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REPORT FROM
1st STUDENT'S SURVEY
ASSUMPTIONS, ANALYSIS AND CONCLUSIONS

Developed by:

Jacek Batóg, University of Szczecin

Barbara Czerniachowicz, University of Szczecin (co-author of part 1 and author of part 4.2)

Proofreading:

Trudy Sutherland (Vaal University of Technology)

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1. Introduction

Many countries as well as companies, institutions and higher education sector in South Africa are still struggling with gender inequalities (Loots and Walker, 2015). In 2019 sub-Saharan Africa scores 0.570 on the Gender Inequality Index, making it the region where women face the most gender inequality in reproductive health, education, political representation, and the labour market - South Africa has much better score of 0.406, with 93 rank among 189 countries, while for Europe and Central Asia we noticed the GII at the level of 0.256 (Human Development Report 2020, 2020). Gender inequality in sub-Saharan Africa is, as with many other regions, largely linked to lower educational attainment and lower income (UN Development Programme..., 2018). Much better situation we can observe for South Africa when we consider Gender Development Index equal to 0.986, which is higher than for sub-Saharan Africa (0.894) and even than for Europe and Central Asia (0.953).

The issue of accessibility to education is important among others from a labor market perspective because the increase of the number of employees could be realized by increasing propensity of women to take up work. Recent studies suggest that societies that increase women's access to employment and narrow differences between men and women in economic opportunities increase the pace of economic development, obtain greater macroeconomic stability and reduce poverty (Stotsky, 2006, p.5). According to The World Bank gender equality, whether in education or other areas is very important for increasing productivity and higher women's integration in the labour market (World Bank, 2012). Although we can observe that the Covid-19 pandemic has erased decades of progress in the female labour force participation rate in many countries e.g. Mexico, Chile and Colombia (Human Development Report, 2020). The study of Licumba et al. based on a panel data of five Southern African countries between 1970 and 2010, suggests that there is a positive and significant effect of gender equality in education on economic growth (Licumba, Dzator, Zhang, 2015). This relation was proved by Klasen (2002) based on sample of 109 countries between 1960 and 1990. Pichler and Striessnig studying of three Caribbean island states — Cuba, the Dominican Republic and Haiti — confirmed the results about the effects of female education on climate risk vulnerability and revealed that women's education also contributes to long-term resilience (Pichler, Striessnig, 2013). One of the obstacles of efficient gender policy is occupational segregation that may channel women into certain economic sectors and occupations characterized by lower wages, resulting in losses of productivity and output (Tzannatos, 1999). This phenomenon is favoured by the lower level of education that characterizes women. Many studies and research confirm that the gender disparity observed in the education sector has also a direct link to poverty (Appleton, 1996).

Although in a modern world women are more represented in the workforce, caught up with men in the rates of higher-education graduation, increased their training and representation in formerly male-dominated professional fields in STEM, and they entered many previously male-dominated occupations (Costa et al., 2014), in many case due to voluntary quotas (Republic of South Africa..., 2019). Despite these gains, gender inequality persists and African women account for only 12% of both humanities and science researchers (Mustapha et al., 2017), and in many countries still women and men continually occupy highly differentiated gender roles, resulting in the greater likelihood of women taking the primary responsibility for home and family in addition to paid work/career (Seierstad, Kirton, 2015).

Tertiary education constitute a crucial factor of economic growth and social progress, driving research and innovation that fosters positive economic and social change. There is also the widespread recognition that tertiary education is main player of gender equality in the family and society (Dandan, Marquez, 2017). Women access to higher education has shown a great deal of improvement during the last two decades, but this improvement is vary from one region to another. In many countries the most significant change observed in higher education sector is the female enrolment which has outpaced the male enrolment. Despite of this change, women in leading positions and ranks in universities still remain very low (Dandan, Marquez, 2017; Mabokela, Mlambo, 2017). Some authors point out that leaders and practitioners in academic science are still unaware of and poorly educated about the nature and impact of barriers to full participation of women in science around the world. This lack of awareness and education results in failures to fully utilise the human capital and limits technological advancements (Coe, Wiley, Bekker, 2019).

When we look at chosen statistical data we can find that in 2019 according to (Human Development Report 2020, 2020) female mean years of schooling in South Africa was equal to 10.6 years, higher even than in Europe and Central Asia (9.9), and really high in comparison with Sub-Saharan Africa (4.9). In South Africa young people and young women in higher education have already realised a significant aspiration in accessing higher education: for every 12 children who enter school, one will make it to higher education, but the participation rate is still skewed to white students at 54.7% compared with 16.5% for black students (Institute of Race Relations, 2016). It is also important if female aspirations may reveal all the capabilities valuable for gender equality at the university (Walker, 2018).

At 58% women constitute the majority of undergraduate students but women are unevenly distributed across faculties, with more women in education, commerce and the humanities than in science and engineering (Council on Higher Education, 2015). Share of female tertiary graduates in science, technology, engineering and mathematics programmes among all female tertiary graduates is equal to 12.9%, while share of female graduates among all graduates of tertiary programmes in science, technology, engineering and mathematics is equal to 42.8% - the most recent year during the period 2009-2019 (Human Development Report 2020, 2020). For Europe and Central Asia we can observe accordingly values of 14.4% and 32.2%.

As a benchmark for South Africa chosen data on tertiary education in European Union will be provided. In 2018 in the EU according to Eurostat 40.7% of people aged 30-34 hold a tertiary degree, although we can observe high variation in attainment rates across countries mostly due to different labour migration or learning mobility patterns (Education and Training Monitor 2018, 2018). In the EU countries, more women complete their studies than men, while in the case of newcomers this proportion is the opposite (Silander, Haake, Lindberg, 2013). In 2016, women accounted for 54.1% of tertiary students in the EU, being a majority among tertiary students in all of the EU Member States except for Greece (48.5%) and Germany (48.2%). Across the EU-28, almost one third (32.0%) of all students in tertiary education were studying social sciences, journalism, information, business, administration or law in 2016. The second most common field of education was engineering, manufacturing and construction-related studies which accounted for 15.7% of all tertiary education students. In this field, almost three quarters (74.1%) of all students were male. Within natural sciences, mathematics, statistics, and information and communication technologies (ICT) the share of men in the total number of tertiary students was 61.1%.

2. Survey objectives and limitations

According to (OECD, 2017) OECD members should adopt practices that promote gender equality in education by: making the study equally inclusive and attractive for women and men, raising awareness among young men and women, parents, teachers and employers about the likely consequences of educational choices for employment opportunities, career progression and earnings as well as encouraging more women who have completed STEM (such as science, technology, engineering and mathematics) studies to pursue professional careers in these areas.

Coe et al. suggest that the chronic lack of recruitment, promotion, and retention of women in science is due to systemic, structural, organisational, institutional, cultural, and societal barriers to equity and inclusion. These barriers must be identified and removed through increased awareness of the challenges combined with evidence-based approaches leading to measurable targets and outcomes like: formal legislation and mandated quotas at national levels (gender parity), increased fairness (gender equity) facilitated through organisational and cultural changes at institutional levels, and development of core competencies at individual levels (Coe, Wiley, Bekker, 2019).

Rogan and Reynolds (2016) suggest that there remains a gap in identifying how factors such as schooling background, academic performance, race and gender are linked with key higher education outcomes and especially with the first-choice degree attainment at university. The production of this “evidence” is an important indicator of public policy debates about gender equality, including both the economic and social interests (David, 2017). The undertaken survey and presented results can be treated as one of such attempts.

However we should be aware that diversity of education without providing clear definitions and policy goals to achieve gender equality, increases the risk for diminishing the transformative intent of broader social justice goals and overlooking gender equality completely (Forbes, Öhrn, Weiner 2011; Loots, Walker, 2015).

That’s why many studies still report on the persistence of deeper inequalities between the genders in all spheres of higher education (e.g. Francis, Burke, and Read 2014). To construct effective policy tools to reduce gender inequalities we need to provide detailed and reliable information on current state of woman in economy and education. This is a reason that the topic of gender equality raised in the PEESA III project is very important for partner universities in South Africa, and is related to the study of the potential of the capabilities approach (CA) in shaping, developing and strengthening policy for higher education institutions.

One of the tools used in the project to collect the necessary data, which are then used for analysis in this area are surveys conducted among students. Such surveys are related to activities undertaken within the scope of the project *Personalised Engineering Education in Southern Africa* (PEESA III – reference number 585966-EPP-1-2017-1-DE-EPPKA2-CBHE-JP), financed by the European Union programme Erasmus+ Capacity Building in Higher Education and realised by South African (Cape Peninsula University of Technology, Durban University of Technology, Vaal University of Technology, Tshwane University of Technology) and European universities from Germany, Poland and Romania. The PEESA III project members are seeking to understand the reasons why women and men have chosen to study engineering. They also try to develop recommendations for policymakers on how to encourage females (and males) success in Engineering and related disciplines. The expected result of the project is to

present which tools and solutions are conducive to increase the number of women choosing engineering studies, to identify determinants of enrolment rate, and also to determine factors that increase the employability of engineering graduates.

Main goals of the first survey dedicated to students and conducted in 2019 were evaluation of the correctness of the questionnaire design and the comprehensibility of the questions and preliminary analysis of issues related to gender equality and propensity of women to undertake engineering study. The survey was preceded by the process of obtaining of ethical clearances. Granted ethics approvals are presented in the appendices 5 and 6, while application letters can be found in the appendices 3 and 4.

