# CONSTRUCTOR INSTITUTE OF TECHNOLOGY

# Equality Guidelines

**Identification:** Constructor Institute Report CIT-2023-009-EGU

**Title:** *Equality Guidelines*

**Status:** (check only one)
       ☑ Public
       ☐ Available to Constructor Institute members only (on Intranet)
       ☐ Restricted availability, subject to approval

**Related documents:** Code of Academic Ethics (CIT-2023-008-CAE); Academic Staff Guidelines (CIT-2023-001-ASG); Faculty Statute (CIT-2023-015-FST); Development Plan (CIT-2023-010-DVP); PhD Program Handbook (CIT-2023-007-PPH).

| Date | Authors | Comments about this version |
|---|---|---|
| 2023-08-08 | Bertrand Meyer | • Formatting, proofreading, corrections.<br>• Approved by Board of Director 08.08.2023<br>• Approved by President 08.08.2023<br>• Approved by Academic Senate 09.08.2023 |
| 2023-08-01 | Bertrand Meyer | • General revision based on comments by Manuel Oriol, Flavia Trifa, Galya Peyankova and others. |
| 2023-07-04 | Working group | • Initial version. |

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# 1  Overview

One of the critical values of Constructor Institute is equality of opportunities, in line with the Quality standards for institutional accreditation (HEdA Accreditation and Ordinance, Annex 1, §2.6), which state that:

"The higher education institution or other institution within the higher education sector shall promote equal opportunities and gender equality for its staff and students. The quality assurance system shall ensure that the higher education institution or other institution within the higher education sector sets objectives in this area and also implements them."

Section 2 describes Constructor Institute's vision for equality and the corresponding goals. Section 3 reviews the current situation regarding equality, both in the community at large and at Constructor Institute. Section 4 presents measures being taken to improve equality and reach the goals of section 2. While all forms of equality are important, a particular focus of this document is gender equality, for which significant imbalances exist (section 2) and must be redressed.

# 2  Equality vision and goals

Constructor Institute is committed to equal opportunity regardless of every individual's race, gender, age, religion, ethnicity, sexual orientation, social background and disability. To implement this vision, Constructor Institute has committed to the following goals:

- Actively promote equality at all levels and in all areas of Constructor Institute.
- Ensure and communicate equal opportunities for students and employees regardless of race, gender, age, religion, ethnicity, sexual orientation, social background and disability.
- Examine and align all processes, decisions and further developments affecting the overall organization of Constructor Institute with regard to their equality orientation and their effects on the achievement of equality goals.
- Strengthen the diversity competence of all employees of Constructor Institute through personnel development measures.
- Develop and pursue special measures for the advancement of women.
- Anchor this self-commitment in all guiding and strategy papers.

While all equality goals are essential, inequality is specifically addressed in our sustainability strategy as a separate goal, "Less Inequality" (hereinafter "LI").

To implement these goals, we set up the following strategic goals:

- LI1: We offer barrier-free educational opportunities for underrepresented groups trough scholarships and other forms of support.
- LI2: We develop special activities to attract more female students.

# 3  Current situation, global and local

Constructor Institute's main fields of academic activity are part of information and communication technologies (ICT), particularly Computer Science and Software Engineering, as well as quantum technologies. In these areas, female participation has historically been low, both at career entry (proportion of female students) and further at later career steps (proportion of female faculty and researchers).

## 3.1 Student gender ratios globally, in Europe and in Switzerland

The overall proportion of female ICT graduates across OECD[1] countries is 20%, and the ratio is even lower (by a factor or more than two) in Switzerland: 8.9% according to 2016 data [1][2]. In contrast, from the same survey, the OECD-wide proportion of women graduates is 79.6% in education, 76.2% in "health and welfare" (Switzerland: 75.2%) and 57.7% overall. Remarkably, ICT fares even worse than "engineering, manufacturing and construction" (25.8% OECD, 15.2% Switzerland).

