# Why do women leave STEM research in The Netherlands? 

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## Preface

The world is in need of ideas and research from researchers in science, technology, engineering and mathematics (STEM) ${ }^{1}$. The energy transition, the rapid growth of artificial intelligence and the ongoing digitalization are clear examples. STEM research is a cornerstone of research and plays a central role in addressing complex societal changes, improving the standard of living and driving economic growth.

If we want the research and ideas to be useful for all of society, then it's important that they come from a diverse group of researchers. We need diverse perspectives and approaches to solving scientific and technological problems. Research has shown that diverse teams are more innovative and creative, leading to better problem solving and more robust solutions. Additionally, because diverse teams bring a wider range of experiences and viewpoints, a diverse STEM research pool can lead to more comprehensive problemsolving and innovative solutions.

With only $17,8 \%$ of the researchers in the field of Technology in the Netherlands being female (Landelijk Netwerk Vrouwelijke Hoogleraren, 2021), women are underrepresented in this field of research. Naturally, diversity goes beyond only gender. While gender diversity is an important aspect of diversity given that $50 \%$ of society is female, it is just one of the many aspects of diversity. As VHTO we know that implementing changes to create a more gender diverse workforce has a positive effect on diversity as a whole.

NWO - the Dutch Research Council has commissioned VHTO - Expert Centre Gender Diversity in STEM - to conduct a study on the potential role that NWO could
play in improving the retention of female STEM researchers in the Netherlands. As part of the study we did for NWO, we reviewed existing literature that provides insight into the possible reasons for the outflow of female researchers in STEM fields.

During this research we were assisted by the Dutch Network of Women Professors (Landelijk Netwerk Vrouwelijke Hoogleraren, LNVH). We made use of their data, reports and insights on this topic and we appreciated their critical input. We thank LNVH for their allyship.

We also thank NWO for this opportunity to dive deeper into the topic of retention of women in STEM research. However, we also emphasise the need for more research on this topic. Unfortunately, most research is international as there is little to no recent research on the retention of female Dutch STEM researchers. We therefore suggest increasing knowledge on this topic within the context of Dutch academia and working closely with all stakeholders to build a more inclusive working environment.

## Sahar Yadegari

Director of VHTO

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## Introduction

In the existing literature, we identified eight factors, extrapolated from national and international literature, that combine to contribute to a reduced sense of belonging of female STEM faculty in the Netherlands and result in a decision to leave academia. There is little to no recent research on the retention of female Dutch STEM researchers, which means that on certain aspects we have to rely solely on findings from international research.

The eight factors that we have identified are:

1. Job insecurity,
2. Workload,
3. Balance between education and research
4. Career progression,
5. Compensation
6. Family responsibilities and Work-life balance,
7. Unsupportive culture and
8. Harassment.

The factors are presented in arbitrary order and no weight is given to the individual factors. While these factors could also contribute to non-STEM female researchers' decision to leave academia, the effect of each factor in a STEM context could be further exacerbated due to stereotypes about women in STEM, as described in factor 7 (Unsupportive culture).

In the paragraph below we describe each factor. In the concluding paragraph we discuss the limitations of this study and we suggest several topics for additional research

Factors that contribute to women leaving STEM research in the Netherlands

The decision to leave is a complicated decision that is influenced by several factors that combined together may result in departure. In a recent Australian study researchers found that female early career researchers in STEM arrived at their decision to leave after months, if not years of careful planning and that they did not necessarily find it an easy decision as being a scientist was so much part of their identity (Christian, Johnstone, Larkins, \& Wright, 2021). The factors that we have identified in this study, could affect male researchers as well and result in their departure from STEM, but the impact on female researchers is stronger for reasons that are detailed in the text below. In addition, male STEM researchers are not underrepresented, which means that their decision to leave has less impact on the male/female ratio in a university.

The following factors were identified in the existing literature

## 1. Job insecurity

In the abovementioned Australian survey amongst female STEM researchers, job insecurity was identified as the most significant barrier to job satisfaction and career advancement for early career researchers (Christian, Johnstone, Larkins, Wright, et al., 2021). In a follow up in-depth qualitative research eight Australian female STEM researchers identified job insecurity as one of the main reasons to leave academia (Christian, Johnstone, Larkins, \& Wright, 2021).

