

# WHY DO WOMEN PHILOSOPHY STUDENTS DROP OUT OF PHILOSOPHY? SOME EVIDENCE FROM THE CLASSROOM AT THE BACHELOR'S LEVEL

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It is well known that there has been a steady and significant underrepresentation of women in philosophy on different professional levels. Numerous hypotheses explaining this underrepresentation have been suggested, but empirical analyses are not yet extensive. In particular, studies of the phenomenon in different countries are nonexistent. In this paper, we present findings from an exploratory study in which we analyze the interests, abilities, beliefs, attitudes, perceptions, and goals of bachelor's students in a semester-long philosophy of science course at a major German university. We furthermore make the first attempt to compare women-only learning environments with mixed-gender learning environments. Our results suggest that while there are generally some gender differences regarding interests, abilities, beliefs, attitudes, perceptions, and goals of students in the classroom, most of the hypotheses we explore to explain dropout rates by gender differences cannot be supported. We conclude that possible factors leading to the underrepresentation of women in philosophy in Germany might be found in the social and institutional environment within which philosophy is taught.

## 1. Introduction

There is no doubt anymore that there is a steady and significant underrepresentation of women in philosophy. This underrepresentation manifests itself in a

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variety of ways, such as in the numbers of published articles in highly ranked journals and of philosophy faculty positions held by women, in the list of invited speakers at academic events, in the number of women contributors to edited volumes, and in the citations of publications by women authors (e.g., Beebee & Saul 2011; Benetreau-Dupin & Beaulac 2015; Haslanger 2008; Healy 2015; Paxton, Figdor, & Tiberius 2012).<sup>1</sup> While the underrepresentation of women is not unique to philosophy (Beebee & Saul 2011), it is particularly pronounced in philosophy. The situation is comparable to that in STEM fields, that is, science, technology, engineering and mathematics, and –surprisingly– worse than in other humanities (Antony 2012; Leslie, Cimpian, Meyer, & Freeland 2015; Paxton et al. 2012).<sup>2</sup>

While the underrepresentation of women in philosophy is apparent on all professional levels, the underrepresentation already begins at an early career stage. For example, Paxton et al. (2012) analyze an existing gender gap in philosophy across different professional levels. Their results show that the statistically significant dropout rate in the United States can be found at the bachelor's level and is particularly pronounced between introductory courses and the decision to major in philosophy (Paxton et al. 2012; Baron et al. 2015, Dougherty, & Miller 2015; Hutchison & Jenkins 2013). Along the same lines, Thompson, Adleberg, Sims, & Nahmias (2016: 2) find that women leave philosophy disproportionately often after taking only a few courses.

That the underrepresentation of women in philosophy is much larger than in other humanities is particularly striking. This discrepancy suggests that there might be features specific to philosophy to which men and women respond differently and in turn contribute to this situation. Examples of such discipline-specific features could be the methodologies used in philosophy (e.g., argumentation, logic, thought experiments, etc.), its subject matter, its strong emphasis on argument and discourse, and the canon of philosophical ideas, among others.<sup>3</sup> Discussions around whether such features are ultimately responsible for women's underrepresentation often rest on the implicit assumption that women and men have inherently different interests, attitudes, perceptions, and professional goals that philosophy can or cannot satisfy. This difference may lead to gender differ-

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1. [http://web.csulb.edu/~jvancamp/doctoral\\_2004.html](http://web.csulb.edu/~jvancamp/doctoral_2004.html) [accessed: January 18, 2021].

2. In the literature, this underrepresentation of women or the “lack of gender parity in philosophy” has also been called the “gender gap” (Paxton et al. 2012: 949). We use the same terminology.

3. For example, the canon in obligatory fields such as history of philosophy or theoretical philosophy has for a long time consisted of (white) male philosophers. Men and women might respond to canonical reading lists differently, encouraging men and discouraging women (Friedman 2013). Another example is that women students might be less interested in philosophical questions because they do not connect with their concerns or because they consider them as too abstract for their tastes (Dougherty et al. 2015, Baron, & Miller 2015). They might also consider philosophical questions, discourse, and methodologies as impractical with respect to their professional goals (Dougherty et al. 2015; Thompson et al. 2016: 4).

ences in attraction towards philosophy as, for example, a discipline providing a comfortable and constructive learning environment and promising an interesting and achievable career.

In this paper, we empirically explore some of the mechanisms that rest upon such “essentialist assumptions” (Thompson et al. 2016: 5) about philosophy and gender and how they play out in German academia. By undertaking an exploratory study at one of the biggest and best-known German universities, namely, the Ludwig Maximilian University of Munich (LMU), we ask whether the underrepresentation of women in the profession can be explained by factors inherent to philosophy as an academic discipline and/or specific to women in order to better understand why women eventually drop out of philosophy.<sup>4</sup> Gaining a better picture of whether there are gender differences in interests, abilities, beliefs, attitudes, perceptions and goals among philosophy students could prompt further research to explore why those gender differences exist in the first place.

We conducted our study in 2014. We compared the interests, abilities, beliefs, attitudes, perceptions, and goals of bachelor’s students in a semester-long philosophy of science course at LMU. LMU houses one of the largest philosophy departments in Germany. As of today, only 3 out of 11 chairs in philosophy are held by women.<sup>5</sup> This roughly reflects the situation in Germany as a whole, where between 2005 and 2016 only an average of 15% of all philosophy chairs were held by women.<sup>6</sup>

In Germany, the dropout rate among philosophy students is highest between the bachelor’s level—where an average of 45% of women graduated between 2005 and 2016—and the master’s level, where on average only 37% of women graduated in the same period.<sup>7</sup> In contrast, an average of 77% of all bachelor’s students in other humanities and an average of 72% of all master students graduating in the same period were women. At LMU, dropout rates are also highest between the bachelor’s and the master’s level. On the bachelor’s level, the drop-

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4. It has sometimes been doubted whether focusing on potentially inherent factors is the right approach. Thompson et al. (2016) find it implausible to justify a claim such as that ‘by nature,’ there are fewer women in philosophy. We do not understand the idea of essentialist assumptions in a strictly biological manner and doubt that there is a ‘natural’ disparity between men and women with regard to philosophy. However, we consider it plausible that there might be a difference in men’s and women’s perception of, and attitudes towards, philosophy based on multiple reasons that are characteristic to philosophy, such as its method, its contents, its canon, etc.

5. At the time we collected our data in 2014, there was only one chair held by a woman who had just taken over her position; the cohort of students taking part in our study were thus almost exclusively taught by men.

6. Source: Federal Statistical Office of Germany.

7. We thank the Federal Statistical Office of Germany for providing us with the data upon request; data include students who majored in philosophy and successfully passed the degree examination.

out rate among philosophy students at LMU generally is rather high. Between 2013 and 2016, the dropout rate was 41% among women and 42% among men. While those dropout rates are similar, the reasons behind this dropout rate might differ across gender. The underrepresentation of women in Germany becomes more evident at the master's level. While on average, 42% of students in the philosophy master's program are women, on average only 32% of those women finished the master's program between 2013 and 2017.<sup>8</sup>

Our analysis of students' interests, beliefs, abilities, attitudes, perceptions, and goals is unique in that it provides, first, a set of preliminary insights into possible causal factors behind women's underrepresentation in philosophy in Germany that could be studied further. Second, by introducing an empirical design that allows for comparing mixed-gender and women-only study environments, our analysis provides a basis for re-applying this study design elsewhere and thereby allows for cross-country comparisons. Our analysis points out a set of avenues that should be explored in Germany and elsewhere as well as on a large scale. It also can initiate a substantial discussion of concrete institutional changes that could potentially counteract underrepresentation, such as whether women-only environments can encourage women to continue studying philosophy.

By studying the underrepresentation of women in philosophy in German academia, our analysis complements existing studies conducted in other countries, such as the United States, the United Kingdom, and Australia (Adeberg, Thompson, & Nahmias 2014; Baron et al. 2015; Beebe & Saul 2011; Paxton et al. 2012; Thompson et al. 2016). First, while more empirical data is available, empirical studies that aim at better understanding the relevant factors and their significance across countries are missing. Causally responsible factors, the way those factors interact, and their level of influence might vary across geographical and cultural borders. Therefore, results from Germany might help us to assess such potential variations. Second, while our study is similar in focus to existing studies, we consider additional factors such as those embodied in the essentialist assumptions mentioned above.