As Constructor Institute currently offers *master* programs only, a more precise point of comparison is the study by Informatics Europe (the association of computer science departments and industry research labs in Europe) which, every year, performs a systematic analysis [3] of informatics (computer science) education in European countries[3]. It is worth reproducing the table for master students from [3] in full[4] (Table 1). "RU" refers to Research Universities (the category of reference for Constructor Institute) and "UAS" to Universities of Applied Sciences.

| Table 4bis. Women percentage of total students in Informatics Master's programs | | | | | | |
|---|---|---|---|---|---|---|
| | 2012/13 | 2013/14 | 2014/15 | 2015/16 | 2016/17 | 2017/18 |
| (RU) Austria | 16.3 | 16.5 | 17.0 | 17.5 | 19.3 | (a) |
| (UAS) Austria | 15.6 | 14.9 | 16.0 | 16.6 | 17.5 | (a) |
| (RU) Belgium | 9.0 | 13.5 | (a) | (a) | (a) | (a) |
| (UAS) Belgium | 1.5 | 2.9 | 5.8 | 5.9 | (a) | (a) |
| (RU) Bulgaria | 37.9 | 37.8 | 39.6 | 37.7 | 35.2 | (a) |
| (RU) Denmark | 37.6 | 38.4 | 20.8 | 23.8 | 27.9 | 29.9 |
| (RU) Estonia | 33.6 | 31.4 | 29.0 | 29.6 | 33.7 | 36.1 |
| (RU) Finland | 20.5 | 21.1 | 21.4 | 21.0 | 21.6 | 21.6 |
| (UAS) Finland | 33.5 | 32.3 | 35.1 | 34.8 | 37.8 | 35.1 |
| (RU) Germany | 17.1 | 17.7 | 18.3 | 19.0 | 19.8 | (a) |
| (UAS) Germany | 14.6 | 16.3 | 16.6 | 18.0 | 19.5 | (a) |
| Greece | 32.1 | 32.7 | 31.1 | 29.9 | (a) | (a) |
| (RU) Ireland | 22.3 | 22.4 | 26.1 | 25.0 | 26.7 | (a) |
| (UAS) Ireland | 17.2 | 16.7 | 17.4 | 22.0 | 20.9 | (a) |
| Italy | 15.1 | 14.8 | 15.2 | 15.7 | 16.2 | (a) |
| Latvia | 21.0 | 22.3 | 28.0 | 31.2 | 33.9 | 27.3 |
| (RU) Lithuania | n.a. | 22.1 | 19.5 | 18.8 | 20.7 | 20.0 |
| Poland | 14.2 | 15.0 | 15.0 | 16.4 | 17.6 | (a) |
| Romania | 38.1 | 35.4 | 35.2 | 38.0 | 36.8 | (a) |
| Spain | 19.5 | 18.9 | 18.6 | 19.8 | 20.3 | (a) |
| (RU) Switzerland | 16.6 | 15.5 | 16.0 | 15.5 | 15.7 | 17.0 |
| (UAS) Switzerland | 8.8 | 9.0 | 10.5 | 10.1 | 10.7 | 11.2 |
| UK | 23.3 | 24.7 | 25.9 | 27.5 | 26.6 | (a) |

Table 1: *Female percentages in computer science master program in Europe,2012- 2018 Source: Informatics Europe report [3] , page 50*

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[1]Democratic industrialized countries, members of the Organization for Economic Co-operation & Development.

[2]Number in brackets refer to the reference section at the end of the present document.

[3]Disclosure: the report series was initiative by the current Provost of SIT in his earlier role as president of Informatics Europe, and he co-wrote the first two annual versions in 2011-2013.

[4]We chose the 2018 report since it is freely available on the Web. More recent versions require member access to the Informatics Europe site https://informatics-europe.org.

Note that the proportions for *bachelor* degrees in Switzerland in the Informatics Europe report (page 46) are consistent with those the OECD report cited above (slightly higher: RU 16, UAS 10[5]). At first sight the higher numbers (by 50% or more) for master students might seem surprising, since master students must have taken a bachelor degree first, almost always in the same field (computer science/informatics) but it is in fact easy to explain: thanks to the exchange mechanisms made possible by the Bologna agreement, students can move to another university, possibly in another country for their master degree; due to the high quality of its programs, Switzerland is attractive to many good students from other countries. While we have not definitely proved this explanation, it is reinforced by the observation that the proportion actually *diminishes* (11.3 to 10!) from bachelor to master in Universities of Applied Sciences[6], which are less attractive internationally – they are typically not research-oriented, and they often conduct a significant part of the instruction in German or French rather than English – whereas it increases (11.9 to 16, i.e. 46%) for research universities, which among other attractions for international students usually conduct their master programs in English.

