the subjects of biology, chemistry and English language. Compared to the female pupils, the male pupils had greater expectancy of success in the subject of informatics. With regard to grade, statistically significant differences were found for the subjects of informatics, mathematics, physics, chemistry, biology and English language.

An interesting finding is that fourth grade pupils had lower levels of expectancy of success in these subjects compared to the first-grade pupils. Moreover, a statistically significant effect of gender X grade interaction was found for the subject of history. The fourth-grade female pupils had significantly lower expectancy of success in the subject of history compared to the first grade female pupils.

3.2.5 INTEREST IN STEM RELATED OCCUPATIONS AND CAREERS AND THE ASSESSMENT OF SUCCESS

Interest in STEM occupations and careers was examined through a scale designed for the purposes of this research. The pupils were asked to assess on a scale ranging from 1 'not at all' to 5 'yes, definitely' to what extent they agreed with each of the specified assertions. The Table 33 below show the average values determined for the items with regard to gender and grade.

Table 33. Interest in STEM related occupations and careers

	GRADE	M	F
Some jobs in the fields of natural sciences, technology, engineering and mathematics are interesting.	I	3.90	3.93
	IV	3.64	4.19
Studying natural sciences, technology, engineering or mathematics at university takes a long time.	I	3.84	3.83
	IV	3.67	3.52
I am interested in a job in the field of natural sciences, technology, engineering and mathematics. **	I	4.08	3.76
	IV	3.45	4.17
When choosing an occupation, earnings are the most important factor. *	I	3.60	2.95
	IV	3.26	3.29
Jobs in the fields of natural sciences, technology, engineering and mathematics are boring. *	I	2.36	2.50
	IV	2.72	2.02
Jobs in the fields of natural sciences, technology, engineering and mathematics are solitary jobs. **	I	2.38	2.67
	IV	2.91	2.29
The jobs in natural sciences, technology, engineering and mathematics can earn you good money. **	I	4.40	4.26
	IV	3.76	4.40
Private life is neglected because of the demands of jobs in the fields of natural sciences, technology, engineering and mathematics. **	I	2.42	2.71
	IV	3.07	2.48

***p<0.05; ** p<0.01**

No statistically significant differences were found in relation to the assertions on gender and grade. The first and fourth grade female and male pupils assessed their level of agreement with each assertion equally. Statistically significant effects of gender X grade interaction were found for individual assertions. As shown in the Table 33 interest in some of the jobs in STEM fields among the fourth-grade male pupils was lower than that of the first grade male pupils and that this ratio was the reverse for the female pupils.

The same set of results was determined for the assertion according to which jobs in STEM fields 'can earn you good money'. Moreover, compared to the fourth-grade male pupils lower values were determined for the first grade male pupils for the assertion that jobs in STEM fields are boring whereas the fourth grade female pupils considered STEM jobs less boring compared to the first grade female pupils.

An interesting finding is that compared to the first grade female pupils the fourth grade female pupils believed to a lesser extent that jobs in STEM fields lead to the neglect of family life, while the reverse was the case with the set of results determined for the male pupils.

As with the primary school pupils, preferences toward specific activities in relation to occupations linked to STEM were examined ('solving mathematical problems', 'understanding how things are built' or 'work on finding a new cure'). The pupils were asked to assess on a scale ranging from 1 'does not apply to me at all' to 5 'completely applies to me' to what extent they would like to pursue the specified activities. A statistically significant difference was found only for the assertion related to the activity 'finding a new cure' (with a higher average result for the female pupils) and 'creating computer applications' (where male pupils achieved a higher average result).

Lastly, the pupils were asked to assess how successful they would be in the jobs or occupations linked to STEM fields. Table 34 below shows the average values of the assessments with regard to gender and grade. Namely, compared to the assessments of the male pupils the female pupils assessed that they would be more successful in jobs as scientists. On the other hand, the male pupils assessed that they would be more successful in the jobs requiring programming skills and knowledge. Compared to the fourth-grade male pupils the first-grade male pupils assessed that they would be successful in jobs as researchers in a scientific field. Lastly, compared to those of the first-grade female pupils the fourth-grade female pupils assessments of their success in jobs requiring basic computer skills and knowledge were higher. The same pattern of increase in the results for the girls was determined for the assessment of success in the occupation of engineer.

Table 34. Performance appraisal in STEM occupations

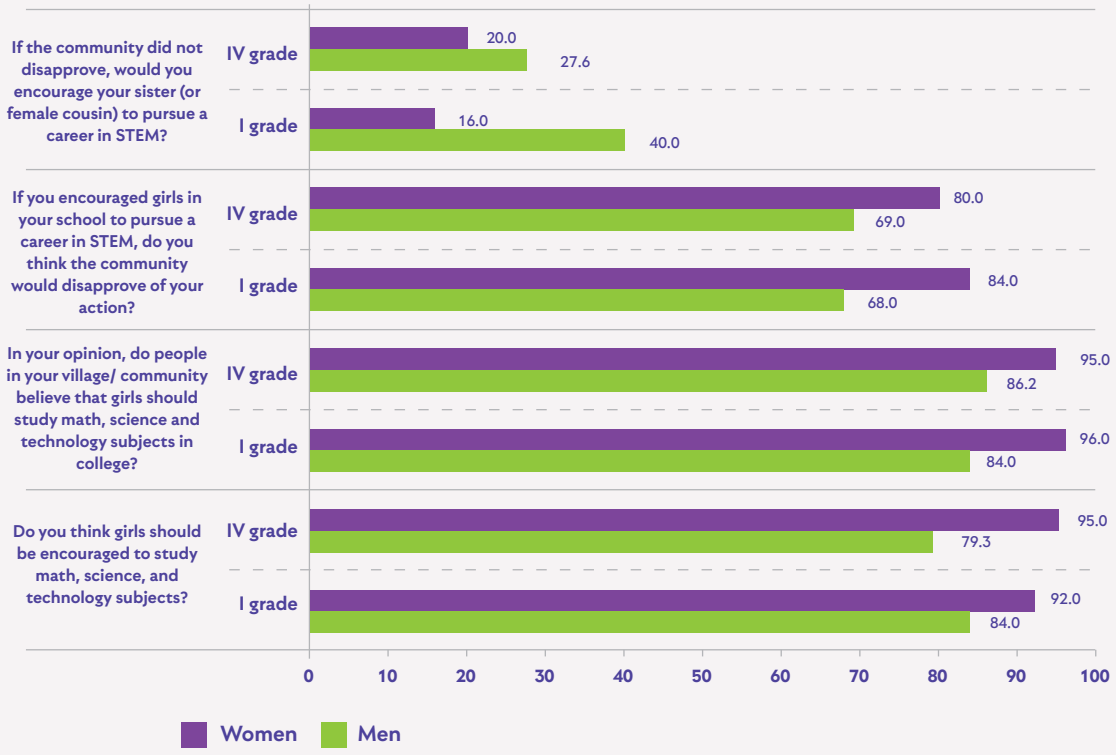
How successful would you be in the jobs/occupations....	GRADE	M	F
....of scientists	I	2.57	3.09
	IV	2.17	2.78
...requiring knowledge of advanced mathematics	I	3.06	2.63
	IV	2.63	2.56
.... requiring frequent use of mathematics	I	3.31	2.77
	IV	2.90	2.91
... requiring programming skills and knowledge	I	4.02	3.09
	IV	3.83	3.47
... requiring basic computer skills and knowledge	I	4.43	3.86
	IV	3.92	4.11
.... of researchers in a scientific field	I	3.31	3.65
	IV	2.98	3.09
... of engineers	I	3.55	3.00
	IV	3.32	3.76

3.2.6 PERCEPTION OF GENDER DIFFERENCES IN THE STEM FIELDS

The pupils were asked to respond to four questions examining the gender stereotypes that potentially exist in their immediate and broader environment such as 'Do people in your environment believe that girls should take up university studies in a field belonging to the STEM domains?' The pupils had to respond to the question by circling 'yes' or 'no' answers. Figure 24 below shows the affirmative answers determined for the male and female pupils in percentages.

As can be seen from Figure 24, the majority of pupils believed that girls should be supported in taking up university studies in a field belonging to the STEM domains. However, compared to the female pupils somewhat fewer male pupils responded affirmatively to this question. Similar results were also determined for the question on whether they would support their sister or female cousin in building a career in a field belonging to the STEM domains. Compared to the female pupils somewhat fewer male pupils responded affirmatively to the question on whether people in their environment believed that girls should take up university studies in a field belonging to the STEM fields.

Figure 24. Percentage of 'YES' answers



Moreover, the pupils were asked for their opinions on whether men or women are better in specific fields. The pupils were given a list of fields and asked to indicate next to each occupation using a bipolar scale whether they thought women or men are better or whether women or men are equally good at a specified occupation.

Figure 25 below shows the results determined for the male and the female pupils. The pupils, irrespective of their gender, believed that men are better in the fields of technology, engineering and informatics and that women are better in the fields of foreign languages and natural sciences. Both the male pupils and female pupils believed that men and women are equally good at mathematics. No statistically significant differences with regard to gender were found in the opinions of the pupils.

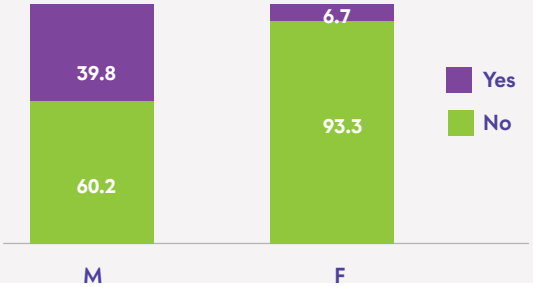
Figure 25. Assessing the performance of women and men in different areas

The gender differences were also examined through a series of assertions. The pupils assessed their level of agreement with each assertion using a scale ranging from 1 'I highly disagree' to 6 'I highly agree'. The Table below shows the average values of each assertion with regard to gender. Although the results indicate the existence of specific gender stereotypes, no statistically significant differences were found in the average values with regard to gender.

Table 35. Perception of gender differences

	Gender	
	Male	Female
Science is a better career choice for men than for women	2.25	2.14
Women are discriminated against in science	3.09	3.42
Women cannot be as successful in engineering as men	2.84	2.61
Women's and men's brains are different	3.90	3.85
Men are more talented in mathematics than women	2.30	2.10
Men are better scientists than women	2.45	2.02
Mathematics is a better career choice for men than for women	2.30	1.91
Overall, boys are more successful pupils than girls	2.14	1.93
Women like science less than men do	2.72	2.40
Women are equally good in computer skills as men	4.31	4.34
Women who enjoy studying computer sciences are strange	2.30	1.97

Figure 26. It is more appropriate for men to have a developed career than for women



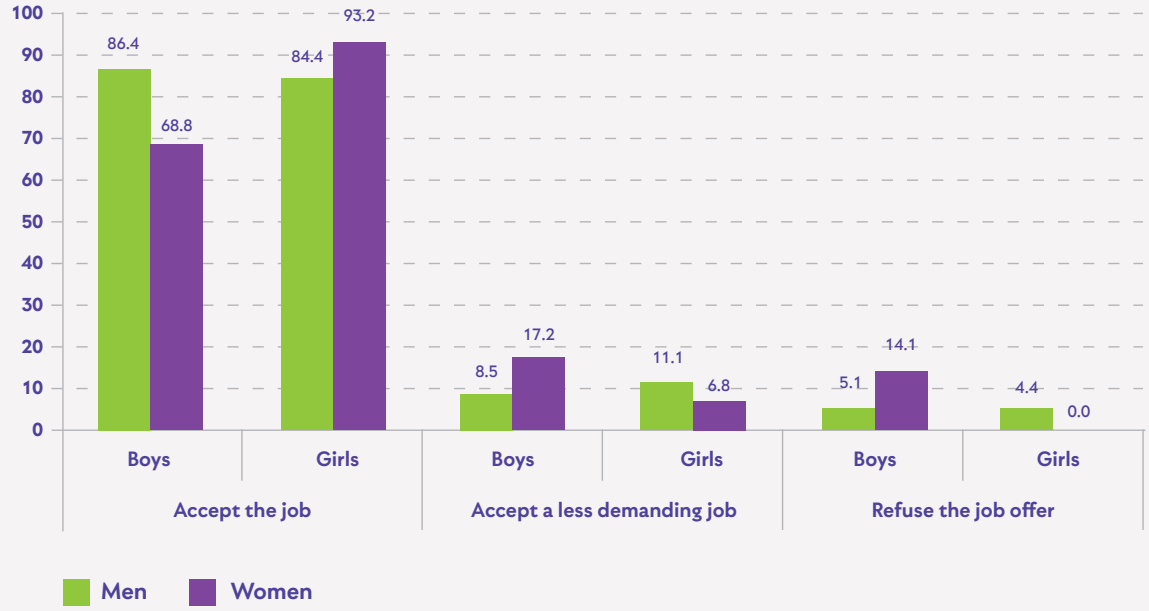
As much as 39.8 per cent of the male pupils responded affirmatively to the assertion that it is more appropriate for men to have a developed career, while 6.7 per cent of the female pupils also responded affirmatively to this assertion (see Figure 26).

A vignette was created to examine gender stereotypes wherein a scenario was presented where a person who was offered a job as an engineer had to decide whether to accept the job. There were two scenarios one with the main character as a woman and the other with the main character as a man. After reading the vignette, the

pupils had to decide what the main character in the story should do by circling one of the three offered answers: 'accept the job', 'do a less demanding job' or 'refuse the offer and be at home in order to take care of his/her family'. Figure 27 below shows the responses in relation to the gender of the main character in the two scenarios (a man or a woman) and in relation to the gender of the pupils (boys or girls). It is evident from Figure 27 that the majority of pupils (irrespective of their gender) chose the answer according to which the main character in the scenario should accept the job. A significantly lower percentage of the pupils chose the second or third offered answers. However, some differences are evident in the percentages with regard to the gender of the pupils and the gender of the main characters in the respective scenarios.

It is noticeable that a lower percentage of the male pupils preferred the answer to accept the job when the main character was a woman compared to the situation where the main character was a man (86.4% vs. 68.8%), while for the girls this difference was significantly lower and favoured the female character (84.4% vs. 93.2%).

Figure 27. Results achieved on a vignette created for the purpose of examining gender stereotypes



3.2.7 SUPPORT FROM THE ENVIRONMENT FOR CHOOSING STUDIES IN THE STEM FIELDS

Table 36 below shows the affirmative answers to the questions reflecting family support for studying. The majority of pupils reported discussing their goals in education with members of their family. According to the obtained results, a higher percentage of the girls reported that their family would encourage them to take up university study in a field belonging to the STEM domains (67% vs. 83%).

	Male	Female
Have you ever discussed your goals in education with your family?	93%	94%
Would your family encourage you to take up university study in fields like history, the arts or foreign languages?	35%	46%
Would your family encourage you to take up university study in a field belonging to the STEM domains?	67%	83%

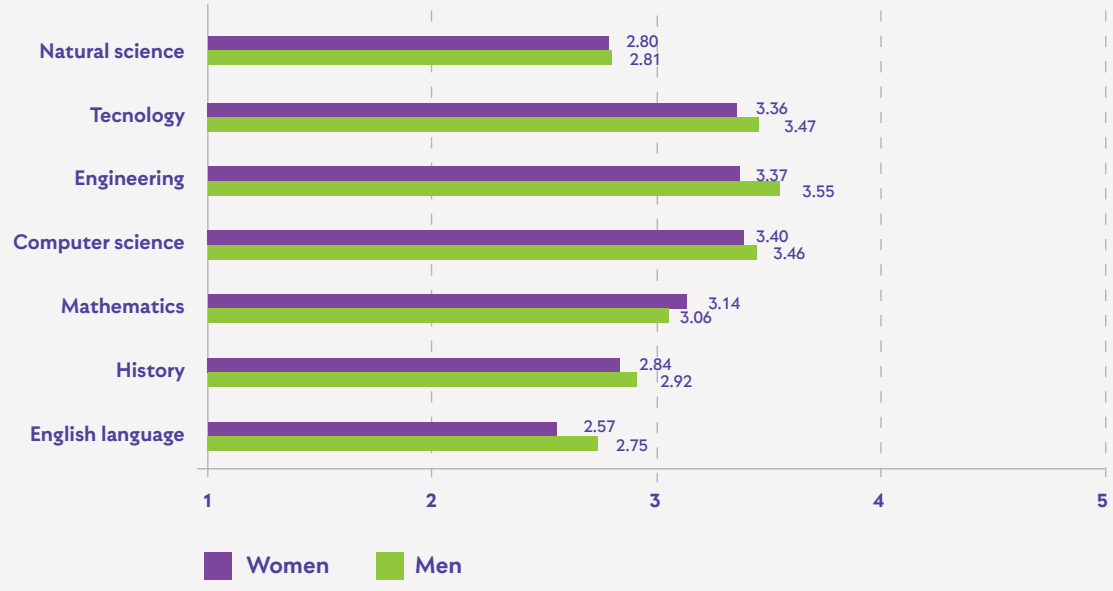
3.2.8 IMPLICIT THEORIES OF INTELLIGENCE

An analysis of the main components examined the validity of the construct of the implicit theories of intelligence. Two components were identified that by their constituent items corresponded to the fixed or growth mindset. The first component (fixed mindset) explains the 38.193 per cent results variance, while the second component (growth mindset) explains the 37.978 per cent results variance.

Figure 28 below shows the average values determined for the scale of the implicit theories of intelligence with regard to gender and grade.

Figure 28. Implicit theories of intelligence

Figure 29. Assessment of abilities in different career areas



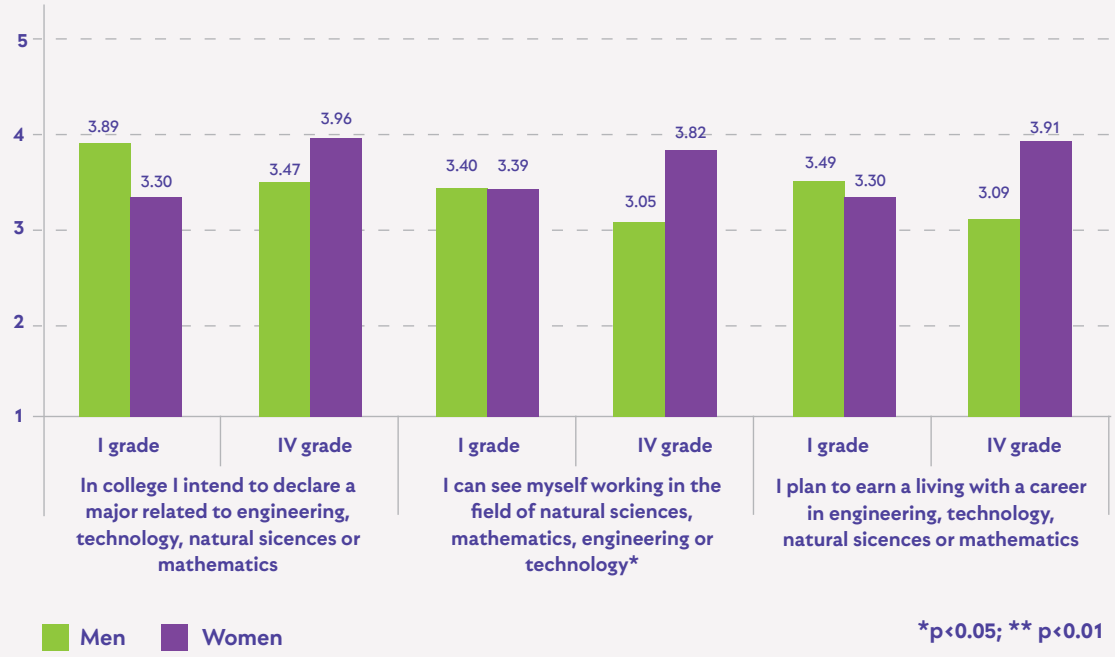
A statistically significant effect of gender was found in the fixed mindset, while a statistically significant effect of the grade was found for the growth mindset. Namely, the female pupils recorded on average lower results on the fixed mindset compared to the male pupils. Additionally, the first-grade pupils recorded higher results on the growth mindset compared to the fourth-grade pupils.

The pupils assessed their own abilities for different STEM and non-STEM fields using a scale ranging from 1 'below average' to 5 'above average'. Figure 29 above shows the average values determined for the pupils with regard to gender. No statistically significant differences were found, and this applied to the grade as well.

3.2.9 FUTURE PLANS

The future plans of the pupils in relation to STEM fields were examined through a scale that consisted of three assertions. The pupils assessed the likelihood of each assertion using a scale ranging from 1 'very unlikely' to 5 'very likely' wherein notch 3 denoted an undecided view. Figure 30 below shows the average values determined for the assertions in regard to gender.

Figure 30. Future plans



No statistically significant differences were found with regard to gender or grade. However, statistically significant effects of gender X grade interaction were found for the assertions 'I plan to enrol in a faculty in the fields of natural sciences, technology, engineering or mathematics' and 'I plan to make a living by achieving a career in the field of natural sciences, mathematics or engineering'.

As can be seen from Figure 30 above, compared to the first-grade female pupils the fourth grade female pupils considered their future goals relating to the STEM fields to be more likely. An opposite trend in the average results was determined for the male pupils. Namely, the fourth-grade male pupils were more undecided compared to the first grade male pupils.

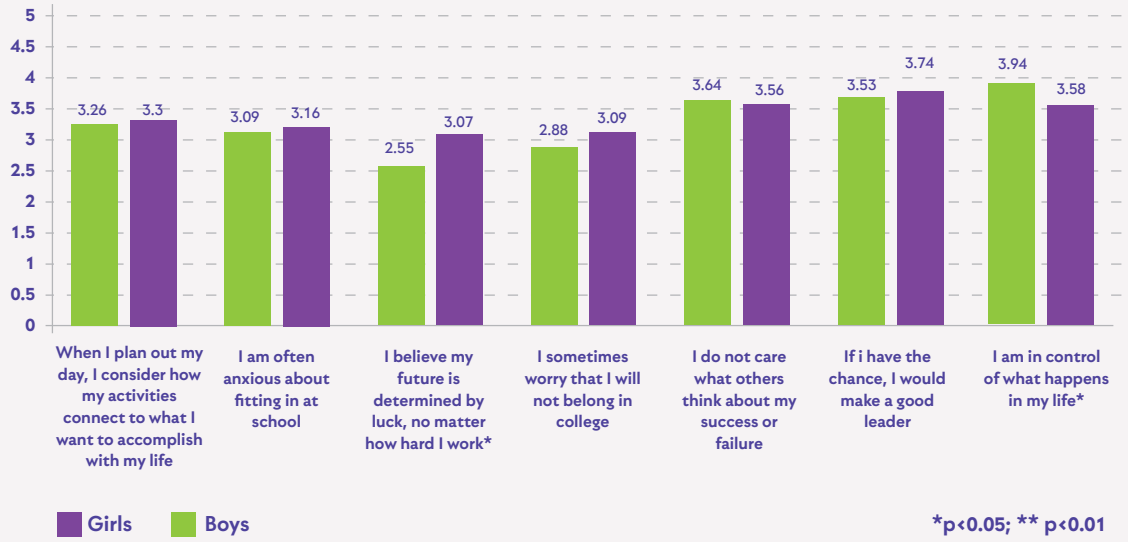
To examine the relationship between their future plans and goals in relation to the STEM fields as well as other relevant variables included in the research, the Pearson correlation coefficient was applied. Correlation coefficients were determined for the pupils' future plans and goals in the STEM fields in relation to the following variables: the level of education of the father and mother, their general attitude toward mathematics, informatics

and natural sciences; self-concept in relation to mathematics, informatics and natural sciences; task values for the STEM subjects (determined as the average value for STEM subjects), their expectancy of success in the STEM fields (determined as the average value of expectancy of success in STEM subjects), their level of interest in occupations linked to STEM (the assertion 'I am interested in some of the jobs in the STEM fields'), their perception of gender differences (determined as the average value of their perception of the abilities of men and women for individual STEM occupations) and their mindset (fixed or growth). A complete matrix of these correlations is provided in annex. As can be seen from the Table 54, a high correlation coefficient was determined between the STEM plans and STEM interests ($r=0.811$, $p<0.01$), moderately high correlation coefficients were determined between STEM plans and the self-concept for the natural sciences variables ($r=0.544$, $p<0.01$), the self-concept in mathematics ($r=0.457$, $p<0.01$), the task values in the STEM fields ($r=0.459$, $p<0.01$), the STEM task values ($r=0.438$, $p<0.01$), the expectancy of success ($r=0.414$, $p<0.01$) and the general attitudes toward natural science subjects ($r=0.399$, $p<0.01$). Somewhat lower correlation coefficients were determined between STEM plans and the self-concept in relation to informatics ($r=0.360$, $p<0.0$) and family support ($r=0.366$, $p<0.01$), followed by general attitudes toward informatics ($r=0.260$, $p<0.01$) and mathematics ($r=0.294$, $p<0.01$). No statistically significant relationship was determined for other variables in relation to their plans in the STEM fields.

3.2.10 EMPOWERMENT OF ATTITUDES

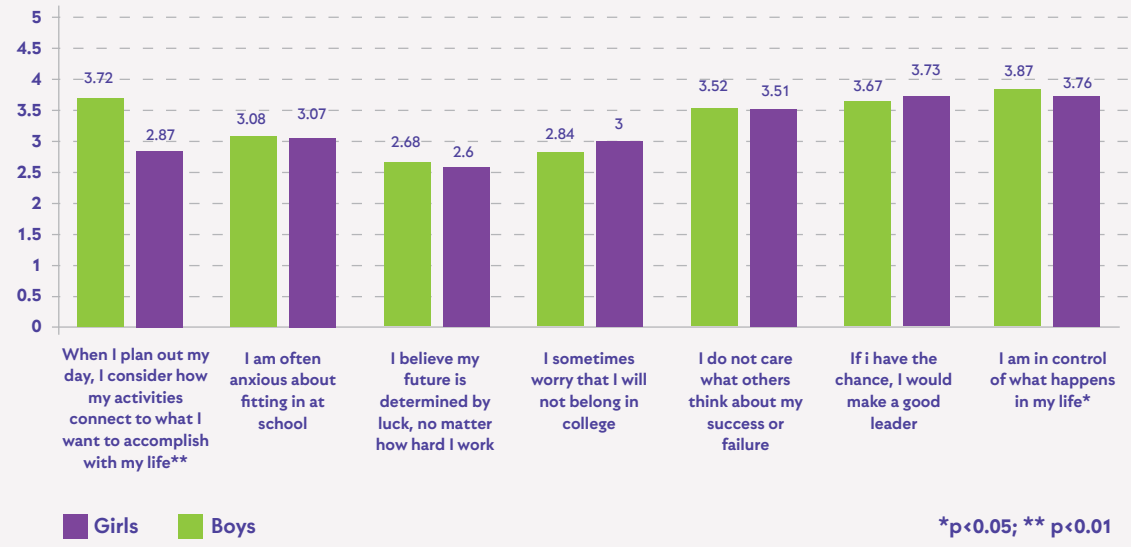
The girls attending the first grade believed statistically more significantly that fate determines their future regardless of how hard they work ($p=0.04$; $p<0.05$).

Figure 31. Empowerment attitudes (first grade students)



The boys attending fourth grade were statistically significantly more certain that their day-to-day activities will shape what they want to achieve in their life ($p=0.00$; $p<0.01$).

Figure 32. Empowerment attitudes (fourth grade students)



3.3 UNIVERSITY

Two additional variables were created for the purposes of data analysis: the 'year of study' and the 'field of study'. The first and second year students formed one category within the 'year of study' variable, while the third and fourth year students formed another category of this variable. Moreover, the faculty of electrical engineering and the faculty of computer science, mechanical and electrical engineering students formed the category for the STEM fields. On the other hand, the faculty of philosophy students formed the category for the non-STEM fields.

3.3.1 FAVOURITE STUDY SUBJECTS AND PREFERRED OCCUPATIONS

The STEM and non-STEM male and female students answered a large number of questions on their favourite study subjects. The majority of male students majoring in STEM reported programming as their favourite subject (33.9%), which was significantly higher when compared to the female students of which only 12.9 per cent reported programming as their favourite subject. Just 8.3 per cent of the total number of male students reported mathematics as their favourite subject, while only 4.1 per cent of the female students reported mathematics as their favourite subject. A similar ratio was also determined for the subject Electrical Engineering Basics with 8.3 per cent of the male students and 4.7 per cent of the female students reporting this subject as their favourite.

A high level of variability was determined for the answers of the students majoring in non-STEM subjects. A number of the female students reported statistics as their favourite subject (4.4%), while others covered many other technical subjects. When it came to their first choice of occupation, the male students preferred the fields of engineering and programming (66.21%) and the female students preferred the fields of liberal arts (49.0%).

Table 37. First choice of occupation

	Male		Female	
	N	%	N	%
Engineering/Programming	96	66.21	68	27.31
Education	16	11.03	24	9.64
Liberal arts	13	8.97	122	49.00
Business/Finance	7	4.83	8	3.21
Researcher	4	2.76	10	4.02
Communication/Media	2	1.38	7	2.81
Entertainment	1	0.69	2	0.80
Politics	3	2.07	5	2.01
Medicine/Healthcare	1	0.69	1	0.40
Community/Social services	1	0.69	0	0.00
Manufacturing/Production	1	0.69	0	0.00
Art/Design	0	0.00	2	0.80
Total	**145**	**100.00**	**249**	**100.00**

When it came to the second choice of occupation, the male students mostly preferred the fields of engineering and programming (47.17%) and the female students mostly preferred the fields of liberal arts (57.01%).

Table 38. Second choice of occupation

	Male		Female	
	N	%	N	%
Engineering/Programming	96	66.21	68	27.31
Education	16	11.03	24	9.64
Liberal arts	13	8.97	122	49.00
Business/Finance	7	4.83	8	3.21
Researcher	4	2.76	10	4.02
Communication/Media	2	1.38	7	2.81
Entertainment	1	0.69	2	0.80
Politics	3	2.07	5	2.01
Medicine/Healthcare	1	0.69	1	0.40
Community/Social services	1	0.69	0	0.00
Manufacturing/Production	1	0.69	0	0.00
Art/Design	0	0.00	2	0.80
Total	**145**	**100.00**	**249**	**100.00**

The majority of students wanted to achieve the second level of education (male 34.5% and female 46.6%).

Table 39. The level of education that the students wanted to achieve

Level of education	Male		Female	
	Frequency	Percentage	Frequency	Percentage
Secondary education	1	0.7	0	0.0
Higher education	6	4.3	9	3.2
First level	20	14.2	11	4.0
Second level	58	34.5	129	46.6
Third level	56	33.3	128	46.2
Total	**141**	**100.0**	**318**	**100.0**

3.3.2 THE MOTIVATION TO STUDY AND GENERAL ATTITUDES ON STEM SUBJECTS

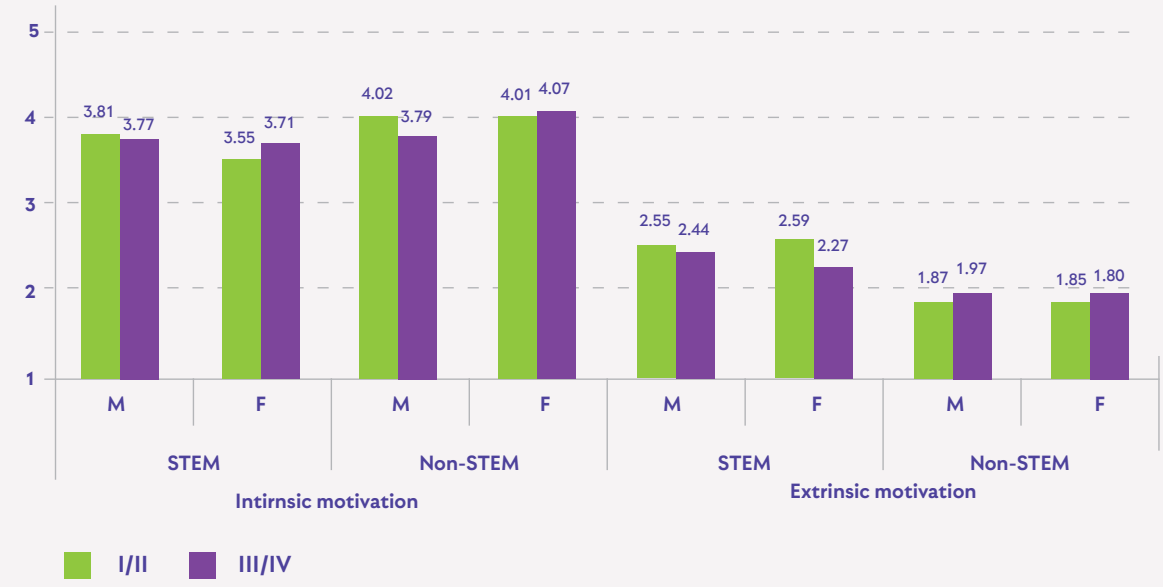
The motivation to study was determined through a scale designed for the purposes of this research. The scale consists of six items that by their content described the intrinsic (e.g. 'I am very interested in the study subject') and extrinsic (e.g. 'It was my parents' wish') motivation. An analysis of the main components examined the validity of the construct of the scale.