Gaining a better understanding of the mechanisms underlying women's underrepresentation in philosophy is important for multiple reasons. Primarily, if universities can identify the mechanisms, they can take concrete steps towards mitigating underrepresentation, which is central to promoting equal career opportunities for women in philosophy. Furthermore, diverse representation is essential for the quality of philosophy as a discipline. Diversification guarantees that the best candidates—men or women—get the chance to produce high quality work in the profession, allowing us to draw from a wider pool of original

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8. We thank the administrative staff at LMU for providing us with this data.

ideas.<sup>9</sup> This exploratory study takes a first step towards a better understanding of the mechanisms that cause women to abandon philosophy at an early stage.

## 2. Suggested Mechanisms and Hypotheses

Likely, not a single factor, but multiple mechanisms operate simultaneously and together contribute to the underrepresentation of women in philosophy (see also Antony 2012; Thompson et al. 2016: 4).<sup>10</sup> While there is thus no single causal model to explain women's underrepresentation among philosophy students, a number of mechanisms have been identified—sometimes only on the basis of anecdotal evidence—as being *potentially* responsible for it (e.g., Dougherty et al. 2015; Thompson 2017).<sup>11</sup> In this section, we present the most frequently discussed mechanisms underlying underrepresentation and select those that we explore in our analysis.

A first mechanism (M<sub>1</sub>) relates to gender differences in students' scientific and/or mathematical abilities (Thompson 2017: 3). Students' abilities may play a role when they select study programs or decide whether to continue with their selected program. Regarding philosophy as a field of study, the underlying idea is that men and women differ in their abilities of abstract thinking and rational reasoning, and their skills in using formal and mathematical tools, such as logic. Because philosophy is a field that uses those skills, women drop out once they realize that those skills are required.

A second mechanism (M<sub>2</sub>) relates to gender differences in students' interests. Women may have different interests than men. For instance, women might care more about problems that are practically or socially relevant (Baron et al. 2015; Dougherty et al. 2015: 2). Because from their point of view large parts of philosophy do not address such problems, they switch disciplines and choose a field in which they see their interests better realized.

A third mechanism (M<sub>3</sub>) refers to gender differences in beliefs about one's own abilities and about general abilities that are required for success in a field (Thompson 2017: 6). The concern is not what abilities students actually have but what they believe their own abilities are (Dougherty et al. 2015; Leslie et al.

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9. This line of thought equally applies to underrepresentation of other groups not explored here.

10. For discussions of a set of different factors influencing the underrepresentation of women in philosophy see Beebe (2013); Beebe & Saul (2011); Friedman (2013); Haslanger (2008); Leuschner (2015); Saul (2013).

11. Which mechanisms are at play also differs across levels; the factors that lead women students to drop out of their master's program in philosophy are most likely different from those that prevent them from finishing their PhD. Finally, causally relevant factors most likely vary across geographical, cultural, and institutional context.

2015); those beliefs can clash with their actual abilities.<sup>12</sup> M<sub>3</sub> as well as M<sub>1</sub> and M<sub>2</sub> can interact, as students' actual abilities and their ability beliefs can both influence their interest in a specific field and vice versa. Receiving low grades in a certain subject—say, in philosophy—may decrease interest in the subject and the motivation to work hard. It can lead to a shift in interest towards an area in which one performs better. At the same time, an originally large interest in a subject as well as higher marks may come with a greater motivation to work hard and the desire to continue studying the subject (Arcidiacono 2004).

A fourth mechanism (M<sub>4</sub>) refers to gender-specific schemes that we unconsciously use to collect and save information about the world (see, e.g., Valian 1997). They allow us to generalize and form stereotypes that are grounded upon characteristics that we attribute to a particular gender. These schemes can clash with reality when they do not align with our observations. For instance, when historically thinking of a philosopher as male, women may find it difficult to imagine themselves as philosophy majors, as the schema for 'philosopher' and the schema for 'woman' clash (Calhoun 2015; Hutchison & Jenkins 2013). Because we draw on schemes that rely on connotations of 'philosopher', 'rational reasoning', 'logical thinking,' 'abstractness,' etc. as male, such a clash comes with the risk that women are (unintentionally) excluded from the profession or leave philosophy voluntarily (Haslanger 2008).

A fifth mechanism (M<sub>5</sub>) refers to gender differences regarding the sense of belonging and the perceived atmosphere in philosophy as a field, which in turn influences confidence and the willingness and ability to perform well. The idea is that there are gender differences regarding the perceived atmosphere in seminars, colloquia, and other educational contexts and that, because women perceive the atmosphere negatively in those contexts, they feel less comfortable in them than men. M<sub>4</sub> and M<sub>5</sub> can be further enforced by the lack of female role models in philosophy.

Two additional mechanisms are implicit bias (M<sub>6</sub>) and gender stereotype threat (M<sub>7</sub>). Implicit bias captures the idea that women are generally and unconsciously viewed more negatively than men in philosophy (Saul 2013), which also manifests itself in class discussions, student assessments, etc. (see, e.g., Boring, Ottoboni, & Stark 2016). M<sub>6</sub> can potentially interact with other mechanisms, such as M<sub>1</sub>, M<sub>2</sub>, and M<sub>3</sub>, as for example women students' abilities might be judged lower than they objectively are, if instructors hold implicit biases against women (Dougherty et al. 2015: 4). Gender stereotype threat describes the fear that because of consciously or unconsciously formed negative stereotypes about members of an underrepresented group (here women), members of that group

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12. For example, women could perceive their own abilities as lower than they are due to stereotype threat.

are judged in light of those stereotypes or will conform to those stereotypes. This in turn can lead to their reinforcement (Hill, Corbett, & St. Rose 2010; Spencer, Steele, & Quinn 1999). Other effects can be a lower self-identification with philosophy and worse performance on skill tests. If implicit bias and/or gender stereotype threat operates in philosophy, it can make philosophy a hostile environment for women (Saul 2013).

A last mechanism (M8) potentially operating in academic philosophy is gender-specific discrimination, that is, the systematic discrimination against a person because of their gender. Such behavior can result from implicit bias; as such, this mechanism can be closely connected to M6. Gender-specific discrimination can also include sexual harassment. M8 is particularly relevant when pursuing a career in philosophy, such as, for example, at the level of selection procedures in job searches, or at the level of professional positions, such as editorships, as well as the selection and refereeing procedures of journals (Friedman 2013).<sup>13</sup>

Those mechanisms cannot be cleanly separated, as they frequently operate simultaneously or reinforce each other. However, to further systematize M1 to M8 and make them fruitful for empirical analysis, Dougherty et al. (2015) have offered a set of hypotheses about how they manifest themselves in the classroom. For our purpose, we selected the following five hypotheses that rest upon some essentialist assumptions about gender and philosophy as a discipline.

- 1) *Adversarial Argumentation Hypothesis*
- 2) *Subject Matter Hypothesis*
- 3) *Formal Methods/Abstractness Hypothesis*
- 4) *Role Model Hypothesis*
- 5) *Impractical Subject Hypothesis*

The *Adversarial Argumentation Hypothesis* suggests that the discussion style in philosophical debates is often aggressive and arguments are expressed in a particularly adversarial manner (Beebe 2013). Because women tend to shy away from an aggressive discussion style, they are less inclined to engage in such discussions (Dougherty et al. 2015: 4). That results in male-dominated seminar discussions. As a consequence, men not only appear more active and interested but also shape the discussion content and culture in seminars. The hypothesis mainly rests on M4 and M5 in that an aggressive discussion style is stereotypically associated with male behavior. Because of that and other factors such as stereotype threat, women do not feel a sense of belonging in such seminar settings.

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13. Gender-specific discrimination and implicit bias are highly complex and require separate treatment, which is why we do not explicitly explore them.

We also explore our data with respect to several hypotheses that relate to the content of philosophy courses. First, we study whether there is any empirical support for the *Subject Matter Hypothesis*, which is grounded in M2. It holds that female and male students have different interests and that the problems discussed in philosophy courses tend to be more tailored to the interests of men (see also Baron et al. 2015). A variant of this hypothesis is what we call the *Formal Methods/Abstractness Hypothesis*. This hypothesis can be interpreted in two ways. On the externalist interpretation of the hypothesis, women perform worse when using abstract methods than men, which implies that their instructors and/or peers treat them as less able to succeed in formal or more abstract subjects than men, processes which are described by M1. A possible underlying mechanism to explain women's lower performance could be discriminatory behavior (M8), which could but does not have to result from implicit bias (M6). On the internalist interpretation, women (correctly or incorrectly) hold beliefs about their own abilities (as captured by M3) and draw inferences about how their perceived abilities relate to the skills required for being successful in philosophy.