During the survey, some limitations and obstacles appeared. Among the most important were:

- limited possibilities to draw general conclusions for the population of South African engineering students, but it should be underline that there was sufficient number of answers to verify research hypothesis from statistical point of view ($n=708$),
- long waiting time to obtain ethical clearances,
- some incomprehensible and incorrect answers - it can be solved by dictionaries of e.g. faculty (study field) names,
- some missing answers in case of particular questions,
- some overlapping questions, like:
 - 15.9. Better job prospects after graduation,
 - 15.10. Future possibilities (earnings, social status),however they can be used for testing the coincidence of responses,
- unbalanced or/and not representative sample: e.g. males (61.16%) vs. females (38.84%) – recommendation: the drawing procedure like bagging applied to the whole set of responses could ensure the representativeness of the final sample across gender and/or ethnicity and/or study field and/or study year (but we need to possess the detailed structure of students population at every university).

3. Questionnaire development and implementation

The questionnaire and survey conducting were implemented by the University of Szczecin team in the close collaboration of representatives of South African partners:

- Lesley Cooke (DUT),
- Hester Jackson (DUT),
- Zakheeya Armoed (DUT),
- Maureen Ramaube (TUT),
- Trudy Sutherland (VUT),
- Luclaire Airey (CPUT).

All tasks and possible problems were consulted on the regular basis with members of Project Board.

The whole process of student's surveying was realised in the following steps:

1. Analysis of gender equality at PEESA III partner universities in South Africa based on received materials and reports, January 2018 (This document presents the initial analysis of gender equality at PEESA III partner universities in South Africa based on received materials and reports for the Erasmus + program: Higher education - building international capacity 585966-EPP-1-2017-1-DE-EPPKA2-CBHE-JP "Personalized education Engineering in South Africa"(PEESA III) – USZ Team Report and part of the presentation of USZ Team “PEESA III Gender Equality Issues among PEESA III partner universities in South Africa” in Sibiu, October 2019).
2. Preparation of first version of the gender equality survey dedicated to students presented in Szczecin in October 2018.
3. Consultations of the gender equality survey and first improvement of gender equality survey based on feedback and comments of SA partners, April 2018.
4. Next modification of the gender equality survey: survey structure, questions, and design development, May 2018.
5. Correction of questions and survey layout of gender equality survey dedicated to students, June 2018.
6. Elaboration and consulting the final version of questionnaire with partner universities in South Africa, August 2018.
7. Last improvement of the survey: correction of questions and survey layout based on the analysis of received recommendations from PEESA III partner universities in South Africa, September 2018 (questionnaire forms are presented in appendices 1 and 2).
8. Beginning and conducting of the procedure of ethical clearance required by ethical committees at all partner universities in South Africa.
9. Creation of the on-line survey questionnaire using Microsoft Form, October 2018.
10. Providing a link to the on-line version and request for conducting the gender equality survey dedicated to students at all partner's universities in South Africa (DUT, CPUT, TUT, VAL), December 2018.
11. Preparation of answer's database (cleaning up, assuring the comparability of two set of data related to two slightly different questionnaires, because of additional requirements expressed by CPUT after ethical committee approval), 2019-2020.
12. Empirical analysis and writing the final version of survey's report, 2020.

4. Sample structure and results

4.1. Quantitative analysis

Sample and answers structure

In this report 708 full responses were analysed in detail (275 made by women – 38.84%). Figure 1 presents the structure of the sample according to the name of the university where the respondent is studying.

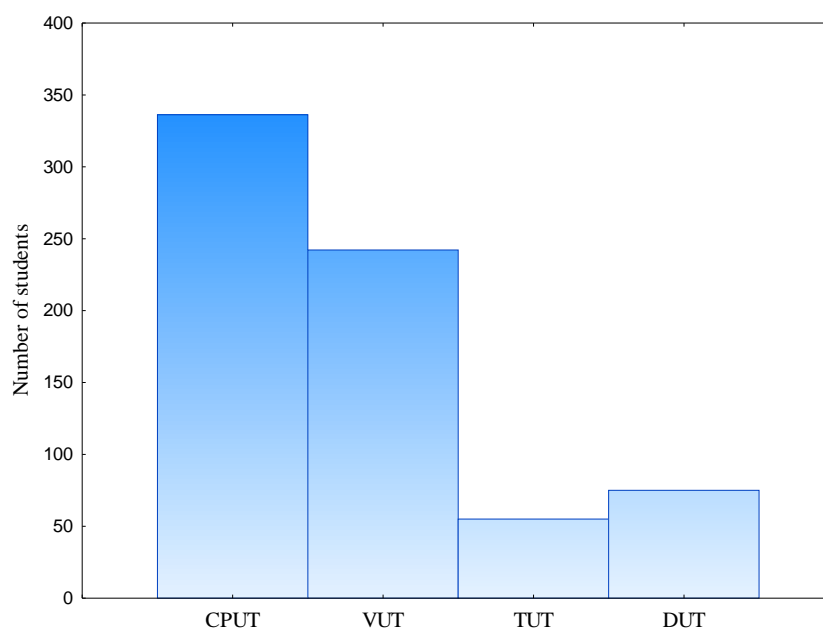


Fig. 1. Sample structure according to the name of the South African partner

Source: own calculations.

The highest number of answers was obtained from CPUT students (336), which constitutes for 47.47%. Second largest group were students from VUT (242, 34.18%).

The vast majority of students who responded were up to and including 25 years of age, representing 83.47% of all respondents.

The majority of students came from households with an annual income not exceeding R 350 000.

Among the types of parental education, "Secondary school" for mothers (304) and "Elementary/Primary school" for fathers (225) dominated. The most numerous group were students whose parents had these levels of education (148). For 22 students alone, both parents had a university degree.

Most student's answers were received from undergraduates (571, 80.65%), 1st year of the study (433, 61.16%), those who graduated public schools (623, 87.99%) and were living in a town/city (urban area) before studying (424, 59.89%).

Table 1 presents contingency table for two variables: Sex and Ethnicity. We can observe that the dominant share of student's ethnicity was African (82.20%) and males (61.16%).

Table 1. Sample structure according to Sex and Ethnicity

	Ethnicity					
	Gender	African	Coloured	White	Indian	Total
Count	Males	341	38	39	15	433
Total Percent		48.16%	5.37%	5.51%	2.12%	61.16%
Count	Females	241	19	2	13	275
Total Percent		34.04%	2.68%	0.28%	1.84%	38.84%
Count	All Groups	582	57	41	28	708
Total Percent		82.20%	8.05%	5.79%	3.95%	100.00%

Source: own calculations.

The relation between Sex and Study field was shown in Table 2. It can be note that only at Chemical field of study women form the majority of students. All the others are dominated by males (apart from Industrial). Most answers came from students of Electrical and Mechanical studies (43.08%).

Table 2. Sample structure according to Sex and Study field

Sex	Construction	Chemical	Civil	Electrical	Industrial	Mechanical	Other
Males	36	22	53	109	35	102	76
	5.74%	3.51%	8.45%	17.38%	5.58%	16.27%	10.73%
Females	24	43	31	54	38	40	45
	3.83%	6.86%	4.94%	8.61%	6.06%	6.38%	6.36%
All Groups	60	65	84	163	73	142	121
	9.57%	10.37%	13.40%	26.00%	11.64%	22.65%	6.37%

Source: own calculations.

Table 3 includes comparison of two variables: Sex and Different treatment in grading system.

Table 3. Contingency table for Sex/Different treatment in grading system

	Different treatment in grading system (1 – not at all, 5 – to a large degree)					
	Gender	1	2	3	4	5
Count	Males	321	25	41	22	16
Total Percent		46.25%	3.60%	5.91%	3.17%	2.31%
Row Percent		75.53%	5.88%	9.65%	5.18%	3.76%
Count	Females	196	27	27	11	8
Total Percent		28.24%	3.89%	3.89%	1.59%	1.15%
Row Percent		72.86%	10.04%	10.04%	4.09%	2.97%

Source: own calculations.

It is visible that more than 80% of students do not observe any different treatment related to grading system due to their gender. This proportion for women is even higher for females and equal almost to 93% of women subsample. This is really a good proof of equal treatment of students during their assessment process from point of view of their sex at the largest technical universities in South Africa.

Dependence analysis

The relationship of all factors for students enrolment pointed out in the questionnaire points 12.1-12.10, with three student's features: the gender (sex), type of graduate school and place of living before attending the university, was analysed using statistical package STATISTICA 13.3 and the multiple correspondence analysis (MCA).

Figure 2 presents a part of database and the STATISTICA workspace. The number of complete questions for question no. 12 was equal to 683.