Even the best Swiss number of 16.6 is pitifully low, of course, and the situation is only slightly better in the rest of Europe. The highest figures, about 1/3rd, are for Bulgaria, followed by Romania, and they are outliers; most countries hover in the 15%-20% range[7].

The rest of the world does not differ much from Europe in these indicators. It is important to note, however, that the situation is not *universally* bleak. Some institutions, through proactive policies, have against all odds managed to break out of the gender inequality trap. In spectacular contrast to the above statistics, Carnegie Mellon University (CMU)[8] has attracted considerable attention by the success of a steadfast policy which over just a few years succeeding in breaking the 50% barrier, as shown in Table 2[9].
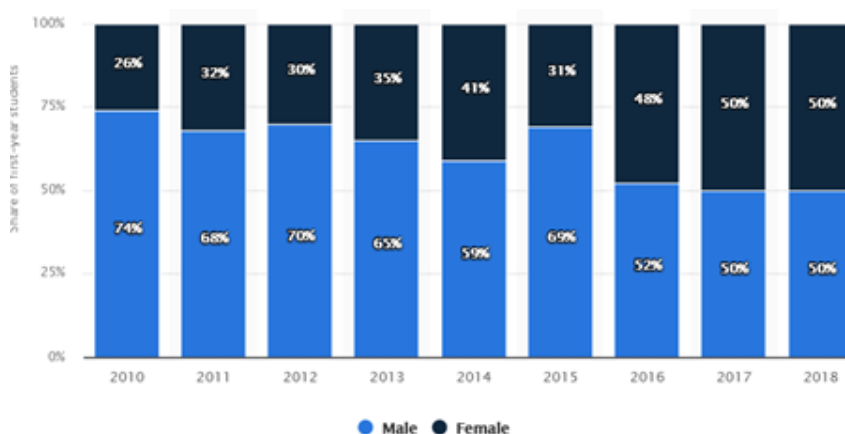


Table 2: *Female percentages in computer science (incoming freshman class) at Carnegie-Mellon University, 2010-2018 Source: Statista [4]*

When asked about the recipe behind such results, CMU representatives like to state that "it is not rocket science"[10] but the application of simple policies. Section 3 will explore some of the techniques with a view towards transposing them to Constructor Institute.

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[5]Averages (exact values are 16.05 and 10.05) from 2012 to 2018 in Table 1.

[6]Data for bachelor programs also from Informatics Europe report, Table 3bis page 46 of [3], averaged 2012-2018.

[7]It is important to note the following feature of the Informatics Europe reports: they are extensively researched and cross-confirmed, and use reliable, certified data. As a result, they only cover countries for which such official data can be found and verified. Countries for which it is not possible to apply these rules are not included. That is the reason why the list of countries is not exhaustive; for those included, the results are robust.

[8]The present report relies on the CMU experience since it has been amply documented, but other examples exist of institutions that have used similar policies to reach a high female ratio, for example Caltech.

[9]The ratios are rounded in Table 3 but were slightly above the symbolic 50% in 2017. The last one we have ascertained is again 50% for 2020. Informal reports suggest that the ratio has remained close to that value since.

[10]In the words of Prof. Lenore Blum, one of the prime movers behind the CMU effort, as cited in [6]. See also [5].

## 3.2 Student gender ratios at Constructor Institute

The situation at Constructor Institute, while still falling short of a perfect CMU-like gender balance, is significantly better than in most institutions of reference in Switzerland, Europe and elsewhere. Since our start in 2019, the ratio of female students has increased from 25% to 40%. Female students have been particularly successful, capturing special awards (e.g. best master thesis etc.) in both the 2022 and 2023 graduations (see Figure 1).