Applied to the classroom situation, both interpretations imply that women find the abstract problems, the narrow methodological focus on logic, and the methodology of rigorous argument especially in analytic philosophy less interesting, more difficult, and/or not as easily acquirable for them compared to their male classmates. Both interpretations individually or together indicate that women's success in subjects relying on formal methods (such as logic or mathematical philosophy) is compromised (see also Thompson 2017). The hypothesis is grounded in M3; men are more confident than women in their own abilities, including the ability to do mathematics. Because women more often deprecate their own abilities and skills, they are more prone to think of themselves as having lower chances of pursuing philosophy successfully.

As Dougherty et al. (2015) have pointed out, the *Subject Matter Hypothesis* closely connects with the *Role Model Hypothesis*. According to the latter, female students lack a sense of belonging in academic philosophy (captured by M5) mainly because of a lack of female role models, reinforcing a gender-specific scheme of philosophy as being mainly done by, and offered for, men (captured by M4) (see also Thompson 2017: 4). This lack of role models becomes visible, for example, in the absence of women teachers, the men-dominated canon of the core curriculum, the presentation of images of male philosophers on presentation slides, posters, or philosophy websites, and the lack of women authors on course syllabi (Dougherty et al. 2015: 3; Paxton et al. 2012). The lack of role models may signal to women that philosophy is not a place for them, and even less so will offer them a successful career, reinforcing women's lack of a sense of belonging and self-confidence (M5).

The absence of role models further comes with a risk of generating a study environment in which stereotype threat (M7) becomes more likely than would be the case in an environment in which women were well represented (Saul 2013). A similar effect applies to implicit bias (M6), as an environment lacking role models facilitates ignoring the excellent work done by women and instead associates good work with role models who are men (Saul 2013).

The *Subject Matter Hypothesis* is also related to the *Impractical Subject Hypothesis*. The latter states that women are disproportionately less inclined to major in philosophy because besides striving for career goals, such as a secure job and a high income, and/or for personal life goals, such as personal growth, they consider it important that those goals help them have a social impact. The idea is that women want to engage with problems they consider relevant and which are more practical or concrete in nature (see also Dougherty et al. 2015: 7 f.). Because the problems and skillset of philosophy are perceived as impractical for these matters, it does not help women achieve their life goals and they eventually lose interest in philosophy (also captured by M2). The hypothesis further captures the idea that there are gender differences in long-term career and personal life goals and in the beliefs about the usefulness of philosophy for achieving them. Women are more concerned about getting a secure job than men. They perceive an education and an academic career in philosophy more generally as riskier than an education and career in disciplines that address concrete problems and teach applicable skills. In Germany, this could be reinforced by the fact that because, for instance, the tenure-track system has not yet been broadly implemented, the conditions for successfully pursuing an academic career and having a family are often not in place. Studying a more practical subject is perceived as advantageous by women because of their immediate concern to balance family life and professional career (see Antony 2012).<sup>14</sup>

### 3. Research Setup and Methodology

In this section, we present our research setup to explore those five hypotheses. We take students' reports of their interests, beliefs, abilities, and goals, and we regard their perceptions of the academic environment they are part of as equally

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14. Here (as well as with most hypotheses) it is important to note that if such gender differences existed, one should not falsely—as has sometimes been done—conclude that these differences exist for biological reasons and are therefore natural and of no further concern. Women are not only subject to stronger socially gendered care expectations than men, but philosophy might be particularly hostile for women with regard to combining professional and familial duties; for example, philosophy promotes a strong discussion culture that often extends beyond office hours (see also Antony 2012).

important as their expressed attitudes towards that environment. We understand attitudes as individual beliefs about the attributes of a specific object (say, academic philosophy), which can be influenced by other attributes (Aijzen 2001; Crano & Prislin 2006; Aijzen & Fishbein 1975). But first, to better understand the demographics of the philosophy discipline beyond the UK, the United States, and Australia and to enable a cross-country comparison of the possible causes of women's underrepresentation, some notes about the German educational and academic systems are in order.

First, given the federal organization of the German educational system, only some students arrive at the university with prior knowledge of philosophy. In all federal states, philosophy replaces religious education in high school and is thus open only to pupils who do not officially belong to any denomination. The content of philosophy classes is typically limited to ethics but does not have to be (see Report of the KMK 2020). This also holds for the federal state of Bavaria, which hosts the LMU. In Bavaria and other federal states, high school students can further pursue their interest in philosophy by taking voluntary philosophy courses, if offered at their particular school (Report of the KMK 2020: 19f.).<sup>15</sup> Consequently, students arrive at university with different backgrounds, and most of those who have some background in philosophy have it limited to practical philosophy.

Second, German high school students choose at least four areas they wish to focus on in their final high school exam. Depending on the federal state and the other courses they choose, philosophy can but does not have to be one of them. Specialization typically begins only with entering the university system. Once students enter university, they specialize in the field they major in. If students enroll in a philosophy major program, they specialize in philosophy from the first semester onwards. Given that there are typically no prerequisites for enrolment in a philosophy program at German universities, all students can do so, given that they have successfully finished high school. This also applies to LMU.<sup>16</sup>

Third, changing academic specialties during their bachelor's program is generally not as difficult as in other countries. Because there are usually no high tuition fees, changing one's degree program is rather easy, especially if a student changes to a degree program that does not have any entry requirements. Nevertheless, some factors could make changing one's major difficult. For instance, not all course assessments might be recognized as valid in the new study program. Furthermore, changing one's major can mean changes to a student's

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15. Note that national students at LMU come from all federal states in Germany, not only from Bavaria.

16. [https://www.uni-muenchen.de/aktuelles/amtl\\_voe/o800/887-10ph-ba240-2012-ps00.pdf](https://www.uni-muenchen.de/aktuelles/amtl_voe/o800/887-10ph-ba240-2012-ps00.pdf) [accessed on January 4, 2021].

funding.<sup>17</sup> Finally, switching from philosophy to a different study program can be challenging if the new study program has specific entry requirements. All three aspects can influence a student's decision to change his or her study program in Germany.

**Procedure.** We conducted this study with bachelor's students enrolled in a philosophy of science class. The course was organized in terms of a lecture format. It was obligatory for all bachelor's students at LMU who majored in philosophy, that is, who studied philosophy as a so-called 'Hauptfach'. There were no entry requirements for participating in the course, but students had to pass the course to successfully finish their degree program in philosophy.<sup>18</sup> The lectures were given by a male professor and accompanied by weekly tutorials taught by male and female PhD and postdoctoral students. All but one tutorial were organized as mixed-gender study environments, one of them taught in English. One tutorial was open only to women and was taught by a woman. Students could choose whether to attend a tutorial, and if so which one. While students had to answer weekly questions and write two practice essays, the formal requirement for successfully finishing the course was passing a two-hour exam at the end. Final grades were based solely on the exam.<sup>19</sup>

**Materials.** In total, we used three pen and pencil questionnaires that we distributed at the beginning and at the end of the term. To explore the aforementioned five hypotheses, our questionnaires asked about the following:

- 1) *Motivation to study philosophy*
- 2) *Performance regarding, and perceived usefulness of, mathematics in philosophy*
- 3) *Perceived difficulty of the class*
- 4) *Active engagement in seminars*
- 5) *Actual course performance*
- 6) *Perceived degree of difficulty of different subject areas in philosophy of science*
- 7) *Interest in, and perceived relevance of, topics discussed in class*
- 8) *Feelings and attitudes during seminar discussions generally*

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17. See <https://www.bafög.de/de/ausbildungsabbruch-und-fachrichtungswechsel-195.php> [accessed on January 4, 2021].

18. See the study regulations for the bachelor's program in philosophy at LMU: [https://www.uni-muenchen.de/aktuelles/amtl\\_voe/o800/887-10ph-ba240-2012-ps00.pdf](https://www.uni-muenchen.de/aktuelles/amtl_voe/o800/887-10ph-ba240-2012-ps00.pdf) [accessed on January 4, 2020].