Two interpretable components were identified that by the content of their items corresponded to the intrinsic ('I am very interested in the study subject', 'I did not know where else to enrol' and 'Ever since I was a small child, I wanted to study this at university') and the extrinsic ('There are more job opportunities after completion of studies', 'because my friends enrolled in this faculty too', 'It was my parents' wish) motivation. The first component (intrinsic motivation) explains the 28.025 per cent results variance, while the second component (extrinsic motivation) explains the 26.271 per cent results variance.

Figure 33 below shows the average values determined through the scale on the intrinsic and extrinsic motivation of the students majoring in STEM and non-STEM subjects in relation to gender and the year of study.

Statistically significant differences were found with regard to the field of study. The students in non-STEM fields showed higher intrinsic motivation and lower extrinsic motivation compared to the students in the STEM fields. No statistically significant differences were found with regard to gender or the year of study.

Figure 33. The motivation to study



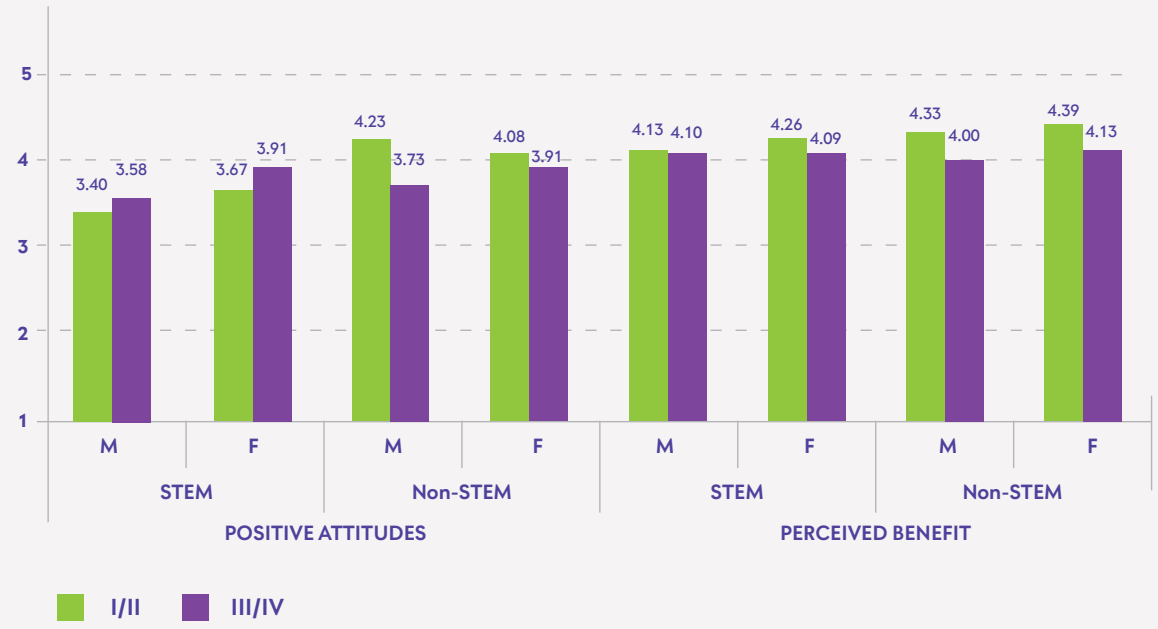
The general attitudes toward study were determined through a scale designed for the purposes of this research. The scale consists of eleven items relating to the different aspects of study (e.g. 'I look forward to the classes in the subjects that I am taking' and 'Study subjects are difficult'). An analysis of the main components verified the validity of the construct of the scale. The final solution contained six items distributed over two components.

The first component described the positive attitudes toward study ('I look forward to the classes in the subjects that I am taking as part of my studies', 'The subjects that I am taking as part of my studies are exciting' and 'I learn interesting things in my studies'), while the second component described the perceived benefit of study ('The things that I learn in my studies will help me in my career', 'The things that I learn in my studies will help me in my further education' and 'My studies will prepare me to get a good job in the future'). The first component explains the 36.794 per cent results variance and the second component explains the 32.859 per cent results variance.

Figure 34 below shows the average values determined through the scale on positive attitudes toward study and the perceived benefits of study with regard to gender, the field and the year of study. A statistically significant effect was found in relation to the year of study in terms of the perceived benefit and a statistically significant effect was found in relation to the field of study in terms of the positive attitudes. A statistically significant effect of year X field interaction was also found.

The first and second year students perceived greater benefit resulting from their studies compared to the third and fourth year students. The interaction effect indicates that this trend was present among the students in non-STEM fields, while an increase in the average values in relation to the positive attitudes in terms of the function of the year of study was determined for the students in the STEM fields. Moreover, compared to the students in the STEM fields the attitudes of students in the non-STEM fields were more positive toward their studies.

Figure 34. Positive attitudes toward study and perceived benefit of study



3.3.3 SELF-CONCEPT IN STEM FIELDS

The self-concept among the students in the STEM fields was determined through a scale designed for the purposes of this research. The scale consisted of 18 items relating to the different aspects of the self-concept in relation to mathematics, natural sciences and informatics. An analysis of the main components was performed in order to verify the validity of the construct.

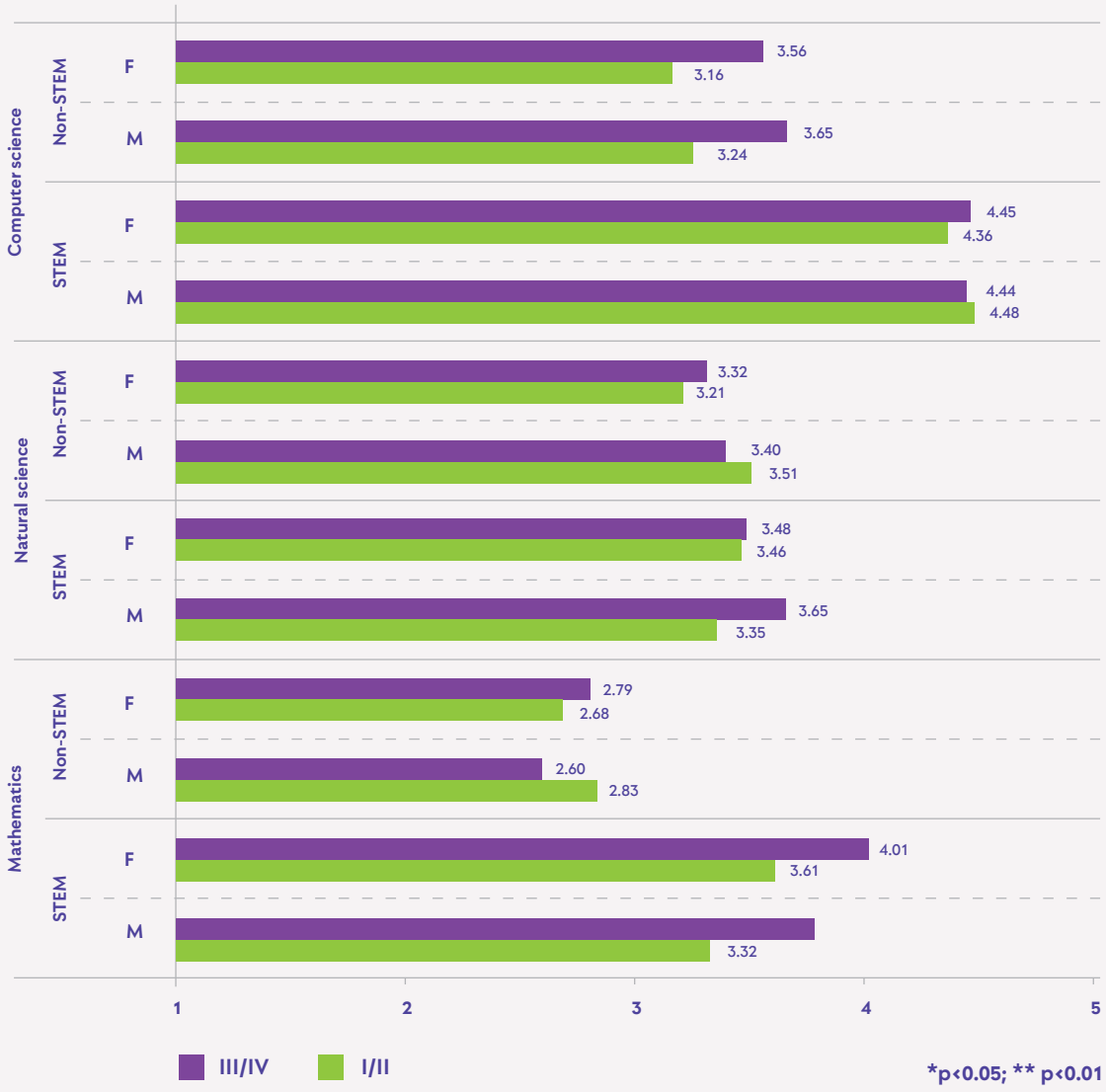
The analysis of the main components identified three interpretable components that by their content corresponded to the self-concept in relation to mathematics (five items, 'Mathematics is interesting to me', 'I

can quickly master things in mathematics', 'It is important to me to be good in mathematics', 'Knowledge of mathematics will benefit me in the future' and 'I can achieve excellent results in mathematics), natural sciences (four items, 'I quickly grasp concepts and theories in natural sciences', 'It is important to me to know as many things as possible in natural sciences', 'Knowledge of natural sciences will benefit me in the future' and 'I can become a successful scientist') and informatics (five items, 'I am not good at using computers', 'I quickly master things in informatics', 'It is important to me to be good in informatics', 'Knowledge of informatics will benefit me in the future' and 'I can become a successful programmer').

The first component, the self-concept in mathematics, explains the 23.723 per cent results variance, the second component, the self-concept in natural sciences, explains the 21.916 per cent results variance, while third component, the self-concept in informatics, explains the 18.223 per cent results variance. High values of the internal reliability coefficients were determined for the self-concept in relation to mathematics, natural sciences and informatics (α=0.871; α= 0.785; α=0.835 respectively).

Figure 35 shows the average values determined through the scale of self-concept in relation to mathematics, natural sciences and informatics with regard to gender, and the field and the year of study.

Figure 35. Self-concept in STEM fields



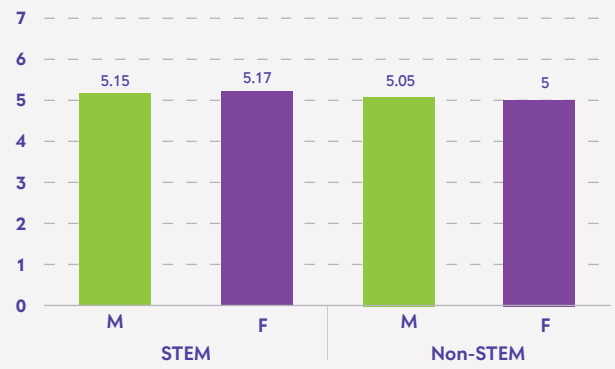
A statistically significant effect of the field was found for the self-concept in relation to mathematics and informatics. The students in the STEM fields had a higher self-concept in mathematics and informatics compared to the students in the non-STEM fields. Moreover, a statistically significant effect of the year of study on the self-concept was found in relation to informatics. The higher year students had a higher self-concept in relation to informatics compared to the lower year students. Lastly, a statistically significant effect of field X year on the self-concept was found in relation to mathematics and informatics.

The self-concept for the students in the STEM field of mathematics was significantly higher among third and fourth year students compared to the first and second years of study. This was not the case in the non-STEM fields, where no major increase in the function of the year of study was found.

When it came to informatics, an increase in the self-concept in relation to the function of the year of study was found for the students in the non-STEM fields (the ceiling effect was evident for the students in the STEM fields). No gender differences were found.

3.3.4 THE SENSE OF ACADEMIC BELONGING

Figure 36. Positive attitudes toward study and perceived benefit of study



The sense of academic belonging was examined through a social fit scale (Walton and Cohen, 2005), which was defined as a global measure. The scale consisted of 17 assertions relating to the areas of study and studying. The assertions were adjusted for the purposes of this research. The students were asked to assess their level of agreement with the assertions (e.g. 'I feel like I do not belong to this department' and 'I am not aware of how my department works') using a scale ranging from 1 'I completely disagree' to 7 'I fully agree'. The total result was determined as a linear combination of the results for all items. The internal consistency was determined through the Cronbach coefficient α=0.841.

Figure 36 above shows the average values determined through the scale on the experience of academic belonging with regard to gender and the field of study. No statistically significant differences were found for any of the items.

3.3.5 PERCEPTION OF GENDER DIFFERENCES IN THE STEM FIELDS

A series of assertions examined the perceptions of gender differences. The students assessed their level of agreement with each assertion using a scale ranging from 1 'I highly disagree' to 6 'I highly agree'. The Table below shows the average values for each assertion with regard to gender.

Table 40. Perceptions of gender differences

	Gender	
	Male	Female
Science is a better career choice for men than for women **	2.44	1.82
Women are discriminated against in science **	2.80	3.70
Women cannot be as successful in engineering as men **	2.86	2.32
Women's and men's brains are different	3.69	3.80
Men are more talented in mathematics than women **	2.38	2.09
Men are better scientists than women **	2.43	1.88

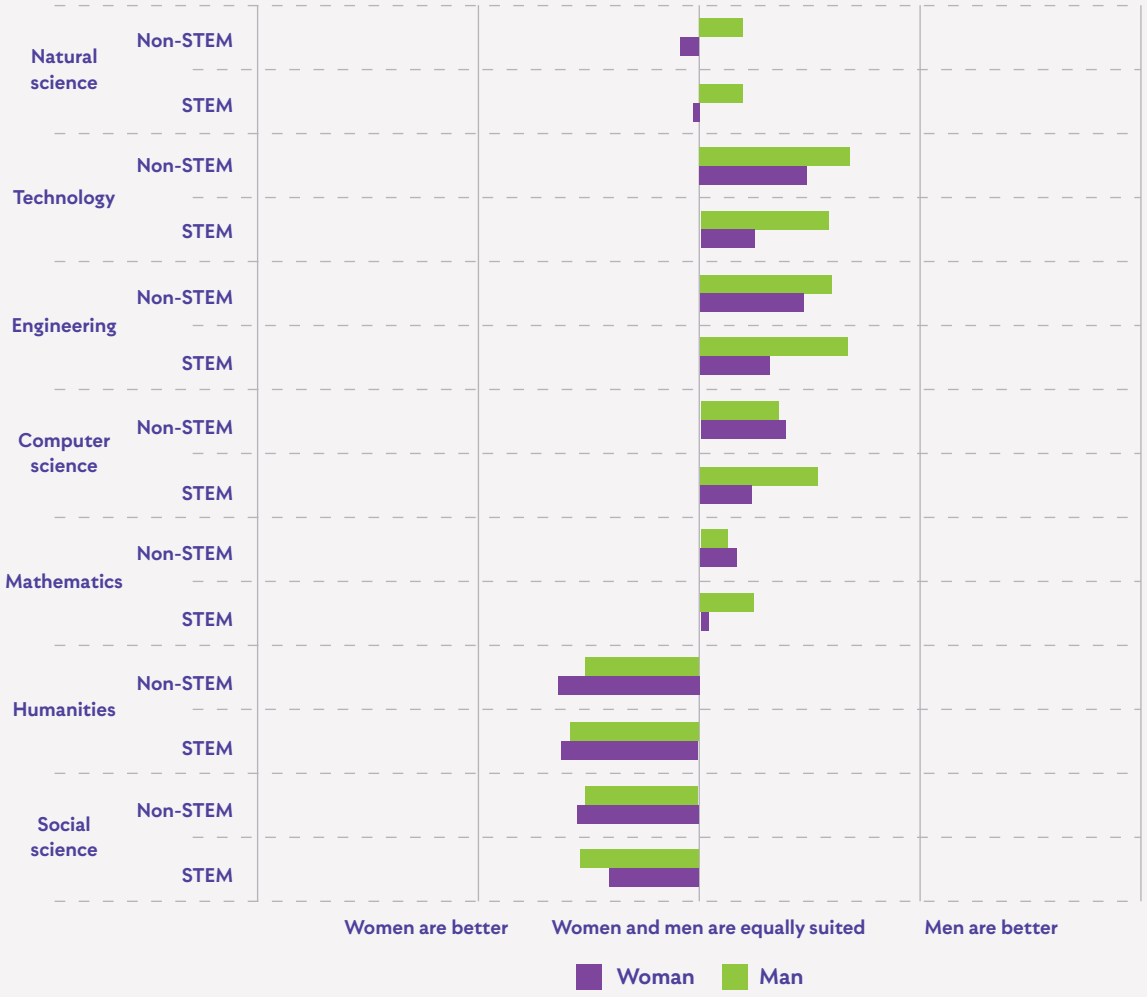
Mathematics is a better career choice for men than for women **	2.28	1.85
Overall, men are more successful students in my field of study **	2.83	2.00
Women like science less than men do **	2.81	2.15
Women are equally good in computer skills as men **	4.18	4.96
Women who enjoy studying computer sciences are strange **	2.24	1.65

***p<0.05; ** p<0.01**

Compared to the female students the male students were more confident in the assertions that 'science is a better career choice for men than for women', 'men are more talented in mathematics than women', 'men are better scientists than women', 'mathematics is a better career choice for men', 'women like science less than men do' and that 'women who enjoy studying computer sciences are strange'. The male students believed that men are generally more successful in their field of study.

The average values of the assessments of the differences between men and women in relation to the abilities required in specific scientific fields also supported these strong gender stereotypes. Overall, the students, regardless of gender and field of study, believed that men are better in technology, engineering and informatics and that women are better in humanities and liberal arts (see Figure 37 below).

Figure 37. Assessing the performance of women and men in different occupations



The students were also asked to respond to three questions examining the gender stereotypes that potentially exist in their immediate and broader environment (e.g. 'Do people in your environment believe that girls should take up university studies in a field belonging to the STEM domains?'). Figure 38 below provides the affirmative answers determined for the male and female students in percentages.

Figure 38. Percentage of 'YES' answers

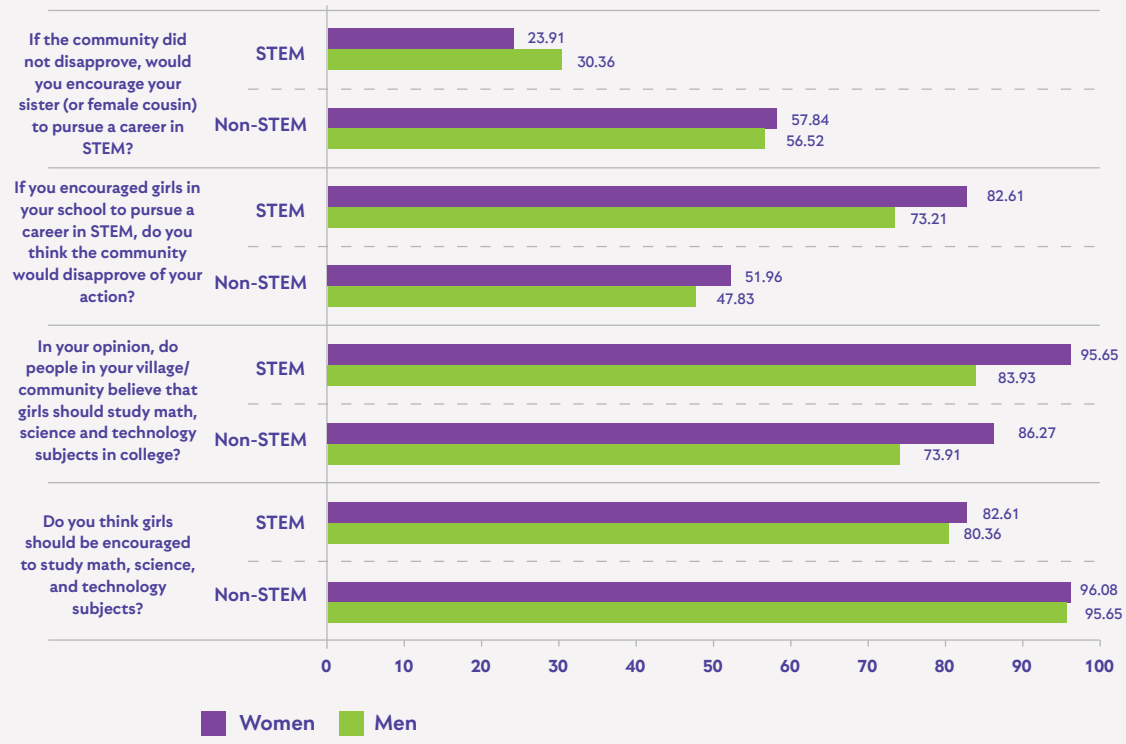
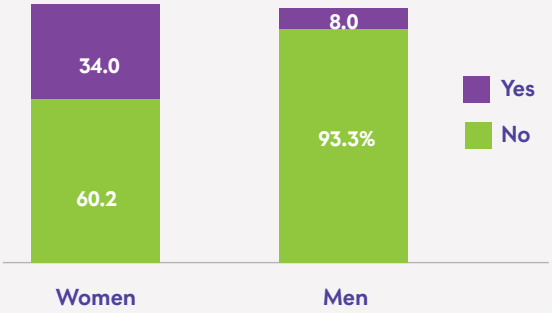


Figure 39.It is more appropriate for men to have a developed career than for women

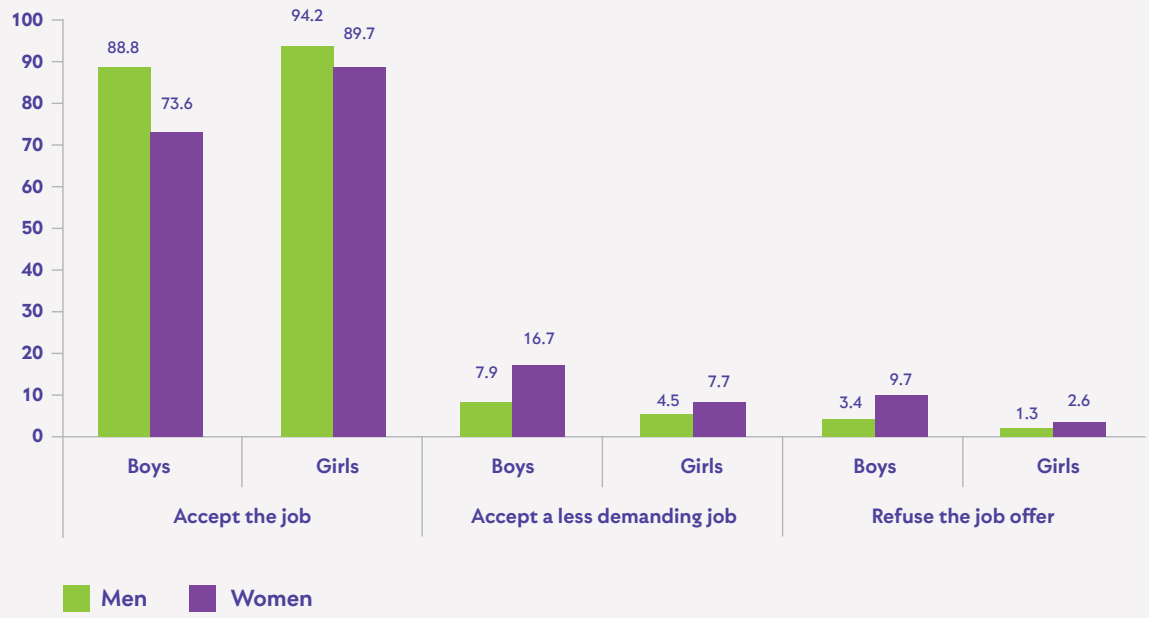


As can be seen from Figure 38 above, the majority of students believed that girls should be supported in taking up university studies in a field belonging to the STEM domains. However, compared to the students in non-STEM fields somewhat fewer students in the STEM fields responded affirmatively to this question ($p<0.01$). It is statistically significant that more female students, regardless of their field of study, reported that people in their environment believed that girls should study the STEM fields. Irrespective of gender, there was a significantly higher number of students in the non-STEM fields who reported that they would support their sister or female cousin in building a career in the STEM fields. Yet as many as 34 per cent of the male students responded affirmatively to the assertion that it was more appropriate for men to have a developed career, while 8 per cent of the female students also responded affirmatively to this assertion (see Figure 39 above).

The gender stereotypes were examined further through use of a vignette. Two versions of a scenario describing a situation where a person had to decide whether to accept a job offer as an engineer were created: one where the main character was a woman and another where the main character was a man. After reading the vignette, the students had to decide what the main character in the story should do by circling one of the three offered answers (accept the job, do a less demanding job or refuse the job offer in order to be at home to take care of

his/her family). Figure 40 below shows the responses with regard to the gender of the main characters in the two scenarios (man or women) and the gender of the respondent students (male or female).

Figure 40. Results achieved on a vignette created for the purpose of examining gender stereotypes



It is evident from Figure 40 above that the majority of students chose the answer according to which the main character in the story (irrespective of gender) should accept the job. A significantly lower percentage of the students chose the second or third offered answer.

3.3.6 SUPPORT IN THE ENVIRONMENT IN RELATION TO THE CHOICE OF STUDY IN THE STEM FIELDS

Table 41 below shows the affirmative answers to the questions reflecting the level of family support for studying. The majority of students reported discussing their goals in education with members of their family. Compared to the students in the STEM fields more students studying in non-STEM fields were encouraged by their family to study humanities and the liberal arts. On the other hand, more students in the STEM fields were encouraged by their family to study STEM rather than liberal arts or humanities. A larger number of female students reported that their family encouraged them to take up university studies, particularly in the STEM domains.

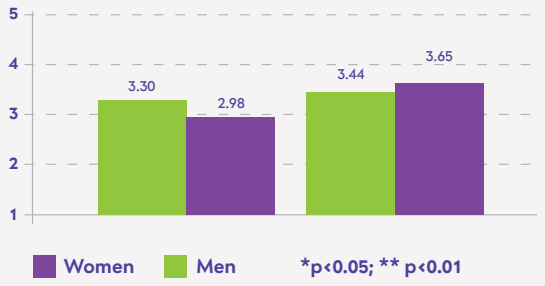
Table 41. Support in the environment in relation to the choice of study in the STEM fields

		Male	Female
Have you ever discussed your goals in education with your family?	STEM	84.7%	86.5%
	non-STEM	88.4%	88.8%
Has your family encouraged you to take up university studies in humanities and liberal arts?	STEM	16.3%	16.5%
	non-STEM	46.5%	50.0%
Would your family encourage you to take up university studies in a field belonging to the STEM domains?	STEM	36.2%	57.4%
	non-STEM	26.2%	26.5%

The students were asked to assess to what extent persons significant to them (professors, family and friends) believed that they should choose a career in science. No statistically significant differences were found with regard to gender or the field of study.

3.3.7 IMPLICIT THEORIES OF INTELLIGENCE

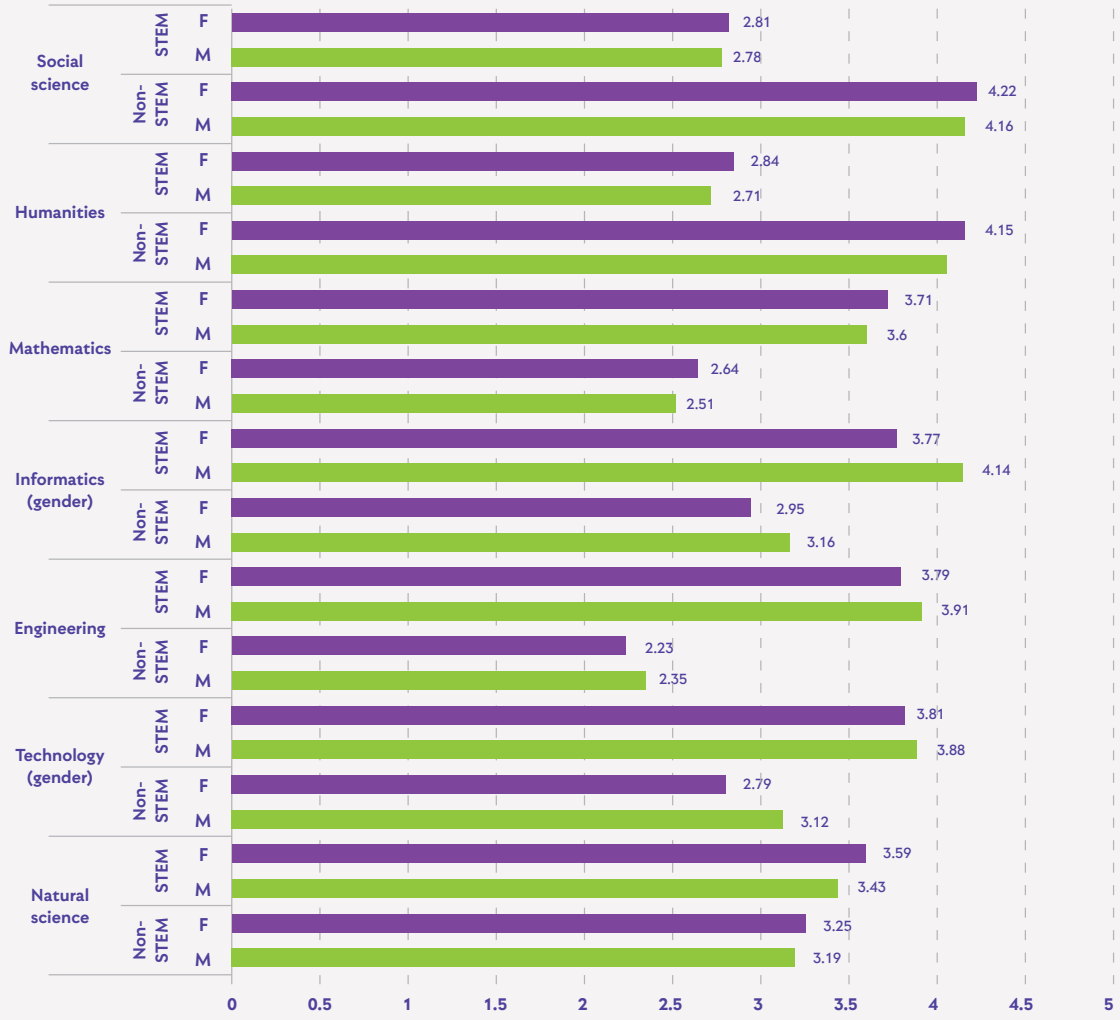
Figure 41. Implicit theories of intelligence



An analysis of the main components examined the validity of the construct of the implicit theories of intelligence. Two components that by their constituent items corresponded to the fixed or growth mindset were identified. The first component (fixed mindset) explains the 39.545 per cent results variance, while the second component (growth mindset) explains the 36.89 per cent results variance.

Figure 41 below shows the average values determined on the scale of the implicit theories of intelligence with regard to gender.

Figure 42. Percentage of 'YES' answers



A statistically significant effect of gender was found in both constructs. Compared to the male students the female students had a lower percentage of fixed mindset and a higher percentage of growth mindset.

The students assessed their own abilities in relation to different STEM and non-STEM fields on a scale ranging from 1 'below average' to 5 'above average'. Figure 42 below shows the average values determined for the students with regard to gender and field of study. Statistically significant differences with regard to gender were found in the assessment of their abilities in relation to informatics and technology wherein the female students, irrespective of the field of study, assessed their abilities as being lower compared to the male students.

Statistically significant differences with regard to the field of study were found for each field: the students (irrespective of gender) in the STEM fields assessed their abilities in relation to natural sciences, technology, engineering, informatics and mathematics as being higher, while the students in the non-STEM fields (irrespective of gender) assessed their abilities in liberal arts and humanities as being higher.

3.3.8 CAREER INTENTIONS

Twelve items were designed and taken over from other studies (e.g. Seaton, 2012) to measure the intentions among the students to complete or continue their studies in the next cycle and to then forge a career in their chosen fields. The answers were measured on a seven-notch scale ranging from 1 'no, not at all' to 7 'yes, definitely'. Table 42 below shows the average values determined for each item with regard to gender. The results shown are for the students studying in the STEM fields.