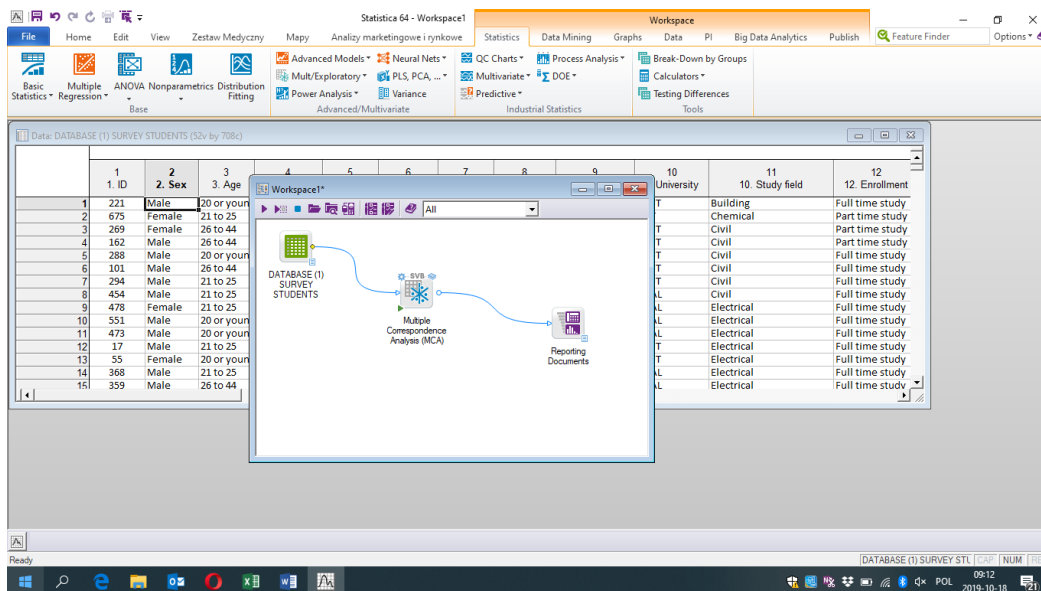


Fig. 2. Sample part of the database and calculation workspace
Source: own elaboration.

12.1. Family and relatives influence

➤ Gender

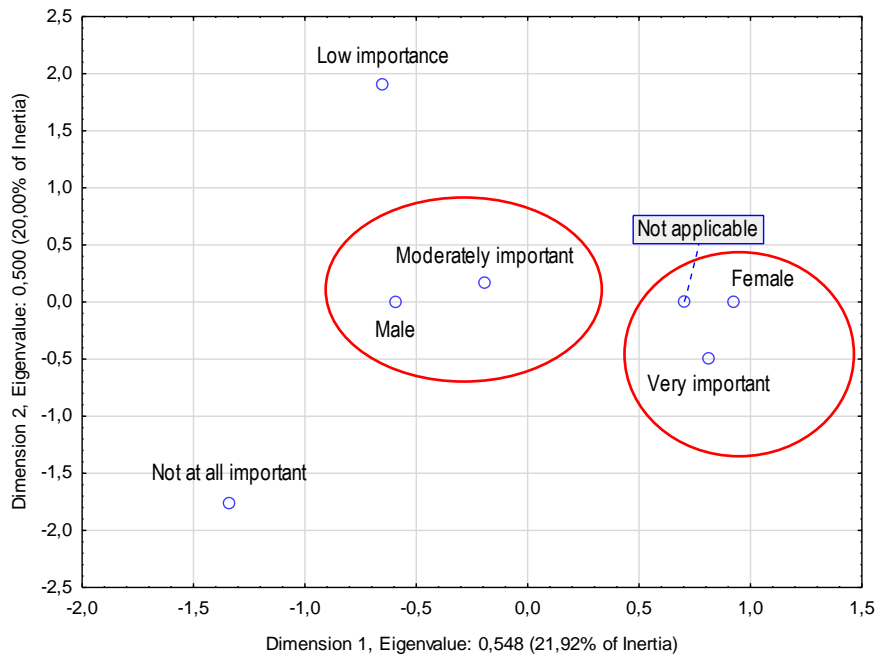


Fig. 3. The relationship between gender and the factor “Family and relatives influence”
Source: own elaboration.

Interpretation: for both male and female students the opinion of family and relatives was important when they decided about the studying subject/area.

12.4. Having an engineer as a family member increase knowledge/interest in engineering

➤ Gender

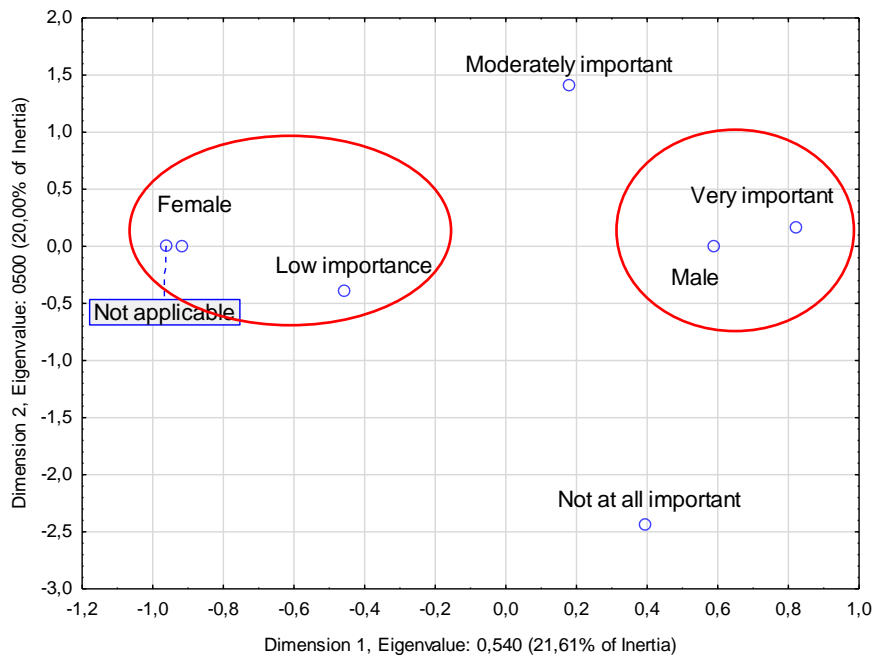


Fig. 4. The relationship between gender and the factor “Having an engineer as a family member”
Source: own elaboration.

➤ *Living place*

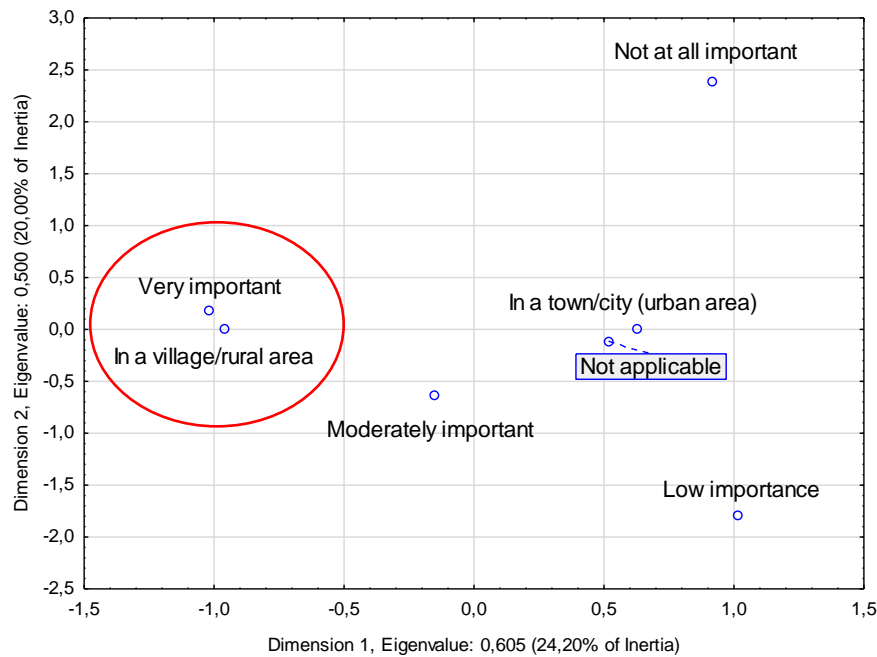


Fig. 5. The relationship between living place and the factor “Having an engineer as a family member”

Source: own elaboration.

Interpretation: having an engineer in the family was important in terms of choosing the type of study only for men and these students who were living in the village/rural area.

In case of answers no. 12.5 “Teachers’ influence” and no. 12.6 “Discussions and workshops with schools and career guidance teachers” the living place has the same meaning like for the answer no. 12.4.

12.7. Your own ability/skills

➤ *Living place*

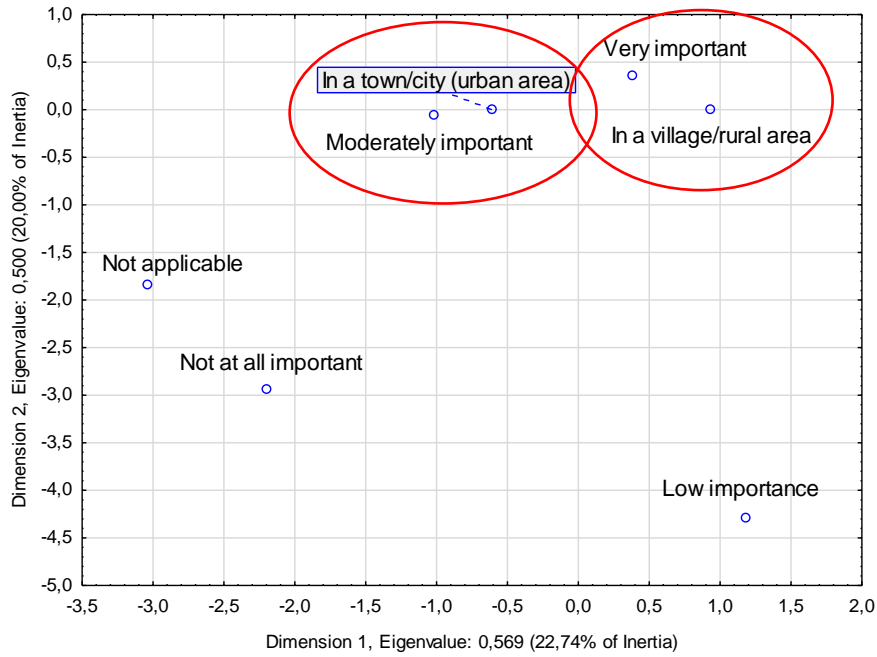


Fig. 6. The relationship between living place and the factor “Your own ability/skills”
Source: own elaboration.