19. Note that, although the Munich Center for Mathematical Philosophy (MCMP) at LMU specializes in logic and philosophy of science, the course where we conducted our study is independent of the MCMP insofar as the course is not part of any special degree program at the bachelor's level but is rather part of the general curriculum. The MCMP only offers a specialized degree program at the master's level. Therefore, the fact that the MCMP is part of LMU's philosophy department does not question the representativeness of our sample for philosophy bachelor's students in Germany more generally.

- 9) *Perceived discussion culture in seminars*
- 10) *Discussion participation in seminars*
- 11) *Existence of social networks among peers*
- 12) *Existence of female role models in academic philosophy*<sup>20</sup>
- 13) *Perceived career opportunities in philosophy*

The first questionnaire contained 17 items, consisting of closed-ended questions and Likert scales. It included some control questions and (1) questions for collecting demographic and biographical data about the participants and questions about (2) their motivation to study philosophy, (3) their high school grades, (4) their skills in mathematics and computer science, and (5) their perception of the role and usefulness of mathematics in philosophy. The questionnaire was accompanied by a math test to check students' actual mathematics skills. The test contained 14 problems of basic high-school mathematics that students were asked to solve. Questionnaires and tests were distributed after the first lecture.

The second questionnaire was distributed at the end of the term. It contained 33 items, including close-ended questions, Likert scales, and open-ended questions. Students could fill out this questionnaire during the last session of each tutorial or after the exam. Items were subdivided into the following sections: (1) demographics, (2) participants' major and minor, (3) their performance in high school, (4) their interest and active participation in the course, (5) their assessment of course topics and philosophical problems more generally, (6) their assessment of philosophy as an academic discipline, (7) their feelings and attitudes in seminar discussions and towards the discussion culture more generally in philosophy, (8) their active participation in seminar discussions, (9) their career expectations in philosophy, and (10) their interest in philosophy as an academic discipline.

The third questionnaire was attached to each student's exam. It contained four items consisting of close-ended questions, asking about (1) the discipline they studied as major and minor, (2) the frequency of their course participation, (3) the tutorial they had chosen, and (4) how frequently they had attended the tutorial. An additional datum was (5) the grade that students obtained on the exam. Students' participation in all three questionnaires was voluntary.

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20. Note that the questionnaire did not contain any questions containing the term 'role model' to avoid revealing to students that the study conducted was concerned with the gender gap in philosophy. The only question it contained that spoke to the role model hypothesis among students at LMU was asking how many men and women philosophers students were able to name. This question was meant to give us some indication of the degree to which students at LMU lack role models. However, we can of course not fully exclude the possibility that students were able to guess that this was a questionnaire on gender.

**Participants.** The number of participants varied across questionnaires. This can be partly explained by the fact that throughout the semester, some students decided to postpone the exam or not attend the (nonobligatory) lecture and/or tutorials. Accordingly, there were three groups of participants in this study. The first group consisted of those students who attended the first lecture and filled out the first questionnaire. The second group consisted of those students who attended the last lecture and/or the last tutorial and filled out the second questionnaire. The third group consisted of all students who took the final exam and filled out the third questionnaire. Of course, the three groups overlap. We can assume that students taking the final exam and attending the final lecture also attended the first lecture. It is less likely that the opposite was true. Overall, the participation rate in all three questionnaires was high, given that between 2013 and 2017 on average 156 students were annually enrolled in the class.<sup>21</sup>

**First questionnaire.** For our first questionnaire, we had a sample of  $N = 153$  participants:<sup>22</sup> 64 women (42%) aged between 18 and 60 years ( $M_{\text{age}} = 23.87$  years,  $SD = 6.85$ ), and 88 men (57.5%) aged between 18 and 45 years ( $M_{\text{age}} = 22.69$  years,  $SD = 3.91$ ). Nearly 65% of all students majored in philosophy (68.6% of all women and 61.4% of all men). Nearly 11% (10.9%) of all women and 19.3% of all men majored in a social or natural science. All others majored in some other program.

**Second questionnaire.** The turnout rate for the second questionnaire was  $N = 98$ , 54.1% of them women and 45.9% of them men. Sixty-one percent of all students in this sample majored in philosophy. Students were aged between 19 and 61 years ( $M_{\text{age women}} = 24.04$ ,  $SD = 6.34$ ;  $M_{\text{age men}} = 22.25$ ,  $SD = 2.32$ ).

**Third questionnaire.** The turnout rate for the third questionnaire was  $N = 129$ . More than 46% (46.5%) of those students majored in philosophy, a total of 37.2% being women and 44.2% being men. More than 18% (18.6%) of the students did not reveal their gender in this questionnaire.

#### 4. Results

Using cross-tabulation analysis with gender as the independent variable, we explored potential differences among women and men students regarding the aforementioned indicators. For every statistical analysis minimum, alpha levels of .05 were established for contrasts; values equal to or lower than .05 were taken as significant.

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21. Enrolment numbers between 2013 and 2017 in this course were 138 students (in 2013), 162 students (in 2014), 166 students (in 2015), 168 students (in 2016), and 147 students (in 2017).

22. Note that one person did not reveal their gender.

**Table 1.** Students' Motivation to Choose Philosophy as their Study Program.

Motivation	Men		Women		$\chi^2$ Test
	Yes	No	Yes	No	
Because of my interest in the subject-matter	81%	19%	92%	8%	$\chi^2(1,152) = 3.962$ , $p = .047^*$
In light of a specific job prospect or goal.	14%	86%	16%	84%	$\chi^2(1,152) = 0.118$ , $p = 0.731$
Because of my interest in social/political issues.	36%	64%	33%	67%	$\chi^2(1,152) = 0.206$ , $p = 0.65$
To have good income opportunities.	3%	97%	9%	91%	$\chi^2(1,152) = 2.367$ , $p = .124^a$
To have room for personal development.	65%	35%	64%	36%	$\chi^2(1,152) = 0.008$ , $p = 0.928$
As a temporary solution.	11%	89%	16%	84%	$\chi^2(1,152) = 0.589$ , $p = 0.443$
Because I strongly wanted to do a B.A.	1%	99%	8%	92%	$\chi^2(1,152) = 4.356$ , $p = .037^{*,a}$
Because I still have time to earn money during my studies.	1%	99%	2%	98%	$\chi^2(1,152) = 0.052$ , $p = .820^{a,b}$
Because I still have time to pursue my other interests.	9%	91%	8%	92%	$\chi^2(1,152) = 0.077$ , $p = 0.781$
I did not know what else to do.	8%	92%	2%	98%	$\chi^2(1,152) = 3.036$ , $p = .081^b$

Note. Students could give multiple answers. \* Chi-square statistics are significant at the .05 level.

<sup>a</sup> In this sub-table more than 20% of the cells have expected cell frequencies of less than 5. Therefore, the results of Chi-Square may be invalid. <sup>b</sup> In this sub-table, the smallest expected cell frequency is less than 1, so Chi-square results may be invalid.

#### 4.1. Motivation of Students

In the first questionnaire, we asked students about their motivation to study philosophy. As Table 1 shows, we found few significant gender differences regarding motivation.

Table 1 shows that most students reported an intrinsic motivation to study philosophy, pointing to their interest in the subject. Women were even more intrinsically motivated than men. This difference was significant. Future job

opportunities and expected future income were of no concern for students of both genders, questioning the idea underlying the *Impractical Subject Hypothesis*.

Other instrumental reasons that would distract them from their studies, such as enrolling in a bachelor's degree program just because they did not know what else to do, were also not mentioned as primary motivational factors. This is interesting insofar as being intrinsically motivated to engage with a field would potentially guide students also through situations in which individual circumstances change, would prevent students from easily switching to another field, and often grounds the goal of pursuing an academic career in that field.

#### ***4.2. Mathematical Skills and Perceptions of the Role and Usefulness of Mathematics in Philosophy***

To further explore possible gender differences in interests, mathematical skills, and assessments of one's own abilities, we asked students about their mathematics background, examined their performance in basic high school mathematics, and inquired into their perceptions of the role and usefulness of mathematics in philosophy.