Table 42. Career intentions

I intend to...	Male	Female
complete the studies that I am enrolled in	6.58	6.79
continue my studies in my field in the 2nd and 3rd cycles	5.28	5.77
transfer to other studies	1.78	1.57
complete studies in a different department	1.90	1.94
develop further in my field of study *	5.78	6.14
look for a job in companies or organisations that pursue scientific research	4.23	4.44
work on international research projects	4.29	4.74
become a recognised expert in my field of study	5.19	5.28
receive high recognition in academic circles	4.43	4.80
assume a leadership role in academic circles	3.43	3.88
pursue scientific and applied research	4.62	4.92
write and publish papers in prestigious scientific journals	3.27	3.64

***p<0.05; ** p<0.01**

Although the female students recorded higher average results for the career intentions items, a statistically significant difference was only found for 'I intend to further develop in my field of studying' item. The female students showed a higher intention to develop further.

3.3.9 VULNERABILITY TO THE THREAT OF STEREOTYPE

A revised version of the Social Identity and Attitudes Scale (Picho and Brown, 2011) was used to measure vulnerability to the threat of stereotype. The original scale contains 30 items that measure a person's susceptibility to the threat of stereotype based on six constructs that are key moderators of the impact of stereotyping at work: ethnic identity, gender identity, awareness of ethnic stigmatisation, awareness of gender stigmatisation, negative affectivity and identification with mathematics. The items measuring 'ethnic identity' and 'awareness of ethnic stigmatisation' were excluded for the purposes of this research and therefore the revised version comprised of 21 items.

An analysis of the main components utilising Oblimin rotation examined the validity of the construct. Four factors that by their content corresponded to gender identity, awareness of gender stigmatisation, negative affectivity and identification with mathematics were determined. The total percentage of the explained results variance was 71.837 per cent.

The first component on 'awareness of gender stigmatisation' contained five items ('My gender impacts how people treat me', 'My gender impacts how people behave toward me', 'The majority of people assess me based on my gender', 'Members of the opposite sex interpret my behaviour based on my gender' and 'My identity is firmly connected to my gender') and explained the 31.53 per cent results variance.

The second component on 'identification with mathematics' contained six items ('It is important to me to be good in mathematics', 'Knowledge of mathematics would benefit me in the future', 'My mathematical skills are important in my academic success', 'Mathematics is important to me', 'Success in mathematics is key for my future success' and 'I appreciate mathematics') and explained the 21 per cent results variance.

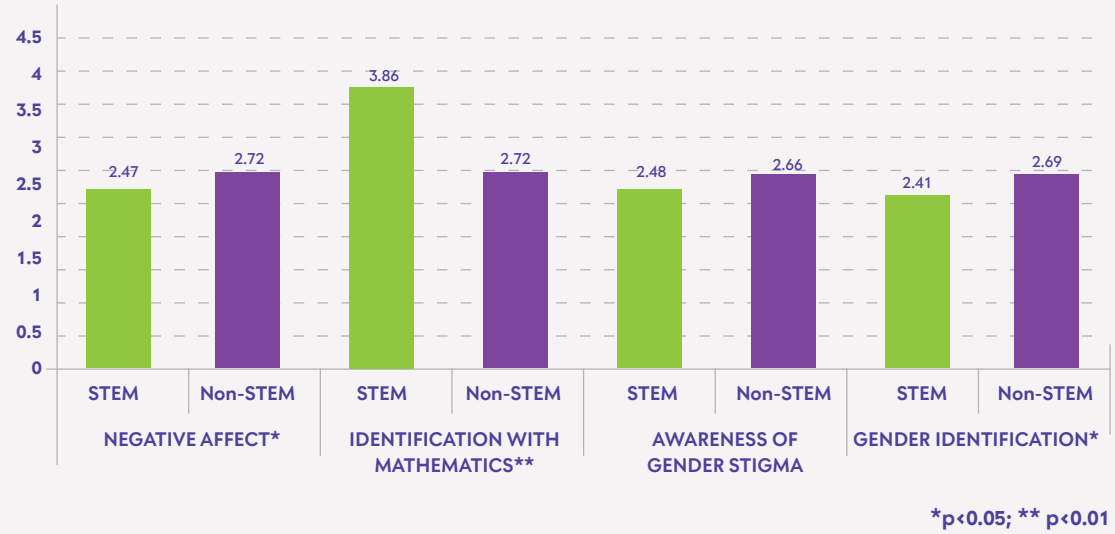
The third component related to 'negative affectivity' contained six items ('When I do difficult mathematical tasks I feel like a failure', 'When I do difficult mathematical tasks I start to lose confidence in my abilities', 'When I do difficult mathematical tasks I feel hopeless', 'When I do difficult mathematical tasks I feel that I let myself down', 'When I do difficult mathematical tasks I feel like giving up' and 'When I do difficult mathematical tasks I start questioning my mathematical abilities') and explained the 14.65 per cent results variance.

The fourth and last component measured 'gender identity' and comprised of four items ('My gender contributes to my self-confidence', 'My gender is central in defining who I am', 'My gender has an impact on how teachers perceive my behaviour' and 'My gender has an impact on how I feel'). The fourth component explained the 4.65 per cent results variance.

High values of the internal reliability coefficients were determined for 'gender identity', 'awareness of gender stigmatisation', 'identification with mathematics' and 'negative affectivity' (α=0.799; α = 0.921; α =0.918 and α=0.910 respectively).

Each construct on vulnerability to the threat of stereotype were examined for the female students in relation to their field of study in order to define the differences in the average values. The average values are shown in Figure 43 below. Overall, the female students achieved a lower average result (lower than the theoretical average of 3). This indicates a low level of vulnerability to the threat of stereotype. A higher level of 'identity with mathematics' was determined for the female students in the STEM fields along with a lower level of 'negative affectivity' related to doing difficult mathematical tasks. A higher value was present in the gender identification subscale for the female students in the non-STEM fields.

Figure 43. Vulnerability to the threat of stereotype



3.3.10 FAMILY AND CAREER

Family and career orientations were measured through an eponymous scale (Battle and Wigfield, 2003), which was translated and adapted to the purposes of this research. The scale comprised of 16 items that measured the perception of importance attached to family and career. The respondents were asked to respond to all of the assertions using a scale ranging from 1 'I mostly disagree' to 5 'I highly agree'.

Table 43 below shows the average values for each assertion with regard to gender. Statistically significant differences were found in the level of agreement with each assertion except for two: 'I believe that women who have a developed career are better mothers' and 'I believe that women who have a job and take care of their family are overburdened'.

Table 43. Family and career orientations

	Male	Female
I believe a marriage is too stressful when both the husband and wife have a job.	2.27	1.76
I believe the family suffers when the mother has a job.	2.17	1.73
I think a mother should be present at home when her children come back from school.	2.83	2.47
I believe a woman should decide whether she will commit to her career or her family.	2.80	2.38
I believe it is better for the family if the mother stays home.	2.62	1.90
I believe that women should put their careers "on hold" when they start a family.	2.47	1.94
I believe that women who have a job and take care of their family are overwhelmed.	3.19	3.07
I believe it is better for children to spend shorter but quality time with them, than spending all of your time with them.	3.28	3.53
I believe women should earn money and contribute to the household income even after they become mothers.	3.85	4.41
I think a working mom sets a good example to her children.	3.95	4.44
I believe father should spend just as much time raising their children as mothers do.	4.32	4.60
I think it is a good experience for children to spend time with other caretakers, not just their mother.	2.93	3.17
I believe that women who have a developed career are better mothers.	2.91	2.97
I believe women should have a career, regardless whether they have children or not.	4.08	4.63
When a woman becomes a mother she should continue working at her job outside the household.	3.89	4.51
I believe women can successfully balance their career and family care responsibilities.	3.99	4.53

Compared to the female respondents the male respondents were more convinced that marriage is stressful when both the husband and the wife are employed, that family suffers when the mother works, that the mother should be present at home when her children come back home from school, that it is better for the family if the mother stays at home, and that women should put their careers 'on hold' when they start a family.

Compared to the male respondents the female respondents were more convinced that fathers should also spend the same amount of time as mothers on raising their children, that women should make money and contribute to the household budget even after they become mothers, that an employed mother sets a good example for her children, that women can successfully balance a career and taking care of their family, that a woman should continue doing her job outside of the household even after she becomes a mother, and that women should have a career irrespective of whether they have children or not.

3.3.11 EMPOWERMENT OF ATTITUDES

According to the obtained results, the female students worried statistically significantly more about whether they would fit in at university (p=0.02; p<0.05) and whether they would be accepted at the workplace (p=0.00; p<0.01).

Figure 44. Empowerment of attitudes

3.4 TEACHERS

According to the obtained results, 98.20 per cent of the teachers spoke to their pupils about their educational goals and 95.90 per cent of them spoke to their pupils about their plans for their career, while 90.60 per cent of teachers expected their pupils to conduct their own research into material related to the subjects they taught and all of the teachers encouraged their pupils to ask questions about the lessons.

Figure 45. Teacher support

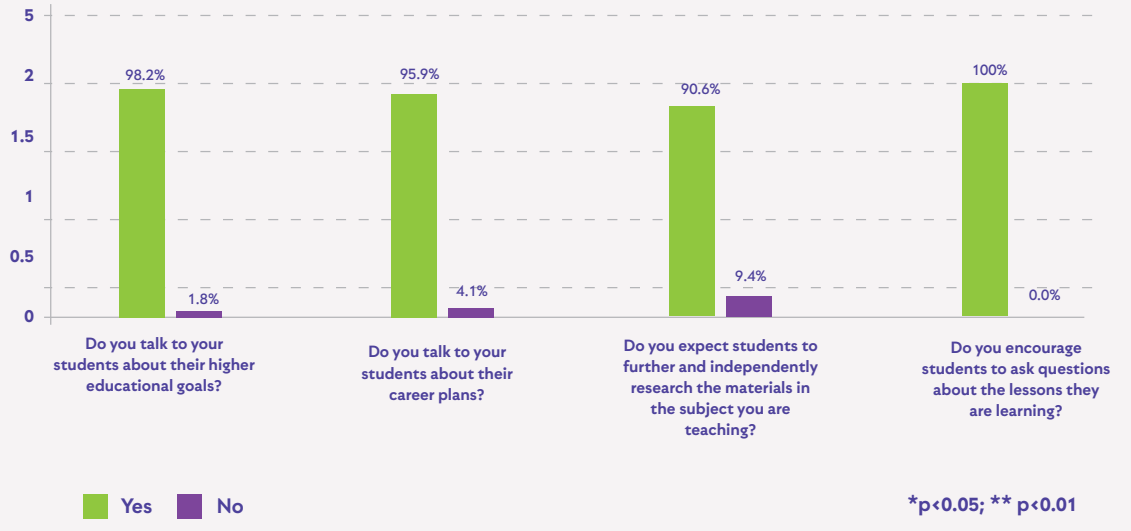


Figure 46. Student assessment

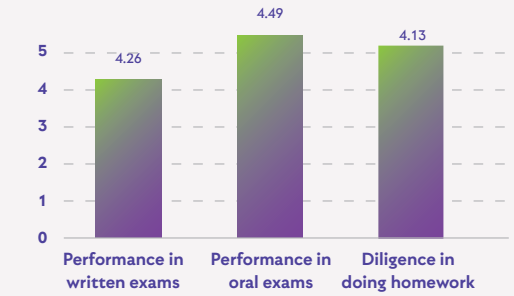
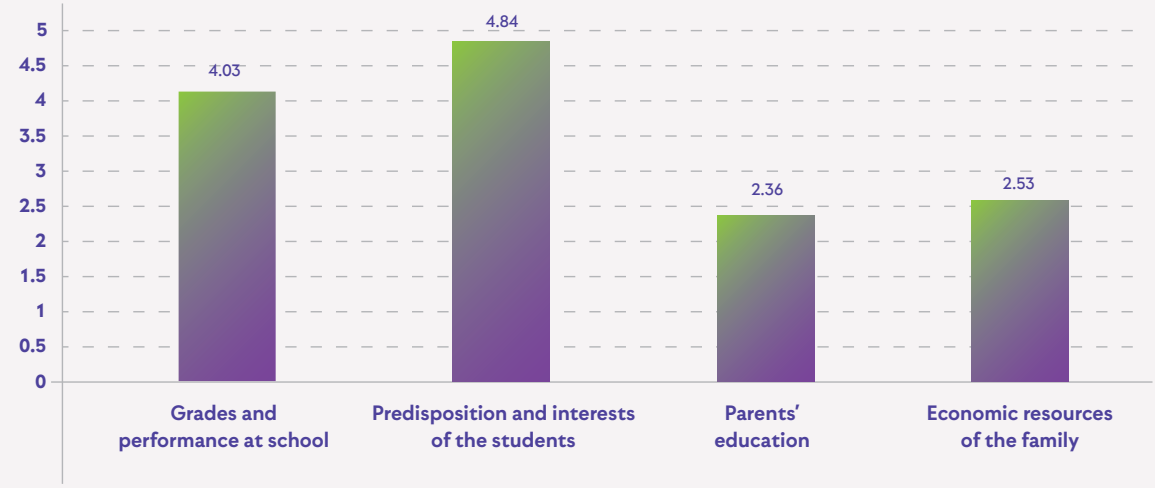


Figure 46 below shows the average grades for the components to which the teachers paid most attention when grading pupils.

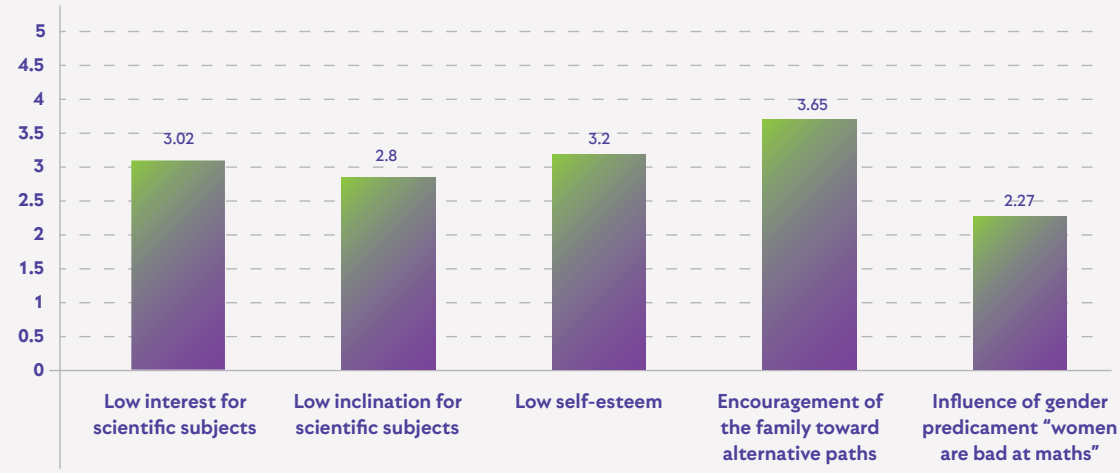
Figure 47 below shows the average grades for the components that the teachers considered most when recommending educational or career orientation for their pupils. Therefore, teachers attached highest importance to the predisposition and interests of their pupils and the lowest importance to the level of education of the pupil's parents.

Figure 47. Recommendations for education and career



When it came to the factors that influenced the girls' orientation toward alternative non-STEM paths, the teachers highlighted encouragement within the family for girls to follow an alternative path.

Figure 48. Factors that influenced the girls' orientation toward alternative non-STEM paths

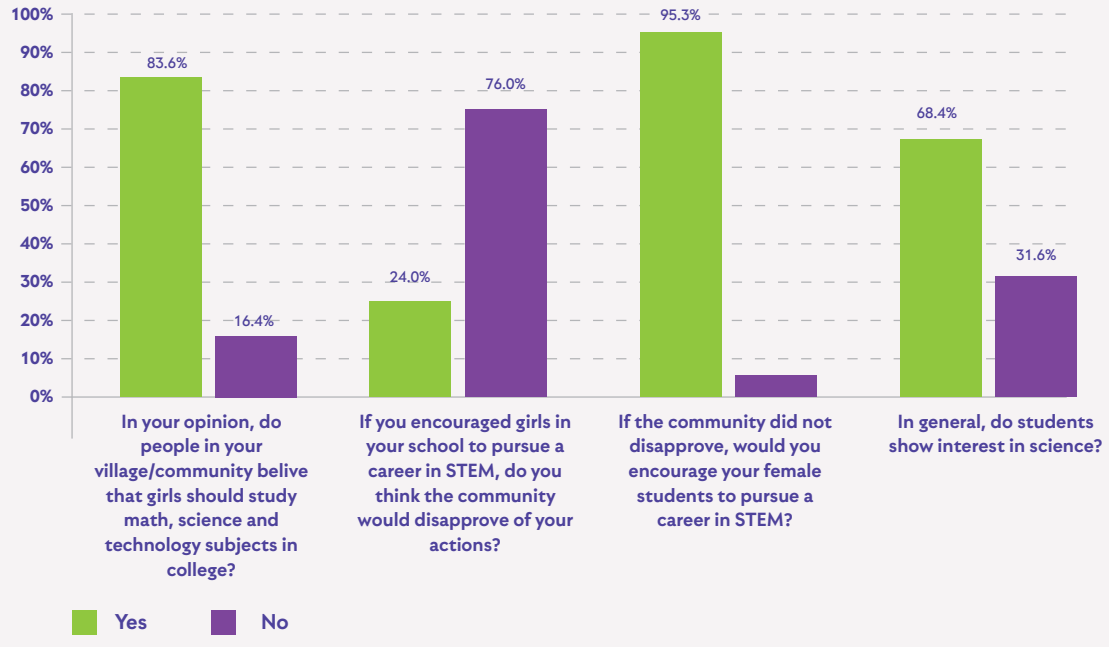


Data analysis with regard to the gender of the participants found that compared to their male colleagues the female teachers attached greater significance to the factor 'encouragement of the family toward alternative paths'.

Figure 49. Factors that influenced the girls' orientation toward alternative non-STEM paths according to the gender of teachers

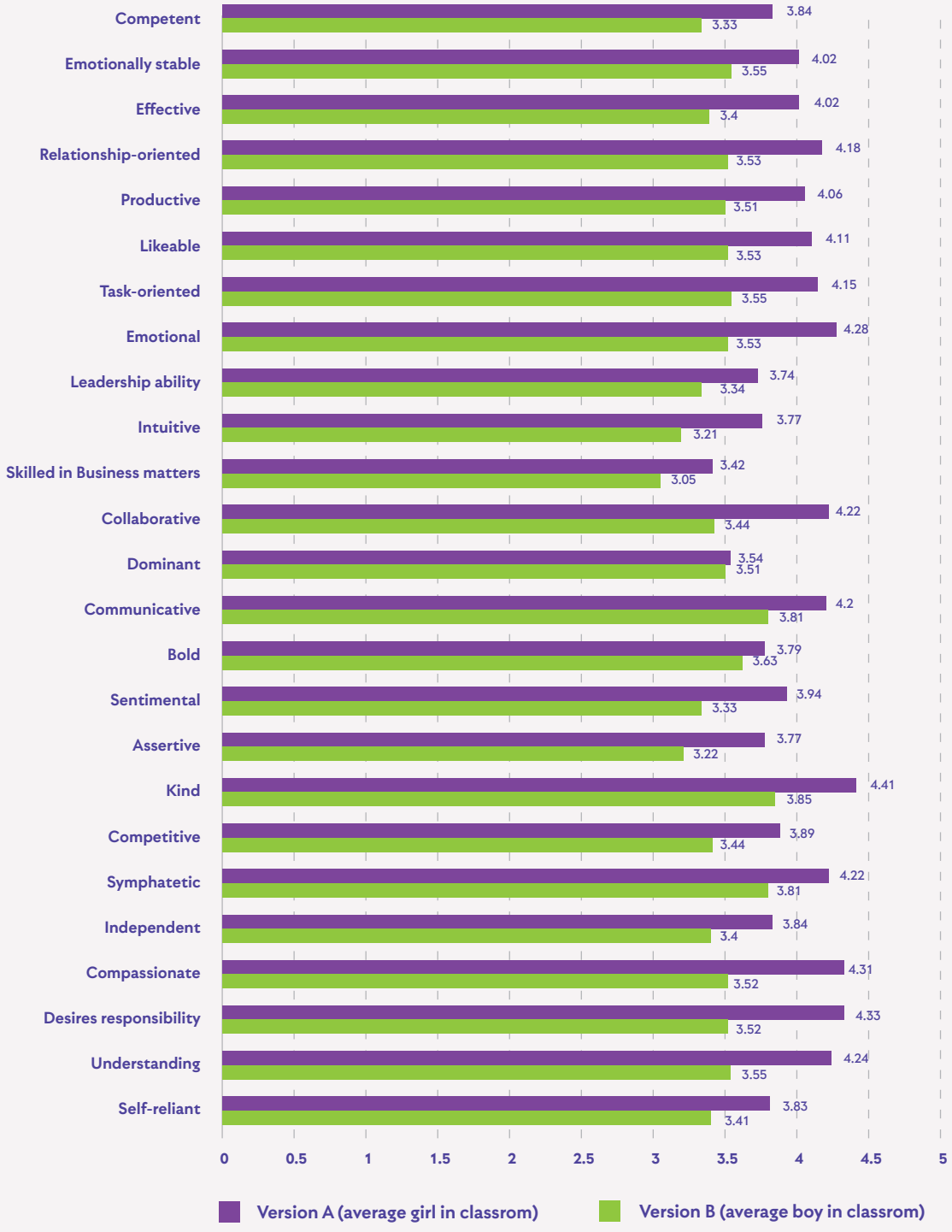
According to the obtained results, 83.6 per cent of the teachers believed that the people from the community would support girls to pursue the STEM fields, 76.0 per cent of them believed that the community would not disapprove of their decision to support girls to pursue the STEM fields, 95.3 per cent of them said that they would encourage girls to pursue the STEM fields and 68.4 per cent of the teachers asserted that male/female pupils were interested in science. The teachers were also asked to assess who is more interested in science wherein 77.8 per cent of them reported that boys and girls are equally interested in science, 17.10 per cent believed that girls are more interested in science and 5.10 per cent reported that boys are more interested in science.

Figure 50. Environmental support in the choice of STEM occupation and perceptions of students' interest in science



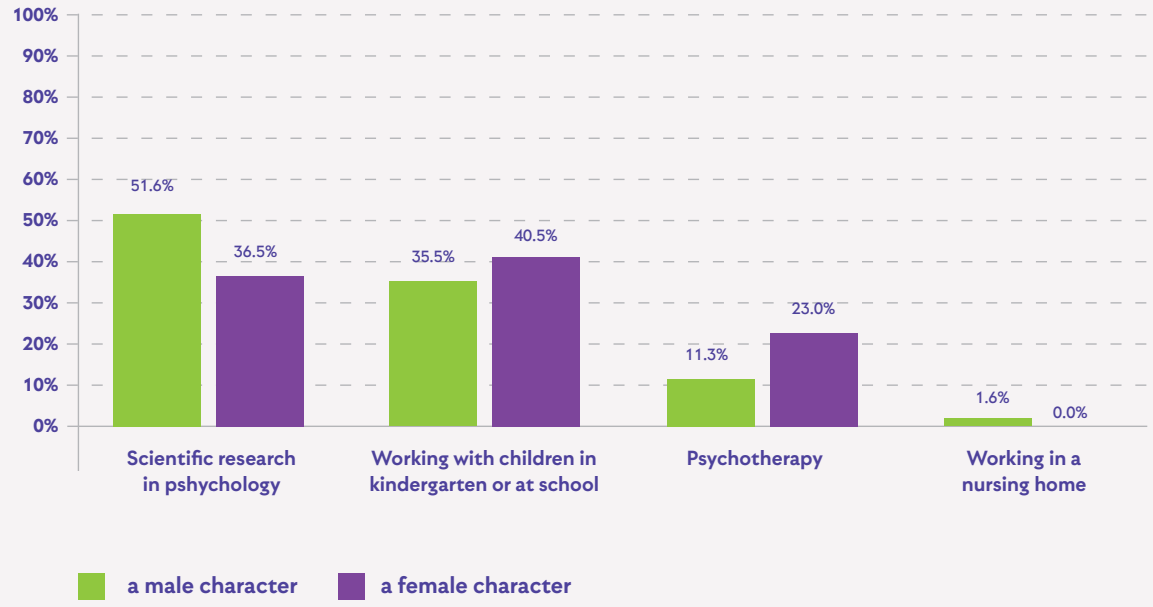
The teachers were asked to grade female and male pupils according to a series of characteristics. Figure 51 below shows the average grades, which infer that both female and male pupils were graded highly on each characteristic.

Figure 51. Assessment of students characteristics



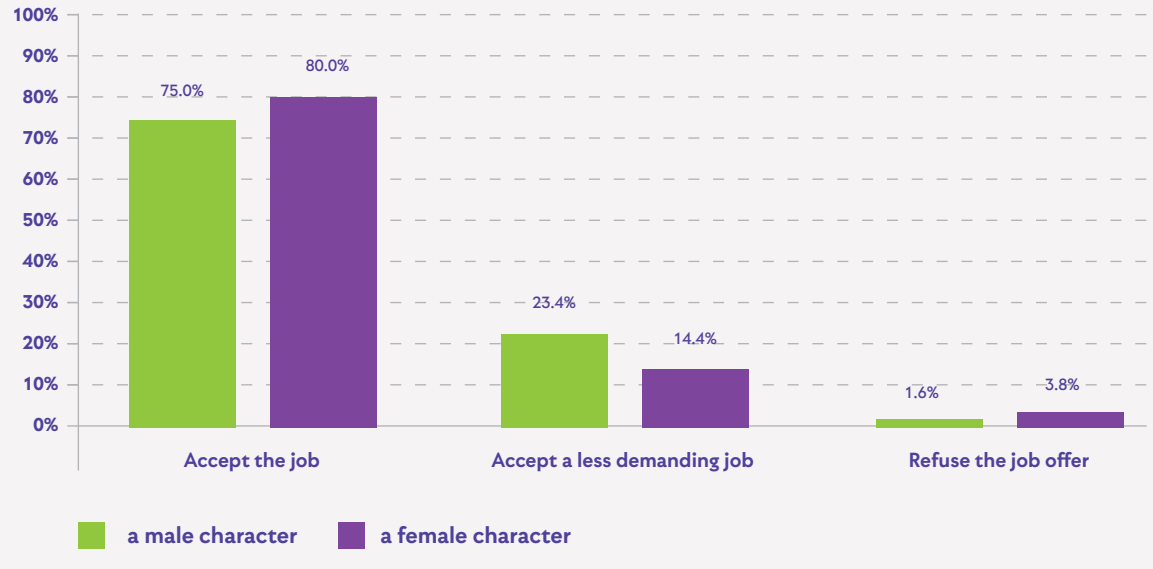
Two versions of a scenario wherein the main character was either a male pupil or a female pupil who had completed his/her psychology studies with remarkable results were described to the respondents. The respondents were then asked to recommend a career field for the main characters in the different versions. In the scenario where the main character was a man, the highest percentage of respondents recommended a career in research (51.6%) whereas in the version where the main character was a woman the highest percentage of respondents recommended that she work at a day-care centre (40.5%). The results are shown below in Figure 52.

Figure 52. Results achieved on a vignette created for the purpose of examining gender stereotypes



The respondents were offered two versions of a scenario wherein a person (man or woman) should decide whether to accept a job offer as a neurosurgeon. The situation was described in such a way that the main character (man or woman) faced a dilemma because he/she had just started a family and needed to care for a newborn child. Irrespective of the gender of the main character, the majority of respondents believed that the person (man or woman) should accept the job.

Figure 53. Results achieved on a vignette created for the purpose of examining gender stereotypes



The respondents were given a scenario where because of the unfavourable financial situation a father had to decide whether to ensure university study for his son or his daughter, both had completed their secondary education at the same time. In the scenario, the father decides to ensure higher education for his son. The respondents were asked to assess to what extent they agreed with the father's decision using a scale ranging from 1 'I firmly disagree' to 5 'I firmly agree'. The average score on agreement with the father's decision was M=1.47 (SD=0.88). This infers that the respondents mainly disagreed with the father's decision to ensure higher education only to his son.

The respondents were asked to specify for whom they would ensure education if they found themselves in a similar situation: son or daughter. Their response was that 91.3 per cent would borrow money to ensure education for both and 4.3 per cent of the teachers would ensure education for the daughter, while 4.3 per cent of the teachers responded through the choice of answer 'I do not know'.

The teaching staff were asked to make the same decision but with the proviso that the daughter was a considerably better pupil. In this case, 88.4 per cent of the teachers reported that that they would borrow money to ensure education for both the son and the daughter and 10.1 per cent reported that they would ensure education for the daughter, while 1.4 per cent responded through the choice of answer 'I do not know'.

The teachers were also asked to give their opinion on whether the father in the scenario should have consulted his wife before making his final decision. In this case, 98.6 per cent of the teachers responded affirmatively and 1.4 per cent respondents through the choice of answer 'I do not know'.

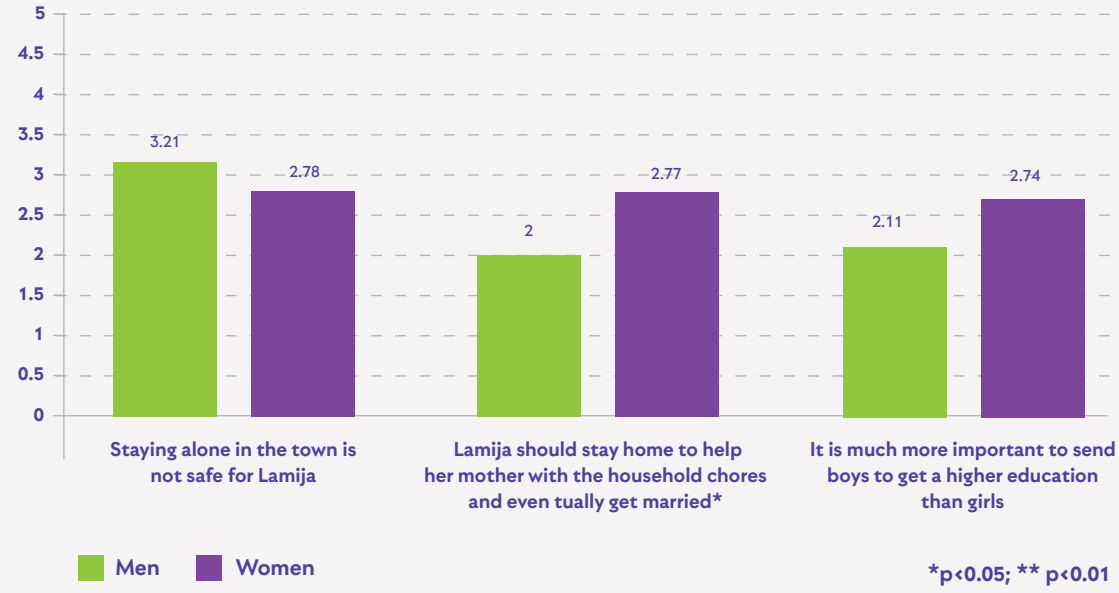
The teachers were also asked to assess the reasons why the father chose to ensure education for his son, in accordance with a scale ranging from 1 'I firmly disagree' to 5 'I firmly agree'. The results are shown in Table 44. A data analysis at the level of the entire sample found that the respondents mainly disagreed with the offered reasons for the father's choice to ensure higher education only for his son.

Table 44. The reasons for the decision made by the character presented in the described scenario

	Male
It is not safe for Lamija to be alone in the city.	2.84
Lamija should stay home, help her mother with the household chores and eventually get married.	2.63
It is much more important to send boys than girls to get higher education.	2.63

Even though the respondents mainly disagreed with the aforementioned assertions, it was found that compared to their male colleagues the female teachers offered statistically significantly higher grades in relation to the assertion 'Lamija should stay home, help her mother with the household chores and eventually get married'.

Figure 54. The reasons for the decision made by the character presented in the described scenario according to the gender of teachers



The respondents were given a scenario describing a four-member family that often discussed the distribution of household chores based on the obligations it had. The respondents were asked to assign tasks to each family member to perform. The questions were multiple choice. The results are shown in Table 45 below.

The respondents reported that all family members should perform all of the offered household chores. However, the mother and daughter were most often assigned the chores of cooking, cleaning the bathroom, cleaning the kitchen and the laundry. The mother was also assigned the task of taking care of the children. When it came to the father and son, they were mostly assigned the chores of repairing home appliances and gardening.