Interpretation: when we consider ability and skills of candidates for engineering study, we can observe that for all of them, but especially for these living in the village/rural area, such features are important determinants to support an enrolment decision.

12.8. Your interest/passion

➤ Gender

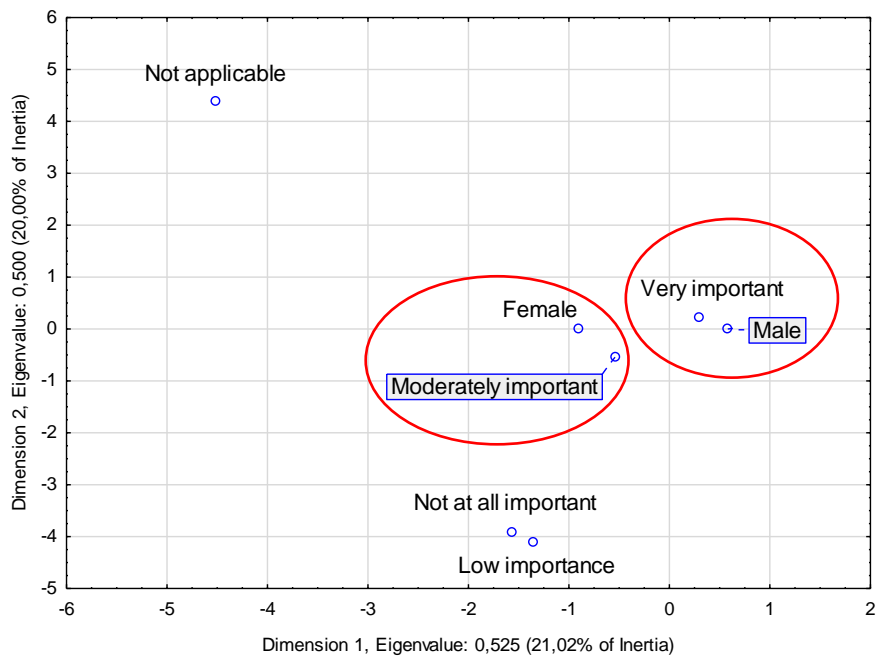


Fig. 7. The relationship between gender and the factor “Your interest/passion”
Source: own elaboration.

Interpretation: own interest/passion is very important for female and especially for men when they chose the engineering study.

➤ *Type of graduate school*

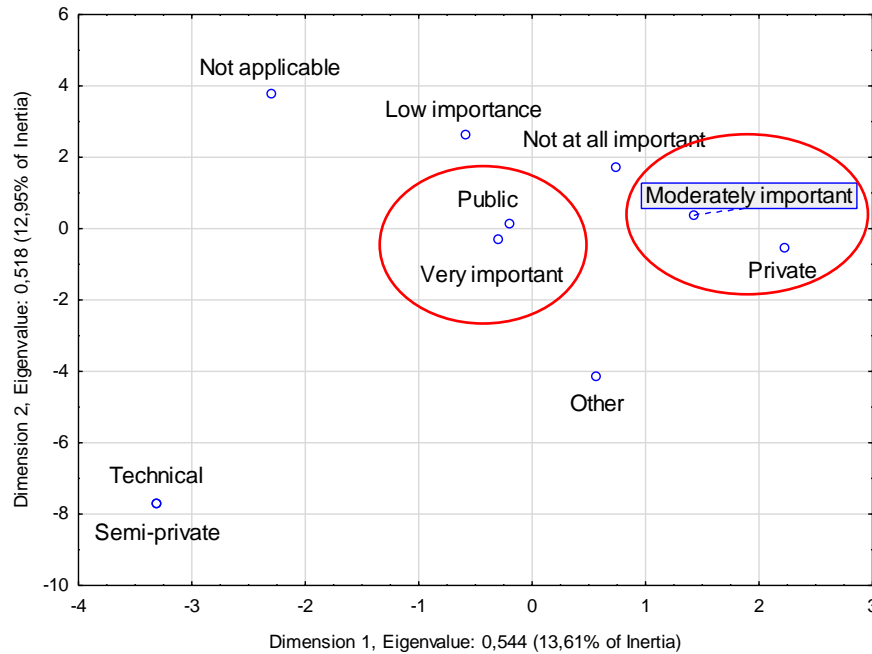


Fig. 8. The relationship between type of graduate school and the factor “Your interest/passion”
Source: own elaboration.

Interpretation: own interest/passion is very important enrolment determinant for these students who graduated private and especially public schools.

We can also notice that the influence of living place in case of own interest/passion factor plays the same role as for answer no. 12.7.

Question 12.9. Better job prospects after graduation

➤ *Gender:*

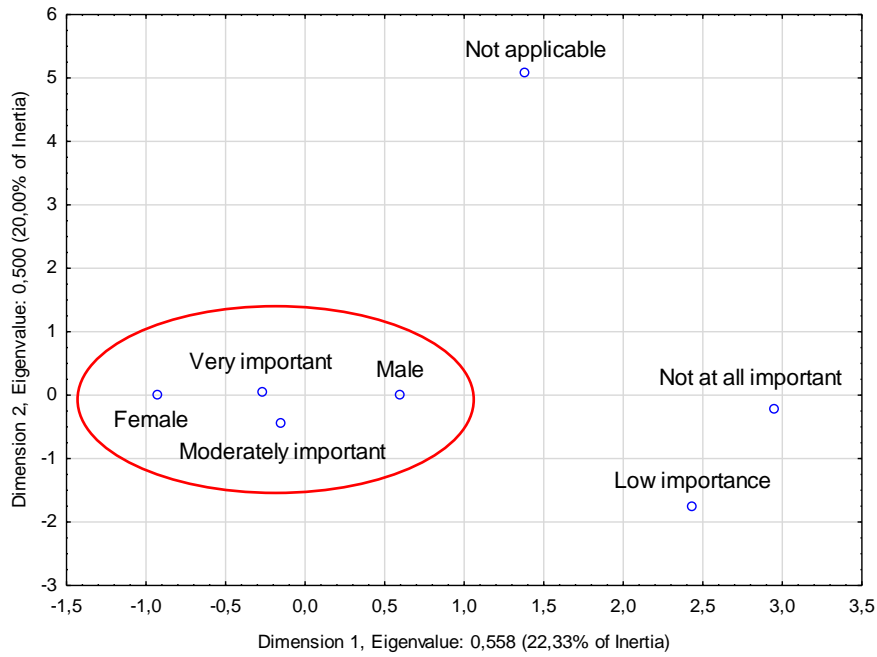


Fig. 9. The relationship between gender and the factor “Better job prospects”
 Source: own elaboration.

Interpretation: we can observe that better job prospects after graduation are really an important factor of enrolment to engineering studies, both for men and women.

➤ *Type pf graduate school*

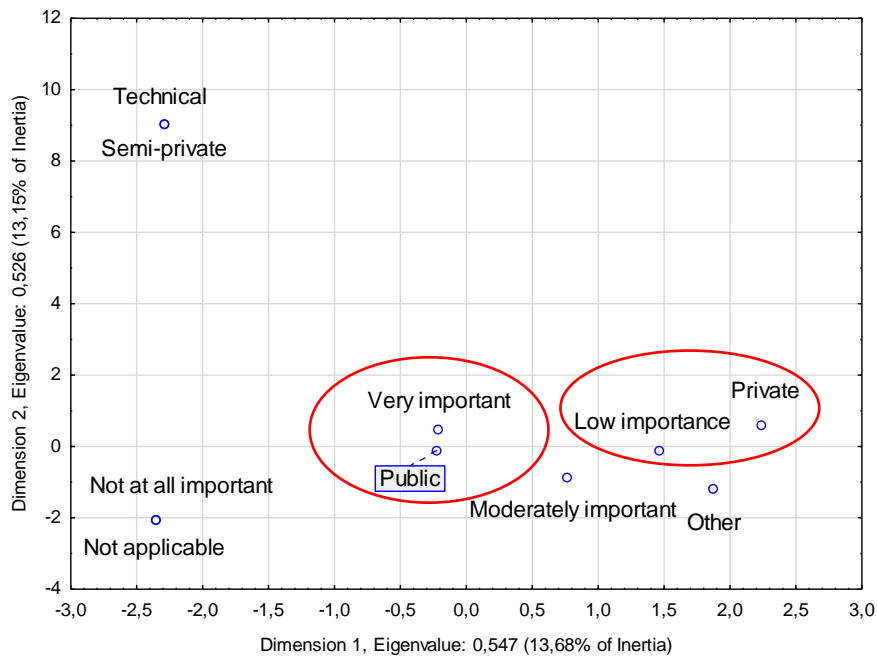


Fig. 10. The relationship between type of graduate school and the factor “Better job prospects”
 Source: own elaboration.