First, there were no notable gender differences in students' self-reported overall high school grade ( $M_{\text{grade women}} = 2.18$ ,  $M_{\text{grade men}} = 2.12$ ); the grade scale used ranged from 1 to 6 (1.0 = excellent; 4.0 = passed; over 4.0 = failed). Second, we asked students about their mathematics background and their choices of whether to continue with mathematics in high school. A Chi-square test showed a significant gender difference in their choice to either select mathematics as a part of their core curriculum in their final high school years or not. Only 75% of women but 89.7% of all men had chosen mathematics as part of their core curriculum in high school ( $p < 0.5$ ).<sup>23</sup> However, there were no significant differences in their average mathematics grades ( $M_{\text{grade women}} = 2.86$ ,  $M_{\text{grade men}} = 2.52$ ). This indicates that women tend to avoid mathematics in school for reasons that are as of yet largely unknown (see also Mann & DiPrete 2016; OECD 2015).<sup>24</sup>

We also asked students to rate their computer skills. The only significant gender difference was in the rating of their programming skills. Almost half (48.3%) of all men reported that they had some or even good programming skills, while 72.6% of all women reported having no programming skills whatsoever; we did not find significant differences in their reported ratings of other skills (e.g., use of text processing programs, programs for plotting and graphing, spreadsheet

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23. In the German final high school exam known as 'Abitur', pupils can choose a set of disciplines that they specialize in and are examined in.

24. PISA and other studies found that girls tend to be more anxious about mathematics than boys and/or feel less confident regarding their mathematical skills, even when there was no difference in their actual performance (OECD 2015; Herbert & Stipek 2005).

**Table 2** Students' Attempt to Solve the Math Problems and Correctness of the Solutions

Variable	Men	Women	Sig. (Two- Tailed)
Attempted to solve at least half of the test questions.	72%	47%	$\chi^2(1,152) = 9,531$ $p = .002^*$
Attempted to solve less than half of the test questions	28%	53%	
Correctly solved at least half of the questions attempted	90%	41%	$\chi^2(1,150) = 19,535$ $p = .000^*$
Incorrectly solved at least half of the questions attempted	10%	59%	

Note. \* Chi-square statistics are significant at the .05 level

programs, statistics programs, etc.). We did not find that women reported lower computer skills (which are representative for skills closer to STEM fields) than men or lower language skills (which are representative for skills more extensively used in the 'soft' sciences).

To compare students' actual mathematics skills to their general perceptions of, and subjective attitudes towards, mathematics, we asked them to complete a short math test, examining their level of high school mathematics. Results were classified, first, as 'tried to solve' and 'did not try to solve' and, second, 'if tried, correctly solved' and 'if tried, incorrectly solved'. Our results of a Chi square test were significant, showing that overall, men performed better than women. Of the questions they attempted to solve, 90% of the men correctly solved at least half of the questions they attempted to solve, whereas only 41% of the women correctly solved at least half of them (see Table 2). It was also notable that 53% of all women as opposed to only 28% of all men did not even try to solve half or more than half of the problems.

Through more frequent attempts to solve a math problem, men have a higher chance to receive more points on a test or even arrive at the correct result; that was also the case in our test because students also received points for partial solutions. As such, just attempting to solve a problem increases the likelihood that they also perform better overall in mathematics tests. Better performance in turn can then motivate them to continue in the respective field.

We furthermore asked students about their subjective attitudes and their general perceptions towards mathematics.<sup>25</sup> We found significant gender differences in their attitudes (see Table 3) but not in students' general perceptions

25. The order of having the test first and then asking about their perceptions was meant to avoid possible ordering effects. Asking students to follow the reverse order—answer questions

**Table 3** Students' Subjective Attitudes of Mathematics

Question	Gender	N	Mean	SE	Sig. (Two-tailed)
Mathematics is fascinating and fun.	women	61	3.38	0.144	0.000***
	men	81	2.65	0.132	0.000***
If I engage with mathematics, I quickly disconnect once a problem emerges.	women	61	3.20	0.175	0.174
	men	81	3.49	0.135	0.181
I try to avoid everything that is related to mathematics.	women	61	3.02	0.180	0.000***
	men	82	3.82	0.119	0.000***
I deeply enjoy doing mathematics as a logical science.	women	61	3.44	0.135	0.000***
	men	82	2.76	0.112	0.000***
Mathematics is too difficult for me.	women	61	3.34	0.162	0.198
	men	82	3.60	0.119	0.209

Note. Students' perception of mathematics; 1 = totally agree and 5 = totally disagree. \*  $p < .05$ ; \*\*  $p < .01$ ; \*\*\*  $p < .001$

(Table 4). On average, men rather than women reported that they viewed mathematics to be fascinating and fun and that they deeply enjoyed it. This result correlated positively with the actual performance on the math test: the more points students got on the test, the more they agreed with the view that mathematics is fascinating and fun and with the view that they deeply enjoyed mathematics. Also, women rather than men reported avoiding math-related issues. This negatively correlated with the performance on the math test: the more points students got on the test, the more they disagreed with the view that they avoided math and that math was too difficult for them. Yet, there were no gender differences in students' view of the difficulty of mathematics. On average, students reported that it was rather not the case that mathematics was too difficult for them.

To analyze whether—before taking the course—students had different general perceptions towards the role and usefulness of mathematics in philosophy, participants were asked to express agreement/disagreement and to again rate specific statements describing the role of mathematics in philosophy. Table 4 summarizes students' perceptions at the beginning of the semester. We could not find significant gender differences.

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about their perceptions of, and attitudes towards, mathematics first and then take the math test—would potentially have triggered gender-specific results in the math test.

**Table 4** Students' General Perceptions of Mathematics and its Role in Philosophy

Statement	Gender	Likert Scale <sup>a</sup>				
		1	2	3	4	5
Philosophy should only concern itself with fundamental questions, without trying to formally formulate or solve them mathematically.	women	3%	25%	34%	25%	9%
	men	9%	20%	24%	23%	16%
Philosophical questions can never be described and/or solved with mathematical accuracy.	women	17%	22%	34%	17%	6%
	men	13%	26%	20%	24%	10%
Mathematical methods help in understanding philosophical issues, especially if they are unclear.	women	8%	44%	28%	16%	2%
	men	19%	40%	23%	7%	5%
I believe that I can also be successful in my job without mathematics.	women	19%	25%	16%	20%	17%
	men	11%	18%	23%	20%	20%
One arrives at viable conclusions only when someone understands and can apply mathematics.	women	3%	17%	33%	25%	19%
	men	3%	17%	32%	24%	17%

Note. N = 153. n women = 64. n men = 88; <sup>a</sup>1=totally agree and 5= totally disagree.

Most students considered mathematics to have a role to play in philosophy, namely, to clarify philosophical problems. Overall, students were open to the idea that mathematics could be useful in philosophy, which does not support the hypothesis that there are substantial gender differences regarding students' perceptions of formal methods and their interests when it comes to more formal subjects. When asking students the same questions again at the end of the term, their perceptions had slightly changed. While all students had become slightly less skeptical towards the usefulness of mathematical methods in philosophy, a more extensive change in perceptions towards more skepticism was found among men, namely, when asked whether viable conclusions can only be arrived at in philosophy by applying mathematics (see Figure A1 in Appendix).

As such, while general perceptions of mathematics and its role in philosophy were similar across both genders, we found gender differences in students'

performances and their subjective attitudes. Those gender-differences in attitudes, their correlations with students' performance on the mathematics test, and the gender differences in actual performance ask for validation and further explanation. Our preliminary results should be explored further in a large-scale study that tests a set of hypotheses to identify mechanisms—at the pre-university and at the university level—leading to those behaviors.

### 4.3. Active Engagement in the Classroom

The hypothesized gender difference in perception of the discussion culture captured in the *Adversarial Argumentation Hypothesis* can be measured in physical attendance in seminars, the willingness and frequency of speaking up in class, and students' actual performance. We first measured general engagement in academic activities by attendance frequency in tutorials. Using measures starting with 'every week' to 'never', we found no significant gender differences in students' self-reported frequency of attendance in tutorials, according to a Chi square test ( $\chi^2(3, 98) = 1.991, p = .57$ ). Three-quarters of all students attended the tutorials at least every 2 or 3 weeks, and 34% of all students attended it every week throughout the term.