Table 45. Results achieved on a vignette created for the purpose of examining gender stereotypes

	Mother	Father	Daughter	Son	All family members
Cooking	37.3%	11.2%	18.7%	4.5%	62.7%
Appliance repair	8.2%	55.2%	3.0%	20.1%	17.9%
Tidying common areas	7.5%	4.5%	3.0%	2.2%	90.3%
Cleaning the bathroom	21.6%	4.5%	13.4%	4.5%	73.9%
Cleaning the kitchen	35.1%	3.0%	23.1%	4.5%	63.4%
Tidying the garden	8.2%	16.4%	2.2%	9.0%	76.1%
Washing clothes	38.8%	3.0%	18.7%	2.2%	56.0%
Taking care of elderly	5.2%	4.5%	1.5%	0.7%	87.3%
Taking care of young children	33.6%	29.1%	0.0%	1.5%	61.2%

The respondents were then asked to specify who in their household was responsible for each of the specified chores. The questions were multiple choice. In addition to a high percentage of respondents reporting that all family members performed the offered household chores, they reported that the mother or daughter were assigned obligations such as cooking, cleaning the bathroom and the kitchen and doing the laundry. Taking care of elderly persons, children and tidying shared rooms were also assigned to the mother, while the father and son were mainly assigned chores such as repairing home appliances.

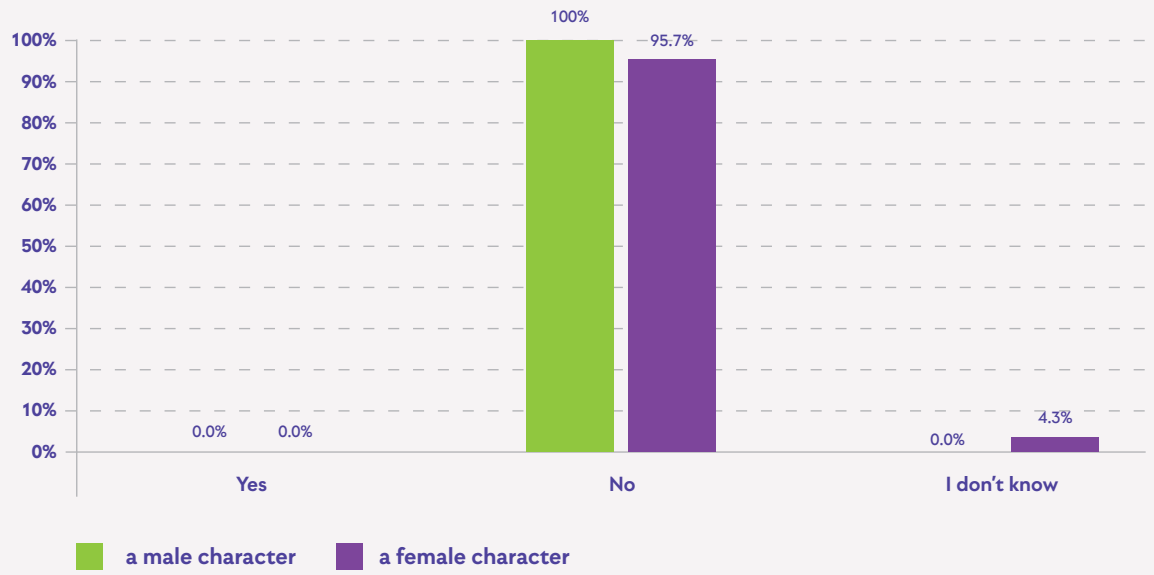
Table 46. Distribution of household chores in the household of the respondents

	Mother	Father	Daughter	Son	All family members	It does not apply to my family
Cooking	57.4%	12.4%	12.4%	3.9%	40.3%	0.8%
Appliance repair	10.1%	49.6%	0.8%	10.9%	15.5%	78%
Tidying common areas	17.8%	6.2%	3.9%	3.1%	78.3%	2.3%
Cleaning the bathroom	48.1%	9.3%	13.2%	6.2%	45.0%	3.1%
Cleaning the kitchen	55.8%	6.2%	17.8%	3.1%	41.9%	1.6%
Tidying the garden	11.6%	19.4%	2.3%	4.7%	60.5%	17.1%
Washing clothes	58.9%	7.8%	15.5%	2.3%	37.2%	3.1%
Taking care of elderly	16.3%	10.1%	3.9%	4.7%	65.1%	16.3%
Taking care of young children	37.2%	29.5%	0.8%	1.6%	48.8%	14.0%

The respondents were given a scenario in which both of the main characters (a man aged 21 and a woman aged 21) had gained the title of electrical engineer and both had been offered a job in their chosen profession. However, in the scenario, the parents believed that it would be hard for them to balance their private and business lives if they accepted the offer of a very demanding job. The parents thought that it was appropriate that they find a marital partner and that their family life should have priority over their career.

Figure 55 below shows that in the case of the female character 95.7 per cent of the respondents disagreed with the decision of her parents that she should dedicate herself exclusively to marriage while neglecting her chosen career. On the other hand, in the case of the male character all respondents disagreed with the parents' decision.

Figure 55. Results achieved on a vignette created for the purpose of examining gender stereotypes



The respondents were asked to express the extent of agreement with several assertions using a scale ranging from 1 to 5. The average grades on each of the offered assertions are contained in the respective figures below. The obtained results do not indicate the existence of gender stereotypes. The respondents were also asked to specify what they would do if they were in the place of the main characters (a man and a woman). Regardless of what role they were supposed to put themselves in, the respondents gave priority to employment over getting married, as well as discussing the issue with their parents.

Figure 56. The female character

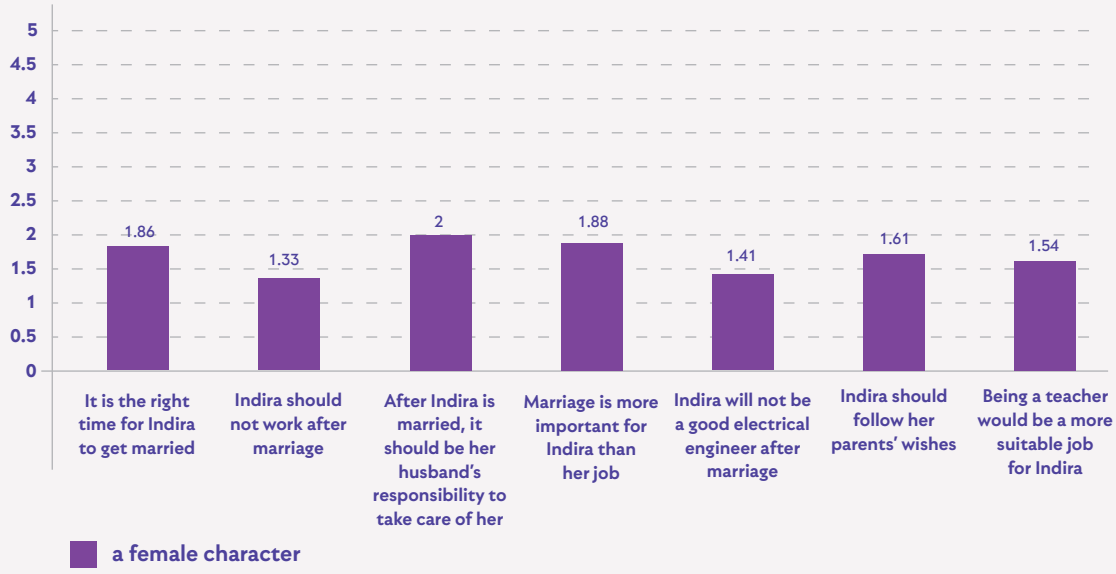


Figure 57. The male character

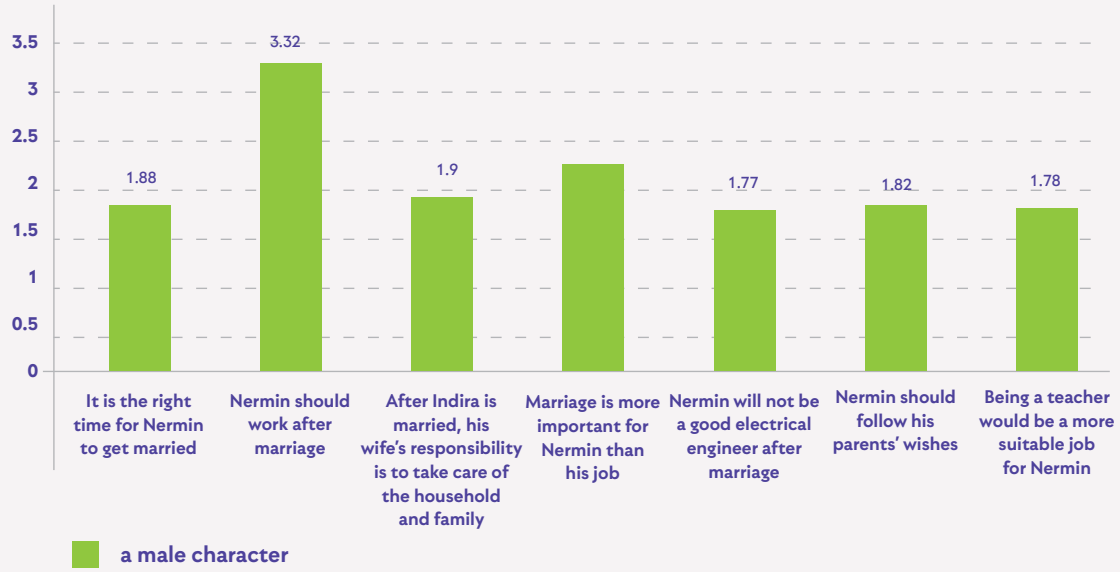
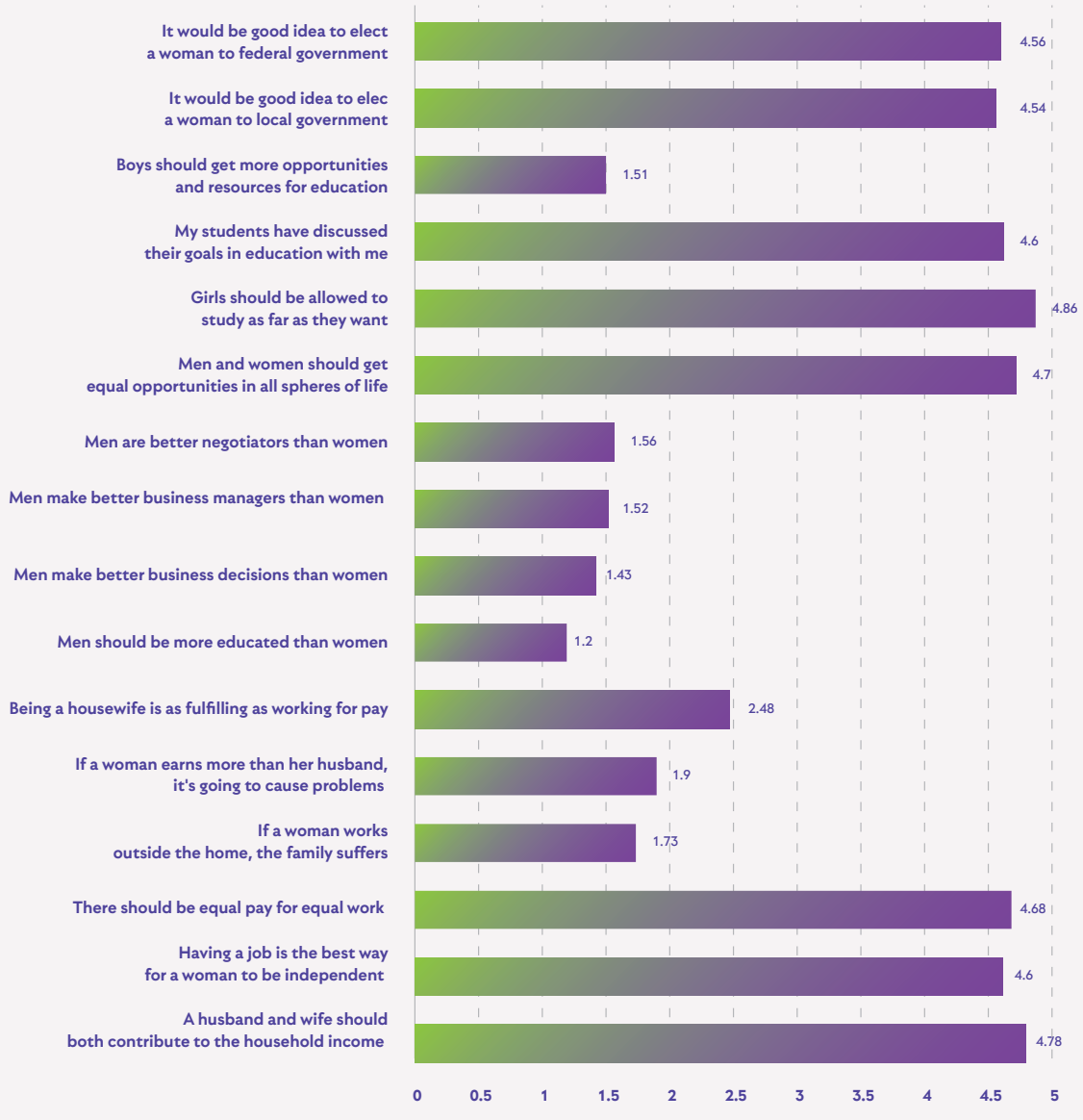


Figure 58. Gender stereotypes



As part of the questionnaire, the respondents were asked to use a scale for measuring gender stereotypes. An item analysis was performed for each item in order to obtain more detailed results; however, the final four items varied depending on the version of the questionnaire. Items in version A referred to women whereas in version B they referred to men.

The results in Figure 58 above suggest the nonexistence of gender stereotypes within the sample of teachers, while further analysis did not find any differences in regard to the gender of the participants.

Figure 59. Version A

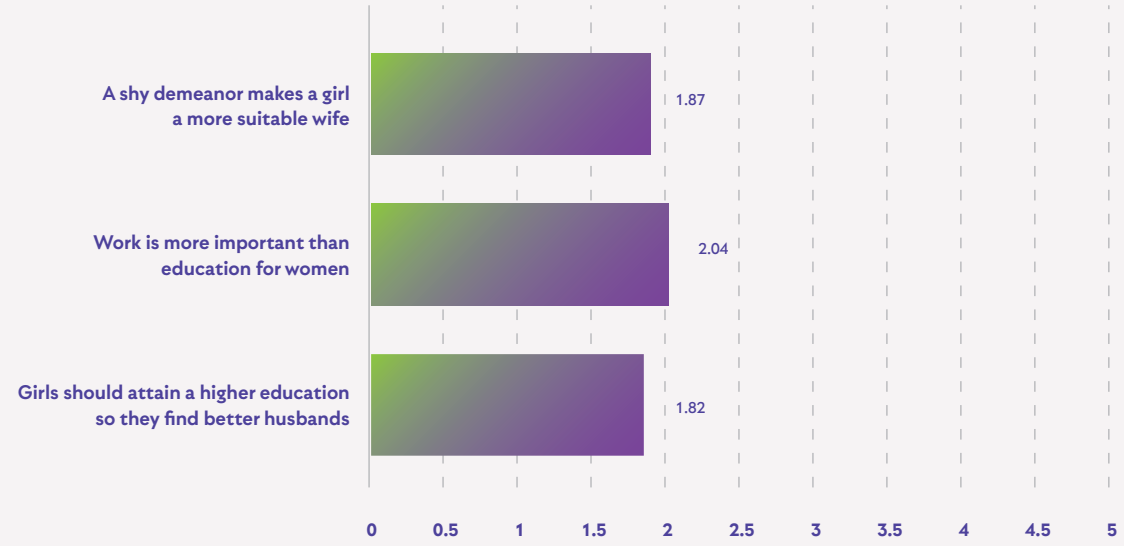
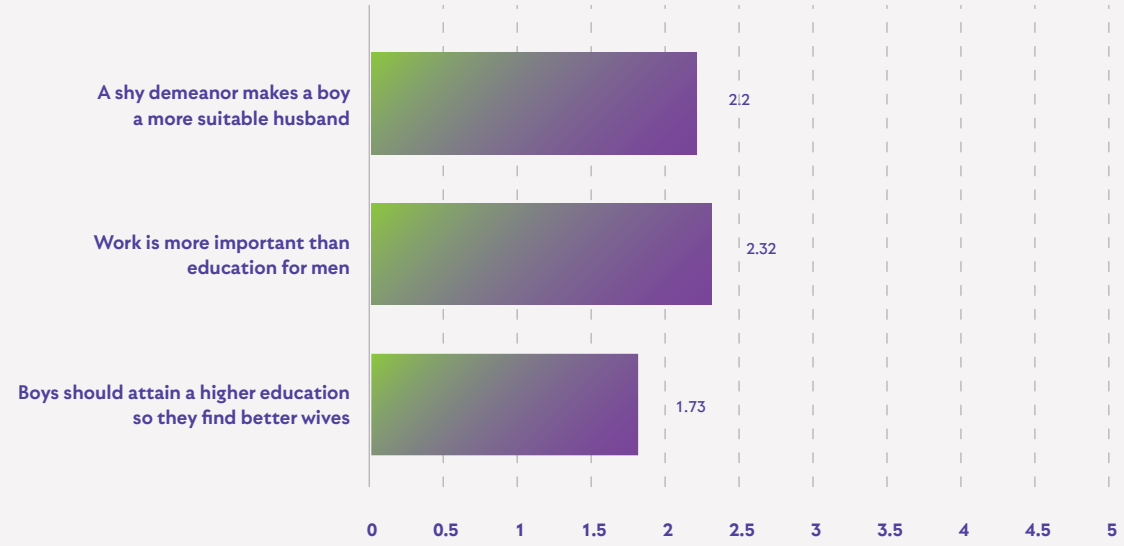


Figure 60. Version B



3.5 THE QUALITATIVE PART OF RESEARCH

3.5.1 FOCUS GROUP RESEARCH WITH PRIMARY SCHOOL PUPILS

Table 47. Sample of primary school pupils

	Male	Female
Vrhbosna Primary School in Sarajevo	2	6
Sveti Sava Primary School in Foča	5	5
Mustafa Ejubović-Šejh Jujo Primary School in Mostar	2	5

The pupils reported being most interested in the following subjects: mathematics, physics, informatics, chemistry, biology, geography, history, English and German languages, Bosnian/Croatian/Serbian languages and physical education. Two female pupils in one school offered a more detailed explanation by reporting that they were interested in mathematics only because it requires logical thought whereas they were interested in English language because of its application in daily life.

Irrespective of their personal preferences, the pupils reported that their interest in school subjects and their performance depended largely on how the teachers taught the subject, the atmosphere in the classroom and the type of lessons they worked on. As the discussion progressed, the majority of the participants in the research focus group in one of the schools expressed a negative attitude toward STEM subjects. Namely, the majority of them stressed that lessons in geography, chemistry, physics, informatics and mathematics were mostly uninteresting or difficult.

The quotes below relate to several female pupils who expressed their views and experiences in relation to subjects belonging to STEM.

"No matter how much I practice, I am not good at mathematics."

"I am simply not good at mathematical tasks. I don't know, I am not for that side of the science. Physics is also difficult."

"I was not made for mathematics."

In regard to gender differences in relation to interest and performance in STEM subjects, the majority of the pupils at one of the schools believed that women achieve better performance in mathematics, physics, biology, chemistry and geography; some expressed a neutral position. On the other hand, the participants at the same school expressed the view that men achieve better performance in the field of informatics. One female pupil expressed her view that boys undoubtedly achieve better performance in STEM subjects compared to girls.

"They have something in their head that they can tap into to succeed in this, to understand STEM subjects and to generally know this from their life."

All pupils thought that knowledge of STEM subjects would benefit them in the future. In this regard, one of the pupils stressed that mathematics and physics were very important for day-to-day life and success in any job. Similarly, the female pupils who responded to the question related to the usefulness of STEM subjects in the future also stressed that informatics was very important because of developments in technology. The pupils at one school stated that they learned 'Q basic' programming language in their informatics classes.

Moreover, the pupils reported that success in STEM subjects or any other career field that they chose would be the result of their talent, the effort they invested, their motivation and level of interest in specific fields. They believed that their parents, friends and their environment had a significant impact on their level of interest. They

also reported that ongoing dedication is the most important determinant of success in any field.

"Ninety per cent of success is effort."

"Talent can help us to skip a step, but it will never take us to the top. We can only make it to the top by working."

When it came to their involvement in extracurricular activities, the pupils at one of the schools responded that they were involved in the following activities in order to have fun, learn and prepare to pass the external matriculation examination: the choir and the geography club followed by the physics, mathematics, informatics, Bosnian/Croatian/Serbian languages and literature and geography clubs.

In another school, the female pupils reported mostly that they were involved in the choir and media, drama, hiking, dance, music and the Serbian and English language clubs. On the other hand, the boys reported their involvement in mathematics, informatics and music clubs.

Lastly, one group of female pupils highlighted their engagement in the choir and the geography, literary and the librarians' clubs; one reported that he was only involved in the geography club.

When it came to their education goals after completion of primary school, the majority of the female pupils expressed their preference for academic secondary schools, secondary schools of dental technology, secondary schools of medicine (physiotherapy as the major course of study); two female pupils expressed their wish to enrol at a secondary school of transport and communications or the police academy, while two pupils reported wanting to enrol at a secondary school of economics and a secondary School of hospitality and tourism (chef as the major course of study) because they believed that they would quickly find a job after completing these schools.

Academic secondary school education (natural sciences and mathematics as the major course of study) was the option of choice for one pupil in answer to the question related to further goals and aspirations in education. The majority of the participants in the focus group research stated that they discussed their education and career goals with their parents and teachers and that they had their support for their choices.

The female pupil who expressed her wish to enrol at a police academy reported that boys often made fun of her because of her decision, ***"They say that is not for me and for girls, that I am stupid for that. They joke with it. That is not a woman's job. The Police Academy or the Secondary School of Transport is not for you. Still, we are in the twenty-first century and I believe that everybody does all jobs."***

The female pupil who expressed her wish to enrol at a secondary school of transport and communications said, ***"Everybody is capable for the job they want to do. I would now enrol on purpose in a secondary school of transport to prove to boys that I can. There shouldn't be any segregation of jobs by gender. Everybody should try to do what they want."***

One of the pupils stressed that what a person wants is what matters when choosing a job, ***"When choosing a job, we shouldn't be prevented by whether we are male or female. What matters is what we want."***

When it came to the choice of occupation, the girls in one of the schools expressed the wish to pursue athletics, veterinary medicine, medicine, chemistry and criminalistics in the future and the boys stated their interest in pursuing mathematics, informatics and medicine. The girls in another school responded to the question on the occupation in which they felt they could be successful by citing doctor, Turkish language teacher, pharmacist and German language teacher, while the boys believed that they would be successful bankers. The girls also believed that women would be more successful as bankers.

"I believe that it is somehow better for women to be bankers because women are somehow more precise and more responsible. Men somehow do everything hastily; women organise themselves better."

The female pupil who answered that she would like to be a pathologist in the future believed that her parents did not have support here choice.

"They do not support me. They said that it was stupid for me to be a pathologist because I am a woman and women are emotional and can't withstand the pressure."

In response to the question on why some people believe that women cannot be successful pathologists, one of the female pupils reported, *"Women were disenfranchised, and they could not do everything that men could do. Maybe this has left an imprint on the present generations, so people still believe nowadays that women can't do something that is predominantly done by a man."*

When it came to those jobs that traditionally are attributed to men, such as miners and shipbuilders, the pupils said that these jobs are more appropriate for men because of biological differences. Some pupils stated that it is not appropriate for men to pursue the following occupations: hygienist, tailor or makeup artist. At the same time, the participants believed that the notions about the suitability of jobs and the characteristics of men and women are acquired over time and that they are the result of the socialisation process.

"...only in the situation of hard physical jobs that women can't withstand simply because of their biology."

"...for example, when a building is constructed. I believe that women shouldn't do that because that is not a woman's job and they are not that strong and fit."

"That is mostly machinery operation. Lack of strength is an issue."

"Nobody will take it seriously when a woman is a police officer, at least in our country. Police officers should be serious and strict, imagine being arrested by a woman."

The views of the participants were divided when it came to their desire to pursue science. Two female pupils reported that they would like to study chemistry or biology in order to help mankind through new discoveries. Boys at one school were not sure whether they would like to pursue science because it is underdeveloped in Bosnia and Herzegovina. Although many pupils believed that more men pursue science, they did not perceive the STEM fields as a domain intended exclusively for men.

"Overall, there are more men in these sciences. Yet I don't see what is preventing a woman from being good at it."

"Maybe men strive more to be good at mathematics, physics and informatics, but I don't see a problem in women pursuing these either."

When it came to balancing private life and career, the participants shared the view that it is hard, especially for women, to balance private and business lives. The pupils stressed that it is harder for women to achieve a balance between these contrasting obligations because they take more care of the family. They agreed that men should also contribute to household chores such as childrearing, but also that women are more adept and more emotionally attached to family.

"It is all relatively easier for men."

"It's harder for women to balance family obligations and career because such are the times we live in. There is a lot of gender-based judgement nowadays. Although the majority of us agree there are no men's and no women's jobs, I believe that others don't think so. I believe that nowadays I could not do any job, because I am a woman. I could apply for a job, but there would for sure be a lot of finger pointing at me. A pathologist, for example ... my parents were the first ones to say that it was not a woman's job. Many more of them think like that for sure."

"It is harder for women. Women are always expected to look perfect, to perform perfectly and to be perfect in everything they do, while men don't have to do that."

Some of the female pupils believed that women should temporarily leave their career when the circumstances required one marital partner to leave their career in order to take care of the children; however, they also believed that such a decision should not be a long-term one.

One of the boys who participated in the research expressed the opposing view. He believed that it is harder for men to balance their career and family life, ***"I believe that it is men who should mainly bring more money home and work more than their partner. I don't believe that anyone expects a woman to work if she is under some kind of stress or if she is ill, while a man is probably expected to get through it or he is thought to be pretending. I believe that this too is an environmental stereotype."***

3.5.2 FOCUS GROUP RESEARCH WITH SECONDARY SCHOOL PUPILS

Table 48. Sample of secondary school pupils

	Male	Female
Third Academic Secondary School in Sarajevo	2	6
Secondary school centre in Foča: Gymnasium	0	8

The female pupils from the gymnasium in Foča said that they enrolled in an academic secondary school mainly because of the general education that it provides. At the same time, they stressed that a major problem in small communities is that they are not able to offer a wide spectrum of educational and career orientations.

"We don't have a really big choice here. We have a secondary school of medicine in which I am personally not interested. I believe that we opted for academic secondary school because of the general knowledge that will benefit us in everything, so we will have more options to choose from later on."

"Academic secondary school provides us with the general knowledge that will help us to choose our faculty."

"Society in a small community is different. Academic secondary school or the secondary school of medicine are attended by better pupils, while lower achieving pupils enrol in other major courses of study, for example, mechanical technician."

"We are not considered smart enough if we don't enrol in an academic secondary school or the secondary school of medicine."

Other pupils cited the general knowledge and wide spectrum of options offered in relation to their further education as the main reasons for enrolling in an academic secondary school. The female participants at one of the schools stated that they were interested the most in the subjects of physics and chemistry because of the practical work involved in and the way the teachers taught these subjects. All of the pupils from one of the schools that participated in the research showed interest in mathematics and programming. They highlighted the fact that in their informatics classes they learned the C++ and Python programming languages.

"Primarily we do a lot of experiments, applying knowledge practically in the right way. We also have teachers who do their job in a quality manner and explain lessons in a very interesting way."

"We no longer follow the old curriculum of teaching the lessons and memorising them. The time has come for something truly new, something innovative. We learn primarily through understanding. Teachers know that we will understand better if something is closer to use, more interesting, funnier. They give us examples and encourage us to think."

The majority of the participants stressed the importance of the teaching method and the teacher's approach in terms of stimulating their interest in a specific field. However, one of the female pupils emphasised that the teacher's approach did not represent a significant determinant in her interest in mathematics.

"I like mathematics and would like to enrol in mathematics as my major course of study: Yet because of the teachers, who explain more poorly and don't give examples, I am losing my desire for the subject that used to be my favourite subject. In primary school, it used to happen that the teacher opened presentations and we copied their contents in our notebooks. There is not any joy in it. There is no fun in the class, the subject simply becomes boring to us and we no longer have any desire to learn it. On the other hand, we get motivation to learn a subject if teachers discuss with us, if they show us in person some things and if we can ask what we want to ask."

"I like mathematics and it has always been interesting to me. Teachers would never bother me so much so that I began to hate it and to no longer like this subject. If the teacher doesn't know how to explain or if the class is monotonous, I will do something more interesting. I will practice by myself or learn online."

In relation to the subjects belonging to the STEM fields, the pupils at one school emphasised that they achieved poorer results in chemistry because of the challenge of adjusting to the teaching and grading styles in secondary school.

"I believe that we all came from primary school where nobody genuinely studied chemistry. We did only theory and then we enrol in secondary school where the teacher asks us to think. This has been a major transition for all of us."

"I don't care about tasks. I am a person who learns theory more poorly and who is better at logical tasks. That is why I prefer physics, mathematics and programming because this is my forte."

The majority of the pupils had no preference in terms of genders when responding to the question of who achieves better performance in STEM subjects; however, the pupils at one school emphasised that girls engage more often in additional mathematics classes.

"There are no rules. It is all up to the person."

"I believe that it is pretty much the same."

"Here is what is interesting, for example, there are always many more girls in additional mathematics classes. The number has never been equal, but overall, as far as the grades are concerned, the performance is pretty much equal."

The participants also believed that girls are more persistent and hardworking than boys.

"Girls are somehow more hardworking because it is OK for boys if they get a D or C, whereas this upsets us more. We study much more."

"I believe that it upsets girls more if something is done poorly. Everything is made easier for boys in a way. Parents pressure boys less and girls more to have good grades, in order for girls to make it in life. Parents raise them to not be dependent on men, to not need someone in life."

"I'd say it is more likely that it is in women's mentality to simply work more. They have more will than we do."

Moreover, one female pupil reported that men were significantly more successful in STEM subjects and science.

"I believe that men are smarter, they learn more quickly. I mean, it all depends from person to person, but men who want to learn master the contents more quickly compared to girls. We need a lot more time to learn something."

The participants offered the following answers to the questions related to their future career orientation.

"I would like to study electrical engineering at university or pursue physics and chemistry."

"I want to invent something new and craft something new, something extraordinary."

"I always wanted to design and make something. It was mainly weaponing or explosives. That is what I was interested in but then I consulted a little with my friends and started growing closer to informatics. I realised that it was pretty interesting to me."

"I would like to be productive. Repairman will repair, while some engineers will merely produce things that are designed already. But I would like to be productive, to create something that will make the performance of jobs easier for those engineers."

"Information technology is great for me. That is why I chose IT as a major course of study, but I still have not decided exactly what I will do later."

"I don't have any goals set. I know pretty much what subjects I wouldn't like. I know I will not enrol in a faculty with subjects such as mathematics, physics or chemistry."

"I would like to pursue acting, but that is not really the best job in our country. One can't make a living doing that so I will probably enrol in the Faculty of Architecture."

"I will enrol in economy. I like mathematics and physics, so I would like to pursue that."

"I plan to enrol at the Faculty of Electrical Engineering, because I like mathematics."

"I perform more poorly in natural sciences and mathematics. That is why I want to pursue law or political sciences."

"I wanted to enrol in journalism. However, the status of journalists in our country is very poor."

The participants said that they discuss their educational goals and career orientation with their parents and teachers and stressed that they receive support from within their environment for their decisions. Some female pupils believed that their parents and teachers would support them even if they chose occupations traditionally attributed to men such as lathe operators or mechanical technicians. The participants offered the following answers in relation to the perceived 'suitability' of occupations based on gender.

"Here in Bosnia and Herzegovina it is impossible for a woman to be a car mechanic. This is prejudice. The only comment you could hear on this is that they 'would ruin something on a car'. The same goes for men if, for example, they were a cleaner or nanny."

"The thing is that a man endures biologically and physically some things more easily. Digging, for example, is more for men and then automatically he can't cook so this is assigned to a woman. I gave this as an example because it is like that. Simply, a long time ago in history, it was distributed in the way that is easier. We can change it, but I believe that there is no point in doing that. People saw through history what would be easier, faster and more efficient. A woman can also be pregnant and at the same time pursue e.g. digging, while a man can do this constantly more efficiently and quickly because he is more superior physically. I believe that there are no 'male' and 'female' jobs. It is only that some jobs suit men more and some others suit women more."