Figure 1: *Bestowing an award at the 2023 graduation ceremony*

## 3.3 Faculty and researchers

The gender gap does not only affect students but is also pronounced in computer science research worldwide, where women only account for an estimated 15% to 30% of positions [2]. Constructor Institute is not doing well in this respect in its faculty, which currently is entirely male. The situation is better for researchers (PhD students, postdocs), where we currently have about 30% females.

# 4 Redressing the gender imbalance: what works

It is easy, and commonplace, to bemoan the low ratio of women in ICT and particularly among students and faculty. It is also common to offer "plain common sense" supposed remedies. Everyone has an opinion, justified or not. At Constructor Institute, we prefer an approach based on objective results. Since the issue is not new – academics and academic management have been tearing their hair over it for three decades – there exists a reasonable body of experience and knowledge about what works and what does not. In addition, current faculty members have direct management experience of analyzing and addressing the problem: as department chair of the Computer Science (Informatik) at ETH Zurich; as dean of informatics at USI (University of Lugano); as president of Informatics Europe, which devoted considerable attention to gender equality in the field, in cooperation with its counterpart in the US, the Computing Research Association; and as a participant in diversity efforts at ABB.

## 4.1 Curriculum adaptation

Around 2003, Ludwig Maximilian University in Munich attracted considerable attention by obtaining a 30% female enrollment ratio in a new program called "Web informatics", with an emphasis on user interface design skills, but in reality consisting for a large part of the same courses as the standard computer science curriculum with less than half that female ratio. (In other words, branding was as important as the actual curriculum content.)

The experience appears to have been short-lived. It remains the case, however, that programs labeled "business informatics" (Wirtschaftsinformatik in German-speaking countries) systematically have a higher female ratio, closer to 30% than to the usual Swiss 10-15% ratio for computer science programs.

We should note, however, that the academics behind the successful Carnegie-Mellon change emphasize that they did *not* change the curriculum, and strongly advise against doing so. In the words of [5]: "*We did not need to change the curriculum to be 'pink' in any way. Indeed, beliefs in a gender divide may actually be deterring women from seeing themselves in male-dominated fields*".

It seems indeed to be the case that curriculum adaptations can have a small effect at best. They also do not seem to be in line with equality concerns. (Airline pilot programs are not different according to gender.) They seem to perpetuate rather than remove stereotypes, such as "men like hard technical problems, women are more attracted to topics requiring social skills".

Among their most distinctive features, Constructor master programs emphasize leadership, management and communication skills. This aspect should be equally attractive to men and women (as it is to potential employers).

More generally, available evidence suggests that we should not focus on "painting pink" the curriculum itself. We should devise the best curriculum possible, for both genders. The real issues like elsewhere.

## 4.2 Student selection

A prime tool in Carnegie-Mellon's strategy was simply to select more females from the applicant pool. This very simple strategy is available to top US universities. In the applications to CMU, for example, "*Over 32,000 high-achieving teens applied to be part of Carnegie Mellon's Class of 2026—13.5% were accepted*" [11]. With such a pool of good applicants, it is clear that for every student accepted at CMU there was one who also had good chances of success and could have been accepted without hampering the quality of the student body in any significant way – but was rejected. Universities that find themselves in such a luxury situation can obtain almost any ratio they aim for, simply by skewing admission criteria to include gender.

It is interesting to note that this approach is *not* open to traditional Swiss universities, who by law must admit any student fulfilling basic criteria – essentially, a science "matura" (high-school degree). This is one of the key reasons why they are (in words used above) tearing their hair about the gender issue: much of it is beyond their reach, as high schools (Gymnasiums) have already made the gender-based selection at the student age of 13 or so. As Constructor Institute currently recruits students at the master level only, we are not subject to such constraints and should use this feature to its advantage.

The word "quota" tends to bring unpleasant connotations, but to the extent we talk of quotas they are positive quotas (not the exclusionary quotas of sinister memory in European history). They are in fact more reminiscent of "affirmative action" as practiced in the US to redress historical imbalances.

We intend to use our recruitment policy, as Carnegie-Mellon so successfully did, to increase female recruitment.

An important qualification is required: any affirmative policy to favor the recruitment of women must ensure that it *does not affect the quality* of recruited students. The strategy is clear: broaden the pool of applicants, through the growing reputation of Constructor Institute's programs and through smart marketing particularly targeted at excellent potential women students.