We also could not find significant gender differences regarding the amount of time students invested in weekly preparations. Considering the proportion of students who handed in two voluntary practice essays, however, a Chi square test showed that there were significant gender differences regarding students' engagement. Women submitted significantly more essays than men ( $\chi^2(1, 98) = 5.936, p = .02$ ). However, in both essays, they obtained slightly, yet not significantly, lower grades than men ( $M_{\text{women}} = 2.38, M_{\text{men}} = 2.08$ ; and  $M_{\text{women}} = 2.02, M_{\text{men}} = 1.98$ , for the first and for the second essays respectively).<sup>26</sup> The same holds for the final exam grades: there were—on average—no significant differences regarding students' grades ( $M_{\text{women}} = 4.14, M_{\text{men}} = 3.76$  and  $M_{\text{women}} = 3.52, M_{\text{men}} = 3.49$ , for the first and for the second exam<sup>27</sup> respectively). Whether there is a gender difference in final grades is important because receiving lower grades in philosophy, which might be due to gender bias on the part of instructors, could lead women to switch their majors, especially when they receive higher grades in other courses (see Thompson et al. 2016: 6).

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26. For research on gender effects in grade discrepancy in philosophy courses, see Thompson et al. (2016).

27. The second exam was taken by students who did not pass the first exam, including those students who did not pass the exam because they did not show up. Therefore, the results of the performance in the second exam are based on a small sample. We were also not able to separate out those students that had already failed the first exam.

We also explored whether women and men participated with a different frequency during seminar discussions generally and in the particular seminar environment that we studied. As shown in Table A1 in the Appendix, results from a Chi-square-test reveal some gender differences in the kind of participation. While the number of students reporting that they participated in seminars once per session or once every other session was roughly the same, more men than women reported that they participated more than once in each seminar session. In comparison, more women than men reported that they rarely or never participated in seminar discussions. While this effect was not significant, we got the same result when asking about students' average participation in the tutorials that students had been attending, where the difference was significant. This speaks to the more general observation that women shy away from seminar discussions more frequently than men (Carter et al. 2018).

With open questions, we inquired why those students who reported rarely participating did so. While we cannot generalize from those answers, there were some differences between women's and men's reports. Women more often indicated that they did not speak up because they needed more time to think, that they feared they might say something wrong, and that they preferred not to speak in larger groups. In contrast, men reported that they participated less in class not because of a perceived lack of skills or abilities but rather because of laziness, lack of interest, or self-preparation. They also reported that they perceived the topic as boring, that discussions were useless and mostly not efficient and that there was too much babbling in seminars anyways.<sup>28</sup> The difference in men's and women's answers might partially speak to gender differences in perceived abilities (M3) and the existence of implicit biases (M6) and stereotypes (M7) that motivate the *Adversarial Argumentation Hypothesis*.

We also wanted to know whether there were gender differences in forming support networks in class throughout the term. When we asked students how many people they knew in the course and how many of those had taken the same tutorial with them ('nobody', '1-2 people', 'more than 3 people'), 60.5% of all men but only 42% of all women reported that they personally knew more than 3 people in the course. More men (26.2%) than women (15.2%) reported that they knew at least 3 or more people in their own tutorial. As those differences were not significant, we cannot conclude that men felt less afraid to speak in class because they had a larger social network in that particular class. However, the relationship between having a large social network and being

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28. The answers to this and all other open questions contained in the questionnaire are in German. The authors make them available on request.

actively engaged in a class would generally be something worth exploring further. Being in a group with more people whom one feels similar to (for example, a woman feeling more similar to other women than to men) might contribute to feeling more confident about engaging in class.<sup>29</sup> When we asked students how many new people they got to know through the lecture and in the tutorials in particular, around 40% of all women and 46% of all men reported that they did not make any acquaintances throughout the term. Roughly the same percentage of each group reported that they got acquainted with 1 or 2 people throughout the course.

#### 4.4. *Feelings and Attitudes during Discussions in Philosophy*

As captured by the *Adversarial Argumentation Hypothesis*, a large part of the discussion about why women drop out of their philosophy studies concerns whether they have different attitudes, perceptions and feelings with respect to philosophy as an academic discipline and with respect to the discussion culture in particular. We asked students about their attitudes towards seminar discussions. Students reported that they were generally open and interested, while not being particularly engaged and communicative. We could not find any gender differences regarding their attitudes (see Table A2 in Appendix). There were also no significant gender differences in how students perceived the discussion style in philosophy. Men and women did not find the discussion style particularly aggressive, intimidating, degrading, or uncomfortable. Rather, all students reported that while the discussion style was rather competitive, they perceived it as friendly, and overall suitable for philosophy. Women reported that they perceived the discussion style to be slightly less comfortable than their male colleagues reported. However, this difference was not significant.

However, when we asked participants to report their feelings in seminar discussions, we found some significant gender differences. Giving them the options of 'bored', 'afraid', 'excited', and 'relaxed', we asked them for each feeling to indicate whether it 'fully applies', 'applies in parts', or 'does not apply.' While all students were equally excited and generally not bored in seminars, more women reported that they felt afraid in seminars and less relaxed than men (see Table A3 in Appendix). The gender difference regarding a feeling of fear was significant.

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29. Bailey et al. (2020), for example, found evidence that women in undergraduate life science classes at a large US university engaged significantly more in discussions if there was a bigger proportion of women in the classroom.

Correlational analyses between reported feelings, such as fear and being relaxed, and attitudes such as being communicative show that feeling less relaxed and being less communicative is correlated (see Table A4 in Appendix). Reported feelings of being afraid in seminars was also correlated with perceiving discussions as degrading and intimidating. We do not know whether women, because they tended to be more afraid in seminars, perceived the discussion style as more degrading or intimidating or vice versa. However, our results suggest that because men tended to be less afraid in seminar discussions, they were also more communicative (see Table A4 in Appendix). Our results suggest that such factors might be related, and they speak to the need to further explore the causal chain underlying such factors in a hypothesis-based causal analysis with large samples or experimental designs.

#### 4.5. *Perceived Difficulty of Philosophy Courses*

To further explore the *Formal Methods/Abstractness Hypothesis* as well as the *Subject Matter Hypothesis*, we asked students to report their perception of the level of difficulty of the course. Results from a 5-point Likert scale, where 1 corresponded to “very easy” and 5 to “very difficult,” showed no significant gender difference in students’ perception ( $t(93) = 1.13, p = .33$ ). However, the mean for women (3.85,  $SD = .78$ ) was slightly higher than that for men (3.67,  $SD = .68$ ); overall, 67% of all students perceived the course to be difficult or very difficult. We furthermore asked students about their perceptions of the level of difficulty of all course topics—ranging from abstract metaphysical problems (e.g., laws of nature), to formal problems (e.g., Bayesian confirmation theory), to more hands-on topics (e.g., the social dimension of science, theory change), to traditional philosophical issues (e.g., scientific realism and anti-realism).

First, we found no gender differences regarding the degree of perceived difficulty of each course topic (see Figure A2 in Appendix). All students found formal topics more difficult than less formal topics. Second, we could not find any gender differences regarding the perceived abstractness of the topics. More students found the problems of analytical philosophy generally, and of analytical philosophy of science in particular, to be abstract rather than concrete. Results from a 5-point Likert scale, where 1 corresponded to “concrete” and 5 to “abstract,” showed no significant gender difference in students’ perception ( $M_{\text{women}} = 3.74, M_{\text{men}} = 3.55; t(88) = 1.07, p = .39$ ). Our results do not support both hypotheses. They suggest that the contents of philosophy courses are generally perceived as abstract and that formal topics are perceived as difficult but that does not seem to only apply to women. It is therefore unlikely that either motivates women to drop out of philosophy.

#### 4.6. *Students' Preferences and Interests regarding Philosophical Problems and the Perceptions of Their Relevance*

It has been suggested that what partially explains dropout rates among women bachelor's and/or master's students is that they are proportionally put off from continuing their studies in philosophy because they have certain goals and they judge philosophy as unhelpful for pursuing them (Dougherty et al. 2015: 7f.). Those goals can be diverse; they can include getting a specific—for instance, secure—job and acquiring skills that allow them to make a difference in the world or to tackle problems they consider relevant. In part, those mechanisms underlie the *Impractical Subject Hypothesis* as well as the *Subject Matter Hypothesis*. To further explore the plausibility of both hypotheses, we wanted to see whether we found gender differences in students' preferences for, interest in, and aversions to distinct topics. We furthermore asked students about their view regarding the relevance of the topics discussed in class.