"We already learned that women are more emotional and weaker and that is why we were given some easier jobs to perform. In Bosnia and Herzegovina, if a man does a job that is intended for women or that is easier, he is considered to be a homosexual, effeminate and different."

"In physical jobs, men are more superior and a woman can't compete with them. But as far as jobs that require thinking are concerned, that is up to one's will and effort."

"If I were interested in a physical job, I would make an effort to be the best at it."

"When one makes an effort there is nothing that they won't succeed in. Sometimes gender can be an obstacle due to the prejudices that we must do away with like when I made something in my yard. The toolbox was there, and my neighbour told me 'grab your notebook'."

"If I want something, I will do it."

"I believe that men are more for craftsmen occupations. But, let's say, being a hairdresser is a craft but women are for sure better there than men."

"There are men too who pursue cooking professionally, but for women it is more of a habit to pursue it at home."

"I believe that men can do all jobs that women do, but that women can't do all jobs that are pursued by men such as a car mechanic."

"Women don't identify themselves with physical jobs. When we enrolled in secondary school, girls who previously didn't have good performance had to enrol in that major course of study. I believe that after secondary school they don't have much of an opportunity."

When it came to programming, all of the participants agreed that both men and women can be equally successful in this field. Likewise, they believed that men and women have an equal chance of success in the fields that they wish to pursue. The participants stressed that grades in this subject are very important to them and that nowadays science is very important to us all even though some pupils may not want to pursue science in the future.

"It is easier for all of us to study what is already given. Rarely anyone will choose to invent something new."

"That is a hard job."

"Everything takes will and effort and many are too lazy to pursue this."

In response to the question related to the determinants of success in their chosen field, the pupils stressed effort and talent as the main factors of success.

"Everything depends on effort and work and how much we want to succeed at something."

"I believe that both men and women have equal intellectual abilities ... or we are at least trying to be equal."

"I believe that we can't achieve the highest goals if we don't have the ability, talent, no matter how much we practice."

"Talent is required, which is increasingly developed through effort."

"You must at least have some knack for mathematics or physics, but a lot can be achieved through practice."

The views of the participants differed when it came to the question of who can more easily balance the obligations of family and career. Many participants expressed either a neutral position or the view that the distribution of household chores should also depend on the nature of the jobs pursued by the partners and the amount of time that they spend at work. A scenario was given to pupils wherein one marital partner had to give up their career temporarily in order to take care of the family. In this regard, the female pupils were asked to specify for whom such a choice would be more appropriate. Yet although their answers indicate that the girls had a stronger attachment to family not a single one of the female participants in the research believed that giving up a career should be a long-term measure.

"I can say, based on my own example, that the mother is the one who works and takes care of the family. When the father comes back home from work, he sleeps or watches TV. The mother prepares lunch and completes other obligations in the house. She is somehow more attached to family."

"Teachers are often done with their workday earlier, while engineers and architects must also work night shift."

"Women are somehow the head of the family. Men are not that involved in the bringing up the children. Women are more involved and so it is harder for them to balance their job and family obligations."

"We need to dedicate ourselves to our children during the period of their growing up. They will grow up anyway and we should dedicate ourselves later on to our career."

"I believe that our life is not fulfilled if we don't have family."

"We have to think about the future of our children and family by thinking about our career."

"Probably every mother would like to spend time only with her children. One should think about this on time. If a man has the means, then a family can be started."

"A mother should be with her children because children are attached more to their mother."

3.5.3 FOCUS GROUP RESEARCH WITH STUDENTS

Table 49. Sample of students at the Faculty of Electrical Engineering of Sarajevo University

	Male	Female
Faculty of Electrical Engineering students	2	3

Five students from the Department for Automatic Control and Electronics, of whom three were female and two males, joined the focus group research.

The female students reported that they had always been interested in creative work and discovering something new. One of them specified her goals in the domain that she pursues.

"I am interested in bioengineering. Even as a small child, I thought about the devices that reduce pain and I wanted to research the heart. My goal is to help people through science and to make their life easier. If there is already an artificial kidney then it is for sure possible to design an artificial heart too."

The students reported that their parents had always encouraged them in their desires and had recognised their potential as early as in their childhood.

"My father is an engineer. I was raised with that job of his and such movies."

"My interest in engineering developed when I disassembled my first toy car. I made new things out of it and I disassembled and reassembled all sorts of things. My parents supported me in these activities."

"I disassembled and reassembled all my toys together with my dad. He always encouraged me in this, even though he is a novelist."

"I didn't show any interest in science to my parents. I pursued music and realised that they would support me in anything. When I chose this faculty, they allowed me right away to take extra tutoring."

"I always practiced mathematics with my dad. He bought me new compendiums, while my mom encouraged me to be creative. We talked a lot and she encouraged me and told me that only the sky is the limit. They never let me think that I couldn't do something."

"I always had financial support from my parents, allowing me to study in a different city."

Most of the students reported that they had always had maximum support from their teachers and lecturers in their educational efforts. The only exception was a male student who described his experiences at primary school where a teacher had told him that he would not be successful in life. When he was at secondary school originally, they would not allow him to enrol in mathematics as his major course of study.

"When I told her that I wanted to enrol at the Faculty of Electrical Engineering my secondary school teacher provided me with maximum support."

"I wasn't a really good pupil at secondary school. I wanted mathematics as my major course of study but I had to transfer to liberal arts because of a poor average grade. They rejected my application to study mathematics as my major course of study. However, the psychologist supported me and I finally enrolled in the major course of study that I wanted."

"Teachers supported me when I decided to enrol at the Faculty of Electrical Engineering. They always gave me additional literature to work on."

The general impression among the female students was that they had never encountered any form of discrimination because of their striving to engage in a male dominated field. However, they believed that overall women are discriminated against because of patriarchal values in society wherein women are expected to deal with the household rather than pursue an education and/or career in science. They agreed that there are prejudices that have to be overcome.

All of the students believed that women and men can be equally successfully in pursuing scientific work and that gender does not affect their ability in terms of programming. They reported that we should respect the differences between people and use them properly to improve society.

The majority of students wanted to pursue scientific work and publish scientific papers. The only major exception was one female student who believed that she was not able to research something new because she was not innovative and therefore preferred to pursue work of a more practical nature.

3.5.4 FOCUS GROUP RESEARCH WITH PRIMARY SCHOOL TEACHERS

Table 50. Sample of primary school teachers

	Male	Female
Vrhbosna Primary School in Sarajevo	1	7
Sveti Sava Primary School in Foča	3	4
Mustafa Ejubović-Šejh Jujo Primary School in Mostar	1	7

The subjects taught by the teachers at the abovementioned schools included mathematics, physics, biology, chemistry, technical culture, informatics, Bosnian/Croatian/Serbian languages, literature and art. Two female homeroom teachers and one female social worker also participated in the focus group research.

The majority of the participants were of the opinion that pupils who achieve good results had the most interest in the subjects that they taught. The teachers also noticed generational differences in regard to the level of interest in their subjects. The teachers at one school did not believe that socioeconomic status plays an important role in determining the level of performance in their subjects. In support of their assumption, they gave examples of children who achieved excellent school achievement irrespective of their unfavourable environmental factors. Yet teachers from other schools reported that children coming from families of low socioeconomic status had poorer school achievement, which they attributed to the insufficient level of support provided by parents and/or insufficient interest among these children in their school performance.

"We are frustrated. You know that a child has a talent for something, yet that talent is wasted because the child does not have the basic support at home."

The majority of the participant teachers at one of the schools reported that they had not noticed any differences in the level of interest in the subjects taught by them with regard to gender and highlighted the fact that overall children do not show sufficient interest in these subjects.

According to the opinion of the teachers from this school, there is an increasing lack of interest in pupils in relation to creative work and that this is reflected in their diminished interest in participating in extracurricular activities.

In this regard, the general impression of two informatics teachers was that boys were more interested in participating in extracurricular informatics and robotics clubs than the girls. They reported that female pupils have the opportunity to engage in extracurricular clubs in the STEM subjects but do not show much interest. One of the teachers attributed the reduced interest among girls in pursuing informatics to traditional beliefs that encourage women not to engage in this field.

The teachers at another school believed that girls are more inclined to do their work on their own compared to boys. Yet the teachers at other schools that participated in the research did not share this view. They reported that gender differences do not condition interest in research work and that in general children do not like additional work that they have to do on their own and show only limited interest in conducting research.

Moreover, the informatics and technical education teacher at one of the schools noted that informatics is considerably more interesting to children because of the ubiquity of multimedia and information technology. This teacher also believed that girls show more interest in text processing, while boys show more interest in programming. The teacher attributed these differences in the individual fields within informatics to the expectations of pupils in relation to the characteristics of the working environment, including IT literacy, and greater awareness of programming as a profitable profession among the boys. The teacher also reported that the girls showed greater interest in operating the 'lendskype' application, which involves design and drawing.

One of the mathematics teachers reported that the boys predominantly showed a higher level of interest in mathematics, especially in the fields of analytics and geometry, while the girls sometimes showed greater interest in arithmetic compared to the boys. One of the teachers stressed that girls show greater affinity toward creative work and pay more attention to aesthetic editing of texts and art projects.

Lastly, the technical education, biology and chemistry teachers believed that boys and girls are equally interested in these subjects. They said that they often discussed career orientation with their pupils and based their recommendations on further education on the knowledge, work and affinities of each child. These teachers address the issue of professional orientation during class meetings.

Teachers from the Sveti Sava Primary School in Foča highlighted the limited choice of courses of study and occupations as a major problem in Foča. The teachers consistently stressed the importance of raising awareness among children about market demands.

When it came to the 'suitability' of occupations in relation to gender, the teachers' views differed. According to the opinion of one of the teachers, the segregation of occupations according to gender is absurd and that it is society that perpetuates the existence of such differences.

"We are all able to do all jobs."

Some of the teachers said that occupations such as mechanics and welders are more appropriate for men and that working in education is more appropriate for women.

"...imagine a woman welder or mechanic."

"I would say that education is more appropriate for womenfolk. Women prefer to have more obligations toward their children, toward the kitchen, toward the plate. Men will communicate more by far in coffeehouses with a colleague unlike womenfolk who will be more attached to home, family and children."

When it came to technical sciences, one of the male teachers was of the opinion that the work of an architect that is conducted mainly in an office and exclusively as intellectual work is more appropriate for women whereas the occupation of civil engineer that potentially requires heavy duty physical labour is more appropriate for men. The viewpoint of one of the other teachers who highlighted biological factors as a determinant of the successful performance of highly accountable jobs such as a surgeon or pilot was interesting.

"One should consider the female brain when it comes to any accountable occupation. We all know that women have menstrual cycles and that it is not simple at all for them. Imagine ... you will rarely see anywhere a woman surgeon or pilot. Do you know how the national volleyball team of China won a gold medal? They timed it so that their menstrual cycles were at the same time ... meaning a little bit of hormone therapy. They timed it so that their match for the medal was when they were in PMS because they were more energised."

Some of the teachers expressed the contrary belief that both men and women can pursue all jobs, but with the proviso that the performance of activities within individual occupations might depend on gender. Some of the teachers emphasised that the segregation of occupations according to gender is socially conditioned and absurd and that when choosing a career, children should refer to their affinities.

Lastly, one of the teachers believed that men and women do not have an equal chance of success in all fields. The teacher gave the example of a female electrical engineer, stressing the fact that she would have to invest significantly more effort to prove her competence in the field to her employers.

"There was always talk ... how did you end up at the Faculty of Electrical Engineering, what are you doing here."

The majority of the teachers believed that it is harder for women to balance career and family obligations because they take more care of family and have more household obligations. According to the opinion of the teachers, such a distribution of roles is conditioned culturally and by tradition.

"There are always drawings of mother cooking, father hammering in the children's textbooks."

The teachers were aware of the existence of social expectations related to a woman's role in the family. They also described several examples from their private life where men readily took on roles traditionally attributed to women such as taking care of a newborn or taking sick leave in the case of an injured child.

However, the majority of them believed that women, because of their sensitivity and attachment to community, continue to pay more attention to family and household obligations regardless of gender equality. At the same time, they reported that it is more appropriate for a woman to leave her career temporarily should circumstances compel one family member to give up their career in order to take care of the family.

3.5.5 FOCUS GROUP RESEARCH WITH SECONDARY SCHOOL TEACHERS

Table 51. Sample of secondary school teachers

	Male	Female
Third Academic Secondary School in Sarajevo	0	8
Secondary School Centre in Foča	1	6

The female teacher participants at the Third Academic Secondary School in Sarajevo taught the following subjects: sport and physical education, mathematics, informatics, programming, English language, physics, biology, and religious education. The subjects taught by the teachers from the Secondary School Centre in Foča included practical classes, chemistry, physical education, Serbian language and literature, technical group of subjects in the field of medicine (anatomy, physiology, pathology, surgery, infectiology and paediatrics).

The views of the teaching staff differed in relation to the influence that socioeconomic status has on school achievement. They offered examples of successful pupils that came from families of a low socioeconomic status but overall the majority believed that children of poorer socioeconomic status and children of divorced parents achieved less because of their decreased concentration, tendency toward irritability and undermined family situation.

The general impression among female teachers at one of the schools was that they had not witnessed and did not promote gender differences in relation to school achievement and career choice; however, they were aware that society, parents and some teaching staff often do so.

All of the teachers reported that overall pupils were interested in the subjects taught by them. They believed that the reason for this lay primarily in the fact that children who enrol in an academic secondary school do so because they are interested in the subjects at this type of school and choose their major course of study based on their interests and the fact that they believe that the knowledge they will gain will be useful to them.

Some of the major courses of study, such as mathematics and informatics, are currently popular because they qualify pupils for popular and highly paid occupations. Accordingly, pupils are also motivated and interested to take these subjects as their major course of study. According to the teachers, the factors that make children interested in a subject are primarily the **relevance of what is studied in a particular subject in relation** to their

future employability followed by their personal **preferences,** the t**eacher's method of work** and how much the teacher **motivates pupils** to learn and **makes the subject interesting.**

The female participants believed that there were no differences between boys and girls in terms of their level of interest in individual subjects or extracurricular activities. They were also of the opinion that no differences exist between these two groups of pupils when it comes to their choice of course of study. They reported that there were more girls than boys in some classes, such as mathematics and informatics, and that compared to the boys some girls had better performance.

In this regard and according to the experiences of the teachers, children with an affinity to a subject who invest more effort in activities in that subject achieve better results. They did not believe that gender is relevant to achieving success in any subject, regardless of the fact that girls sometimes achieve better results in a subject at which boys should perhaps be expected to be better.

Yet some participants held the opposite opinion reporting that gender differences can determine achievement or interest in specific subjects. One example was a participant of the focus group research who reported that it is normal for fewer girls to enrol in a mechanical vocation and that those girls that do enrol in this course of study mainly do so because they have no other choice. One of the female teachers stressed that it is all too evident why girls do not choose the third level of technical vocation by citing the physically demanding nature of the job. Although she believed that gender equality is important and that children should be qualified to pursue the kind of jobs they want, she stated that this is not always possible in practice because in this part of the world there is clear segregation of occupations according to gender. Their opinions were conflicting when it came to engineering and programming.

It was the opinion of the teaching staff that different factors influence whether a child will achieve good results in a subject, but they did not consider the pupil's gender by itself to be one of these factors. They considered the internal motivation of a pupil and his/her level of interest in a subject to be the main factors influencing whether the child would achieve better performance in a given subject. As previously mentioned, they also considered the perception of employability to be a very important factor in motivating children to achieve better results. They also believed that the environment from which the child comes is important because parents who are engineers will probably encourage their children to pursue a similar occupation.

The teachers reported that the perception of employability has an increasingly stronger impact on pupil's preferences in relation to their choice of subject and occupation and that this factor has an even greater impact on pupils than that of their parents. They reported that an increasingly larger number of young people want to become programmers because it is an attractive occupation, is interesting to children and offers an easy route to finding a highly paid job.

Through their work with the pupils on their subjects and through the projects in which the school participates two female teachers realised that pupils are very interested in science and research work. They reported that the level of interest was high amongst both boys and girls and that no gender group stands out in that regard.

The teaching staff reported that they discuss educational goals and career options with their pupils. They said that sometimes this is because the pupils or parents ask them for their opinion and sometimes because the teachers want to offer advice based on their insight into how good a pupil is at a given subject.

Some female teachers stressed that they always advise pupils to choose a career related to what they like and that it is very important for them to study or do what they like, regardless of considerations such as money, the prospects of an occupation or the pupil's abilities in that regard.

On the other hand, some participants give their recommendations based on their assessment of the capabilities of pupils based on their work with them. If through their work with a pupil they assess that he/she is good in a particular field then they recommend that the child continue to pursue their aim, but if they believe the child is not good at a particular subject then they advise him/her not to pursue an occupation closely related to that subject.

The teachers at the Secondary School Centre in Foča highlighted the issue of reduced opportunities to choose an occupation in small communities.

"Someone might want to be a beautician or pursue a completely different occupation, but in a community such as ours the school does not make it possible. The school offers only a specific number of occupations and so some of the pupils enrol in a specific major course of study not because they want it but because they have to."

Based on the aforesaid, we can say that teachers try to support pupils in their choice of occupation. The exception was a female teacher at one of the schools who stressed that she would not encourage female pupils to pursue an occupation that required the use of physical force.

As far as the role of the teachers in terms of advising pupils on their career choice was concerned, they believed that this role is important but can be an unwelcome one. This is because the advice provided by teachers is not the only one that is considered. Children often choose an occupation based on the advice they receive from their parents or what their parents tell them to pursue. According to teachers, rarely it is based on the pupils' true interests and wishes. As one of the teachers puts it, that is why the children themselves often "struggle with their desires and their parents' desires."

Pupils often choose occupations that are in demand or well paid, but their educational course of study and choice of occupation largely depend on their ability and interests. Yet people who are important to pupils, such as parents and teachers, can have a great influence on their choice of education and career.

If a parent or teacher tells them that a particular occupation is not the right choice for them, this can have a major impact on their future.

"Even though it is wrong, you still have people who will advise their son not to work as a midwife in a hospital because that is a job for women. This is something that is implanted in us at the unconscious level."

"Many teachers or parents advise their daughters to choose female occupations because they are easier and less taxing for women. It is better to, for example, be a teacher because working hours are shorter and they manage to dedicate themselves to their family too."

Overall, the teachers were of the view that the majority of occupations are appropriate for both girls and for boys. Yet one group of female teachers believed that there are examples of occupations where it is more appropriate for men to work, although they did not rule out the possibility that women could be equally successful in these occupations. They gave the occupation of mining as an example. They believed that it is more appropriate for men to be miners because they are physically stronger, even though physically strong women can also be good miners.

According to the views of the teachers, the obligations of private life can be balanced with those of a successful career; however, they emphasised that this is very often harder for women and that it is especially harder for women with children. The teachers believed that women now have the double obligation of being successful in their career, which they saw as a new imperative imposed on women, and taking care of their family, which remains an obligation that most often women shoulder alone.

The teachers believed that women managed these dual obligations by investing much more time and effort compared to men. They also believed that even without taking the obligations of private life into consideration it is still much easier for a man to build a career than for a woman. They thought that women can be very good experts in a field, but that the business world continues to favour men more. They not only thought that the prejudices that favour men as having more developed abilities existed among businessmen but also among women. The teachers gave examples of situations where women were prevented from advancing in their careers by the need and expectation that they should first take care of their family.

"A woman always has to make more effort than a man to prove that she can and knows how to do things. When a woman has done something well, it is implied that this is normal, and nobody makes any noise about it. When a man does something well, everybody applauds him, and they are fascinated by it."

"Women themselves favour men more than women. This is something that has been implanted in us since our childhood."

"Men are in a better position right from the start. They have no obligation to take care of the family and therefore they are better rested and more able to be good at their job. Women still don't have that option. In some companies there is a practice to first make women redundant and only then men, especially if the woman has taken sick leave to take care of her children."

Small advances in doing away with prejudice in relation to the business success of men and women have been made but not to any major extent. The participants in this focus group believed that a lot of work still has to be done in this respect. They commented that prejudices are being confronted and changing more quickly around the world and that this has led to men becoming more involved in taking care of the family.

3.5.6 FOCUS GROUP RESEARCH WITH FACULTY LECTURERS

Two female professors and one male professor from the Faculty of Philosophy in Pale participated in the focus group research: Department for Psychology and Department for English Language and Literature.

When it came to the representation of male/female students in these departments, the participants reported that there was a higher number of female students in the Department for Psychology but that the representation in the Department for English Language and Literature was equal. The respondents noted that the Department for History comprised mainly of male students, while female students most often studied sociology or political sciences.

The reported disparity in the representation of men and women in the Department for Psychology could be a product of stereotypical beliefs related to expectations regarding men and women and therefore an example of the culturally based stereotypical segregation of occupations within the territory of Bosnia and Herzegovina. Yet the participants reported that overall students showed interest in the field they study and that there were no noticeable gender differences in their interests. The lecturers stressed that the level of interest depends on the students' personal affinities, experiences and perceptions of the usefulness of the subject matter in relation to their daily life and that gender is not a determinant of the existing differences.

According to the lecturers, there were no noticeable differences related to gender with regard to performance at the faculty and that it was the level of interest, motivation, desire to know, invested effort, cognitive abilities, work habits and critical thought processes that were the determinants of success.

When it came to choosing occupations, the lecturers reported that the way in which one is raised along with generally accepted beliefs can potentially influence preferences among men and women in relation to their choice of occupation. The respondents agreed that the preconception that it is not appropriate for women to pursue careers in engineering were present along with the preconceptions that occupations such as childcare workers and obstetricians are inappropriate careers for men. According to the lecturers, the choice of occupation should depend on the persons' interests and abilities. The respondents stressed that both male and female students should not be steered by the confines of their upbringing or their prior education toward those occupations that society characterises as 'appropriate' for a specific gender.

They also stressed that it is far harder in the context of Bosnia and Herzegovina for women to balance their private and business lives because of the social and cultural expectations. The beliefs and expectations that require a woman to perform household chores successfully at the same time expect a man to be the one who secures the financial resources for the family. They believe that people internalise these social beliefs and that women feel less worthy if they do not perform the role of housewife successfully. Similarly, men feel insecure and useless if they do not have a job that allows them to provide financially for their family.

3.5.7 FOCUS GROUP RESEARCH WITH FEMALE IT SECTOR EMPLOYEES AND FEMALE FIT STUDENTS

Table 52. Sample of women employed in the IT sector and female students at the faculty of information technology

	Male	Female
Female IT sector employees	0	6
Female FIT student	0	1

The participants in this focus group research pursued the following occupations: full stack developer, data engineer, software engineer, bioinformatician, data analyst and strategic partner executive. The reason for choosing these professions and studying at the Faculty of Information Technology were interest in mathematics, physics, logical tasks, problem solving, the demand for this occupation in the labour market and opportunities for professional growth and development afforded by within the IT sector.

"I have always wanted to pursue mathematics. Considering that the IT sector is a field with good prospects, I redirected my love of mathematics to a broader field of its application in the field of automatic control and the IT sector."

"There were no mathematical tasks that I didn't like to solve."

"My love of mathematics was the primary motivator. I had doubts about whether I should study at the Faculty of Natural Sciences and Mathematics or at the Faculty of Electrical Engineering. To strike a compromise between my love of mathematics and supply in the labour market, I opted for engineering. Because of my love of mathematics, I identified with the data science branch. It was completely natural to me because I combined my interest in IT and algorithmic problem solving."

"I chose this occupation because I recognised the positive impact of technology on society and day-to-day life."
"I have always been someone who likes to solve problems so my enrolment in the Faculty of Electrical Engineering was a logical sequence. I wanted to contribute to my environment through task solving and system and application design."

The participants reported that their parents and persons close to them had always supported their choices. One participant provided an example where her parents had steered her to pursue a lectureship in the IT field, believing that it was an easier job to pursue.

"I am grateful to my parents for being where I am, because when I was a small child and when I practiced mathematics my mom was the one who worked with me. If parents are willing to help their child, then anything can be achieved."

"Mom was sceptical sometimes. She said that I would always work on my laptop, destroying my eyesight. That is why she proposed that I be a teacher, because women maybe enjoy working with children more. Parents always encourage us to pursue something that is safer."

The majority of the participants stressed the lack of encouragement and empowerment in this field among the primary and secondary education teaching staff, which they attributed primarily to the poor quality of the education system, outdated teaching methods and insufficient training of teaching staff in new trends in the fields they teach. This relates to insufficient support for teachers to pursue this field and the deficiencies in the education system but not to discrimination with regard to gender.

"It is not about whether they want to or don't want to or whether they should support pupils or not. Sometimes the lack of support is a result of the teachers themselves not being engaged in their job. Education for him/her ended, for example, some 15 years ago, so when a child asks for something more about mBot everything stops there. It is sometimes for that reason that the young crew in schools does not get the additional encouragement it needs."

"Somehow I believe that is and was brave to enrol in the Faculty of Electrical Engineering. In school, in informatics classes, we covered the basics, something that 6-year old children know nowadays. We could have learned much more in secondary school had the education system been better."

"Education in Bosnia and Herzegovina requires a lot of investment. The lack of support reflects the fact that they themselves don't know much about this field. My male colleagues didn't have proper support either."

Other participants highlighted positive examples where they had received support from the teaching staff in the form of encouragement to participate in competitions in mathematics, informatics or physics.

The experiences of the female participants with regard to their acceptance by their male colleagues at faculty varied. They cited individual negative comments that they encountered during their transitory phase but stated that such comments had no effect on their commitment to persevere in their chosen field.

"Sometimes there were comments from boys: 'What are you as a woman doing in this, you are not the right fit for a developer'."

"When, for example, a girl doesn't know something at the faculty that is much worse than when a male colleague doesn't know it. I remember enrolling in my first practical class in the second year of faculty when a couple of them (male students) asked me what I was doing in that practical class, because I was the first one in our generation who had decided to engage in that practical class and to learning something more. They said that I must be there to 'print something out' or that I was 'taking coffees to colleagues in the office'. That was humiliating. Peers can sometimes be vitriolic and make inappropriate comments. Maybe it is jealousy. It is as though they minded if women are better in something, more active and if they want to learn something more."

One of the participants highlighted her exposure to major misunderstanding by her female peers in education.

"I would rather say that male colleagues always showed understanding, unlike female peers who said that I couldn't do this; maybe out of their jealousy."

In relation to their experiences in the business environment, one of the participants believed that women sometimes have to make more effort to gain the trust of their male colleagues. The respondents emphasised that older generations appear to be more prejudiced compared to newer generations. One of the participants reported encountering examples in practice of clients that were surprised because of the approach adopted by her as a woman in the business sector in terms of her assertiveness and leadership during meetings.

Yet the participants believed that such forms of discrimination are not common and that the examples of collegiality are more numerous at the faculty as well as later at the workplace. They stressed that the companies in which they were employed fostered a culture of gender equality.

The participants reported that when applying for a job in the IT sector the tasks given to them as part of the application process were returned to them after the interview. Performance on these tasks is critical in the selection of candidates and therefore the selection process is based on the quality of work of candidates. They were unsure whether discrimination was present with regard to gender during the CV review phase.

"Male colleagues have always been a support to me. In the generation, four of us (three guys and I) always studied and worked together. We were there for each other."

"I was always told that they couldn't imagine me in any other field except this field."

"I don't remember ever being exposed to misunderstanding or prejudices because I am a girl."

"If I were 18 now and were enrolling in the faculty again, I would do it all over again. I had a beautiful experience. I always studied with my colleagues and we worked together on projects. The environment that you study and work in should be positive because only then can you give your maximum."

"During my studies and also now at the workplace, we are always guided by the mutuality principle. In my opinion, some of those small negative comments didn't dissuade my desire to pursue what I want because I am committed to it. Also, at work I didn't have a feeling that I have to justify myself to someone or that I had to gain someone's trust. I saw this with others too. When a new employee comes, I often monitor acceptance process for new members, and I have never seen gender based difference in this respect."

"It is important in the IT sector to know how to manage projects, skills are important not gender. Although it is possible that prejudices exist, even though we don't have many personal experiences with them. My parents, for example, are mechanical engineers. Mom often got comments that it was not a good fit for a woman to pursue mechanical engineering."

One of the participants described an experience where she experienced positive discrimination, because the human resources management was delighted because a woman had decided to pursue a career in engineering.

"Gender shouldn't have any role in the job, especially it shouldn't be the main reason why I got the call for the job. My qualities have nothing to do with me being a woman. I am not worth any more or less because of it."

When it came to the qualities that are required for successful performance of jobs in the STEM fields, all of the participants stressed the focus on goals, perseverance, self-sacrifice, accountability, consistent learning, the desire to advance and teamwork.

"Success means longevity. If you last, it means that you give more, that you are committed and engaged in your job, that you are giving 120 per cent irrespective of the field concerned."

Lastly, the female participants stressed that the influence of the traditional notion of the roles of women and men are outdated and should no longer apply. They believed that this is particularly important within the context of the family. They reported that their marital partners participated jointly in family obligations and that understanding and mutual support are very important factors in achieving a successful balance between the obligations of family and career.

4

OVERVIEW OF THE RESULTS AND RECOMMENDATIONS

The research results show that the female primary and secondary school pupils had greater interest and a more positive general attitude toward the subjects of natural science, while the male pupils showed more interest in the subject of informatics. Since the results suggest that the female pupils have less interest in the subject of informatics, intervention strategies should include efforts aimed at stimulating female pupils to pursue this field. According to the theory of interest, interest represents the result of the valuation of the content of a subject and a positive emotional experience (Krapp, 2004). In this regard, female pupils should be provided with the opportunity to gain a positive emotional experience in relation to computer science through the organisation of workshops accompanied by diverse content. Psychological literature contains three conditions that fall within the function of motivation strengthening. The three conditions are based on the theory of self-determination: promote social involvement, competency and autonomy. Other conditions that are relevant to motivation strengthening include the relevance of the content of the informatics material that female pupils would study during workshops, their interest in the material and the quality of teaching.

Since everyone has a need for effective action wherein a person is considered competent if their action results in the achievement of the desired goal, female pupils should be provided with an opportunity to experience this sense of competence in the field of computer science. The sense of competence is linked to positive feelings that stem from the performance of a given task and represent a type of reward for the performed activity.

The main prerequisite for the experience of competence for the female pupils would be achievement of the optimal level of difficulty of the tasks performed by them within the educational workshops and positive feedback on their work, which ultimately would have a positive impact on their experience of autonomy. Emphasis should be on setting the optimal level of difficulty of the tasks. This is because research has shown that pupils stay longer on those tasks that are at least one notch above their level when choosing the tasks freely.

Tasks with a medium level of difficulty are accompanied by positive emotional reactions whereas tasks that are too easy are not perceived as a challenge, while the performance of tasks that are too difficult can potentially result in frustration. Moreover, people have an innate need for autonomous action. Accordingly, female pupils should be given the option to choose the steps when working on a thematic unit or performing tasks.

During the informatics workshops, for example, female pupils should be encouraged to solve problems on their own. The workshops should also include teamwork on a mini project. Female pupils should perceive the content of the workshops as relevant, where the relevance of the content relates to its usefulness with respect to the application of acquired knowledge and skills in different situations.

Finally, the workshop moderator can stimulate interest in the content of the workshops through an enthusiastic approach. Research shows that enthusiastic and engaging teaching has a positive impact on the development of intrinsic motivation in pupils (Nježić, 2017).

The overview below shows the steps to consider when designing educational informatics workshops.

1. The content should be relevant to female pupils.
2. Before designing the content of the educational workshops, test the female pupils in informatics in order to gain an insight into their knowledge.
3. The tasks should be of medium difficulty and adjusted to the age and knowledge of the participants.
4. Provide positive feedback on the work done.
5. Strengthen the collaborative atmosphere.
6. Provide examples of successful female peers in the field of informatics.
7. Stimulate autonomy.

Given that a lack of interest in a specific field can be the result of a low level of perceived self-efficacy, intervention programmes aimed at increasing self-efficacy should refer to all four sources of self-efficacy: personal experience, vicarious experience, social persuasion and the emotional state. Intervention strategies in the context of personal experience should adjust tasks and activities to the abilities of the pupil so that the tasks are challenging but not excessively difficult.

Social persuasion relates to the provision of positive feedback and encouragement and therefore female pupils should be encouraged to interpret their experiences in a manner that increases their self-efficacy. Moreover, teaching techniques that can allow them to cope better with stress (such as visualisation exercises and breathing techniques and relaxation techniques) and time management techniques to female pupils would have a positive effect on their perception of their self-efficacy. Likewise, a positive effect on self-efficacy is also achieved through exposure to female IT role models (Rittmayer, Beier and Houston, 2009).