In the majority of European countries, including the Netherlands, more women in academia have a precarious contract (no contract, fixed-term contract of up to one
year, or with other contracts often associated with student status) than their male colleagues (Directorate-General for Research and Innovation (European Commission), 2021). The 2021 Dutch Network of Women Professors Monitor (LNVH) shows that women in academia more often have a temporary contract. In 2021 31,6\% of female assistant professors had a temporary contract as opposed to $26,8 \%$ of their male counterparts (Landelijk Netwerk Vrouwelijke Hoogleraren, 2021).

## 2. Workload

According to a study on postdocs (including non-STEM researchers) in Germany overall, postdocs' working situations are characterized by career insecurity, high dependency on single professors, high workload in the form of teaching and administrative duties. In addition, the timing of promotion or tenure coincides with a period of life when people are typically enmeshed in family life with children. Not surprisingly, such a working environment is particularly challenging for women, the percentages drop from around $45 \%$ of Ph.D. graduates to only around $23 \%$ of professors in Germany (Dorenkamp \& Weiß, 2018).

According to a FNV report (Dutch union) from 2019, 76\% of scientific staff reports high amounts of stress due to workload. $70 \%$ of the female respondents and 60\% of the male respondents that experience a high level of work stress in this study, has considered leaving academia because of the workload (FNV et al., 2019). According to a study from the Dutch Ph.D. network (PNN), there are no significant differences between male and female Ph.D. candidates (not STEMspecific) in terms of self-rated workload

There is however a difference in terms of how Ph.D. candidates are bothered by the high workload that they experience. Female Ph.D. candidates (non-STEM specific) indicate relatively more often to be extremely or considerably bothered by a high workload than male Ph.D. candidates (combined 44.6\% versus 38.5\%) (Mattijssen et al., 2020).

The German study on postdocs shows that an imbalance between perceived high efforts and low rewards seems to evoke negative emotions and strain reactions, which lead the postdoc to devalue his or her current job situation. As a result, job satisfaction decreases, increasing the intention to leave academia. The study further found that work stress resulting from adverse working conditions is directly related to female postdocs' considering leaving academia but not to men's considering leaving academia. According to this study, overcommitment has a significantly stronger effect on psychological strain for female postdocs. The researchers note that this may be caused by the fact that postdocs are in a life phase in which family obligations are high or that this result may be related to the characteristics of male postdocs, such as a higher self-efficacy (Evers \& Sieverding, 2015), which buffer the effect of overcommitment on psychological strain (Dorenkamp \& Weiß, 2018).

One could also argue that there is an actual imbalance between how the work of female faculty is rewarded and how the work of male faculty is rewarded. According to a recent Dutch study by Van Veelen \& Derks (2021), academics perceive agency (e.g., self-confident, self-focused, competitive, traits that are typically associated with men and masculinity) as more descriptive of the stereotypical successful academic than communality (e.g., team-oriented, good teacher, collegial, traits that are typically
associated with women and femininity) (van Veelen \& Derks, 2021). This standard of success means that agentic behavior is more likely to be recognized and rewarded than communal behavior. One example of how differences in rewards manifest themselves is in teacher evaluations. An American study examined gender bias in student ratings of teaching by falsifying the gender of assistant instructors in an online course and asking students to evaluate them along with a number of instructional criteria. The findings support the existence of gender bias in that students rated the instructors they perceived to be female lower than those they perceived to be male, regardless of teaching quality or actual gender of the instructor. Student evaluations are still used in assessments and as an appointment criterion for assistant instructors (MacNell et al., 2015). Other research has shown that college students were more likely to rate the same conference abstracts as lower in scientific quality if the author's name was female instead of male, particularly if these topics had traditional masculine themes (Knobloch-Westerwick et al., 2013).

## 3. Balance between education and

 researchThe duties of a (Dutch) academic include providing and developing effective education, acquiring new projects and funding, coordinating and realizing research projects, and supervising other staff and/or students (Universiteiten van Nederland, n.d.). However, some of these duties are valued more within academia than others. This includes the undervaluation of education (Bleijenbergh et al., 2013). Being a good teacher does not make an academic excel; when research or valorization is of high-quality, mediocre performance in teaching is allowed. In recent years, the Dutch academic community has initiated a process to reassess how academic performance is recognized and rewarded (Erkennen en
waarderen). The initiative aims to steer away from a strict focus on publications and to appreciate the intrinsic value of education and societal impact (VSNU et al., 2019).