We are aware that such affirmative policies are not in the European tradition and can raise objections. In the end, however, one has to be honest. Everyone beat one's breast about gender inequality, and yet (as cruelly shown by statistics shown above) the facts are there: the situation has not improved in three decades of chest-beating. Gender inequality is a shameful disease which keeps out potential contributors to the field and by damaging its quality hurts everyone. Difficult problems require serious solutions.

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[11] Citation from "*How to Get Into Carnegie Mellon: Acceptance Rate & Strategies*", 14 June 2023, online at `https://www.collegetransitions.com/blog/how-to-get-into-carnegie-mellon/`.

## 4.3  Other measures

Some techniques, complementing those already discussed, can be used to redress the imbalance.

### 4.3.1  Removing the requirement for programming experience

Part of the CMU strategy has been to remove "previous programming experience" from acceptance requirements into computer science programs (in their case, first-year bachelor)". The published analyses [5] [6] indicate that this measure has played a key role, since many girls have not had the early exposure to coding that more of their male schoolmates have enjoyed. According to the same articles girls often compensate for this absence by exhibiting more mathematical skills. Such talented students can then learn programming through courses in the first two years.

*Analysis, and application to Constructor Institute*:

As teachers of computer science, we appreciate mathematical and more generally logical-reasoning skills as much as programming experience.

It has indeed been a feature of the Constructor Institute recruitment scheme for the master programs (CSSE, CSSEL. . . ) that we recommend but *do not require* a Bachelor degree in computer science. We consider applicants with a strong background in a different scientific or technical discipline, particularly mathematics, computer engineering or mechanical engineering. We have been criticized for that choice, since the conventional wisdom in computer science curricula in the German-speaking computer science community is that there is no salvation for souls not trained in computer science since their earliest baby steps. Experience, however, have vindicated our choice: many of our most successful students – many of them women – have come from other fields. This experience is confirmed by the record at CMU. We intend to continue that experience and attract highly talented students with excellent scientific skills whether or not they are fluent in Python.

### 4.3.2  Special outreach to high-school students

ETH Zurich and other universities attempt to address the source recruitment problem mentioned above – the small female numbers on entry to the pipeline through the science "Matura" – by organizing special awareness sessions for high-school students, some reserved for girls. In particular ETH computer science has a "Schnupperstudium" program which offers coding classes during the summer, for girls in the last years of their high school curriculum.

Analysis, and application to Constructor Institute:

It might be argued that initiatives of this kind are not relevant for Constructor Institute since we currently recruit at the master level, not immediately after high school. Our analysis is different, however, taking into account that:

- It is important to plant the seeds early.
- Outreach to local high-school students is part of our "good-citizen" involvement with the community, in Schaffhausen and in Switzerland.
- Even if the immediate result is to attract more girls to other universities offering a BSc, that is good for the discipline as a whole, and those students might of course consider Constructor Institute later on in their careers.

We have already offered such actions, particularly in the context of our "Insights in Technology" conferences which attract the local community and in which we have special sessions for high-school students. No one at Constructor Institute who was there for the session involving Professor Wolfgang Ketterle, a Nobel Prize winner, demonstrating to a roomful of girls and boys the properties of materials in extremely cold temperatures[12] will forget the experience.

We will continue such outreach actions in close connection with the Schaffhausen high schools.

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[12]16 December 2019, see `https://constructor.org/events/26` and a press article at `https://www.linkedin.com/pulse/die-neugr%C3%BCndung-schaffhausen-institute-technology-sit-zimmermann/?originalSubdomain=de`.