Moreover, female primary school pupils had a higher level of interest in mathematics compared to female secondary school pupils. Yet it is noteworthy that positive general attitudes toward natural science subjects were highest amongst the first grade of secondary school. Both primary and secondary school male pupils had more pronounced self-concept within the subject of informatics, while the self-concept in natural science subjects was more pronounced in the female pupils in both primary and secondary schools.

Considering the obtained results, we propose the design of intervention programmes to promote the self-concept in informatics among female pupils. Here we rely on the theory of constructionism, which focuses on the knowledge gained by children when designing and building things, performing activities (learning about how to learn, how to think, how to learn from mistakes made in a design, etc.).

We refer to the concept of videogame-based learning and the concept that video games allow authentic adoption of knowledge by giving children an opportunity to personalise avatars and the videogame environment. Studies have shown that personalisation and contextualisation have an impact on intrinsic motivation and learning outcomes.

Similarly, trainees in a study programme performed graphic design functions in a computer simulated design studio. The study's results show that these activities had a positive impact in terms of the enhancement of self-confidence, with the trainees reporting that the acquired skills were also applicable to their day-to-day life (Plass and associates, 2007). Accordingly, it is possible to organise workshops through which female pupils could adopt programming concepts by designing simpler computer games in cooperation with IT sector experts and programme avatars at their own discretion.

The male primary school pupils valued informatics tasks more compared to the female pupils, while the female pupils valued natural sciences tasks more. The expectancy of success in STEM subjects was equal for the female pupils and the male pupils; the only exceptions were biology and chemistry. On the other hand, the female secondary school pupils valued mathematical tasks more compared to the male pupils. There was also a significant increase in the valuation of mathematical tasks in relation to the function of the class among the female pupils and a corresponding decrease among the male pupils.

On the other hand, the male pupils valued informatics tasks more. However, an increase in the valuation of informatics tasks was evident among the female pupils in relation to the function of the class: no difference was found between the female and male pupils of the fourth grade.

The female secondary school pupils expected higher performance in natural science subjects whereas the male pupils expected higher performance in informatics. Providing positive experiences in a field can lead to an increase in the valuation of a specific activity.

The male primary school pupils showed more interest in individual STEM occupations compared to the female pupils. The boys were more interested in the occupations of programmer and engineer, while the girls were more interested in the occupations of doctor, psychologist and journalist. The research results show that the boys were more interested in the activities that entailed the creation of computer applications and that the female pupils were more interested in finding a new cure.

When it came to the male secondary school pupils, it was found that the level of interest among fourth grade male pupils in some of the jobs within the STEM fields was lower compared to the first grade pupils, while this ratio was reversed for the female pupils. The same set of the results was determined for the assertion according to which jobs in the STEM fields 'offer good money'. Moreover, compared to the fourth-grade male pupils' lower values were determined for the first-grade male pupils in relation to the assertion that jobs in the STEM fields are 'boring'. The fourth-grade female pupils considered STEM jobs to be less boring compared to the first-grade female pupils.

An interesting finding is that compared to the first-grade female pupils the fourth-grade female pupils believed that family life is neglected to a lesser extent in relation to jobs in the STEM fields, while a reversed set of results was determined for the male pupils. Preferences for specific activities relevant to the STEM occupations were equal with the exception of the assertions relating to the activity 'finding a new cure' (a higher average result for the female pupils) and the creation of computer applications (where the male pupils achieved a higher average result) as was the case with the primary school pupils. The female secondary school pupils assessed that they would be more successful in jobs as scientists compared to the assessment made by the male pupils, while the male pupils assessed that they would be more successful in the jobs that required programming skills and knowledge.

The results of the survey on perceptions related to gender differences in the STEM fields indicated the presence of stereotypes. Yet it should be kept in mind that more than 50 per cent of the primary school pupils and around 40 per cent of the secondary school believed that it is more appropriate for men to have a developed career than for women. Moreover, both primary school and secondary school pupils, irrespective of their gender, believed that men are better in the fields of technology, engineering and informatics. A similar set of results was also determined for the students.

Namely, the students, irrespective of their gender and field, believed that men are better in these fields, even in mathematics, and that women are better at humanities and natural sciences. Moreover, the students were more convinced that science is a better career choice for men than for women and that women cannot be as successful in engineering.

Accordingly, workshops should be organised to raise awareness among pupils and students with regard to the stereotypes related to the 'suitability' of occupations according to gender. Additionally, the 'jigsaw classroom' method should be applied in order to reduce stereotypical beliefs. The jigsaw classroom primarily represents a classroom work technique designed to reduce prejudice and raise self-confidence. Workshops based on this technique should be adjusted to the age of the pupils. The example of a classroom based on this method described below is based on the sample of male and female primary and secondary school pupils.

The technique entails breaking the pupils up into several groups, where each group should include both boys and girls. Each member of the group is assigned a lesson from the thematic unit and finally the pupils have to solve a task or implement a mini project together. To do this successfully, information from all of the previously assigned lessons or material is required. In this regard, every member of the group has to prepare their part of the material and to teach the material to the others who have no access to it. Accordingly, the members of the group work jointly to master and to present the material and mutually cooperate to achieve the goal and this promotes a sense of belonging.

If the task is, for instance, in the field of informatics then the application of this technique potentially results in reduced prejudice that girls are not good enough at informatics. This is because, based on the completed task and their teaching and presentation of the material, the participants can gain an objective insight and make an objective judgement. If the tasks are from a traditionally female dominated domain then the participants would potentially gain an understanding that such activities can be performed equally well by men.

Irrespective of the previously described results, the majority of the respondents from all of the age groups and levels of education reported that they would support their sister or female cousin in building a career in the STEM fields. It is interesting that, despite the gender stereotypes on what is a male or female job, the family support for studying in STEM was even higher for both primary and secondary school female pupils.

The results obtained through our research also speak about the importance of gender roles in understanding the gender gap in the STEM fields.

Namely, compared to the female students the male students were more convinced that marriage is stressful when both the husband and wife are employed, that family suffers when the mother works, that the mother should be present at home when her children come back home from school, that it is better for the family if the mother stays at home and that women should put their careers on hold when they start a family.

On the other hand, compared to the male respondents the female respondents were more convinced that fathers should spend the same amount of time as mothers on raising their children, that women should make

money and contribute to the household budget even after they become mothers, that employed mothers set a good example for their children, that women can successfully balance a career and take care of their family, that a woman should continue to do her job outside of the household even after she becomes a mother and that women should have a career irrespective of whether or not they have children.

In this regard, we also propose the implementation of educational workshops aimed at raising awareness about the stereotypes related to gender roles. In addition to the educational workshops, it is possible to implement 'role enactment' workshops where trainees are encouraged to take on roles opposite to their natural roles. The idea is that by taking on the opposite role the pupils can gain a better understanding of the 'other side'.

Lastly, the PISA results showed gender differences when it came to the attitudes toward school and the perception of the importance of effort at school. Namely, compared to the boys the girls in Bosnia and Herzegovina had a more positive view of school and greater belief that effort is required to achieve success. This result is in line with the findings obtained in our research, according to which the girls showed a higher growth mindset compared to the boys. Compared to the male primary school pupils the female primary school pupils had more pronounced plans and goals in the STEM fields. When it came to secondary school, the plans and goals in the STEM fields were more pronounced among the fourth grade female pupils compared to the first grade female pupils.

5

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6

RECOMMENDATIONS FOR INTERVENTIONS

Author: Rachel Binder-Hathaway, MPA, BA, BS
UN Women Behavioural Science Specialist and STEM and Inclusive Economic Growth Specialist at UNDP HQ

6.1 BACKGROUND

Since the beginning of civilisation, people have banded together for safety, security, resource sharing and to fulfil the human need for social belonging. The first communities formed and soon thereafter institutions were erected to create the policies and laws needed to govern and protect the masses. Yet along with community and institutional development came the systematic exclusion of underrepresented groups. Issues of social stratification and inequality arose as did persistent social norms and gendered stereotypes that would pass down from generation to generation. To this day, antiquated instances of gender bias and social exclusion act as barriers that keep women and girls from realising their full economic and social potential.

Historically, interventions to overcome social exclusion have centred on the reformation or abolishment of structural and institutional barriers. While structural change is certainly a step in the right direction, tearing down archaic institutional frameworks is insufficient as a standalone measure.

Why is this? Over time, institutions shape how societies function, interact and process information. They signal which actions and beliefs are socially acceptable and which are not. Beyond this, institutions create the social constructs and mental models[1] that shape our perceptions, decisions and behaviour.

What happens when people hold fast to norms, perceptions and beliefs that legitimise the old rules? The institutional legacy lives on, through mental models and boundedly rational behaviours[2] that persist long after harmful structural and institutional barriers have been lifted (Hoff and Walsh, 2017).

6.2 KEY CONSTRAINTS

In the context of inclusive economic growth in the field of STEM, persistent mental models such as harmful social norms, gendered stereotypes, implicit discrimination and bias, the dangers of stereotypes,[3] self-censorship and adaptive preferences[4] are binding constraints that hold girls back from realising their full economic potential. We hypothesise that interventions targeting these boundedly rational behaviours can shift social norms, encourage communities to update gendered misperceptions about STEM ability and inclusion and thus expand the set of science, technology and math-driven opportunities available to women. This in turn can spark a virtuous cycle of inclusive economic growth, where both boys and girls feel a sense of belonging in these traditionally male dominated fields.

1 A mental model is a construct that explains an individual's thought process about how something works in the real world. It is a representation of the surrounding world, the relationships between its various parts and a person's intuitive perception about his or her own acts and their consequences (and perceptions about the acts and consequences for others) ....
2 Bounded rationality refers to a wide range of descriptive, normative and prescriptive behaviour that depart from traditional economic assumptions of perfect rationality.
3 Stereotype threat refers to the risk of confirming negative stereotypes about an individual's racial, ethnic, gender or cultural group. The term was coined by the researchers Claude Steele and Joshua Aronson, who performed experiments that showed that black college students performed worse on standardised tests than their white peers when they were reminded before taking the tests that their racial group tends to do poorly in such exams. When their race was not emphasised, however, black students performed similarly to their white peers.
4 Adaptive preferences: when an oppressed group views the discrimination imposed on them as the natural or even preferred state of being (adapted from Hoff and Walsh, 2017).

6.3 INTERVENTION PROPOSALS

Given the intractable nature of gender inequality and our desire to bring lasting change through STEM and inclusive economic growth initiatives (IEG), we assert that interventions are needed at multiple entry points throughout a woman's lifecycle. Biased social norms limit women's opportunities to engage fully in STEM courses and careers and therefore we recommend interventions that target mental modes. Lastly, we note that stakeholders other than the women we aim to support perpetuate many persistent instances of bounded rationality. As such, we also recommend interventions that address the key behavioural constraints of these influential community members (in particular male peers, parents and teachers).

However, our task is not to create a comprehensive list of potential solutions but instead to suggest a shortlist of interventions deemed most likely to yield outsized impacts. Thus, although there are many options available to us, we propose the following interventions:

- an intervention that tests the impact that an inclusive norms campaign would have on social inclusion perceptions among primary school children (with separate tracks for girls and boys);
- an intervention that tests the impact that female role model engagement has on STEM aspirations and uptake (targeting girls at the secondary school/pre-college level);
- interventions that test the effect that social normative messaging has on biased parental and teacher perceptions, because these groups represent key decision-makers who can have a strong impact on outcomes for girls in the field of STEM and inclusive economic growth.

Intervention 1A. Target population: girls (primary school)

Intervention 1B. Target population: boys/peers (primary school)

Intervention 2. Target population: girls (secondary school)

Intervention 3. Target population: teachers

Intervention 1 (tracks A and B): Updating Gendered Mental Modes on STEM through exposure to Edutainment Media and Peer Discussion Groups

Theory of Change: Social norms[5] and peer effects[6] are examples of human behaviour under the pull of social influence. Each represents our desire to conform to the behaviour of others around us. As humans, we are strongly influenced by our perception of what others are doing and keenly aware when we are 'out of step' with expectations. This inclination to fit in with the crowd can be a powerful motivational tool and one that would incentivise behavioural change.

Drawing upon this knowledge, social scientists have developed simple cost-effective interventions that utilise social norms frames called Social Normative Messaging (SNM) and campaigns (SNC) to bring peer comparisons and collective standards into focus. Time and again, SNM/SNC has proven an effective approach for encouraging compliance across a wide array of policy areas (Binder-Hathaway, 2019).

Edutainment: Recently, a new development in the realm of social normative messaging (SNM) and behavioural change campaigns has emerged in the form of educational entertainment or 'edutainment'. Edutainment is an innovative behavioural tool that disseminates messages through theatre skits, soap operas, radio shows and other widely followed media channels. It uses compelling easy-to-follow stories and relatable characters to encourage viewers to replace outdated norms with new community narratives.[7] It is proving to be an effective way of shifting social norms at scale.

Through storied examples, characters subtly introduce new norms across a variety of topics ranging from gender equality to HIV prevention and from financial literacy to family planning. It has also proven effective for reducing gender-based violence (La Ferrara et al., 2012; Banerjee et al., 2019; Arcand et al., 2011; WHO, 2013; Ravallion et al., 2014).

5 Social norms are implied rules that signal society's standards for normal, acceptable behaviour. They are persistent and influential. In many ways, they act as implied social contracts signalling expectations for in-group conformity to a particular group, community or culture (Hathaway, 2020).
6 Peer effects relate to our desire to conform to the behaviour of others.
7 Community narratives: representations of shared cultural and social norms.

Why is this behavioural tool so powerful? Firstly, evidence suggests that people respond less to explicit messages about what they 'should' do and instead focus on (and emulate) the behaviour and actions of others. According to Banerjee (Banerjee et al., 2019), "The appeal of [edutainment] a show makes the individual pay more attention to the message and reduces potential resistance to top-down advice." In other words, edutainment leans into peer effects psychology by introducing injunctive messages that subtly convey social approval or disapproval. This has the intended effect of (1) reducing problematic behaviour by messaging that deleterious behaviour is societally unacceptable and (2) increasing prosocial behaviour by highlighting the positive behaviour of others 'like me' in order to encourage emulation and followership.

Secondly, the characters are aspirational figures. The role model effect is realised through viewership. As the characters act out scenes with compelling counter narratives, new mental models and broadened perspectives are introduced and healthier peer-to-peer conversations are sparked. In short, the storylines and characters inspire viewers to think differently about what is possible. It raises awareness on a desired social norm and encourages viewers to update their behaviour in order to mirror the reference group (the actors).

The introduction of new standards for social norms encourages the audience to think differently about what is (and is not) socially acceptable behaviour. Thus, viewership can weaken the influence of negative stereotypes by introducing healthier and more inclusive social norms. The implicit message is 'if a role model like me can achieve this goal then I can too'. Stated differently, through edutainment viewers begin to visualise their relationships, environments and themselves differently. This in turn encourages them to adopt social norms that are more inclusive.

Population of interest: Primary school pupils assigned to girls only discussion groups, boys only discussion groups and mixed gender discussion groups. The pilot should be conducted across multiple schools with a nationally representative pupil sample over a period of two academic years. Randomisation will occur at the school level.

Programme objectives. This intervention aims to update gendered norms among younger children using edutainment coupled with structured discussion groups. More specifically, the treatment aims to encourage a sense of belonging in girls in relation to the STEM fields by updating children's perceptions, behaviour and actions.

It includes programme elements that initially separate children into boys only and girls only discussion groups to address the specific behavioural constraints faced by each sub-group. It later introduces mixed gendered discussion groups with a view to studying the effects of joint programme consumption gains across girls and boys.

Early Stage Discussion Groups

Track 1. The girls discussion group curriculum:

- guided discussions on the edutainment campaign topics (on gender, STEM and IEG);
- encouraging STEM enrolment and active engagement across the lifecycle;
- positive identity primes;
- mental modes;
- growth mindset.

Track 2. The boys discussion group curriculum:

- guided discussions on the edutainment campaign topics (gender, STEM and IEG);
- he-for-she role play focused on prosocial behaviour and actions;
  - including development of an inclusive mindset, awareness and encouraging STEM enrolment and active engagement for all (champions for equality and inclusion);
- CBT techniques to help boys 'slow down' actions and reactions related to gender responsiveness and to encourage critical thought to enable gender-supportive decisions;
- mental modes;
- growth mindset.

The rationale behind the programme specifications (age and gender): The baseline data analysis conducted by UN Women consistently reveals stronger gender bias patterns among males (relative to their female counterparts). This pattern of bias occurs at the explicit and implicit levels. As such, we recommend an intervention that works with the male demographic directly to change gendered stereotypes, social norms and perceptions among boys.

Furthermore, the UN Women baseline analysis suggests that girls explicitly stated higher acceptance rates for women's inclusion in STEM courses and careers. However, the data on implicit bias and from the focus groups suggest that girls lack a sense of belonging in STEM. This can trigger negative gender-identity primes, self-censorship and maladaptive preferences that reduce STEM uptake at the school and career levels.

Age Dimension: We recommend targeting children at an early age, because this is expected to yield outsized impacts. Firstly, the perceptions formed and decisions made early in life will have positive downstream effects at later life stages. If young girls and boys perceive STEM fields as socially and economically inclusive spaces today then this can begin a virtuous cycle of STEM uptake among girls. If, for example, girls feel a sense of belonging in STEM courses from an early age they are more likely to opt in now and continue to do so in the future. Stated differently, the positive associations and perceptions formed today through increased confidence and skill building might also work to increase the likelihood of opting for STEM fields at later stages in life. The alternative, where girls dismiss STEM at this early stage, is likely to close doors to STEM inclusion in the immediate term and diminish the likelihood of STEM uptake at later stages. Thus, 'gateway interventions' targeting younger audiences are highly recommended.
We hypothesise that this will encourage children to update their currently held implicit and explicit gendered perceptions and encourage more optimal outcomes (increased uptake) as they continue along the lifecycle into adulthood. Likewise, encouraging peers to create an enabling and inclusive environment is expected to increase the likelihood of girls opting in.

Gender Dimension: Additionally, the approach of initially grouping children into single gender clusters allows for targeted workshops with tailored lessons taught to each group. The boys curriculum should focus on their role as potential gender champions and introduce new social norms frames that support gender equality. The girls curriculum should encourage positive self-identity frames and updated mental modes. In this way, each sub-group (both masculine and feminine) can address and work through the binding constraints most strongly associated with their particular in-group gendered norms.

Baseline and endline surveys: These are administered at the beginning and end of the intervention to measure beliefs about the gendered dimensions of STEM and IEG and to test changes in stereotypes, social norms perceptions, aspirations and enrolment outcomes over time.

Treatment arms

T1. Exposure to edutainment treatment
T2. Exposure to edutainment treatment + gender-specific discussion groups
T3. Exposure to edutainment treatment + gender-specific discussion groups + mixed gender discussion groups
C. No intervention beyond the standard school

Hypothesis 1. Exposure to edutainment media that incorporates equitable and inclusive gender norms will lead to updated perceptions; this effect will be particularly impactful for younger audiences (with more malleable mental models and greater openness to progressive policies relative to older generations).

Hypothesis 2. Adding gender-specific discussion groups will be more impactful than exposure to edutainment alone.

Hypothesis 3. Adding a mixed gender discussion group at the midway stage of the programme will be more impactful than treatments 1 and 2.

Hypothesis 4: Adding a mixed gender discussion group to the programme midway through will backfire and decrease the impact relative to treatments 1 and 2.

Intervention 2. Introducing successful Female Role Models to mitigate the effects of Implicit Bias and Adaptive Preferences

Theory of Change: The theory of adaptive preferences suggests that through repeated exposure to discriminatory social norms an oppressed group could come to view the biases imposed upon it as a natural or even preferred state of being. The chronic internalisation of harmful stereotypes can discourage or ostracise out-grouped[8] individuals. It interferes with their productivity levels, cognitive function and effectively reduces programme inclusion relative to their in-group peers. We theorise that maladaptive preferences, negative identity primes and other internalised gender norms are key contributing factors that help explain why girls opt out of STEM courses and careers (Steele and Aronson, 1998; Bohnet, 2016; Coffman, 2014; Hoff and Walsh, 2017). As such, interventions designed to counter gendered norms and self-censoring are needed to promote a sense of belonging and encourage uptake.
This theory is supported by the UN Women baseline data analysis. The results suggest that the typical girl in our study believed that the STEM fields should be open to everyone, irrespective of gender. However, nearly one-third of pupils surveyed (male and female) perceive community level opposition to girls' engagement in STEM. Furthermore, roughly 1 in 5 surveyed boys stated explicitly they would not support a sister or female cousin should she pursue STEM. Furthermore, when prompted to designate career paths as either male appropriate, female appropriate or

8 those under discriminatory scrutiny

suitable for both genders the overwhelming majority of pupils associated career ability with gender stereotyped misnomers (i.e. associating girls with careers in arts and humanities (implying that boys are not well suited) and associating boys with STEM careers (implying that girls are not well suited)). These responses suggest that pupils are perpetuating inaccurate gender stereotypes and contributing to a culture of gender-based social exclusion in the STEM fields.

Based on this suggestive evidence, it is clear that interventions should not be modelled simply to target girl's motivation and ability. This is because girls display lower levels of explicit gender bias in response to questions on the inclusion of women in STEM at both the educational and career level. Although their survey responses could be coloured by social desirability bias, the UN Women analysis implies that there are other drivers at play.

More specifically, we hypothesise that girls explicitly believe that STEM should be open to them. Yet girls continue to be exposed to social norms and persistent stereotypes that signal that girls do not belong in the male dominated courses and fields of STEM.

These signals come from their male peers, from the teachers who guide them and from the community at large. Thus, whether conveyed consciously or unconsciously, these messages can deter girls from engaging in STEM subjects. This confluence of factors suggests that maladaptive preferences and the internalisation of harmful gender stereotypes on STEM ability and inclusion could be driving low uptake among girls.

An intervention to counter maladaptive preferences. According to Iris Bohnet (2016), "When we learn a person's sex, gender biases are automatically activated, leading to unintentional and implicit discrimination ... and when girls internalize these stereotypes, the stereotypes can become self-fulfilling prophecies – unless we debias how things are done. Through behavioral design, we can move the needle toward social inclusion and equal opportunity"

Fortunately, the literature on gender bias indicates that simple subtle changes could update pupils attitudes. Seeing is believing! One study on ambient belonging reveals that replacing Star Wars and Star Trek posters with gender-neutral art and pictures from nature strengthened female students' associations between women and computer science careers (Cheryan et al., 2009).

Another factor influencing adaptive preference is the availability or scarcity of female role models. In one study, the researcher examined how displaying posters of successful female leaders can influence positive self-association amongst female pupils. It gives them a status to aspire to and signals that other women before them have persevered and succeeded. Beyond this, according to Bandura, individuals can develop aspirations and expand their perceived set of opportunities simply by observing the successes of others. "Successful role models can help individuals imagine new life paths and boost their perceived self-efficacy" (Bandura, 2010).

Population of Interest: primary school girls (aged 11-14). The pilot should be conducted across multiple schools with a nationally representative pupil sample over the course of one academic year. Randomisation would occur at the school level.

Baseline and endline surveys. These should be administered via text at the beginning and end of the intervention in order to measure beliefs about the gendered dimensions of STEM and inclusive economic growth and to test changes in stereotypes, perceptions of social norms, aspirations and enrolment outcomes over time.

Treatment arms

T1. Encouragement campaign for STEM inclusion
T2. Encouragement campaign
+ pairing girls with a successful female role model working in STEM
C. No intervention beyond the standard school

Hypothesis 1. Exposure to successful female role models with careers in STEM will have aspirational effects on girls. This in turn would encourage increased uptake in STEM courses and fields among the participants.

Intervention 3. Updating Gender Perceptions in STEM: The effects of a Social Normative Messaging campaign on implicit gender bias among teachers

Theory of Change: We know from research and priori theory that teacher engagement strongly predicts pupil performance outcomes, from test scores to graduation rates and from attendance to future earning potential. We also know that implicit bias impacts how teachers engage with pupils and that when bias is present it can negatively influence the targeted pupil's sense of belonging.

For the purposes of our study, we will discuss the effects of implicit gender bias among teachers on pupils' social inclusion in STEM (which in turn impacts their performance and willingness to opt for STEM subjects). More specifically, we will reference the Carlana study, Stereotypes and Self-Stereotypes: Evidence from Teachers' Gender Bias. This research reveals that the "gender gap in math performance increases when students are assigned to teachers with higher bias . . . The gap in math performance between boys and girls generated in [secondary] school would be 34 percent smaller if teachers had one standard deviation lower implicit stereotypes" (Carlana, 2017).

The study goes on to explain that teacher bias activates female students' maladaptive preferences, but "only in male-type domains" like STEM. However, the impact goes beyond the activation of self-stereotyping among girls. The study also finds a correlation between implicit bias among teachers and the secondary school track choices of pupils, through the channel of teacher recommendations. Calling upon early studies with similar findings, Carlana explains that this study is "consistent with a model of stereotype whereby ability-stigmatized groups failing to achieve their potential."

This evidence supports our earlier claim, namely that influential community groups, including teachers, are key decision makers who can strongly impact the outcomes for girls in STEM. As such, creating a more inclusive STEM environment requires interventions that target the biased beliefs of teachers about the abilities of female pupils in STEM relative to their classmates.

We can look to the UN Women baseline survey for additional support for this type of intervention. Herein the teacher responses to questions of explicit bias generally conformed to socially acceptable answers by suggesting equal opportunities across all pupils (as social desirability bias might dictate).

Yet one in four teachers responded, 'Yes, the community would disapprove' in response to the question 'If you encouraged girls to pursue a career in STEM, do you think the community would disapprove of your actions?' Interestingly, and perhaps encouragingly, the overwhelming majority of teachers followed up this question by suggesting they would go against the cultural grain and encourage girls to pursue STEM even if this went against community norms. This suggests an explicit desire to cultivate STEM education opportunities for girls. However, we know less about the impact of implicit bias among teachers.

Thus, given the aggregated responses across pupils and teachers, we rely on the overall evidence that points to entrenched gender norms that hinder women's progress in the STEM fields. As such, we strongly recommend an intervention that updates third party perceptions, specifically targeting implicit bias among teachers.

Population of Interest: STEM subjects teachers. The pilot should be conducted across multiple schools at each grade level with a nationally representative teacher sample over the course of one academic year. Randomisation would occur at the school level.

Baseline and endline surveys: These should be administered at the beginning and end of the intervention in order to measure beliefs and actions on the gendered dimensions of STEM and IEG and to test changes in implicit gender bias, perceptions of social norms, aspirations and engagement outcomes over time.

Please note: In addition to the core programme, please administer teacher IATs at the beginning and end of the study in order gain a better understanding of whether implicit associations with females in STEM have changed over time.

Treatment arms

T1. Social normative messaging campaign on implicit gender bias among teachers
T2. Social normative messaging campaign on implicit gender bias among teachers
T3. Social normative messaging campaign on implicit gender bias among teachers
C. No intervention

Please note: T1, T2 and T3 should offer unique messaging and framing content in order to determine which messaging types and channels are most effective at mitigating implicit bias among teachers.

Hypothesis 1. Exposure to social normative messaging will encourage updated perceptions among teachers and thus reduce implicit bias against girls in STEM.

Hypothesis 2. Positive spillover effects for girls in STEM are expected as a result of this intervention.

7

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8

ANNEXES

8.1 TABLE 53. MATRIX OF CORRELATIONS BETWEEN THE VARIABLES INCLUDED IN THE SURVEY (SAMPLE OF PRIMARY SCHOOL GIRLS)

	Education_ Father	Attitude_ Natural science	Attitude_ Math	Attitude Informatics	SELF_Math	SELF_ Natural science	SELF_ Informatics	STEM_ Tasks value	STEM_ Expectation of success	Perceptions of scientists	STEM_ Interests	Gender differences	Family support	ITI_FIX	ITI_ GROW	STEM_ PLAN
Education_ Mother	.455**	-.051	.017	.011	.045	.092	-.028	.038	.095	-.039	.166	.017	.034	.019	-.002	.057
Education_ Father		.062	.009	-.117	-.067	-.077	-.129	-.027	-.045	-.241*	-.112	.093	-.137	.006	.024	-.100
Attitude_ Natural science			.325**	.304**	.197*	.491**	.187*	.559**	.390**	.246**	.243**	-.089	.014	.060	.163	.238*
Attitude_ Math				.555**	.673**	.415**	.434**	.636**	.517**	.294**	.318**	-.182	.101	.076	.187*	.263**
Attitudes _Informatics					.453**	.421**	.758**	.586**	.467**	.349**	.337**	-.152	.185	.030	.248**	.325**
SELF_Math						.546**	.524**	.704**	.762**	.293**	.439**	-.174	.323**	-.013	.171	.427**
SELF_Natural science							.475**	.750**	.690**	.429**	.449**	-.121	.292**	.172	.149	.472**
SELF_ Informatics								.622**	.563**	.305**	.358**	-.140	.233*	.019	.196*	.422**
STEM_Tasks Value									.813**	.402**	.379**	-.174	.289**	.088	.125	.438**
STEM_ Expectation of success										.404**	.484**	-.244**	.342**	.057	.143	.501**
Perceptions of scientists											.250**	-.081	.143	.056	-.005	.242*
STEM_ Interests												-.183	.303**	.101	.095	.327**
Gender differences													-.118	-.255**	-.013	-.168
Family support														-.215*	-.116	.463**
ITI_FIX															-.261**	-.042
ITI_GROW																-.073

8.2 TABLE 54. MATRIX OF CORRELATIONS BETWEEN THE VARIABLES INCLUDED IN THE SURVEY (SAMPLE OF SECONDARY SCHOOL GIRLS)

	Education_ Father	Attitude_ Natural science	Attitude_ Math	Attitude Informatics	SELF_Math	SELF_ Natural science	SELF_ Informatics	STEM_ Tasks value	STEM_ Expectation of success	Perceptions of scientists	STEM_ Interests	Gender differences	Family support	ITI_FIX	ITI_ GROW	STEM_ PLAN
Education_ Mother	.401**	-.177	-.062	-.097	-.080	-.025	-.031	-.161	.052	.206	-.035	-.117	-.157	.124	-.115	-.080
Education_ Father		-.049	-.126	-.146	-.163	-.241*	-.096	-.096	-.187	-.060	-.009	-.102	-.112	.150	-.178	-.126
Grade			-.179	-.101	-.015	-.065	.018	.135	-.198	-.372**	.113	.199	.147	-.091	-.082	.204
Attitude_ Natural science				.436**	.433**	.493**	.220*	.088	.582**	.498**	.451**	-.122	.037	-.130	.109	.398**
Attitude_ Math					.279**	.301**	.714**	.247*	.506**	.407**	.470**	.100	.288**	.128	.096	.294**
Attitudes _Informatics						.119	.100	.534**	.247*	.250*	.165	-.147	-.033	-.068	.272**	.260*
SELF_Math							.323**	.161	.674**	.619**	.453**	-.106	.339**	-.022	.092	.457**
SELF_Natural science								.248*	.532**	.441**	.635**	.049	.393**	.258*	-.067	.544**
SELF_ Informatics									.326**	.249*	.267*	-.042	.193	-.084	.247*	.360**
STEM_Tasks Value										.821**	.494**	-.171	.221*	.166	.033	.459**
STEM_ Expectation of success											.422**	-.276*	.217*	.082	.085	.414**
STEM_ Interests												-.099	.419**	.152	-.014	.811**
Gender differences													.068	.042	-.111	-.034
Family support														.120	.107	.366**
ITI_FIX															-.405**	.069
ITI_GROW																.008

The authors of the questionnaires:

PhD Nermin Đapo
Faculty of Philosophy
Department of Psychology

Rachel Binder-Hathaway, M.P.A., B.A., B.S.
Behavioral Science Specialist, UN Women
STEM & Inclusive Economic Growth Specialist, UNDP HQ

MSc. Ivona Čelebičić
proMENTE social research

Lamija Spahić, MA
proMENTE social research

8.3 QUESTIONNAIRES

Student Questionnaire for Primary Schools

Dear Students,

We are conducting research in several primary schools on the territory of Bosnia and Herzegovina regarding education in Humanities and STEM (Science, Technology, Engineering and Mathematics) subjects. We are interested in your thoughts, experiences, opinions and attitudes towards these subject areas.

We kindly ask that you help us in this research by completing the attached questionnaire. We wish to emphasize that there are no correct or incorrect answers to the questions. It is only important that you write down your own thoughts and draw from experiences you have had. Therefore, we ask that you answer the questions INDEPENDENTLY and please do not discuss your answers with other students. When finished, please raise your hand and the researchers will come for your questionnaire.