A report from LNVH, (Landelijk Netwerk Vrouwelijke Hoogleraren, 2020) shows that Dutch female researchers spend more time on education than their male colleagues, on average 52 hours more a year. Female assistant professors even spend, on average 70 hours more hours on education than their male colleagues (Landelijk Netwerk Vrouwelijke Hoogleraren, 2020). Women, however, spend less time on research than men, 70 hours a year (Landelijk Netwerk Vrouwelijke Hoogleraren, 2020).

One explanation for this gender difference may have to do with family planning. When women make plans to have children, the overlap between their optimal years of fertility and tenure pursuits result in many viewing STEM careers, or tenure-track academic careers in general, as unsuited to achieving their familial goals (Wang \& Degol, 2017). In academia, for instance, women seem to be vacating tenure track positions or seeking out more flexible part-time academic positions at higher rates than men, resulting in women becoming overrepresented in part-time or full-time instructor and lecturer positions and underrepresented among full-time associate professors and full professor faculty positions (Kena et al., 2015).

Another potential explanation that has not yet been fully researched, is gendered work dynamics that require women to be more helpful in taking on extra tasks whereas it is more accepted for men to decline such requests. There is existing research on female researchers performing more academic services than male researchers (Guarino \& Borden, 2017)

Regardless of the cause of this imbalance between education and research, it could be a factor that contributes to lower job satisfaction. According to an American study on retention of STEM women faculty, high levels of teaching productivity were negatively related to satisfaction with compensation and satisfaction with job autonomy, but high levels of committee service were associated with higher satisfaction with job security. One interpretation of these findings may be that within the academy, research and administrative responsibilities are often rewarded by reductions in teaching responsibility. Practices such as course releases, teaching only appointments relegated to non-tenure earning faculty, and emphasis on research for tenure and promotion, contribute to an academic culture where teaching is marginalized. From this perspective, STEM women faculty members who have high levels of teaching productivity may feel this to be a competitive disadvantage, which could contribute to lower levels of satisfaction with compensation and job autonomy (Pascale, 2018).

## 4. Career Progression

In the existing literature, we found five main factors that could hinder the career progression of female STEM researchers, namely implicit gender bias in the performance evaluation process, unequal caring responsibilities and access to networks, access to funding and access to resources.

## Implicit gender bias

Negative stereotypes about women in STEM are present in many countries, but the Netherlands is a unique case in this sense. An international study on the link between gender stereotypes and underrepresentation of women in STEM found that higher female employment in the researcher workforce related to weaker explicit, but not implicit,
gender-science stereotypes. The sample consisted of 66 countries and the Netherlands turned out to be particularly striking in terms of outcomes.
Despite scoring high on composite indices of gender equity, this nation had the strongest explicit and second strongest implicit gender-science stereotypes among the 66 nations (D. I. Miller et al., 2015).

Negative stereotypes about women in STEM could result in gender bias in assessment processes. An American study on women's career in science studied the effect of sex-based negative stereotypes in an experimental market, where subjects were hired to perform an arithmetic task that, on average, both genders perform equally well (Reuben et al., 2014). The study found that without any information other than a candidate's appearance (which makes sex clear), both male and female subjects are twice more likely to hire a man than a woman. The discrimination survives if performance on the arithmetic task is self-reported because men tend to boas about their performance, whereas women generally underreport it. Employers who are biased against women, are less likely to take into account the fact that men, on average, boast more than women about their future performance, leading to suboptimal hiring choices that remain biased in favor of men (Reuben et al., 2014).

This type of implicit gender bias has its impact on the experience of female scientists, as documented in a study where female scientists (both academia and industry) in a range of STEMM ${ }^{2}$ fields in five countries in the Global North were interviewed. Women describe difficulties inherent in working in male-dominated scientific fields. Participants reiterate how hard they must work to be seen as competent compared to men. Participants in this study describe working in organizations where 'stereotypically male traits, such as assertiveness and
overconfidence', are valued. "I think it is incredibly hard for a woman to be recognised as a good leader without having negative attributes ... whereas if men would do similar things they would be regarded as assertive and strong " (Nash \& Moore, 2018).