When asked about their motivation to study philosophy (see Table 1), almost all students (80% of all men and 93% of all women) reported that they started studying philosophy because of its subject matter. There was a significant gender difference in that women reported more often that they chose philosophy out of interest. This suggests that women are especially intrinsically motivated and therefore speaks against M2. We furthermore asked students about their assessment of the relevance of problems in analytic philosophy generally and in analytic philosophy of science in particular. Over 50% of men and women respectively judged the problems to be relevant or highly relevant; we found no significant gender differences.

Our results show that women are highly intrinsically motivated to study philosophy. They are furthermore as interested in philosophical problems as men are. They consider those problems to be equally relevant, apparently so much so that half of them can envision an academic career in philosophy. When we asked women for their reasons for wanting an academic career in philosophy, they pointed to the enjoyment they get when thinking, their interest in philosophical questions and their relevance, their good performance, and their interest in research, among others. We got similar answers from men, who pointed to their actual skills and good performance, the challenge that philosophy poses for thinking through complex issues, and their interest in philosophical problems.

Our data also shows that students generally judge their prospects for a career in philosophy positively. While men are on average more optimistic regarding their career opportunities in philosophy, the gender difference was not significant. When we asked students whether they can imagine a career in academic philosophy, 50% of all women and 56.4% of all men answered yes. There was no statistically significant gender difference.

Given the pronounced intrinsic motivation, interest, and career ambitions among women philosophy students, our results provoke the question of what leads (female) students to either lose motivations, interests, and ambitions along the way or which factors could become more dominant along the way that they eventually drop out of philosophy. One explanation could be that students assess their career opportunities in philosophy differently when they later face, for example, the choice between different master's programs. It could certainly be the case that students become less optimistic regarding their career opportunities in academic philosophy throughout their studies or at later stages. While our results do not allow us to draw any conclusions in this regard, they point towards the importance of studying the reasons behind women's choices of dropping out in light of their initial ambitions. This is important because such research would point to the conditions required for nurturing such intrinsic motivation.

#### 4.7. *The Presence of Role Models*

Another explanation for the high dropout rate of women is that they do not find comfort in the academic environment that philosophy as a field offers. The lack of a feeling of belonging and discomfort (M5) could be partially due to the absence of women role models in philosophy, be they teachers or prominent philosophers who are part of the curriculum. The idea is that women feel that they do not belong in philosophy because they lack role models. There are no women in the educational materials presented to students (Dougherty et al. 2015: 3). Some support for the *Role Model Hypothesis* has also been provided by Paxton et al. (2012), who found that more women major in philosophy at universities that employ a higher number of women teachers.

First, the syllabus for the particular philosophy of science course did not contain any works written by a woman philosopher. In light of the fact that by the time of our study, only one woman had been appointed as full professor at the LMU philosophy department and she had been so shortly before we conducted our study, we can assume that students in our sample did not have any considerable exposure to women philosophers, neither in their teaching nor in their curriculum.

While the lack of role models in philosophy is an established fact, we wanted to get some indication about the actual presence of women philosophers in students' daily studies at LMU. We asked them to name five women and five men philosophers without using any external aid. While 92% of all students were able to name 5 men philosophers, only 6% of all students were able to name 5 women philosophers. Most students (66%) were not able to name more than 2

women, and 17% could not even name a single woman. We could not find any significant gender differences.

Cross-tabulation analysis shows that, generally, of those women who could name 3 or more women philosophers, 27.3 % expected to have good or very good future prospects for an academic career in philosophy, whereas this percentage was only 10.5% for those who could not name 3 women philosophers. Accordingly, of those women who could not name 3 women philosophers, 65.8% expected to have low or very low chances of an academic career in philosophy, whilst only 45.5% of those naming more women philosophers reported that they expected to have low or very low future prospects for an academic career in philosophy. However, those differences were not significant. That the number of cases in the analysis of subgroups was relatively small (n=49) may be one reason why this difference was not significant despite the relatively large difference in percentage points. This suggests the need for large-scale studies to analyze how the absence of role models affects students' future career aspirations and their expected prospects for a successful academic career.

#### ***4.8. The Potential Effects of Women-Only Environments***

There are various suggestions for interventions to reduce underrepresentation in philosophy at the bachelor's and master's level. Most of our results point towards the absence of hypothesized classroom effects referring to course content and teaching methods. As such, causal factors for drop-out rates among women might not be primarily located in philosophy as a field of study with a specific subject matter and methodology. They also do not provide evidence for gender differences originating in features that are intrinsic to men and/or women but rather point towards the social atmosphere of philosophy courses where causal factors should be sought. The gender differences in feelings, especially in the feeling of fear, and in attitudes in seminars also ask for an explanation. It would therefore be worthwhile to explore hypotheses that refer to the social atmosphere in philosophy courses and the seminar as a study environment more generally.

We did so by exploring the effects of one intervention, namely, the implementation of a women-only learning environment. This intervention relied on the premise that causally responsible factors for those gender differences, especially in negative feelings, operate when men—as students and/or instructors—are present and are potentially the dominant group in the classroom. Reasons why women feel more afraid to speak up when men are present can be manifold, ranging from feeling no social support by their (male) peers, to fearing negative judgements due to existing stereotypes, etc. Dougherty et al. (2015: 4) subsume

those mechanisms under a set of hypotheses that refer to the hostile atmosphere in philosophy education. They are closely linked to M5, a lack of sense of belonging, and M6, the operation of implicit bias, but potentially also to M8, the actual or perceived discrimination in the classroom.

For our analysis, we compared the feelings reported by women who participated in the mixed tutorials with the feelings reported by the women attending the women-only tutorial (see Table A5 in Appendix). In total, 47 women out of 64 attended a tutorial. Of those, 18 women attended the women-only tutorial. Our results show that far fewer women in the women-only environment reported feelings of fear. More than three-quarters (78%) of all women attending the women-only tutorial reported that being afraid did not apply to them at all and only 22% reported that feeling afraid partially or fully applied to them. In contrast, only 32% of women attending the mixed tutorial reported that being afraid did not apply to them and 68% of women reported that it partially or fully applied to them. Half of the women attending the women-only tutorial also reported that feeling relaxed fully applied to them, whereas only 24% of female students in the mixed tutorial reported that feeling relaxed fully applied to them. Both differences were significant. Also, more women (44%) attending the women-only tutorial reported a strong commitment to in-class discussions as opposed to the number of women in the mixed tutorial (10%), a result which was also significant. Finally, 50% of women attending the women-only tutorial reported that being communicative fully applied to them, as opposed to only 24% of those women attending the mixed tutorial (see Table A6 in Appendix).

When we compared students' perceptions of the discussion style in philosophy, women attending the women-only tutorial perceived the style as less competitive and slightly less aggressive, friendlier and more comfortable than those attending the mixed tutorials. While only the difference in perceptions of competitiveness was significant, it can be noted that non-significant differences in perceptions generally point towards a higher feeling of comfort of women in the women-only environment (see Table A7 in Appendix).

Finally, we measured the difference in performance of women in both environments in order to explore a connection between a hostile environment and performance postulated in the implicit bias mechanism (M6) and in the stereotype threat mechanism (M7). On average, women attending the women-only tutorial performed slightly, yet not significantly, better in the final exam than women and men attending the mixed tutorial in both exams (see Figure A3 in Appendix). As those results were not significant,<sup>30</sup> we cannot conclude that there was a connection between attending the women-only tutorial and exam

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30. The sample size was relatively small.

performance. However, since our sample was very small and our results point slightly toward a possible connection, future research should study the connection between women-only environments and women's performance.

## 5. Discussion

To summarize our results: We found significant gender differences with respect to the *Adversarial Argumentation Hypothesis*. Women were significantly more afraid, less relaxed and generally less communicative during seminar discussions than men. While we do not know the causal factors for why women felt more afraid in seminar discussions than their male colleagues, we found that women felt less afraid and more relaxed in women-only environments. Our results also indicate on average a slightly better exam performance among those women participating in the women-only tutorial. We did not find significant gender differences in students' perception of the discussion style as particularly competitive or aggressive. This result is consistent with Thompson et al.'s (2016) research, which also found no significant gender difference in the perception of seminar discussions as particularly aggressive or confrontational. Notably, however, in the women-only tutorial, women perceived the discussion-style as significantly less competitive and friendlier than women in mixed tutorials. Men also reported higher levels of discussion participation compared to women. At the same time, men reported having larger circles of acquaintances among their classmates in the tutorials.