Interpretation: the graduates of public schools treat better job prospects as an important determinant of their decision about enrolment decision, while for private school graduates such factor has no meaning at all when they chose engineering studies.

To compare the meaning of specific factor that influence (or not) the propensity of enrolment among engineering students the join percentage of two answers „Moderately important” and “Very important” were calculated (see Table 4).

Table 4. The meaning of particular determinant of engineering study enrolment

Factor	„Moderately important” and “Very important” answers (%) – in brackets percentage share among women
12.1. Family and relatives influence	54.32 (56.55)
12.2. Friends’ influence	20.64 (14.23)
12.3. Schoolmates’ influence	23.72 (18.35)
12.4. Having an engineer as a family member increase knowledge/interest in eng.	49.34 (45.32)
12.5. Teachers’ influence	46.85 (44.94)
12.6. Discussions and workshops with schools and career guidance teachers	64.71 (67.04)
12.7. Your own ability/skills	93.70 (93.26)
12.8. Your interest/passion	94.73 (93.63)
12.9. Better job prospects after graduation	90.19 (94.38)
12.10. Future possibilities (earnings, social status)	82.43 (82.77)

Source: own calculations.

We can assume that four last features (12.7-12.10) were the most important for prospect engineering students to enroll their university. Only in some cases we can observe significant difference between the general sample and female’s attitudes (behavior): 12.2, 12.3, 12.4 and 12.9.

The importance of other factors

The importance of chosen variables, assessed by the join percentage of two answers „Moderately important” and “Very important” was presented in Tables 5-7.

Table 5. The meaning of particular determinant of engineering study enrolment

Factors	„Moderately important” and “Very important” answers (%) – in brackets percentage share among women
14.1. University facilities (e.g. a library, laboratories, sports facilities, dorms)	55.47
14.2. Financial package available to me (scholarships including bursaries specifically aimed at female students, funding support for postgraduate students, etc.)	51.78
14.3. University reputation	69.08
14.4. Workshops with women during study time– industry role models	35.06
14.5. Academic writing workshops for women during study time	30.92
14.6. Other academic workshops during study time	46.01

14.7. Lecturers / teachers/ professors reputation	57.40
14.8. Pre-courses to improve math and science (e.g. Winter School, Summer School)	51.18
14.9. Engineering open days (with a specific focus on females)	40.38
14.10. Specific Women in Engineering day	35.80

Source: own calculations.

We can assume that the university reputation (14.3) is the most crucial factor from above that influence the potential students to enroll engineering study.

Table 6. The meaning of particular determinant of engineering study enrolment

Factor	„Moderately important” and “Very important” answers (%)
16.1. Identifying, visiting, exhibiting at your school	50.15
16.2. Use of social media and you-tube videos	57.67
16.3. Revised Engineering recruitment videos and the image of females in the videos	42.18
16.4. Specific mention of bursaries that target female students	38.50
16.5. Pre-study workshops in your secondary school increase the knowledge/interest in engineering	56.93

Source: own calculations.

We can see that the “use of social media and you-tube videos” (16.2) and “pre-study workshops in your secondary school increase the knowledge/interest in engineering” (16.5) are the most important factors from above that encourage potential students to enroll engineering study.

Table 7. Different treatment related to gender

Factor	„Moderately important” and “Very important” answers (%)
18.1. Grading system	8.05
18.2. Colleagues (male) attitude	12.01
18.3. Staff attitude	12.43
18.4. Accommodation access	19.21
18.5. Financial support	16.53
18.6. Advice and mentorship	16.52

Source: own calculations.

Although the shares of two best valuations (“4” and “5 – to a large degree”) for all factors considered above are rather low, we can find that “accommodation access” (18.4) can be treated as the most sensitive area of different gender treatment.

The distribution of answers designated to the question no. 21 “Generally speaking, are you satisfied with your decision about taking up engineering studies?” shows that 80.66% current students is completely satisfied with their choice of the engineering study.

4.2. Qualitative analysis

An eye-catching part of the survey, apart from the questions that could have been subject to quantitative analysis, were qualitative questions, including open questions.

The responses of 708 students to open-ended questions show some interesting phenomena. It should be noted that the answer to the descriptive questions was voluntary, so most people selectively answered these questions. Therefore, the respondents could fill in the answer to one or more of the survey's questions. It is also important that some people mentioned several factors influencing a given area included in the question. Therefore, the interpretation covers all the people who raised the issues (and they cannot be summed as a percentage). Answering all the descriptive questions showed the emotional approach of many respondents, so it was also taken into account to show more interesting threats raised by selected respondents. In the quoted fragments of the respondents' statements, efforts were made to keep the original spelling and punctuation, which is an additional value of the study.

Almost five hundreds of respondents (498) answered the question related to other factors of engineering studying decision.

Questions 12 and 13

The most common indications of students, along with the division into female and male groups, in terms of motivation to undertake engineering studies, are presented in Table 8.

Table 8. Students' answers related to factors that determine undertaking engineering studies

Factors	Females 242 (48.6%)	Males 256 (51.4%)	Total 498 (100%)
Hobbies or interests, and passion for engineering studies	86 (35.54%)	63 (24.6%)	149 30%
Influence of the family on the choice of the field of study was indicated by of responses	45 (18.6%)	48 (18.7%)	93 (18.7%)
Favourable financial perspectives, financial freedom and financial aspects	13 (5.4%)	115 (44.9%)	128 (26%)
Lack of engineers in South Africa	1 (0.4%)	26 (10%)	27 (5.5%)
Opportunities and abilities to work in most industries	12 (4.96%)	12 (4.7%)	24 (4.8%)
Better opportunities for life quality	12 (4.96%)	10 (3.9%)	22 (4.4%)
Better job expectations	17 (7%)	13 (5%)	30 (6%)
Future engineering career opportunities	7 (2.9%)	11 (4.3%)	18 (3.6%)

Source: own calculations.

The most important factors were “Hobbies or interests, and passion for engineering studies”, “Influence of the family” and only for males “Favourable financial perspectives, financial

freedom and financial aspects”. Only 5.5% of respondents (1 female and 26 males) pointed the lack of engineers in South Africa as a main reason to choose this field of study.

Among the most inspiring statements were those that indicated:

- “Change situation back at home I love engineering information and knowledge”,
- “As Engineering increases knowledge, I need mind challenge in my life so that I can gain a knowledge of solving problems and Engineering is a good resource for our country, the other reason why I chose it is because I need to use the qualification to gain knowledge from other countries and use it for my Country”,
- “I wanted to be the first engineer at home”,
- “I want know things in engineering field especially in electrical engineering. How things are developed using electricity and being part of engineering field it's one of the greatest things I wish and also working in a company of engineering getting to know things”,
- “It feels really wonderful when you know that you are actually positively contributing something to the society. Words cannot describe the feeling when someone looks at a newly constructed bridge and says, “I had built that bridge.” If you ever get a chance to ask an engineer about his work; notice how they beam with pride when talking about their contribution in creating something new, even if it is as simple as a “like” button on a website.”

The answers to this question also included eye-catching statements by women who strongly emphasized several aspects of gender balance. The following statements were especially inspiring and eye-catching:

- “The need and desire to be an independent women and to empower other young women that engineering for women is possible”,
- “Many people think the engineering field is only for Males only and I disagree with that. Studying engineering made me find it so enjoyable and it has many fields I mean there's Electrical, Mechanical, Civil and quantity survey so a learner can choose any field to study and Engineering is broad”,
- “I wanted to be one of the women in engineering especially metallurgy one because the statistics states that about only 30% of women study engineering, so I wanted to increase the number”.

Questions 14 and 15

Another issue raised in the survey were other factors of undertaken of studying engineering at this specific university, 412 respondents answered this question. Interestingly, as many as 134 students indicated good examples of graduates and job opportunities (which constitutes 30% of this subset of the whole sample - responses of women and men were equally distributed) as a factor influencing the choice of a given university to study at engineering studies. Subsequent responses were focused on practical skills and abilities, level of education, knowledge and experience, which were reflected in the responses of 101 students, which gives 24.5% of this group. Also important were good university resources (equipment, laboratory facilities), which was indicated by 74 students, which constitutes 18% of this group responses. The reputation of the university (recommended by other people, as well as university ranking) for 58 people (14%), localization for 35 respondents (10%), friends and family influence for 17 people (4%)

also turned out to be important. For all above answers shares of responses according to gender were very similar.

Questions 16

Among answers to the question “Factors related to marketing and student recruitment of studying decision at this university” we can find the following:

- “WomEng organisation which has a #girlAskEngineer for high school students”,
- “Open days was very informative, radio talk shows done by university marketing department every month, career exhibitions or career expos done weekly by all universities all local tvet colleges expect UCT AND STELLENBOSCH”, “Open days at the university assisted in expanding my knowledge of engineering which peaked my interest”,
- “Use of social media. The image of females in the video”, “There are Facebook page on social media talking about the thing happening in the University”, “YouTube and internet exposure to creative minds and hands. Self-research”, “Videos sent on you-tube about people who were educated at the university”,
- “I found out about CPUT from people who work in the industry. They explained to me about the advantages and disadvantages of studying at the university”,
- “The prospectus”, “Spread of brochures which extended to my local area”,
- “Career guidance workshops”, “The workshops that were held in high school the year I matriculated”, “Career exhibitions”, “Pre-study workshops in secondary school increase the knowledge/interest in engineering”, “School workshops and school trips to university”,
- “Lecturer mentioned if we wanted to further our studies, we should enroll at this university”,
- “It was advertised on the newspaper that the DUT wanted students with math and physics to study any engineering course of their choice”, “Advertising online”,
- “Well from high levels DUT representatives was usually coming to my high school to market the university (DUT) and i would say my attention was also being taken there”, “DUT marketing team came to our school”.