## Unequal caring responsibilities

Taking leave to attend to family
responsibilities, is another source of
hindered career progression. Results from a survey, held among present and past female and male participants in the biological and biomedical and chemistry-related research workforces, showed that three times as many women as men had taken significant periods of leave during their careers, and a significant proportion of women believe that this has affected their career progression (Bell \& Yates, 2015)

## Access to networks

According to a Dutch study on academic excellence, academics consider network contacts important for disseminating their work. According to this study women not only lack the 'right' network connections with men but they are also unable to benefit from the strong informal network connections in which men recommend and support each other, cite each other's works, and keep each other informed (van den Brink \& Benschop, 2012). Given that networks, connections and knowing the right people are seen as equally important as being good at your work, those whose circumstances do not provide the opportunity or time to develop supportive and influential networks are unlikely to succeed (Bell \& Yates, 2015)

[^1]According to another Dutch study by TechYourFuture among female ICT professionals, women expressed in focus groups the requirement to adjust to men to be able to connect with men and to gain access to relevant networks. The women also expressed a need to get more support from their supervisors to get access to networks (Tech Your Future, 2018).

## Access to funding

In 2019, the funding success rate was 1.5 percentage points higher for men than women in the Netherlands (Directorate General for Research and Innovation (European Commission), 2021).

## Access to resources

Compared to men, women report having less access to resources needed to do their work as a researcher, including research equipment, travel budget, hiring of assistant and their own office space (Landelijk Netwerk Vrouwelijke Hoogleraren, 2020).

## 5. Compensation

A report of LNVH shows that, on average, the difference in a full-time gross monthly salary between a male and female academic of the same age is EUR 390 (Landelijk Netwerk Vrouwelijke Hoogleraren, 2016). This difference can be largely explained by the fact that fewer women hold senior jobs within the university. If men and women of the same age and the same job level are compared, women earn on average EUR 53 less per month than men. The wage gap appears to be larger within the social sciences (where the salaries are relatively high and where relatively many women work) than within the arts \& humanities and the exact sciences.

Men receive an allowance more often than women, even within the same job category and level. This allowance gap is larger within the exact sciences and social sciences than within the arts \& humanities
(Landelijk Netwerk Vrouwelijke Hoogleraren, 2016). In the exact sciences, $15,3 \%$ of the men receive an allowance compared to $9,5 \%$ of the women.

Salary disparities between male and female researchers are disconcerting, as expressed by a female researcher in an American study: "I was the lowest paid associate professor when I was associate, and then I was the lowest paid full professor when I was full professor in the department, and I was serving as chair!" (Gardner, 2012). However, within the limitations of this research, we were not able to identify the salary gap as the main reason for departure

## 6. Family responsibilities and work-

 life balanceTo what extent are family responsibilities and a unsatisfactory work-life balance a motive to leave academia? As one STEM researcher who now has left academia puts it, 'I think a science career as a researcher is geared to the single male who's got time on his hands and wants to make his career. And it benefits and advantages anyone that fits that model (Bell \& Yates, 2015).

More women work part-time compared to men researchers (Directorate-General for Research and Innovation (European Commission), 2021), especially when they have children (Landelijk Netwerk Vrouwelijke Hoogleraren, 2020). Men that do work part-time often have another paid job while women use the time they work less on unpaid care and household tasks as well as finishing their University work (Landelijk Netwerk Vrouwelijke Hoogleraren, 2020). Caretaking responsibilities are not equally shared in Dutch families and this inevitably means that female researchers fail to live up to the image of the ideal scientist. The disproportionate impact of COVID on female academics with children living at home further demonstrates this unequal distribution of family responsibilities. Female academics with
young children experienced the highest amount of conflict in combining work with family obligations (De Jonge Akademie \& Landelijke Netwerk Vrouwelijke Hoogleraren, 2021). Ultimately, this lack of fit between professional life and personal life could result in departure (TechYourFuture, 2018).

In the literature, emphasis is put on STEM women shifting their priorities to family-centred goals as they become parents (Wang and Degol, 2017) and less so on men not shifting their priorities as they become parents. In a more recent study, however, both male and female ECRs were concerned about parental/ career responsibilities, knowing that delayed research productivity could compromise their career prospects. Men were more concerned about this than women, possibly reflecting recent efforts to accommodate mothers, but not necessarily families (Christian, Johnstone, Larkins, Wright, et al., 2021). Another interesting finding is that according to an American study on retention of female STEM researchers, it is not necessarily the familial responsibility but rather the perception that the institution is family-friendly that influences departure intentions (Pascale, 2018).