All of your answers remain confidential. No one, including the researchers in the classroom, will know how you answered the questions. Please **DO NOT WRITE YOUR NAME** anywhere on this consent form or on the questionnaire.

If you do not wish to take part in this research, you do not have to. At any time, you can withdraw from answering a question, or decide against completing the questionnaire.

If you have any questions or require clarification while responding to the questionnaire, please raise your hand and one of the researchers will come to you and answer your question.

- If y**ou want** to participate in today's questionnaire, please place an X within the box labelled YES.
- If y**ou do not want** to answer the questions, please place an X mark within the box labelled NO.

I want to participate in the questionnaire, by answering the questions. ☐Yes ☐No

Thank you for your help.

MODULE I

1. Below please list your two favorite school subjects.

Subject 1: _____

Subject 2: _____

2. Let's play an imagination game. Picture yourself in college, and imagine that you can study any subjects you want. In this imagination game, what scientific field would you pursue?

The scientific field I would pursue is: _____

3. Now imagine your future self as a grown up with a career. If you were guaranteed success in your chosen career, what job would you want to pursue? Please list your top TWO choices.

Career 1: _____

Career 2: _____

4. What is the highest level of education you would like to complete if finances and school/college opportunities are fully available to you?

a. Completed secondary school
b. Completed higher education
c. I don't know

MODULE II

Below is a list of several school subjects. On a scale of 1 to 5, please rate to what extent you are interested in the content taught within the listed subjects. Circle the number that matches your estimate, where: 1 = I am not at all interested in this subject; 5 = I am completely interested in this subject

	Not at all interested	Somewhat Interested	Neutral	Somewhat Interested	Very interested
1. Physics	1	2	3	4	5
2. Chemistry	1	2	3	4	5
3. Biology	1	2	3	4	5
4. Mathematics	1	2	3	4	5
5. Computer Science	1	2	3	4	5
6. Technical Culture	1	2	3	4	5
7. Mother Tongue	1	2	3	4	5
8. First Foreign Language	1	2	3	4	5
9. Second Foreign Language	1	2	3	4	5
10. History	1	2	3	4	5

MODULE III

Listed below are statements related to natural science subjects (physics, biology, chemistry and geography). On a scale of 1 to 5, please evaluate to which extent the statements relate to you. Circle the number that matches your estimate.

	Does not refer to me at all				Fully refers to me
1. I look forward to studying natural science subjects.	1	2	3	4	5
2. I find natural science classes boring.	1	2	3	4	5
3. The topics I learn in natural science subjects can help me in my future education.	1	2	3	4	5
4. I like natural science subjects more than most other school subjects.	1	2	3	4	5
5. We learn interesting things in natural science subjects.	1	2	3	4	5
6. Natural science subjects are difficult to understand.	1	2	3	4	5
7. Learning natural science topics is useful for getting a good job in the future.	1	2	3	4	5
8. The things I learn in natural science subjects can help me in everyday life.	1	2	3	4	5

Listed below are statements related to the mathematics school subject. On a scale of 1 to 5, please evaluate to which extent the statements relate to you. Circle the number that matches your estimate.

1. We learn interesting things in math.	1	2	3	4	5
2. Math is a difficult school subject to understand.	1	2	3	4	5
3. I find math classes boring.	1	2	3	4	5
4. Learning math is useful for getting a good job in the future.	1	2	3	4	5
5. The things I learn in math can help me in my everyday life.	1	2	3	4	5
6. Learning math is useful for getting a good job in the future.	1	2	3	4	5

Listed below are statements related to the computer science school subject. On a scale of 1 to 5, please evaluate to which extent the statements relate to you. Circle the number that matches your estimate.

1. We learn interesting thing in computer science.	1	2	3	4	5
2. Computer science is a difficult school subject to understand.	1	2	3	4	5
3. I find computer science boring.	1	2	3	4	5
4. The things I learn in computer science will help me in my future education.	1	2	3	4	5
5. Learning computer science is useful for getting a good job in the future.	1	2	3	4	5
6. The things I learn in computer science can help me in everyday life.	1	2	3	4	5

MODULE IV

1. Please indicate your confidence in your ability to complete each of the following courses.

	Insufficient		Average		Excellent
1. Computer science	1	2	3	4	5
2. Mathematics	1	2	3	4	5
3. Chemistry	1	2	3	4	5
4. Physics	1	2	3	4	5
5. Biology	1	2	3	4	5
6. History	1	2	3	4	5
7. English language	1	2	3	4	5

2. How successful would you be in a profession requiring knowledge and skills in the subjects listed below?

	I would not be successful				Very successful
1. Mathematics	1	2	3	4	5
2. Computer science	1	2	3	4	5
3. Physics	1	2	3	4	5
4. Chemistry	1	2	3	4	5
5. Biology	1	2	3	4	5
6. History	1	2	3	4	5
7. English language	1	2	3	4	5

3. Think about the classes you are taking now. For each subject below, how important is it for you to learn as many course topics as possible this year?

	Not important at all				Very important
1. Mathematics	1	2	3	4	5
2. Computer science	1	2	3	4	5
3. Physics	1	2	3	4	5
4. Chemistry	1	2	3	4	5
5. Biology	1	2	3	4	5
6. History	1	2	3	4	5
7. English language	1	2	3	4	5

4. How important will the knowledge and skills you gain this year be for your future? For each subject below, please rank its importance for your future, from 1 to 5.

	Not important at all				Very important
1. Computer science	1	2	3	4	5
2. Mathematics	1	2	3	4	5
3. Chemistry	1	2	3	4	5
4. Physics	1	2	3	4	5
5. Biology	1	2	3	4	5
6. History	1	2	3	4	5
7. English language	1	2	3	4	5

5. How important is it for you to achieve the best possible success, during the next academic year, within the school subjects listed below?

	Not important at all				Very important
1. Chemistry	1	2	3	4	5
2. Physics	1	2	3	4	5
3. Computer science	1	2	3	4	5
4. Biology	1	2	3	4	5
5. Mathematics	1	2	3	4	5
6. History	1	2	3	4	5
7. English language	1	2	3	4	5

6. Imagine your future self. Please indicate your degree of confidence in your ability to complete the job duties associated with the career paths below.

	I would not be successful at all		neither successful or unsuccessful		Very Very successful
1. Engineering	1	2	3	4	5
2. Physics	1	2	3	4	5
3. Computer science	1	2	3	4	5
4. Biology	1	2	3	4	5
5. Mathematics	1	2	3	4	5
6. History	1	2	3	4	5
7. English language	1	2	3	4	5

7. Take a moment to think about your future goals, both short term and long term. Please rate the likelihood of each statements on the following scale:

	Very Unlikely	Somewhat Unlikely	Undecided	Somewhat Likely	Very Likely
In college I intend to take declare a major related to engineering, technology, natural sciences or mathematics	1	2	3	4	5
I can see myself working in the field of natural sciences, mathematics engineering, or technology	1	2	3	4	5
I plan to earn a living with a career in engineering, technology, natural sciences or mathematics	1	2	3	4	5

MODULE V

Listed below are statements. Some of these statements may describe your beliefs, interests and abilities; others will not. On a scale of 1 to 5, please evaluate to which extent you agree with the listed statements. Circle the number that matches your estimate.

	Does not refer to me at all				Fully refers to me
I find math interesting.	1	2	3	4	5
I can quickly master math concepts.	1	2	3	4	5
It is important that I do well in math.	1	2	3	4	5
Knowledge in math will be useful to me in the future.	1	2	3	4	5
I am able to achieve excellent results in math.	1	2	3	4	5
Natural science subjects have always been difficult for me.	1	2	3	4	5
I quickly understand the concepts and theories from natural sciences.	1	2	3	4	5
It is important for me to gain as much knowledge as possible on natural science subjects.	1	2	3	4	5
Knowledge in natural sciences will benefit me in the future.	1	2	3	4	5
I can become a successful scientist.	1	2	3	4	5
I am interested in how devices, machines or motors work.	1	2	3	4	5
I can fix a simple malfunction on a certain device/ machine.	1	2	3	4	5
Knowing how devices work will not benefit me in the future.	1	2	3	4	5
I am not good at using computers.	1	2	3	4	5
I quickly master concepts in computer science.	1	2	3	4	5
Doing well in computer science is important to me.	1	2	3	4	5
Computer science knowledge will benefit me in the future.	1	2	3	4	5
I can become a successful programmer.	1	2	3	4	5

MODULE VI

Listed below are statements. Circle the number that matches your estimate (1-does not refer to me at all; 5-fully refers to me).

When I plan out my day, I consider how my activities connect to what I want to accomplish with my life.	1	2	3	4	5
I am often anxious about fitting in at school.	1	2	3	4	5
I believe my future is determined by luck, no matter how hard I work.	1	2	3	4	5
I sometimes worry that I will not belong in secondary school.	1	2	3	4	5
I do not care what others think about my success or failure.	1	2	3	4	5
If I have the chance, I would make a good leader.	1	2	3	4	5
I am in control of what happens in my life.	1	2	3	4	5

MODULE VII

	Strongly disagree	Disagree	Mainly disagree	Mainly agree	Agree	Strongly agree
1. Science and technology are important for society.	1	2	3	4	5	
2. Science and technology make our lives healthier, easier and more comfortable.	1	2	3	4	5	
3. Science does more harm than good.	1	2	3	4	5	
4. Science and technology will help eliminate world poverty and hunger.	1	2	3	4	5	
5. Science and technology cause environmental problems.	1	2	3	4	5	
6. We should always believe what scientists claim.	1	2	3	4	5	
7. Scientists are unusual.	1	2	3	4	5	
8. Scientists are intelligent.	1	2	3	4	5	
9. Scientists are lonely.	1	2	3	4	5	
10. Scientists are talented researchers.	1	2	3	4	5	
11. Scientists are boring.	1	2	3	4	5	
12. Scientists earn a lot of money.	1	2	3	4	5	

MODULE VIII

The following section of the questionnaire provides a list of activities relevant for particular professions. Which activities would you like to do? Read each sentence carefully and mark, on a scale of 1 to 5, how much it refers to you.

	Does not refer to me at all	Does not refer to me	Neutral	Refers to me	Fully refers to me
1. Understanding how things work.	1	2	3	4	5
2. Work on science projects.	1	2	3	4	5
3. Finding answers to questions about how things work.	1	2	3	4	5
4. Understanding how things in nature work.	1	2	3	4	5
5. Performing experiments.	1	2	3	4	5
6. Building or constructing things and objects.	1	2	3	4	5
7. Understanding how things are built.	1	2	3	4	5
8. Work on finding a new cure.	1	2	3	4	5
9. Solving mathematical problems.	1	2	3	4	5
10. Creating computer applications or designing computer/video games.	1	2	3	4	5

MODULE IX

Read the list of professions below. On a scale of 1 to 5, please rate to which extent you would like to pursue each of the professions, one day when you grow up.

	Not at all				Yes, definitely
1. Mathematician	1	2	3	4	5
2. Programmer	1	2	3	4	5
3. Meteorologist	1	2	3	4	5
4. Biologist	1	2	3	4	5
5. Mechanical Engineer	1	2	3	4	5
6. Astronomer	1	2	3	4	5
7. Geneticist	1	2	3	4	5
8. Doctor	1	2	3	4	5
9. Construction Engineer	1	2	3	4	5
10. Geologist	1	2	3	4	5
11. Physics Researcher	1	2	3	4	5
12. Electrical Engineer	1	2	3	4	5
13. Psychologist	1	2	3	4	5
14. A journalist	1	2	3	4	5

MODULE X

Please read the following story and share your thoughts on the best choice for the character described.

Version A

Lamija is a smart and hard-working young women. She has just graduated from college, at the top of her class. She has a bright future ahead of her:

- ✖ She just married and has a newborn baby.
- ✖ A top firm has offered her a career as an engineer. The job will be fulfilling, but it will require a lot of time and effort.

What should Lamija do next?

Version B

Emir is a smart and hard-working young man. He has just graduated from college, at the top of his class. He has a bright future ahead of him:

- ✖ He just married and has a newborn baby.
- ✖ A top firm has offered him a career as an engineer. The job will be fulfilling, but it will require a lot of time and effort.

What should Emir do next?

a. Lamija/Emir should accept the engineering position
b. Lamija/Emir should pursue a less demanding position
c. Lamija/Emir should turn down outside career offers and stay home take care of her/his family

MODULE XI

1. Have you ever discussed your educational goals with your parent or an adult relative?	Yes	No
2. Do you think your family would encourage you to pursue Arts and Humanities subjects in college?	Yes	No
3. Do you think your family would encourage you to pursue STEM subjects in college?	Yes	No
4. It is more appropriate for men to have a built career than women.	Yes	No

MODULE XII

1. Do you think girls should be encouraged to study math, science and technology subjects?	Yes	No
2. In your opinion, do people in your village/community believe that girls should study math, science and technology subjects in college?	Yes	No
3. If you encouraged girls in your school to pursue a career in STEM, do you think the community would disapprove of your actions?	Yes	No
4. If the community did not disapprove, would you encourage your sister (or female cousin) to pursue a career in STEM?	Yes	No

MODULE XIII

Below is a list of professions. In your opinion, who is better in these professions, men or women?

Some people believe that women and men are equally suited to all careers; whereas others feel that women are better suited to some jobs and men are better suited to other jobs. What are YOUR personal thoughts and opinions on the matter?

For each career option, please circle the box that best reflects your own thoughts and opinions. For example, if you believe that men are better cooks than women, circle the box below „men are better ". If you believe that women are significantly better auto mechanics than men, circle the box below „men are significantly better ". If you believe that women and men are equally well suited to work as counter clerks, circle the box below „both men and women are equally suited ".

Your opinions might be similar to the person in this example, or they might be different. There are no right or wrong answers, just your own thoughts and opinions.

	Women are significantly better suited	Women are better	Women and men are equally suited	Men are better	Men are significantly better suited
Cook				◯	
Auto mechanic		◯			
Counter clerk			◯		

	Women are significantly better suited	Women are better	Both men and women are equally suited	Men are better	Men are significantly better suited
1. Mathematician	☐	☐	☐	☐	☐
2. Programmer	☐	☐	☐	☐	☐
3. Meteorologist	☐	☐	☐	☐	☐
4. Biologist	☐	☐	☐	☐	☐
5. Mechanical Engineer	☐	☐	☐	☐	☐
6. Astronomer	☐	☐	☐	☐	☐
7. Geneticist	☐	☐	☐	☐	☐
8. Doctor	☐	☐	☐	☐	☐
9. Construction Engineer	☐	☐	☐	☐	☐
10. Geologist	☐	☐	☐	☐	☐
11. Physics Researcher	☐	☐	☐	☐	☐
12. Electrical Engineer	☐	☐	☐	☐	☐
13. Psychologist	☐	☐	☐	☐	☐
14. A journalist	☐	☐	☐	☐	☐

MODULE XIV

Listed below are statements regarding intelligence. On a scale of 1 to 6, please evaluate to which extent you agree with the listed statements. Circle the number which matches your estimate. There are no correct or incorrect answers. We would like to know what your views are.

	Strongly disagree	Disagree	Mainly disagree	Mainly agree	Agree	Strongly agree
1. Each person has a certain level of intelligence and he or she cannot do much to change it.	1	2	3	4	5	6
2. A person's intelligence is a part of who they are and not much can change.	6	2	3	4	5	6
3. To be honest, one's level of intelligence cannot change.	1	2	3	4	5	6
4. You can learn new things, but intelligence cannot really be changed.	1	2	3	4	5	6
5. No matter who it is, one's level of intelligence can be significantly changed.	1	2	3	4	5	6
6. Intelligence can always be significantly changed.	1	2	3	4	5	6
7. Intelligence can always slightly change, no matter how intelligent a person is.	1	2	3	4	5	6
8. Intelligence can be significantly increased.	1	2	3	4	5	6

How do you estimate your intelligence and abilities needed in specific subjects?

The intelligence quotient can range from 55 to 145. A person of average intellectual abilities has an intelligence quotient of 100.

Estimate your intelligence quotient: _____

Each STEM subject requires certain abilities. On a scale of 1 to 5, please estimate your own abilities for each of the areas listed below.

	Below average		Average		Above average
1. Natural sciences	1	2	3	4	5
2. Technology	1	2	3	4	5
3. Engineering	1	2	3	4	5
4. Informatics	1	2	3	4	5
5. Mathematics	1	2	3	4	5
6. History	1	2	3	4	5
7. English language	1	2	3	4	5

MODULE XV

Which high school do you plan to enroll in? _____

General information

1. Gender: ☐ m ☐ f 2. Date of birth: _____ 3. Today's date:_____

4. School:_____ 5. Grade: _____ Class:_____

6. Place of residence: _____

7. What was your average school performance at the end of the previous grade (grade point average)?

_____

8. What is the highest educational level of your parents/guardians?

	Mother	Father
Completed primary school	1	1
Completed secondary school	2	2
Completed higher education	3	3
I don't know	4	4

Student Questionnaire for Primary Schools

Dear Students,

We are conducting research in several secondary schools on the territory of Bosnia and Herzegovina regarding education in STEM subjects. STEM is an abbreviation for Science, Technology, Engineering and Mathematics. These four areas are taught within the framework of several school subjects: mathematics, physics, chemistry, biology, computer science. We are interested in what you think about these areas and what your experiences, opinions and attitudes are towards subjects from the STEM area.

We kindly ask that you help us in this research by answering the questions presented within the questionnaire. We wish to emphasize that there are no correct or incorrect answers to the questions. It is only important that you write down what you think and what kind of experiences you have had. Therefore, we ask that you answer the questions INDEPENDENTLY and please do not discuss your answers with other students. When finished, please raise your hand and the researchers will come for your questionnaire.

All of your answers remain confidential. No one, including the researchers in the classroom, will know how you answered the questions. Please **DO NOT WRITE YOUR NAME** anywhere on this consent form or on the questionnaire.

If you do not wish to take part in this research, you do not have to. At any time, you can withdraw from answering a question, or decide against completing the questionnaire.

If you have any questions or require clarification while responding to the questionnaire, please raise your hand and one of the researchers will come to you and answer your question.

- ✖ If y**ou want** to participate in today's questionnaire, please place an X within the box labelled YES.
- ✖ If y**ou do not want** to answer the questions, please place an X mark within the box labelled NO.

I want to participate in the questionnaire, by answering the questions. ☐Yes ☐No

Thank you for your help.

MODULE I

1. Below please list your two favorite school subjects.

Subject 1: _____

Subject 2: _____

2. Let's play an imagination game. Picture yourself in college, and imagine that you can study any subjects you want. In this imagination game, what scientific field would you pursue?

The scientific field I would pursue is: _____

3. Now imagine your future self as a grown up with a career. If you were guaranteed success in your chosen career, what job would you want to pursue? Please list your top TWO choices.

Career 1: _____

Career 2: _____

4. What is the highest level of education you would like to complete if finances and school/college opportunities are fully available to you?

a. Completed secondary school
b. Completed higher education
c. I don't know

	Not at all interested	Somewhat Interested	Neutral	Somewhat Interested	Very interested
1. Physics	1	2	3	4	5
2. Chemistry	1	2	3	4	5
3. Biology	1	2	3	4	5
4. Mathematics	1	2	3	4	5
5. Computer Science	1	2	3	4	5
6. B/C/S language and literature	1	2	3	4	5
7. First Foreign Language	1	2	3	4	5
8. Second Foreign Language	1	2	3	4	5
9. History	1	2	3	4	5

MODULE III

Listed below are statements related to natural science subjects (physics, biology, chemistry and geography). On a scale of 1 (does not refer to me at all) to 6 (fully refers to me) please evaluate to which extent the statements relate to you. Circle the number that matches your estimate.

	Does not refer to me at all	Does not refer to me	Mainly does not refer to me	Mainly refers to me	Refers to me	Fully refers to me
1. I look forward to natural science subjects.	1	2	3	4	5	6
2. Natural science classes are exciting.	1	2	3	4	5	6
3. We learn interesting things in natural science subjects.	1	2	3	4	5	6
4. Natural science subjects are difficult school subjects to understand.	1	2	3	4	5	6
5. Learning natural science subjects has introduced me to new and exciting professions.	1	2	3	4	5	6
6. I like natural science subjects more than most other school subjects.	1	2	3	4	5	6
7. I find natural science classes boring.	1	2	3	4	5	6
8. The things I learn in natural science subjects will help me in my future education.	1	2	3	4	5	6
9. Learning natural sciences is useful for getting a good job in the future.	1	2	3	4	5	6
10. The things I learn in natural science subjects can help me in everyday life.	1	2	3	4	5	6

Listed below are statements related to the mathematics school subject. On a scale of 1 (does not refer to me at all) to 6 (fully refers to me) please evaluate to which extent the statements relate to you. Circle the number that matches your estimate.

	Does not refer to me at all	Does not refer to me	Mainly does not refer to me	Mainly refers to me	Refers to me	Fully refers to me
1. I find math boring.	1	2	3	4	5	6
2. We learn interesting things in math.	6	2	3	4	5	6
3. Math is a difficult school subject to understand.	1	2	3	4	5	6
4. I like math more than most other school subjects.	1	2	3	4	5	6
5. Math classes are exciting.	1	2	3	4	5	6
6. The things I learn in math will help me in my future education.	1	2	3	4	5	6
7. Learning math is useful for getting a good job in the future.	1	2	3	4	5	6
8. The things I learn in math can help me in everyday life.	1	2	3	4	5	6

Listed below are statements related to the computer science school subject. On a scale of 1 (does not refer to me at all) to 6 (fully refers to me) please evaluate to which extent the statements relate to you. Circle the number that matches your estimate.

	Does not refer to me at all	Does not refer to me	Mainly does not refer to me	Mainly refers to me	Refers to me	Fully refers to me
1. I find computer science boring.	1	2	3	4	5	6
2. We learn interesting things in computer science.	1	2	3	4	5	6
3. Computer science is a difficult school subject to understand.	1	2	3	4	5	6
4. I like computer science more than most other school subjects.	1	2	3	4	5	6
5. Computer science classes are exciting.	1	2	3	4	5	6
6. The things I learn in computer science will help me in my future education.	1	2	3	4	5	6
7. Learning computer science is useful for getting a good job in the future.	1	2	3	4	5	6
8. The things I learn in computer science can help me in everyday life.	1	2	3	4	5	6

MODULE IV

1. How would you estimate your confidence in your ability in school subjects listed below?

	Insufficient		Average		Excellent
1. Computer science	1	2	3	4	5
2. Mathematics	1	2	3	4	5
3. Chemistry	1	2	3	4	5
4. Physics	1	2	3	4	5
5. Biology	1	2	3	4	5
6. History	1	2	3	4	5
7. English language	1	2	3	4	5

2. How well do you perform in the school subjects listed below in comparison to your performance in the B/C/S language and literature subject?

	Significantly worse in B/C/S language and literature		Equally good		Significantly better in B/C/S language and literature
1. Mathematics	☐	☐	☐	☐	☐
2. Computer science	☐	☐	☐	☐	☐
3. Physics	☐	☐	☐	☐	☐
4. Chemistry	☐	☐	☐	☐	☐
5. Biology	☐	☐	☐	☐	☐
6. History	☐	☐	☐	☐	☐
7. English language	☐	☐	☐	☐	☐

3. How successful would you be in professions which require knowledge and skills from the subjects listed below?

	I would not be successful at all		Average successful		Very successful
1. Chemistry	1	2	3	4	5
2. Physics	1	2	3	4	5
3. Computer science	1	2	3	4	5
4. Biology	1	2	3	4	5
5. Mathematics	1	2	3	4	5
6. History	1	2	3	4	5
7. English language	1	2	3	4	5

4. How important is it for you to learn as many things possible, during this grade, within the school subjects listed below?

	Not important at all				Very important
1. Mathematics	1	2	3	4	5
2. Computer science	1	2	3	4	5
3. Physics	1	2	3	4	5
4. Chemistry	1	2	3	4	5
5. Biology	1	2	3	4	5
6. History	1	2	3	4	5
7. English language	1	2	3	4	5

5. How important will the knowledge and skills in the school subjects listed below be in your future?

	Not important at all				Very important
1. Computer science	1	2	3	4	5
2. Mathematics	1	2	3	4	5
3. Chemistry	1	2	3	4	5
4. Physics	1	2	3	4	5
5. Biology	1	2	3	4	5
6. History	1	2	3	4	5
7. English language	1	2	3	4	5

6. How important is it for you to achieve the best possible success, during the next academic year, within the school subjects listed below?

	Not important at all				Very important
1. Chemistry	1	2	3	4	5
2. Physics	1	2	3	4	5
3. Computer science	1	2	3	4	5
4. Biology	1	2	3	4	5
5. Mathematics	1	2	3	4	5
6. History	1	2	3	4	5
7. English language	1	2	3	4	5

7. Imagine your future self. Please indicate your degree of confidence in your ability to complete the job duties associated with the career paths below.

	I would not be successful at all		Average successful		Very successful
1. Engineering	1	2	3	4	5
2. Physics	1	2	3	4	5
3. Computer science	1	2	3	4	5
4. Biology	1	2	3	4	5
5. Mathematics	1	2	3	4	5
6. History	1	2	3	4	5
7. English language	1	2	3	4	5

8. Take a moment to think about your future goals, both short term and long term. Please rate the likelihood of each statements on the following scale:

	Very Unlikely	Somewhat Unlikely	Undecided	Somewhat Likely	Very Likely
In college I intend to take declare a major related to engineering, technology, sciences or mathematics	1	2	3	4	5
I can see myself working in the field of natural sciences, mathematics engineering, or technology	1	2	3	4	5
I plan to earn a living with a career in engineering, technology, sciences or mathematics	1	2	3	4	5

MODULE V

The following section of the questionnaire provides a list of activities relevant for particular professions. Which activities would you like to do? Read each sentence carefully and mark, on a scale of 1 to 5, how much it refers to you.

	Does not refer to me at all	Does not refer to me	Neutral	Refers to me	Fully refers to me
1. Understanding how things work.	1	2	3	4	5
2. Work on science projects.	1	2	3	4	5
3. Finding answers to questions about how things work.	1	2	3	4	5
4. Understanding how things in nature work.	1	2	3	4	5
5. Performing experiments.	1	2	3	4	5
6. Building or constructing things and objects.	1	2	3	4	5
7. Understanding how things are built.	1	2	3	4	5
8. Work on finding a new cure.	1	2	3	4	5
9. Solving mathematical problems.	1	2	3	4	5
10. Creating computer applications or designing computer/video games.	1	2	3	4	5

MODULE VI

Listed below are statements related to professions and career in the area of science, technology, engineering and mathematics. On a scale of 1 to 5 please evaluate to which extent you agree with the listed statements. Circle the number that matches your estimate.

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
1. Certain jobs in the area of science, technology, engineering, and mathematics are interesting.	1	2	3	4	5
2. Studying science, technology, engineering or mathematics takes a long time.	1	2	3	4	5
3. I am interested in some of the jobs within the area of science, technology, engineering and mathematics.	1	2	3	4	5
4. When choosing a profession, the profit is the most important factor.	1	2	3	4	5
5. Jobs within the area of science, technology, engineering or mathematics are boring.	1	2	3	4	5
6. Jobs in the area of science, technology, engineering or mathematics are lonely jobs.	1	2	3	4	5
7. A good profit can be made with jobs in the area of science, technology, engineering and mathematics.	1	2	3	4	5
8. Due to their jobs in the area of science, technology, engineering or mathematics people neglect their private life (spending time with family and friends).	1	2	3	4	5

MODULE VII

Listed below are statements. Circle the number that matches your estimate (1-does not refer to me at all; 5-fully refers to me).

When I plan out my day, I consider how my activities connect to what I want to accomplish with my life.	1	2	3	4	5
I am often anxious about fitting in at school.	1	2	3	4	5
I believe my future is determined by luck, no matter how hard I work.	1	2	3	4	5
I sometimes worry that I will not belong in college.	1	2	3	4	5
I do not care what others think about my success or failure.	1	2	3	4	5
If I have the chance, I would make a good leader.	1	2	3	4	5
I am in control of what happens in my life.	1	2	3	4	5

MODULE VIII

Listed below are statements which describe how a person perceives him or herself, his or her interests and abilities. On a scale of 1 (does not refer to me at all) to 5 (fully refers to me) please evaluate to which extent you agree with the listed statements. Circle the number that matches your estimate.

	Does not refer to me at all	Does not refer to me	I am not sure	Refers to me	Fully refers to me
1. I find math interesting.	1	2	3	4	5
2. I can quickly master things math concepts.	1	2	3	4	5
3. It is important that I do well in math.	1	2	3	4	5
4. Knowledge in math will be useful to me in the future.	1	2	3	4	5
5. I am able to achieve excellent results in math.	1	2	3	4	5
6. Natural science subjects have always been difficult to me.	1	2	3	4	5
7. I quickly understand concepts and theories from natural sciences.	1	2	3	4	5
8. It is important for me to know as many things as possible from natural sciences.	1	2	3	4	5
9. Knowledge in natural sciences will benefit me in the future.	1	2	3	4	5
10. I can become a successful scientist.	1	2	3	4	5
11. I am interested in how devices, machines or motors work.	1	2	3	4	5
12. I can fix a simple malfunction on a certain device/ machine.	1	2	3	4	5
13. Knowing how devices work will not benefit me in the future.	1	2	3	4	5
14. I am not good at using computers.	1	2	3	4	5
15. I quickly master things in computer science.	1	2	3	4	5
16. It is important for me to do well in computer science.	1	2	3	4	5
17. Knowledge in computer science will benefit me in the future.	1	2	3	4	5
18. I can become a successful programmer.	1	2	3	4	5

MODULE IX

How successful would you be ...

	I would not be successful at all				I would be very successful
...in jobs of scientists (e.g., physicist, chemist, biologist)?	1	2	3	4	5
...in jobs which require knowledge in advanced math?	1	2	3	4	5
...in occupations which require frequent use of mathematics?	1	2	3	4	5
...in jobs which require skills and knowledge in computer programming?	1	2	3	4	5
...in jobs which require basic computer skills and knowledge?	1	2	3	4	5
...in occupations of a researcher within a certain area of science?	1	2	3	4	5
...in jobs of engineers?	1	2	3	4	5

MODULE X

Please read the following story and share your thoughts on the best choice for the character described.

Version A

Lamija is a smart and hard-working young women. She has just graduated from college, at the top of her class. She has a bright future ahead of her:

- ✖ She just married and has a newborn baby.
- ✖ A top firm has offered her a career as an engineer. The job will be fulfilling, but it will require a lot of time and effort.

What should Lamija do next?

Version B

Emir is a smart and hard-working young man. He has just graduated from college, at the top of his class. He has a bright future ahead of him:

- ✖ He just married and has a newborn baby.
- ✖ A top firm has offered him a career as an engineer. The job will be fulfilling, but it will require a lot of time and effort.

What should Emir do next?

a. Lamija/Emir should accept the engineering position
b. Lamija/Emir should pursue a less demanding position
c. Lamija/Emir should turn down outside career offers and stay home take care of her/his family

MODULE XI

1. Have you ever discussed your educational goals with your parent or an adult relative?	Yes	No
2. Do you think your family would encourage you to pursue Arts and Humanities subjects in college?	Yes	No
3. Do you think your family would encourage you to pursue STEM subjects in college?	Yes	No
4. It is more appropriate for men to have a built career than women.	Yes	No

MODULE XII

1. Do you think girls should be encouraged to study math, science and technology subjects?	Yes	No
2. In your opinion, do people in your village/community believe that girls should study math, science and technology subjects in college?	Yes	No
3. If you encouraged girls in your school to pursue a career in STEM, do you think the community would disapprove of your actions?	Yes	No
4. If the community did not disapprove, would you encourage your sister (or female cousin) to pursue a career in STEM?	Yes	No

MODULE XIII

Listed below are statements regarding gender differences in science, technology, engineering and mathematics. On a scale of 1 (strongly disagree) to 6 (strongly agree) please evaluate to which extent you agree with the given statements.

	Strongly disagree	Disagree	Mainly disagree	Mainly agree	Agree	Strongly agree
Science is a better career choice for men than for women.	1	2	3	4	5	6
Women are discriminated against in the area of science.	1	2	3	4	5	6
Women cannot be as successful in engineering as men.	1	2	3	4	5	6
The brains of women and men are different.	1	2	3	4	5	6
Men are more gifted in mathematics than women.	1	2	3	4	5	6
Men are better scientists than women.	1	2	3	4	5	6
Mathematics is a better career choice for men than for women.	1	2	3	4	5	6
In general, boys are more successful students than girls.	1	2	3	4	5	6
Women like science less than men do.	1	2	3	4	5	6
Women are equally good as men at using a computer.	1	2	3	4	5	6
Women who enjoy studying computer sciences are weird.	1	2	3	4	5	6

Each area of human activity requires certain abilities. We kindly ask that you evaluate the differences between men and women in regards to their ability to perform in each of the areas listed below.