### 4.3.3 Fighting bias

An important element of the long-term success of imbalance-redress policies is to debunk biases, often implicit, that men are from Mars and can code whereas women are from Venus and can sew. Of course no one in 2023, at least in a Western society, will state such crudely expressed views, but implicit bias remains. Measures that have been shown to work include:

- Providing more role models. We are not yet in a position to present Constructor Institute women faculty members in this capacity, but we can point to our brilliant PhD students and postdocs, and to our successful graduates. (In the 2023 MSc graduation ceremony, all but one of the awards (best and second-best Grade Point Average, best research thesis etc.) went to female students. Such a visible result is a great incentive for potential students. Such student role models are also a good way to avoid other kinds of inequality (besides gender) since our student body is so international and diverse.
- Establishing support groups. The computer science department at ETH Zurich has a "Frauenforderung" (women advancement) group; although one can argue that it has not led to significant changes in admissions statistics over more than two decades of its existence, it probably has played a major role in limiting the *attrition* of female students (who, when finding too few soulmates, may give up). Carnegie Mellon has similar groups, although typically self-organized rather than decreed top-down.
- Making everyone in the institution aware of potential biases, conscious and unconscious, and of the need to fight them.

> Analysis, and application to Constructor Institute:
>
> We will continue to apply the measures just described, and to monitor institutions that have succeeded in redressing gender bias.

### 4.3.4 Organizational measures

Constructor Institute has taken several governance-related measures to help achieve the goals outlined in the present document.

We are in the process of appointing (before the end of 2023) an Equal Opportunities Officer (EOO) with the following functions and roles:function. The EOO organizes, on an annual basis, the "round table" (on the topic of "Less Inequality" at the end of Q1 2024), which consists of. The EOO also ensures the implementation of the measures and reports to the President of Constructor Institute and its Board of Directors annually. The EOO is also the contact person for all students and employees in order to cooperate with management on clearing and mediation of all issues related to the topic.

In addition, Constructor Institute will create, by the end of 2023, an Equality Committee made of representatives of the various personnel categories involved. The Equality Committee will be chaired by the EOO and will meet on a regular basis, at least once a semester.

The EOO, supported and guided by the Equality Committee shall perform, among others, the following tasks:

- Raising awareness and providing information, advice and assistance in equality and diversity (not restricted to gender issues).
- Organizing an annual Round Table on Equality with members from faculty, researchers, students, administration and management.
- Setting up and participating in equality training for personnel.
- Creating plans for general and group-specific measures concerning equality and the advancement of women.
- Preparing an annual equality report for the President and Board of Directors, including an objective evaluation of goal attainment, obstacles and achievements.
- Ensuring that all recruitment procedures, particularly for faculty and researchers, include strong measures to favor diversity of applicants and to take diversity into account as one of the principal factors in choosing between applicants.
- Ensuring that all assessment actions at Constructor Institute – such as course evaluations (by students), evaluations of faculty for promotion and tenure (per the process described in detail in the Faculty Statute), contract renewal decisions for PhD students (as described in the PhD Program handbook) and other researchers – take equality issues into account and help assess any equality or diversity mishaps.
- Alerting faculty to include equality concerns into their teaching and research.

In connection with the EOO and Equality Committee, we plan to make sure that Constructor Institute's equality-promoting policy is widely known and to attract excellent female candidates to the faculty positions that will be advertised in the coming months and years per the Development Plan.

The general spirit of this policy is to eschew general proclamations, heart-beating about gender imbalance, as well as self-pleasing but ineffective measures (such as the absurd attempt to make curricula more women-friendly in an unproven and condescending view of what attracts women) and replace them by concrete step-by-step actions, based on concepts that have been objectively demonstrated to work. Such actions may sometimes defy conventional wisdom, but they are the only way to remedy equality violations that cause great damage to the individuals involved, Constructor Institute, the field of ICT, and society as a whole.

# 5  References

(All URLS were operative on August 3, 2023.)

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[3]  Svetlana Tikhonenko, Christina Pereira, for Informatics Europe: *Informatics Education in Europe: Institutions, degrees, students, positions, salaries. Key Data 2012-2017.* Available to Informatics Europe members but also (Aug. 2023) at https://www.fib.upc.edu/sites/fib/files/documents/noticies/informatics-education-europe-2012-2017.pdf.

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[6]  Carol Frieze and Jeria Quesenberry: How One University Is Attracting Women to Computer Science, in Communications of the ACM, Vol. 62 No. 2, February 2019, Pages 23-26, available at https://cacm.acm.org/magazines/2019/2/234346-how-computer-science-at-cmu-is-attracting-and-retaining-women/fulltext. (Also at https://www.brinknews.com/how-one-university-is-attracting-women-to-computer-science/).

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