The requirement to travel (mobility) could further exacerbate the difficulties that female STEM researchers experience when managing family responsibilities. According to an Australian study on female STEM researchers, women experience having to move a lot, including moving abroad making it more difficult to have a family (Christian, Johnstone, Larkins, \& Wright, 2021). As another STEM researcher who now has left academia, puts it: 'And another thing, which more affects females, is that you're often displaced from your extended family and that's the family support that's not there when you've got young children' (Bell \& Yates, 2015).

However, according to the She Figures data (2021), during their Ph.D.s, Dutch male researchers are more mobile than their female colleagues (with 2.3 percentage point), but post-Ph.D. Dutch female researchers are more mobile than their male colleagues (with 11.3 percentage point) (Directorate-General for Research and Innovation (European Commission), 2021).

Within the limitations of this study, we were not able to analyze literature on how single and/or childless researchers experience the work-life balance of a scientist and to what extent those experiences are gendered.

## 7. Unsupportive culture

The literature suggests that the academic STEMM ${ }^{3}$ work environment is more difficult for women than for men (Nash \& Moore, 2018). Women experience stress from an uncertain, over-competitive and unsupportive environment (Christian, Johnstone, Larkins, \& Wright, 2021) and feel the effects of bad research culture disproportionately (Wellcome Trust, 2020). They also experience a lack of organisational support (J. M. Miller \& Feldman, 2015). This is particularly problematic because research also shows that structural support is significantly related to turnover intentions for women but less so for men. Findings from this study further confirm the importance of institutional support as critical for retaining STEM women faculty (Pascale, 2018).

[^2]Women who left academia as early career researchers in Australia mention that the academic culture is one in which you are told you are not good enough, not feeling empowered to discuss how 'just being a woman' was holding her back in the male-dominated environment and being told to be not tough enough (Christian, Johnstone, Larkins, \& Wright, 2021).

According to a Dutch study, women in STEM face double trouble: The combination of working almost solely with male colleagues (being outnumbered) and working in the technical sector (where women are negatively stereotyped) predicted the highest levels of experienced gender identity threat, particularly among women who highly identified with their gender group. Gender identity threat, in turn, negatively predicted women's work engagement and career confidence. To break this vicious cycle, STEM organizations should aim to improve gender equality at work, both numerically (improving women's representation) and normatively (removing negative gender stereotypes). By removing these contextual barriers, the STEM sector likely becomes a more appealing place to work for a larger, more inclusive group of women and men (Van Veelen et. al., 2019)

## 8. Harassment

The unpleasant environment also manifests itself in bullying and sexual harassment (Christian, Johnstone, Larkins, \& Wright, 2021). For example, female early-career researchers indicated experiencing higher rates of inequitable hiring practices and harassment from those in a position of power than their male counterparts (Christian, Johnstone, Larkins, Wright, et al., 2021). LNVH presented a report with the outcomes of a Dutch national explorative study about the different manifestations of harassment experienced by women academics (Landelijk Netwerk Vrouwelijke Hoogleraren et al., 2019).

Even though participants were sometimes reluctant to label their experiences as harassment, their experiences all fell under our definition of harassment as "patterns of intense behaviour that have the aim and/or effect of violating a person's dignity and/or that create a hostile working environment, thereby obstructing scholars in their academic work and their career progress." Based on analysis of the experiences of 53 women academics, the authors conclude that (1) women academics experience different manifestations of harassment, (2) that this harassment is facilitated by cultural and structural factors, and (3) that harassment can have detrimental effects on individuals, organisations and science in general (Landelijk Netwerk Vrouwelijke Hoogleraren et al., 2019).

## Discussion and Conclusion

We discussed eight factors that - combined together - contribute to women leaving STEM research. We want to highlight that these factors reinforce each other, leading to more women than men experiencing a reduced sense of belonging in STEM research and eventually leaving the field. The isolated effect of one factor - such as gaps in compensation - may not be significant, but the overall effect of these factors combined could add up and result in a decision to leave.

STEM research differs from other fields, because of the specific negative stereotypes about women in STEM. However, the way these stereotypes manifest themselves or are successfully mitigated varies across STEM subfields. It is therefore likely that the factors differ in their impact depending on the subfield. Furthermore, the impact of these factors varies depending on the different job levels within academia.