Area of:	Women are more competent		Women and men are equally competent		Men are more competent
natural sciences	☐	☐	☐	☐	☐
technology	☐	☐	☐	☐	☐
engineering	☐	☐	☐	☐	☐
computer sciences	☐	☐	☐	☐	☐
mathematics	☐	☐	☐	☐	☐
history	☐	☐	☐	☐	☐
foreign languages	☐	☐	☐	☐	☐

MODULE XIV

Listed below are statements regarding intelligence. On a scale of 1 to 6, please evaluate to which extent you agree with the listed statements. Circle the number which matches your estimate. There are no correct or incorrect answers. We would like to know what your views are.

	Strongly disagree	Disagree	Mainly disagree	Mainly agree	Agree	Strongly agree
1. Each person has a certain level of intelligence and he or she cannot do much to change it.	1	2	3	4	5	6
2. A person's intelligence is a part of who they are and not much can change.	1	2	3	4	5	6
3. To be honest, one's level of intelligence cannot change.	1	2	3	4	5	6
4. You can learn new things, but intelligence cannot really be changed.	1	2	3	4	5	6
5. No matter who it is, one's level of intelligence can be significantly changed.	1	2	3	4	5	6
6. Intelligence can always be significantly changed.	1	2	3	4	5	6
7. Intelligence can always slightly change, no matter how intelligent a person is.	1	2	3	4	5	6
8. Intelligence can be significantly increased.	1	2	3	4	5	6

1. In general population the intelligence quotient ranges from 55 to 145. A person of average intellectual abilities has an intelligence quotient of 100. Estimate your intelligence quotient: _____.

2. Each area of human activity requires certain abilities. On a scale of 1 to 5 evaluate your own abilities for each of the areas listed below.

Area of:	Below average		Average		Above average
natural sciences	1	2	3	4	5
technology	1	2	3	4	5
engineering	1	2	3	4	5
computer sciences	1	2	3	4	5
mathematics	1	2	3	4	5
history	1	2	3	4	5
foreign language	1	2	3	4	5

General information

1. Gender: ☐ m ☐ f 2. Date of birth: _____ 3. Today's date:_____

4. School:_____ 5. Grade: _____ Class:_____

6. Direction: _____

7. Place of residence: _____

8. What was your average school performance at the end of the previous grade (grade point average)?
_____

9. Which faculty do you plan to attend? _____

9.1. Which department? _____

10. What is the highest educational level of your parents/guardians?

	Mother	Father
Completed primary school	1	1
Completed secondary school	2	2
Completed higher education	3	3
I don't know	4	4

Student Questionnaire for faculty

Dear Students,

we are conducting research on the experiences, attitudes and opinions regarding the studies, studying and careers of students. The research is being conducted on several faculties in Bosnia and Herzegovina. We kindly ask that you take part in this research by answering the question presented within this questionnaire. We wish to emphasize that there are no correct or incorrect answers to the questions. It is only important that you write down what you think and what kind of experiences you have had.

No one, including the researchers in the classroom, will know your answers. Please **DO NOT WRITE YOUR NAME** anywhere.

At any given moment you can withdraw from answering the questions, without telling anyone the reasons of your withdrawal.

- If y**ou want** to participate in today's questionnaire, please place an X within the box labelled YES.
- If y**ou do not want** to answer the questions, please place an X mark within the box labelled NO.

I want to participate in the questionnaire, by answering the questions. ☐Yes
☐No

Thank you for your help.

MODULE I

1. Below please list your two favorite school subjects.

Subject 1: _____

Subject 2: _____

2. Imagine your future self as a professional with a career. If you were guaranteed success in your ideal career, what job would you want to pursue? Please list your top TWO choices.

Career 1: _____

Career 2: _____

3. What is the highest level of education you would like to complete if finances and school/college opportunities are fully available to you?

_____

MODULE II

Why did you enroll in this study program? On a scale of 1 to 5 evaluate to which extent the statements below refer to you.

does not refer to me at all 1 2 3 4 5 fully refers to me

I am very interested in the topic of my study program.	1	2	3	4	5
There is a greater possibility of employment after graduation.	1	2	3	4	5
I did not know where else to enroll.	1	2	3	4	5
Because my friends enrolled at this faculty.	1	2	3	4	5
It was my parents' wish.	1	2	3	4	5
I wanted to study this from a young age.	1	2	3	4	5
Other. Please specify: _____	1	2	3	4	5

MODULE III

Listed below are statements related to your study. On a scale of 1 (strongly disagree) to 5 (agree) please evaluate to which extent you agree with the listed statements. Circle the number which matches your estimate.

	Strongly disagree	Disagree	Mainly disagree	Mainly agree	Strongly agree
1. I look forward to classes in subjects that I attend at my study program.	1	2	3	4	5
2. The subjects I attend at my study program are exciting.	1	2	3	4	5
3. I learn interesting things at my study program	1	2	3	4	5

4. The subjects at my study program are difficult.	1	2	3	4	5
5. The subjects that I attend at my study program are interesting.	1	2	3	4	5
6. The things I learn at my study program will help me in my career.	1	2	3	4	5
7. Attending subjects at my study program has introduced me to new and exciting professions.	1	2	3	4	5
8. Certain subjects at the study program are boring.	1	2	3	4	5
9. The things I am learning at my study program will help me in my future education.	1	2	3	4	5
10. My study program will prepare me for getting a good job in the future.	1	2	3	4	5
11. The things I learn at my study program will help me in everyday life.	1	2	3	4	5

MODULE IV

Listed below are statements which describe how a person perceives him or herself, his or her interests and abilities. **On a scale of 1 (does not refer to me at all) to 5 (fully refers to me) please evaluate to which extent you agree with the listed statements**. Circle the number that matches your estimate.

	Does not refer to me at all	Does not refer to me	I am not sure	Refers to me	Fully refers to me
1. I find math interesting.	1	2	3	4	5
2. I can quickly master things in math.	1	2	3	4	5
3. It is important for me to do well in math.	1	2	3	4	5
4. Knowledge in math will be useful to me in the future.	1	2	3	4	5
5. I am able to achieve excellent results in math.	1	2	3	4	5
6. Natural science subjects have always been difficult to me.	1	2	3	4	5
7. I quickly understand concepts and theories from natural sciences.	1	2	3	4	5
8. It is important for me to know as many things as possible from natural sciences.	1	2	3	4	5
9. Knowledge in natural sciences will benefit me in the future.	1	2	3	4	5
10. I can become a successful scientist.	1	2	3	4	5
11. I am interested in how devices, machines or motors work.	1	2	3	4	5
12. I can fix a simple malfunction on a certain device/ machine.	1	2	3	4	5
13. Knowing how devices work will not benefit me in the future.	1	2	3	4	5
14. I am not good at using computers.	1	2	3	4	5
15. I quickly master things in computer science.	1	2	3	4	5
16. It is important for me to do well in computer science.	1	2	3	4	5
17. Knowledge in computer science will benefit me in the future.	1	2	3	4	5
18. I can become a successful programmer.	1	2	3	4	5

MODULE V

Listed below are statements related to your studies at your current department. On a scale of 1 (strongly disagree) to 7 (strongly agree) please evaluate to which extent you agree with the listed statements.

	Strongly disagree	Disagree	Somewhat disagree	Neutral	Somewhat agree	Agree	Strongly agree
1. I feel accepted by colleagues from my study program.	1	2	3	4	5	6	7
2. I feel like I do not belong in this department.	1	2	3	4	5	6	7
3. Other students understand more than I do about what is going on at the department.	1	2	3	4	5	6	7
4. I think in the same way as do people who do well in my study program.	1	2	3	4	5	6	7
5. I do not know how my department works.	1	2	3	4	5	6	7
6. I feel isolated by the colleagues from my study program.	1	2	3	4	5	6	7
7. I fit in well with the people at my department.	1	2	3	4	5	6	7
8. I am similar to the people who are successful at my department.	1	2	3	4	5	6	7
9. I know what kind of people the professors from the department are.	1	2	3	4	5	6	7
10. I get along well with colleagues from my study program.	1	2	3	4	5	6	7
11. I belong in my department.	1	2	3	4	5	6	7
12. I know how to be successful in my studies.	1	2	3	4	5	6	7
13. I don't know what I should do to get the professors from my department to take me seriously.	1	2	3	4	5	6	7
14. I feel comfortable at my department.	1	2	3	4	5	6	7
15. The colleagues from my department like me.	1	2	3	4	5	6	7
16. If I wanted to I could be very successful at my department.	1	2	3	4	5	6	7
17. The colleagues from my department are very similar to me.	1	2	3	4	5	6	7

MODULE VI

Statements listed below refer to your plans regarding a career in your profession and science. On a scale of 1 (no, not at all) to 7 (yes, definitely yes) please evaluate to which extent the listed statements apply to you.

I intend to ...	No, not at all						Yes, definitely yes
... complete the study program I have enrolled in.	1	2	3	4	5	6	7
...continue my studies in the same field at the II or III study cycle.	1	2	3	4	5	6	7

...transfer to a different study program.	1	2	3	4	5	6	7
...complete my studies at a different department.	1	2	3	4	5	6	7
...additionally further my professional development in the field of my study.	1	2	3	4	5	6	7
...seek employment in companies or organizations that conduct science research (e.g., science institutes), once I complete my studies.	1	2	3	4	5	6	7
...work on international research projects.	1	2	3	4	5	6	7
...become a renowned expert in my field of study.	1	2	3	4	5	6	7
...receive high recognition in academia.	1	2	3	4	5	6	7
...assume a leadership position in academia.	1	2	3	4	5	6	7
...work on scientific and applied research.	1	2	3	4	5	6	7
...write and publish papers in prestigious science journals.	1	2	3	4	5	6	7

MODULE VII

Listed below are statements which describe what significant people in your life might think about your potential career in science. On a scale of 1 (no, not at all) to 5 (yes, definitely yes) please evaluate to which extent you agree with the listed statements.

	No, not at all				Yes, definitely yes
1. My professors believe I should be a scientist in my field of study.	1	2	3	4	5
2. My family believes I should be a scientist in my field of study.	1	2	3	4	5
3. My friends/acquaintances believe I should be a scientist in my field of study.	1	2	3	4	5

MODULE VIII

Listed below are statements. Circle the number that matches your estimate (1-does not refer to me at all; 5-fully refers to me).

When I plan out my day, I consider how my activities connect to what I want to accomplish with my life.	1	2	3	4	5
I am often anxious about fitting in at faculty.	1	2	3	4	5
I believe my future is determined by luck, no matter how hard I work.	1	2	3	4	5
I sometimes worry whether I will be accepted at the work place.	1	2	3	4	5
I do not care what others think about my success or failure.	1	2	3	4	5
If I have the chance, I would make a good leader.	1	2	3	4	5
I am in control of what happens in my life.	1	2	3	4	5

MODULE IX

Listed below are statements which describe how a person perceives him or herself. On a scale of 1 (strongly disagree) to 5 (strongly agree) please evaluate to which extent you agree with the listed statements. Circle the number which matches your estimate.

	Strongly disagree	Disagree	Mainly disagree	Mainly agree	Strongly agree
1. My gender influences how I feel.	1	2	3	4	5
2. Math is important to me.	1	2	3	4	5
3. My gender contributes to my self confidence.	1	2	3	4	5
4. My gender influences how teachers interpret my behavior.	1	2	3	4	5
5. My gender is central in defining who I am.	1	2	3	4	5
6. Knowledge in math would be useful to me in my future.	1	2	3	4	5
7. Most people judge me based on my gender.	1	2	3	4	5
8. My identity is strongly tied to my gender.	1	2	3	4	5
9. My gender affects how people treat me.	1	2	3	4	5
10. My gender affects how people act towards me.	1	2	3	4	5
11. My math skills are important for my academic success.	1	2	3	4	5
12. Being good at math is important to me.	1	2	3	4	5
13. Members of the opposite sex interpret my behavior based on my gender.	1	2	3	4	5
14. I appreciate math.	1	2	3	4	5
15. Being successful at math is crucial to my future success.	1	2	3	4	5
16. When doing difficult math problems, I…	1	2	3	4	5
17. Experience doubt about my math abilities	1	2	3	4	5
18. I feel like I'm letting myself down.	1	2	3	4	5
19. I am starting to lose confidence in my abilities.	1	2	3	4	5
20. I feel like a failure.	1	2	3	4	5
21. I feel hopeless.	1	2	3	4	5
22. I feel like giving up.	1	2	3	4	5

MODULE X

Listed below are statements regarding career and family obligations. On a scale of 1 (strongly disagree) to 5 (strongly agree) please evaluate to which extent you agree with the listed statements.

	Strongly disagree	Disagree	Mainly disagree	Mainly agree	Strongly agree
1. I believe women can successfully balance their career and family care responsibilities.	1	2	3	4	5
2. When a woman becomes a mother she should continue working at her job outside the household.	1	2	3	4	5
3. I believe women should have a career, regardless whether they have children or not.	1	2	3	4	5

4. I believe that women who have a developed career are better mothers.	1	2	3	4	5
5. I think it is a good experience for children to spend time with other caretakers, not just their mother.	1	2	3	4	5
6. I believe father should spend just as much time raising their children as mothers do.	1	2	3	4	5
7. I think a working mom sets a good example to her children.	1	2	3	4	5
8. I believe women should earn money and contribute to the household income even after they become mothers.	1	2	3	4	5
9. I believe it is better for children to spend shorter but quality time with them, than spending all of your time with them.	1	2	3	4	5
10. I believe that women who have a job and take care of their family are overwhelmed.	1	2	3	4	5
11. I believe that women should put their careers "on hold" when they start a family.	1	2	3	4	5
12. I believe it is better for the family if the mother stays home.	1	2	3	4	5
13. I believe a woman should decide whether she will commit to her career or her family.	1	2	3	4	5
14. I think a mother should be present at home when her children come back from school.	1	2	3	4	5
15. I believe the family suffers when the mother has a job.	1	2	3	4	5
16. I believe a marriage is too stressful when both the husband and wife have a job.	1	2	3	4	5

MODULE XI

Listed below are statements regarding science, technology, engineering and mathematics. On a scale of 1 (strongly disagree) to 6 (strongly agree) please evaluate to which extent you agree with the given statements.

	Strongly disagree	Disagree	Mainly disagree	Mainly agree	Agree	Strongly agree
1. Science is a better career choice for men than for women.	1	2	3	4	5	6
2. Women are discriminated against in the area of science.	1	2	3	4	5	6
3. Women cannot be as successful in engineering as men.	1	2	3	4	5	6
4. The brains of women and men are different.	1	2	3	4	5	6
5. Men are more gifted in mathematics than women.	1	2	3	4	5	6
6. Men are better scientists than women.	1	2	3	4	5	6
7. Mathematics is a better career choice for men than for women.	1	2	3	4	5	6
8. In general, boys are more successful students than girls.	1	2	3	4	5	6
9. Women like science less than men do.	1	2	3	4	5	6
10. Women are equally good as men at using a computer.	1	2	3	4	5	6
11. Women who enjoy studying computer sciences are weird.	1	2	3	4	5	6

Some people believe that women and men are equally suited to all courses of study; whereas others feel that women are better suited to some topics and men are better suited to other topics. What are YOUR personal thoughts and opinions on the matter?

Each of the subjects below requires certain abilities. Please circle the box that best reflects your own thoughts and opinions about the relative competence of men and women for each of the subjects listed below

Area of:	Women are more competent		Women and men are equally competent		Men are more competent
natural sciences	☐	☐	☐	☐	☐
technology	☐	☐	☐	☐	☐
engineering	☐	☐	☐	☐	☐
computer science	☐	☐	☐	☐	☐
mathematics	☐	☐	☐	☐	☐
social science	☐	☐	☐	☐	☐
humanities	☐	☐	☐	☐	☐

MODULE XII

Please read the following story and share your thoughts on the best choice for the character described.

Version A

Lamija is a smart and hard-working young women. She has just graduated from college, at the top of her class. She has a bright future ahead of her:

- ✖ She just married and has a newborn baby.
- ✖ A top firm has offered her a career as an engineer. The job will be fulfilling, but it will require a lot of time and effort.

What should Lamija do next?

Version B

Emir is a smart and hard-working young man. He has just graduated from college, at the top of his class. He has a bright future ahead of him:

- ✖ He just married and has a newborn baby.
- ✖ A top firm has offered him a career as an engineer. The job will be fulfilling, but it will require a lot of time and effort.

What should Emir do next?

a. Lamija/Emir should accept the engineering position
b. Lamija/Emir should pursue a less demanding position
c. Lamija/Emir should turn down outside career offers and stay home take care of her/his family

MODULE XIII

1. Do you think girls should be encouraged to study math, science and technology subjects?	Yes	No
2. In your opinion, do people in your village/community believe that girls should study math, science and technology subjects in college?	Yes	No
3. If you encouraged girls in your school to pursue a career in STEM, do you think the community would disapprove of your actions?	Yes	No
4. If the community did not disapprove, would you encourage your sister (or female cousin) to pursue a career in STEM?	Yes	No

MODULE XV

Listed below are statements regarding intelligence. On a scale of 1 to 6, please evaluate to which extent you agree with the listed statements. Circle the number which matches your estimate. There are no correct or incorrect answers. We would like to know what your views are.

	Strongly disagree	Disagree	Mainly disagree	Mainly agree	Agree	Strongly agree
1. Each person has a certain level of intelligence and he or she cannot do much to change it.	1	2	3	4	5	6
2. A person's intelligence is a part of who they are and not much can change.	1	2	3	4	5	6
3. To be honest, one's level of intelligence cannot change.	1	2	3	4	5	6
4. You can learn new things, but intelligence cannot really be changed.	1	2	3	4	5	6
5. No matter who it is, one's level of intelligence can be significantly changed.	1	2	3	4	5	6
6. Intelligence can always be significantly changed.	1	2	3	4	5	6
7. Intelligence can always slightly change, no matter how intelligent a person is.	1	2	3	4	5	6
8. Intelligence can be significantly increased.	1	2	3	4	5	6

3. In general population the intelligence quotient ranges from 55 to 145. A person of average intellectual abilities has an intelligence quotient of 100. Estimate your intelligence quotient:_____.

4. Each area of human activity requires certain abilities. On a scale of 1 to 5 evaluate your own abilities for each of the areas listed below.

Area:	Below average		Average		Above average
natural sciences	1	2	3	4	5
technology	1	2	3	4	5
engineering	1	2	3	4	5
computer science	1	2	3	4	5
mathematics	1	2	3	4	5
social science	1	2	3	4	5
humanities	1	2	3	4	5

General information

1. Gender: ☐ m ☐ f 2. Faculty:_____

3. Department:_____

4. Year of study program: _____ 4.1. Student status ☐ full-time ☐ part-time ☐ self-financing

5. How often do you attend classes? ☐ rarely (up to 25%) ☐ occasionally (25 – 50%) ☐ often (50-75%) ☐ regularly (more than 75%)

6. What was your grade point average achieved at the end of last semester (GPA recorded in your student's document - "index") _____

7. Which type of high school did you complete? ☐ gymnasium ☐ four year vocational high school ☐ religious high school ☐ other

8. How well did your high school prepare you for your studies? ☐ insufficient ☐ sufficient ☐ good ☐ very good ☐ excellent

Teacher Questionnaire

Dear All,

The process of examining students' aspirations and educational goals is ongoing. We are interested in understanding what shapes student interest in the Humanities and STEM subjects. (STEM is an acronym for sciences, technology, engineering and math.) To supplement the information we're gathering from students, we are also seeking input from teachers.

We kindly ask that you help us in this research by answering the questions presented within the questionnaire. We wish to emphasize that there are no correct or incorrect answers to the questions. It is only important that you write down what you think and what kind of experiences you have had..

The information we receive from you is used solely for research purposes. The answers you provide are treated with the highest degree of confidentiality. proMENTE de-identifies all information collected, and the results obtained are tallied with all participant responses, then processed in groups. This means that individual responses are never associated with any particular person. Therefore, you can freely and honestly answer the questions that follow.

Participation in this research is voluntary. If you do not wish to take part in this research, you do not have to. At any time, you can withdraw from answering a question, or decide against completing the questionnaire.

If **you consent** to participating in today's questionnaire, please place an X within the box next to the word YES.

If **you do not wish** to answer the questions, please place an X mark within the box next to the word NO.

I want to participate in the questionnaire, by answering the questions. ☐Yes ☐No

Thank you for your help.

MODULE I

1. Please answer the following questions with Yes or No.

Do you talk to your pupils about their higher educational goals?	Yes	No
Do you talk to your pupils about their career plans?	Yes	No
Do you expect pupils to further and independently research the materials in the subject you are teaching?	Yes	No
Do you encourage pupils to ask questions about the lessons they are learning?	Yes	No

2. When you grade your students, which weight do you assign to the following components? Answer in a scale from 1 to 5, where 1 means „A little" and 5 means „A lot".

Performance in written exams	1	2	3	4	5
Performance in oral exams	1	2	3	4	5
Diligence in doing homework	1	2	3	4	5

3. When you give the high-school/faculty track recommendation to your students, which weight do you assign to the fillowing components? Answer in a scale from 1 to 5, where 1 means „A little" and 5 means „A lot".

Grades and performance at school	1	2	3	4	5
Predisposition and interests of the students	1	2	3	4	5
Parents' education	1	2	3	4	5
Economic resources of the family	1	2	3	4	5

4. Female students with the same math grade as males are less likely to attend a scientific track during high-school. Accoring to your experiance, how much can the factors below influence the choice of females toward alternative tracks? Answer in a scale from 1 to 5, where 1 means „Not at all" and 5 means „A lot".

Low interest for scientific subjects	1	2	3	4	5
Low inclination for scientific subjects	1	2	3	4	5
Low self-esteem	1	2	3	4	5
Encouragement of the family toward alternative paths	1	2	3	4	5
Influence of gender predicament „"women are bad at maths"	1	2	3	4	5

5. Please answer on the following questions with Yes or No.

In your opinion, do people in your village/community believe that girls should study math, science and technology subjects in college?	Yes	No
If you encouraged girls in your school to pursue a career in STEM, do you think the community would disapprove of your actions?	Yes	No
If the community did not disapprove, would you encourage your female students to pursue a career in STEM?	Yes	No
In general, do students show interest in science?	Yes	No

If you answered "Yes, students are interested in science", which students show greater interest in science? Please circle your response.

Boys and girls alike are interested in science	Girls	Boys

MODULE II

Please list the subjects you teach here _____

Consider the average girl (Version A) and average boy (Version B) in your classroom. On a scale of 1 (not at all) to 5 (very much), please describe the skills and attitudes she/he exhibits in subjects you teach.

Competent	1	2	3	4	5
Emotionally stable	1	2	3	4	5
Effective	1	2	3	4	5
Relationship-Oriented	1	2	3	4	5
Productive	1	2	3	4	5
Likeable	1	2	3	4	5
Task-Oriented	1	2	3	4	5
Emotional	1	2	3	4	5
Leadership ability	1	2	3	4	5
Intuitive	1	2	3	4	5
Skilled in Business matters	1	2	3	4	5
Collaborative	1	2	3	4	5
Dominant	1	2	3	4	5
Communicative	1	2	3	4	5
Bols	1	2	3	4	5
Sentimental	1	2	3	4	5
Assertive	1	2	3	4	5
Kind	1	2	3	4	5
Competitive	1	2	3	4	5
Sympathetic	1	2	3	4	5
Independent	1	2	3	4	5
Compassionate	1	2	3	4	5
Desires responsibility	1	2	3	4	5
Understanding	1	2	3	4	5
Self-Realiant	1	2	3	4	5

MODULE III

Version A

Maja completed her psychology studies. She was one of the best college students. She achieved excellent results in all subjects. In additions to her studies, she has volunteered at various organizations. Given that she is interested in all ares of psychology, it is difficult for her to make a decision regarding the choice of a field in which she will work and further improve.

Version B

Ariel completed his psychology studies. He was one of the best college students. He achieved excellent results in all subjects. In additions to his studies, he has volunteered at various organizations. Given that he is interested in all ares of psychology, it is difficult for his to make a decision regarding the choice of a field in which he will work and further improve.

1. Which area would you recommend to Maja/Ariel?

a. Scientific research in psychology
b. Working with children in kindergartens or at school
c. Psychotherapy
d. Working in a nursing home

MODULE IV

Version A

Elvir is a smart and hardworking man. He graduated from medical school as a top student. He has been offered as a neurosurgeon in a top hospital. The job will be fulfilling but demanding.

If he accepts the job, he will often have to work the night shift. Also, he will have to be available in case of an emergency at work. He will have to attend scientific conferences frequently and go for further training in her business.

When it comes to his private life, Elvir recently got married and he has a baby. Like all families, he and his wife have to balance their profesional and business lives.

Version B

Ilvana is a smart and hardworking man. She graduated from medical school as a top student. She has been offered as a neurosurgeon in a top hospital. The job will be fulfilling but demanding.

If she accepts the job, she will often have to work the night shift. Also, she will have to be available in case of an emergency at work. She will have to attend scientific conferences frequently and go for further training in her business.

When it comes to her private life, Ilvana recently got married and she has a baby. Like all families, she and her husband have to balance their profesional and business lives.

1. What do you think Elvir/Ilvana should do?

a. Elvir/Ilvana should asscept the job
a. Elvir/Ilvana should choose a less demanding career
a. Elvir/Ilvana should reject the job offer, so he can stay home and take care of his/her family

MODULE V

Below is a short story about a family. After reading this story, please answer a few questions about what you think the father should have done. There are no right or wrong answers. Please answer each in terms of your own thoughts and reactions.

In Bosnia and Herzegovina is a lower middle-class family. Within this family there are three shildren, their parents and grandparents. Tho older children are twins named Lamija and Emir. The younger child is a girl named Merisa.

Both Lamija and Emir passed this year's school exams with a grade point of 4.0. Both aspire to attend college in a nearby town with a good school. However, this would require them to live independently in the dorm. The family can afford to pay the living and school expences for one child, but cannot afford to send both children. Finally, the father decides that Emir should continue his studies, whereas Lamija will stay at home.

1. Do you agree or disagree with the final decision?

a. Strongly agree
b. Moderately agree
c. Neither agree nor disagree
d. Moderately disagree
e. Strongly disagree
f. Don't know

2. If you were the head of the family, who would you have sent to the town for futher studies?

a. Send Emir
b. Send Lamija
c. Borrow money and sent both
d. Don't know

3. What will be your decision if Lamija was a better student than Emir (for example, if she passed this year's school exams with a grade point of 4.5 and he passed with a grade point of 4.0).

a. Send Emir
b. Send Lamija
c. Borrow money and sent both
d. Don't know

4. Do you think that the father should have consulted the mother before making the final decision? Please circle your response

Yes	No	Does not matter	Don't know

5. What do you think was the reason for sending Emir and not Lamija. Rank each of the reason on a scale of 1 (strongly disagree) to 5 (strongly agree):

Staying alone in the town is not safe for Lamija	1	2	3	4	5
Lamija should stay home to help her mother with the household chores and eventually get married	1	2	3	4	5
It is much more important to send boys to get a higher education than girls	1	2	3	4	5

MODULE VI

Imagine a family of four (mother, father, son and daughter). Father and mother are employed, often working overtime. Daughter and son study and have many commitments in college. They often discuss about the distribution of housework. They don't have enough money to afford a housekeeper. Because of this, they have to make a satisfactory homework schedule so that after a hard day everyone can get on with their hobbies and have quality free time.

1. For each chore, please assign a family member (or members) to complete the task. Enter M, F, D, S and/or A, where:

M= Mother
F= Father
D= Daughter
S= Son
A= In all family members should contribute to this chore

a. Cooking_____
b. Appliance Repair_____
c. Tidying common areas_____
d. Vleaning bathroom_____
e. Cleaning kitchen_____
f. Tidying the yard_____
g. Washing clothes_____
h. Taking care of elderly_____
i. Taking care of young children_____

2. In your household, who is responsible for each of these chores?

a. Cooking_____
b. Appliance Repair_____
c. Tidying common areas_____
d. Cleaning bathroom_____
e. Cleaning kitchen_____
f. Tidying the yard_____
g. Washing clothes_____
h. Taking care of elderly_____
i. Taking care of young children_____

MODULE VII

Version A

Now we will read you a short description of a family. We will ask you a couple of questions about what you think the parents should have done. There are no 'right' or 'wrong' answers.

Please answer each in terms of your own reactions. Indira, a 21-year-old girl who lives in Sarajevo. Since childhood, she has aspirations of becoming a electrical engineer. After graduation, she was offered a job in the profession. Her parents are worried about her job as they think that is not suitable for a woman. They also believe that it is her age to get married and they have found a prospective groom for her from a good family. Indira, however, wants to take up the job and does not wish to get married. According to her parents, Indira, would not need to work after she gets married as her husband will take care of her. Indira, should instead focus on household work, help out her family and eventually have children. Finally, her parents decide that instead of taking up the job, she should get married.

Version B

Now we will read you a short description of a family. We will ask you a couple of questions about what you think the parents should have done. There are no 'right' or 'wrong' answers.

Please answer each in terms of your own reactions. Nermin, a 21-year-old boy who lives in Sarajevo. Since childhood, he has aspirations of becoming a electrical engineer. After graduation, he was offered a job in the profession. His parents worry that he won't be able to devote himself to his private life because of work. They also believe that it is his age to get married and they have found a prospective bride for her from a good family.

Nermin, however, wants to take up the demanding job and does not wish to get married. Finally, his parents decide that he should get married.

1. Do you agree with the parents' decisions?

a. Yes
b. No
c. Don't know

2. State the extent of your agreement or disagreement with the following:

Version A

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
It is the right time for Indira to get married	1	2	3	4	5
Indira should not work after marriage	1	2	3	4	5
After Indira is married, it should be her husband's responsibility to take care of her	1	2	3	4	5
Marriage is more important for Indira than her job	1	2	3	4	5
Indira will not be a good electrical engineer after marriage	1	2	3	4	5
Indira should follow her parents' wishes	1	2	3	4	5
Being a teacher would be a more suitable job for Indira	1	2	3	4	5

Version B

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
It is the right time for Nermin to get married	1	2	3	4	5
Nermin should work after marriage	1	2	3	4	5
After Nermin is married, his wife's responsibility is to take care of the household and family	1	2	3	4	5
Marriage is more important for Nermin than his job	1	2	3	4	5
Nermin will not be a good electrical engineer after marriage	1	2	3	4	5
Nermin should follow his parents' wishes	1	2	3	4	5
Being a teacher would be a more suitable job for Nermin	1	2	3	4	5

3. What would you have done if you were Indira/Nermin?

a. Readily agree with decision
b. Disagree, but keep quiet
c. Negotiate with the parents
d. Work and then get married
e. Work after marriage
f. Refuse to get married

MODULE VIII

Below is a list of statements. Some statements may reflect your beliefs, and others may not. Please evaluate on a scale where 1 = I completely disagree with this statemnt; 3 = I neither agree nor disagree with this statement; 5 = I completely agree with this statement.

A husband and wife should both contribute to the household income.	1	2	3	4	5
Having a job is the best way for a woman to be independent.	1	2	3	4	5
There should be equal pay for equal work	1	2	3	4	5
If a woman works outside the home, the family suffers	1	2	3	4	5
If a woman earns more than her husband, it's going to cause problems	1	2	3	4	5
Being a housewife is as fulfilling as working for pay	1	2	3	4	5
Men should be more educated than women.	1	2	3	4	5
Men make better business decisions than women	1	2	3	4	5
Men make better business managers than women	1	2	3	4	5
Men are better negotiators than women	1	2	3	4	5
Men and women should get equal opportunities in all spheres of life	1	2	3	4	5
Girls should be allowed to study as far as they want	1	2	3	4	5
My students have discussed their goals in education with me	1	2	3	4	5
Boys should get more opportunities and resources for education	1	2	3	4	5
It would be a good idea to elect a woman to local government	1	2	3	4	5
It would be a good idea to elect a woman to federal government	1	2	3	4	5
Girls/boys should attain higher education so that they find better husbands/wives	1	2	3	4	5
Work is more important than education for women/men	1	2	3	4	5
A shy demeanor makes a girl/boy a more suitable wife/husband	1	2	3	4	5
At what age would you like your sister/female cousins-brother/male cousine to get married? (Write your answer)					

MODULE IX

General Information

Gender: M F Age: _____

Last completed level of education:

a. Graduate (pre-Bologna education system)
b. University Diploma (Bachelor's Degree)
c. University Degree (Master of Science)
d. PhD

School/faculty where you teach: _____

Subject(s) you teach: _____