Question 18 and 19

The question related to the indication of other factors respondents felt any different treatment related to their gender contained 162 completed responses including 158 sent by females. The most common factors were: sports opportunities, status, race, transport, looking for information, getting tutors to help, behaviour, accommodation access and empathy. There were also several responses about feelings related to different gender treatment during lectures (10), corruption experiences (3), and bad experiences during strike (3).

Inspiring statements in this regard concerned:

- “My former manager always emphasized that I must be careful and take care of myself, because as a woman in construction industry it means a lot and men can destroy you. Be brave, be strong etc.”,

- “Nowadays females are given first preference in terms of positions and we young men have not played part in excluding women in industries but we are the ones whose are challenged as we compete for the same positions with females”,
- „To be a women in engineering workshop was like big trouble because the most people are there men and they think that the job to be engineer is meant for men”.

Questions 20

With the next question about identifying other possible obstacles, barriers, problems to continue study, as many as 371 responses appeared. 274 students (65% were females) strongly emphasized the financial aspects during their studies and also as a potential problem that could affect the graduation. Problems with bursary (48 students) and accommodation (31) were ranked second. There were also answers related to health (18) as a factor hindering the continuation of studies, the need to work (11) and other difficulties like transportation to campus (9), language barriers (10), safety (7) and security (5). In case of above answers we could observe their similar distribution for both genders.

Below chosen examples of students' statements regarding the question about obstacles, barriers, problems to continue study were presented:

- “Finances. Choosing my mental health as a woman and introverted person”,
- “Study material and financial situation also private matters concerning family”,
- “Protests by students that think tertiary education is a right, rather than a privilege”,
- “The untimed strikes students tend to have at campus, getting to make the varsity more suitable to study at any given day/time”,
- “Working part time is not for the faint hearted, I want to continue with Master’s degree in the future”,
- “Mechanical fields expect many years work experience and highest qualifications without creating job opportunities for us to actually achieve their need. It feels like the field want to leave out the poor class after graduating for diploma regretting why they even bothered investing their time in education than joining sort activities like crime and retail at their earlier age”,
- “Financial. I can’t get financial assistance since bursary (NSFAS) didn't cover my studies, I tried to appeal with financial institution for financial assistance but I couldn't be assistance”,
- “Both my parents are unemployed, I have to travel a very long distance to campus to attend my classes and access to library services since“,
- “Finances is one major problem as I do not have any support from anyone, and NSFAS application declined and sometimes I suffer from having something to eat and cant study with empty stomach, not even concentrating in lectures because of hunger and thinking of what I'm going to eat when arrive at home. Sometimes I sleep on toilets because the guy I am staying to brought his girlfriend and telling me that I must comply or accept whatever he is doing because I pay nothing“,
- “Motivation to women like me to come study the PhD was not easy as I almost lost my job for me to come full time. That is a serious challenge”,
- “Job opportunity struggle with regards to my gender”,

- “Health could be problematic as you can't foresee when you're going to be seriously ill. Obstacles such as being degraded by certain lecturers too, saying things such as you're a female, who's beautiful, why don't you become a tea lady, model or work as a P.A. for someone. If I wanted to become a tea lady, I could have done that, but then again I make horrible tea, plus I want to make a change within in the economy of South Africa, which is a developing country and with that said there are always things that need improvement within in civil as a whole”,
- “I am in my final year and the institution was ill prepared to accommodate the group of students from my workplace for this last year. There is a recognition of prior learning program for persons such as ourselves that have been working in industry for extended periods and the institution did not prepare to accommodate this”,
- “Crime is a major obstacle and has already effected my studies dramatically together with institutional administrative problems”,
- “I have problem to continue to study to a point that I wish to drop out of university. Financial problems even though I wish to be engineer one day to bring change in the society. And tertiary education is expensive I can't afford to pay on my own or neither family can do that”.

Questions 22

One of the questions made it possible for the respondents to freely express themselves on the issues important to them, which were not sufficiently addressed in the previous questions. Therefore, in the questionnaire, the respondents were given the opportunity to write other comments and as many as 262 people took advantage of it, including 106 female, which constitutes 44% of the group of women answering open-ended questions. It is worth to emphasize that 85% of the additional comments were very positive, optimistic and in some cases joyful.

Eye-catching and very optimistic comments include:

- “I love the university because it exposed life out of my village. am slowly developing myself”,
- „I love engineering and I certainly do not see myself doing anything else. I would love to open my own company one day”,
- “I love engineering, I want to show the next generation that women can also become engineers it's not for men only”,
- “Yes, I am proud to be called an engineer in making”,
- “Yes , I'm satisfied with my decision even it is too early to say that now”,
- “It is the best when you are one of the female engineers especially when you come from a township like mine”,
- “All I want is to became the well-known engineer and pursue my dreams in making sure that I help others who are willing to do Engineering”,
- “Job opportunities for technicians or technologists and remuneration is not very high”,
- “I wanted to be an engineer since I was young and the salary that we will be getting at the end it will satisfied my needs”,
- “In this engineering field, we are not treated differently because we are females”,

- “I am very satisfied and proud of being a quantity surveying student. I like to be independent, so to be a quantity surveyor you not depending to any one at work, you have to make sure and bold enough to stand for your decisions. Quantity surveyor is someone who deals with cost of the company, is a trusted person (Accountant in construction companies)”
- “Not many careers offer this sort of opportunity to gain experience and explore new cultures and lifestyles. Engineers working in multinational companies will often travel overseas for conferences and to visit or inspect company facilities, adding variety to their daily routines”.

There were also inspiring but very general statements and comments:

- „What would our world become without engineering”
- “There are only 2 girls out of about 60 students in my class who are studying mechatronics”
- “Engineering is not about how smart you are but the extent of your dedication, motivation , hard work and testing your limits daily”
- “Engineering should start to respect Entry level people and start to make opportunities for them to bring to practice their skills, competencies and knowledge. It is not only female gender and disabled candidate who must get a maximum support. It must also look for how many of us made it through to the finish line financially”
- “Females still face a great challenge with regards to getting to study and even work in the engineering industry. Further the lectures prepared and the examination are not of the same level. It is more misleading as we are not tested on our knowledge from what was prescribed to us or being able to apply the knowledge”
- “Focus should not be lost throughout universities about the actual essence and need of engineering. Focus is on the financial, social, and stability gain that it generally brings not on the meaning of engineering itself”
- “Gender equality is not the problem, the real problem is cultural. How to get different cultures to work together that is the real challenge”
- “Gender is not an issue at all in terms of being an engineer. The history proven women to be capable of handling anything thrown their way”
- “Some of engineers are good at problem solving but when it comes to communication its a problem because we are not good at communicating”.

We could also find negative comments in this question, but there was only 21 of them among all 262 comments. Negative opinions were mainly related to concerns about the financial aspects of studying, job opportunities and the future of respondents. There were also few comments about the classes, mainly online and the tools used (blackboard), lecturers and exams. Below we can find several examples of such comments:

- “Some of the lectures at my institution do not get back to all our problems or questions and I feel like they are just there because they get paid to be there”
- “The university should also accommodate student within the 60 km radius with residence we facing huge challenges as well school and home also travelling”
- “Not getting the job I ever wanted”
- “Engineering skills and social intelligence are a waste of time and energy and should not be taken as a subjects , it interferes with other more important subjects”

- “I am unable to find a job in my career. It is really difficult to find a job with no experience. There's very little graduate programs. There's not many women graduate or development programs. Very racial when it comes to selection in jobs or graduate programs as well as gender issue. Very male dominating”,
- “It is extremely difficult to find a job. I waited one year to find in-service training, co-op was not very helpful in finding me a job placement and I eventually had to find a company on my own”,
- “Job opportunities for technicians or technologists and remuneration is not very high”,
- “The Engineering industry is generally dominated by a certain race at the moment, due to some historical injustices that favored a certain race over all other races. This worries me to an extent, since I do not belong to this dominant race”,
- The industry has a long way to go. I cannot express the pain of walking out of university equipped only to walk into a company and being told you are there for equity and you are useless. No matter how hard you work, you're playing a rigged game. I am positive that I will blaze a trail and it will change, I do wish the university equipped us with psychological assistance once they release us so as not to breakdown”,
- “The University did not offer any workshops or an open day aimed at females; on the open day we were told about the Eskom Bursary fund that could only take 100 female students. The disadvantage was that the bursary had no job offers after the completion of undergraduate studies, because I am doing Civil Engineering, therefore it only offered jobs for Electrical Engineering students”,
- “Well I'm happy to be in the maritime industry but it's kind of difficult cause not much people know about and not much companies want to hire females”.

5. Conclusions and recommendations

The analysis of the whole process of conducting the survey of students from partner universities from South Africa allows to formulate two types of final conclusions and recommendations.