One of the limitations of this study is that the factors presented in this overview are not complete. This may be a result of our selection of papers or the fact that in some cases there is simply not enough research available. The amount of scientific research on why female STEM researchers leave academia in the Netherlands is extremely limited. There is a vast body of international literature on why women leave STEM and to a lesser extent STEM research and there is great documentation of the position of female researchers in the Netherlands thanks to the work of LNVH - The Dutch Network of Women Professors and other researchers. The lack of research on why women leave STEM research in the Netherlands is an additional finding as
part of this study. More specifically, we would like to identify the following areas that require more research:

- Dutch universities have recruited non-Dutch female STEM researchers. How does the inflow of this particular group impact the existing culture within STEM disciplines and to what extent are they at risk for premature departure?
- What is the impact of the tenure track model on female STEM researchers in the Netherlands?
- What are the reasons/incentives for Dutch male STEM researchers to not shift priorities when becoming a parent (e.g. taking parental leave, reducing working hours, changing tasks and responsibilities)?
- What can we learn from STEM subfields in the Netherlands that have managed to succeed in retaining female researchers (e.g. an in-depth case study of a selection of disciplines based on retention indicators)?
- Which STEM research job level is particularly an exit moment for Dutch female researchers? And to what extent does this vary across STEM subfields in the Netherlands?
- What is the view of Dutch female STEM researchers that have left academia, concerning the above-mentioned factors? To what extent has one or more factors been particularly pivotal in their decision to leave? What factors have not yet been identified?

To conclude, women leaving STEM research is a complex problem with a variety of (entangled) causes to which there is not one single solution. In order to retain more women, this topic should be integrated into existing initiatives allowing a strengthened gender focus in each and every aspect of university policies and practice. We suggest increasing knowledge on this topic within the context of Dutch academia and working closely with all stakeholders within STEM to build a more inclusive working environment. The universities should be able to identify what they additionally need from NWO, in their efforts to achieve gender equity in STEM and what this means for NWO's capacity to meet these needs.

## About the contributors

## VHTO

The fields of science, technology and IT - STEM - are characterised by progress and innovation - but also by stagnation: to this day, most positions in these fields are still filled by men. At VHTO, we believe this is a missed opportunity. After all, more women in science, technology \& IT benefits the sector as well as society and marks gender equality and fair opportunities: a win-win-win situation.

That's why at VHTO our objective is more women in science, technology and IT jobs, and greater choices for girls at school: creating the STEM professionals of the future, who can look at technology with a female eye, who notice the blind spots in the design process, and who enrich the world of technology, IT and science professions.

We approach this challenge with a large dose of knowledge, years of experience and a strong network, and armed with ready-to-use activities and smart tools that we can use in any situation to break through stereotypes and (unconscious) bias. Rather than being active at schools and in the workplace, we aim to be active throughout: from school to the workplace. This allows girls to meet role models multiple times in their lives, and to see for themselves that technology is their world too.

Fix the system, not the girls. That's our plan. We have the tools, the knowledge and the fighting spirit to make a change. Will you join us? www.vhto.nl

## vht'o <br> Expertisecentrum voor haar technische ontwikkeling

## NWO

The Dutch Research Council (NWO) is one of the most important science funding bodies in the Netherlands and realises quality and innovation in science. Each year, NWO invests almost 1 billion euros in curiosity-driven research, research related to societal challenges and research infrastructure.

NWO selects and funds research proposals based on recommendations from expert scientists and other experts in the Netherlands and abroad. NWO encourages national and international collaboration, invests in large research facilities, facilitates knowledge utilisation and manages research institutes. NWO funds more than 7200 research projects at universities and knowledge institutions. www.nwo.nl/en

## (0) <br> NWD

## LNVH

The Dutch Network of Women Professors (LNVH) aims to promote and sustain equal representation of women in academia, works towards the betterment of the position of women of all backgrounds and pushes for an inclusive and safe academic community.
www.Invh.nl


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[^0]:    The definition of STEM that is commonly used in the literature that we have studied for this paper, consists of Science,
    Technology, Engineering \& Mathematics. In the subcategory Sciences, Social Sciences, Humanities and Arts are excluded. Within this study, we use STEM to refer to the following disciplines / (sub)fields: Astronomy, Chemistry, Computer Science, Earth Sciences, Life Sciences, Mathematics and Physics and Applied and Engineering Sciences.

[^1]:    2 Science, Technology, Engineering
    Mathematics \& Medicine

[^2]:    ${ }^{3}$ Science, Technology, Engineering,
    Mathematics \& Medicine