The first one concerns the formal and organizational side of the survey. We are talking here about the long time required not only to conduct the survey itself, but most of all to obtain permission to conduct it. It is a very time-consuming activity, in case of some universities it takes months. This is due, among other things, to many conditions that must be met in order to obtain the consent of a given ethics committee.

Important elements related to the construction of the survey questionnaire include discrepancies even between South African partners regarding the terminology used for the selected questions. A separate issue is obtaining precise answers from respondents. The experience gained in this area has allowed us to develop a different approach to creating possible answers. It is recommended that instead of allowing the respondents to give their own answers (e.g. department or field name), it is much more correct to develop dictionaries of names/variants that are chosen by the respondents.

Such a solution was used in the next stage of work in a survey addressed to university employees. While discussing the technical side of the survey, it is also worth mentioning a number of errors appearing in the answers and the need to standardize the answers contained in two different questionnaires. However, when implementing the second questionnaire addressed to students, it is necessary to ensure (recommend) greater uniformity of the number of answers given by students of particular universities.

The second group of conclusions and recommendations can be formulated on the basis of conducted analyses: quantitative and qualitative. They allow to understand, to some extent, the factor which determines that potential students decide to take up engineering studies, determine the effectiveness of particular tools and channels of promotion of these studies used by universities, as well as determine whether and to what extent difficulties/barriers appear during the study itself. On the basis of the conclusions below, the universities may formulate recommendations and take actions aimed at increasing the tendency of potential students to register for engineering studies, as well as modify their promotion and recruitment system.

The most important conclusions drawn from the received answers are

- Almost all kinds of study are dominated by males (apart from Chemical and Industrial).
- Most answers came from Electrical and Mechanical fields of study (43.08%).
- More than 90% students (91% males and 93% females) do not observe any different treatment related to grading system due to their gender.
- For both male and female students the opinion of family and relatives was important when they decided about the studying subject/area.
- Having an engineer in the family was important in terms of choosing the type of study only for men and these students who were living in the village/rural area.
- If we consider ability and skills of candidates for engineering study, we can observe that for all of them, but especially for these living in the village/rural area, such features are important determinants to support an enrolment decision.

- Better job prospects after graduation have a large influence on the enrolment decision in case of engineering studies, both for men and women.
- Graduates of public schools think that better job prospects is an important advantage after they finish engineering study, while for private school graduates such factor has no meaning at all when they chose engineering studies. This results is consistent with results obtained by other authors who suggest that schooling background is strongly associated with study choices (Rogan, Reynolds, 2016).
- Own ability/skills, own interest/passion, better job prospects after graduation, accommodation access and university reputation were the most important enrolment factors for future engineering students.
- The most popular/effective tools used within the promotional and recruitment process were social media and you-tube videos and pre-study workshops in the secondary school. It is highly recommended tool to apply during an enrolment process.
- The most important difficulties that can result in higher drop-out rates indicated by respondents were the financial aspects and problems with bursary and accommodation. These results are similar to those received during an investigation of higher education institutions' enrolment and drop-out rates within the Gauteng province in 2012 based on secondary data from the General Household Survey, that finance and transport to the higher education institutions were the main factors that affect the enrolment rate of students (Matsolo, Ningpuanyeh, Susuman, 2018). Although some authors point out two other crucial reasons for not completing intended course of study: lost interest and marks not good enough (Rogan, Reynolds, 2016).

Although there were made huge efforts in this area it seems that there is still a need to enhance the gender equality topic within study curriculums to integrate equity, diversity, and inclusion (EDI) training at undergraduate and graduate level, along with the expectation that competency in these areas will be required to progress in these fields. Such actions should help establish EDI awareness as a cultural norm for the workplace and realize gender equality policy (Coe, Wiley, Bekker, 2019).

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Appendix 1. Questionnaire for DUT, TUT and VUT

Dear Madame/Sir,

we kindly ask you to complete the following survey. The PEESA III project members are seeking to understand the reasons why women and men have chosen engineering study. The PEESA III Team will ultimately seek to advise policymakers on how best to encourage female (men) success in Engineering and related disciplines. The survey is completely anonymous and its results will be used only for scientific purposes.

STUDENT SURVEY

1. Sex:

- female
- male

2. Age:

- 20 or younger
- 21 to 25
- 26 to 44
- 45 or older

3. Race:

- African
- Coloured
- Indian
- White
- Other _____ (please define)

4. Total annual household income:

- below R 350 000
- between R 350 001 and R 600 000
- more than R 600 001

5. Your parent's education level is:

Level	5.1. Elementary/Primary school level	5.2. Secondary school level	5.3. Vocational (TVET College) level	5.4. Tertiary (public or private university) level
Mother	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Father	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

6. Which degree are you studying for?

- Undergraduate
- Postgraduate
- Doctoral degree (Ph.D.)
- Other _____ (please specify)

7. Year of study

8. University name and qualification name (study field)

9. Enrollment status:

- Full- time study
- Part- time study

10. What type of school have you graduated from?

- Public
- Private
- Other _____ (please specify)

11. Where do you live before attending the university?

- In a town/city (urban area)
- In a village/rural area

12. Please select the appropriate level to which the following factors were important in your decision to study engineering:

Factor	Not applicable	Not at all important	Low importance	Moderately important	Very important
12.1. Family and relatives influence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12.2. Friends' influence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12.3. Schoolmates' influence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12.4. Having an engineer as a family member increase knowledge/interest in engineering	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12.5. Teachers' influence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12.6. Discussions and workshops with schools and career guidance teachers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12.7. Your own ability/skills	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12.8. Your interest/passion	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12.9. Better job prospects after graduation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12.10. Future possibilities (earnings, social status)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

13. Please list below any other factors which were important in your decision to study engineering

14. Please select the appropriate level to which the following factors were reasons for choosing engineering study at Your University:

Factor	Not applicable	Not at all important	Low importance	Moderately important	Very important
14.1. University facilities (e.g. a library, laboratories, sports facilities, dorms)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14.2. Financial package available to me (scholarships including bursaries specifically aimed at female students, funding support for postgraduate students, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14.3. University reputation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14.4. Workshops with women during study time– industry role models	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14.5. Academic writing workshops for women during study time	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14.6. Other academic workshops during study time	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14.7. Lecturers / teachers/ professors reputation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14.8. Pre-courses to improve math and science (e.g. Winter School, Summer School etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14.9. Engineering open days (with a specific focus on females)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14.10. Specific Women in Engineering day	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

15. Please list below any other factors which were reasons for choosing engineering study at Your University

16. Please select the appropriate level to which the following factors related to marketing and student recruitment specifically were important in your decision for selecting Your University:

Factor	Not applicable	Not at all important	Low importance	Moderately important	Very important
16.1. Identifying, visiting, exhibiting at your school	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16.2. Use of social media and you-tube videos	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16.3. Revised Engineering recruitment videos and the image of females in the videos	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16.4. Specific mention of bursaries that target female students	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16.5. Pre-study workshops in your secondary school increase the knowledge/interest in engineering	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

17. Please list below any other factors which were related to marketing and student recruitment specifically were important in your decision for selecting Your University

18. During your studies, did you feel any different treatment related to your gender concerning:

Subject	1-not at all	2	3	4	5 - to a large degree
18.1. Grading system	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18.2. Colleagues (male) attitude	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18.3. Staff attitude	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18.4. Accommodation access	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18.5. Financial support	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18.6. Advice and mentorship	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

19. Please list below any other factors were you feel any different treatment related to your gender:

20. Do you foresee any obstacles/reasons to continue study (e.g. private, financial, health, ...)?

21. Generally speaking, are you satisfied with your decision about taking up engineering studies?

- Yes No It's too early to make a statement

22. Other comments

Appendix 2. Questionnaire for CPUT

DISCLAIMER

Dear Madame/Sir,

We kindly ask you to complete the following survey related to activities undertaken within the scope of the project Personalised Engineering Education in Southern Africa (PEESA III) – (reference number 585966-EPP-1-2017-1-DE-EPPKA2-CBHE-JP), financed by the European Union programme Erasmus+ Capacity Building in Higher Education. The project is realised by several South African and European universities. The PEESA III project members are seeking to understand the reasons why women and men have chosen to study engineering. The PEESA III Team will ultimately seek to advise policymakers on how best to encourage female (and male) success in Engineering and related disciplines.

Please note that this is a voluntary survey and you do not have to complete it. You can also withdraw from the survey at any stage without any consequences, and may choose to respond only to selected questions. The survey is completely anonymous and its results will be used only for purposes of PEESA III. The questionnaire should take no more than 15 min to complete. Members of the project will analyse answers, draw general conclusions and discuss these during their dissemination meetings. Some results after generalization can also account for scientific considerations. We would like to express our understanding and respect for spending your time on this questionnaire.

I understand terms and conditions and want to participate

STUDENT SURVEY

1. Sex:

- female
- male
- other

2. Age:

- 20 or younger
- 21 to 25
- 26 to 44
- 45 or older

3. Ethnicity:

- African
- Coloured
- Indian
- White
- Other _____ (please define)

4. Total annual household income:

- below R 350 000
- between R 350 001 and R 600 000
- more than R 600 001
- unsure

5. Your parent's education level is:

Level	5.1. Elementary/Primary school level	5.2. Secondary school level	5.3. Vocational (TVET College) level	5.4. Tertiary (public or private university) level
Mother	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Father	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

6. Which degree are you studying for?

- Undergraduate
- Postgraduate
- Doctoral degree (Ph.D.)
- Other _____ (please specify)

7. Year of study:

- 1st year
- 2nd year
- 3rd year
- other

8. University name

8A. Faculty name

8B. Study field (qualification name)

9. Enrollment status:

- Full- time study
- Part- time study
- International student

10. What type of school have you graduated from?

- Public
- Private
- Other _____ (please specify)
- Unsure

11. Where did you live before attending the university?

- In a town/city (urban area)
- In a village/rural area

12. Please select the appropriate level to which the following factors were important in your decision to study engineering:

Factor	Not applicable (0)	Not at all important (1)	Low importance (2)	Moderately important (3)	Very important (4)
12.1. Family and relatives influence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12.2. Friends' influence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12.3. Schoolmates' influence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12.4. Having an engineer as a family member increase knowledge/interest in engineering	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

12.5. Teachers' influence	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12.6. Discussions and workshops with schools and career guidance teachers	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12.7. Your own ability/skills	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12.8. Your interest/passion	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12.9. Better job prospects after graduation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12.10. Future possibilities (earnings, social status)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

13. Please list below any other factors which were important in your decision to study engineering

14. Please select the appropriate level to which the following factors were reasons for choosing engineering study at Your University:

Factor	Not applicable (0)	Not at all important (1)	Low importance (2)	Moderately important (3)	Very important (4)
14.1. University facilities (e.g. a library, laboratories, sports facilities, dorms)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14.2. Financial package available to me (scholarships including bursaries specifically aimed at female students, funding support for postgraduate students, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14.3. University reputation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14.4. Workshops with women during study time– industry role models	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14.5. Academic writing workshops for women during study time	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14.6. Other academic workshops during study time	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14.7. Lecturers / teachers/ professors reputation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

14.8. Pre-courses to improve math and science (e.g. Winter School, Summer School etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14.9. Engineering open days (with a specific focus on females)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14.10. Specific Women in Engineering day	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

15. Please list below any other factors which were reasons for choosing engineering study at Your University

16. Please select the appropriate level to which the following factors related to marketing and student recruitment specifically were important in your decision for selecting your University:

Factor	Not applicable (0)	Not at all important (1)	Low importance (2)	Moderately important (3)	Very important (4)
16.1. Identifying, visiting, exhibiting at your school	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16.2. Use of social media and you-tube videos	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16.3. Revised Engineering recruitment videos and the image of females in the videos	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16.4. Specific mention of bursaries that target female students	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16.5. Pre-study workshops in your secondary school increase the knowledge/interest in engineering	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

17. Please list below any other factors which were related to marketing and student recruitment specifically and were important in your decision for selecting Your University

18. During your studies, did you feel any different treatment related to your gender concerning:

Subject	1-not at all	2	3	4	5 - to a large degree
18.1. Grading system	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18.2. Colleagues attitude	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18.3. Staff attitude	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18.4. Accommodation access	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18.5. Financial support	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18.6. Advice and mentorship	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

19. Please list below any other factors where you felt any different treatment related to your gender

20. Do you foresee any obstacles/barriers/problems to continue study (e.g. private, financial, health, ...)?

21. Generally speaking, are you satisfied with your decision about taking up engineering studies?

- Yes
 No
 It's too early to make a statement

22. Other comments

Appendix 3. An introductory letter of ethical clearance (University of Szczecin)

Szczecin, 5th of February 2019

To bodies and persons responsible for ethical clearance at:

Cape Peninsula University of Technology

Durban University of Technology

Tshwane University of Technology

Vaal University of Technology

ETHICAL CLEARANCE APPLICATION LETTER

Dear Sirs,

University of Szczecin is involved together with your University in the project *Personalised Engineering Education in Southern Africa (PEESA III – project reference number 585966-EPP-1-2017-1-DE-EPPKA2-CBHE-JP)* financed by the European Union programme Erasmus+ Capacity Building in Higher Education. One of the aim of our activity is identification of factors that may increase the gender equality among students in engineering education at South African universities. To achieve this goal we have to conduct a survey among students of your university (content of the survey you can find in the attachment).

We kindly ask you to provide the ethical clearance of the survey. From our side we declare that the content of the survey complies with the national and EU rules and practices on research ethics. The survey will be conducted anonymously and the respondents' answer is not obligatory. We also guarantee gathering and protection of data, as well as dissemination of survey results, consistent with well recognized ethical principles.

Obtained results of the survey will not only allow to realize the main goals of the project, but will also form the basis for joint presentations and publications of your university employees and employees of the University of Szczecin.

Appendix 4. Letter of ethical clearance (University of Szczecin)

Szczecin, 4th of February 2019

To bodies and persons responsible for ethical clearance at:

Cape Peninsula University of Technology

Durban University of Technology

Tshwane University of Technology

Vaal University of Technology

ETHICAL CLEARANCE LETTER

I declare that the content of the survey aimed at identifying factors that may increase the gender equality among students in engineering education in South Africa, to be carried out as part of the project *Personalised Engineering Education in Southern Africa (PEESA III – project reference number 585966-EPP-1-2017-1-DE-EPPKA2-CBHE-JP)* financed by the programme Erasmus+ Capacity Building in Higher Education, complies with the rules on research ethics in force at the University of Szczecin, as well as with the recognized ethical practices and fundamental ethical principles. The survey (content in the attachment) will be conducted anonymously and the respondents' response is voluntary. Planned survey is also characterized by ethical clearance with regards to the European Charter for Researchers. Project members – academic staff members of the University of Szczecin – ensure proper conducting, gathering and protection of data, as well as generating, sharing and disseminating results of the survey, in line with recognized ethical principles and practices. They are familiar with the national and international legal requirements regarding data protection and confidentiality protection requirements, and will undertake the necessary steps to fulfil them at all times.

Appendix 5. Ethical approval from Tshwane University of Technology



Research Ethics Committee

The TUT Research Ethics Committee is a registered Institutional Review Board (IRB 00005968) with the US Office for Human Research Protections (IORG# 0004997) (Expires 30 Jan 2020). Also, it has Federal Wide Assurance for the Protection of Human Subjects for International Institutions (FWA 00011501). In South Africa it is registered with the National Health Research Ethics Council (REC-160509-21).

May 3, 2019

REC Ref #: REC2019/05/001
Name: Ramaube M
TUT Staff Member

Ms M Ramaube

Faculty of Engineering: Mechanical Engineering, Mechatronics and Industrial design

Dear Ms Ramaube,

Decision: Approved – Gatekeeper

Name: Ramaube M

Project title: PEESA III Student Survey

Qualification: Non-degree Project

Thank you for submitting the project documents for review by the Research Ethics Committee (REC), Tshwane University of Technology (TUT). In reviewing the documents, the comments and notes below are tabled for your consideration, attention and/or notification.

The Chairperson of the Research Ethics Committee, Tshwane University of Technology, reviewed the project documents on May 3, 2019. The application for **Gatekeeper Permission** is **Approved**. The proposed research project may now continue with the proviso that:

- 1) The researcher/s will conduct the study according to the procedures and methods indicated in the **approved proposal**, particularly in terms of any undertakings and/or assurances made regarding the confidentiality of the collected data.
- 2) The proposal will be submitted to the Committee for prospective ethical clearance if there are any substantial **deviations** and/or changes from the approved proposal.
- 3) The researcher/s will act within the parameters of any applicable **national legislation, professional codes of conduct**, institutional guidelines and scientific standards relevant to the specific field of study. Strict adherence

to the following South African legislation, where applicable, is especially important: Protection of Personal Information Act (Act 4 of 2013), Children's Act (Act 38 of 2005) and the National Health Act (Act 61 of 2003).

- 4) The researcher will inform the REC as soon as possible of any **adverse events** involving research participants that may have occurred during the course of the study. It includes the actions and/or processes that were implemented to mitigate and/or prevent any further injuries and/or adverse outcomes.
- 5) The researcher will inform the REC of any **new or unexpected ethical issues** that may have emerged during the course of the study, as well as how these ethical issues were addressed. The researcher must consult with the REC for advice and/or guidance in any such event.
- 6) The current ethics approval expiry date for this project is **April 30, 2021**. No research activities may continue after the ethics approval expiry date. An application for the extension of ethics approval must be submitted for projects that need to continue beyond the expiry date.

Note:

The reference number [top right corner of this communiqué] should be clearly indicated on all forms of communication [e.g. Webmail, E-mail messages, letters] with the intended research participants.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'HD Mason', with a horizontal line drawn underneath it.

HD Mason (Dr)

Chairperson: Research Ethics Committee

[TUTRef#2019=05=00=RamaubeM]

Appendix 6. Ethical approval from Cape Peninsula University of Technology




FACULTY OF ENGINEERING & THE BUILT ENVIRONMENT

On 14 May 2019, the Engineering and the Built Environment Ethics Committee of the Cape Peninsula University of Technology granted ethics approval to **Anthony Peter Staak, Staff No: 30015451** for research activities related to his research project at the Cape Peninsula University of Technology.

Title of research project	<i>Strategies to promote the enrolment of female students in engineering programmes</i>
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Comments:

Data collection is required - questionnaire attached.



PROF TV OJUMU

RESEARCH COORDINATOR (ACTING)

07/07/2020

2019FEBEREC-ST-005