While we know that women were more afraid and less communicative during seminar classes, we do not know why. Numerous mechanisms could underlie this result. Philosophy is often perceived as a male discipline (see also Baron et al. 2015; Calhoun 2015; Haslanger 2008),<sup>31</sup> which is why women might experience a lower sense of belonging (M5) or see themselves confronted with a gender schema clash (M4). The deviant feelings of women as well as M4 and M5 could also be (partly) explained by implicit bias (M6) or stereotype threat (M7). However, another possibility could be that, for example, the presence of stereotype threat could explain why women do not feel that they belong in philosophy, which could manifest itself in feelings of fear and anxiety. Because all of these mechanisms could individually or jointly explain why women are more afraid and less likely to speak up in seminars, their possible presence should be studied further in studies of larger scale. Another mechanism underlying our

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31. Given that overall, students of both genders had more trouble naming women philosophers than men philosophers and in light of the fact that there was only one female professor at the department who had just arrived at the time of our data collection, this suggests that philosophy was perceived as a more masculine discipline by our cohort.

finding could simply lie in a lower interest of women in the subject matter (M2). However, as we discuss in the next section, our results do not point in such a direction.

We did not find evidence for the *Subject Matter Hypothesis* or for the *Impractical Subject Hypothesis*, as our results do not show any gender differences regarding students' interest (M7) in and their perceptions of the usefulness and relevance of the subject matter. Women reported even more often than men that they chose philosophy out of interest; overall, they were highly intrinsically motivated.

We also did not find evidence for the *Formal Methods/Abstractness Hypothesis*: both women and men equally perceived the course to be difficult. We also did not find gender differences regarding the degree of perceived difficulty of specific topics. All students reported that they found formal topics more difficult than non-formal topics. As such, our results do not show gender differences in perceptions of one's abilities with respect to different philosophical topics (M3). Furthermore, we did not find gender differences regarding the perceived usefulness of formal methods in philosophy. On average, however, more men than women reported that they thought of mathematics as fascinating and fun and that they deeply enjoyed doing it. Also, fewer men than women reported that they avoided math-related issues. This indicates that there was a gender difference in attitudes in our cohort, not towards philosophy (M2), but towards mathematical methods.

Relatedly, we found significant gender differences in students' mathematical skills. While women did on average not only perform worse than men on the math test, we also found significant gender differences in students' willingness to try to solve a math problem. We can only speculate about the underlying mechanisms. Experienced stereotype threat (M7) could be a possible cause for lower performance and fewer attempts. M7 would also explain women perceiving math as less fun and their reported attitude of avoiding math-related issues. It could also be that women are simply less interested in mathematical problems (M2) and therefore dedicate less time and effort to each one of them. Our results thus point to the need to investigate in more extensive studies whether M7 or M2 operates and, if the latter, why women have a lower interest in the first place.

Regarding the *Role Model Hypothesis*, our analysis shows that it was considerably easier for all students to name men as opposed to women philosophers. Given that almost no female role model on the professor level was present before the start of our study, we can confirm that the established fact of a lack of role models in philosophy also applies to students at LMU. One promising route for exploration would be to study possible correlations between a large exposure to role models and the willingness of women to continue their studies in philosophy and their aspirations for an academic career in philosophy. Our findings also suggest this route in that they point towards a difference in perceived

chances for a successful academic career between those women who were able to name three or more women philosophers and women who were not able to name three women philosophers.

Generally, our results suggest that mechanisms other than those that we primarily explored are responsible for gender differences in seminar experience. We therefore suggest that mechanisms pointing to the social environment in which academic philosophy takes place should be studied to explain them. Several hypotheses formulated in the literature are possible candidates to explain our results about reported students' feelings in seminars. First, the *Sexist Mistreatment Hypothesis* suggests that women become victims of sexist, sexually harassing or otherwise discriminatory behavior in their study environment (Baron et al. 2015). Second, it would be worthwhile exploring gender discrimination. Implicit bias is viewed as a specific variant of this mechanism, namely, that teachers and students hold negative implicit biases towards women as being less capable philosophers than men (Saul 2013). Being subject to such biases can be reflected in lower performance and discriminatory treatment by teachers and other students (Dougherty et al. 2015). The presence of stereotype threat is another mechanism potentially underlying some of our results, especially the differences in math performance and women's lower active engagement in class. Those hypotheses suggest that female students' feelings, which are triggered by experiences of discrimination or indirect discrimination effects during their first philosophy classes, decrease their willingness to major in philosophy.

Our results about gender differences in grades also point towards further exploring the *Gender Differences in Grades Hypothesis*. This hypothesis suggests that students tend to major in subjects in which they receive the best grades (Arcidiacono 2004). Several mechanisms can be thought of to explain grade differences. One mechanism is gender differences in interest (M2) (Thompson 2017). However, our results do not support such a difference. Mechanisms that relate performance to discriminatory behavior have also been said to explain grade differences. Again, women could possibly achieve lower grades because they are exposed to stereotype threat (Haslanger 2008; Thompson et al. 2016).<sup>32</sup> Because gender discrimination is a highly complex phenomenon, it has to be studied in relation to different mechanisms.

While we did not directly explore any of those hypotheses and mechanisms, our results provide indirect evidence for one or more of them. Our study is exploratory and results are not generalizable. However, the aforementioned

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32. For example, the absence of role models could increase women's feeling of being part of an underrepresented group, thereby potentially increasing stereotype threat, and in turn resulting in decreased exam performance.

results open up possible avenues for future research that is dearly needed in Germany and elsewhere.

## 6. Possible Countermeasures

Our results indicate that attending women-only tutorials provided an experience for women that was overall more pleasurable and less stressful than attending mixed tutorials. Moreover, women in the women-only tutorial performed slightly better on the final exam. This suggests that the effect of women-only environments on the motivation and performance of women could be a route for mitigating such gender differences, which in turn would most likely motivate more women to remain in academic philosophy.

As a step in this direction, we suggest the creation of women-only learning spaces and events such as tutorials, colloquia, workshops, roundtables, or informal study gatherings. These suggestions are supported by empirical research in other fields. For example, Booth, Cardona-Sosa, and Nolen (2014) found that women in a first-year introductory economics course at the University of Essex were 7% more likely to pass exams when randomly assigned to women-only classes. Furthermore, a UCLA study of 6,000 female students found that those students who entered the university after attending women-only schools showed a higher academic self-confidence at the beginning of their university studies (Riggers-Piehl, Lim, & King 2018). Those results suggest that such measures help limit potential stereotype threat and increase the presence of role models on different levels.

Given that some women in our study reported that they did not engage in seminar discussions because they felt that they did not have enough time to think or were afraid to say something wrong, concrete steps can be taken in a seminar to foster women's engagement in discussions. This could mean, for example, designing exercises in which students prepare something for themselves first, and, in general, establishing learning methods that enable students to think first with sufficient time before they have to speak up in class.

Lastly, we recommend the targeted support for and promotion of women philosophers at universities and particularly in the classroom in Germany as elsewhere. The inclusion of women can be achieved in a number of ways, such as, for example, by including more women on course syllabi, by inviting more women to talks and conferences, and by offering seminars in which the work of women is at the center. We suspect these measures would signal a learning environment to women in which their presence is natural and their contributions are appreciated and welcome.

## 7. Contributions and Limitations

Our study is the first systematic empirical investigation in the German-speaking context that explores some of the hypotheses regarding the origins of underrepresentation of women in philosophy at the student level. Besides providing results about existing gender differences and their underlying mechanisms among philosophy students in the classroom, the contributions of our study are also methodological. It is the first study that implements a design allowing for comparisons of, for example, feelings and performance of women in women-only study environments and mixed study environments to better understand how the social context potentially contributes to drop-out rates and, more generally, women's underrepresentation. Furthermore, using a panel design with multiple questionnaires, including a mathematics test to check for students' background knowledge, for the same group is equally unique. Finally, the specific combination of interests, abilities, beliefs, attitudes, perceptions, and goals has also not been focused on before. This innovative design is part of the exploratory aspect of the study and can function as an exemplary design for future studies in other countries and/or on a larger scale in Germany to frame and make comparable future research in this area.

Despite its contributions, our study has limitations. First, it was carried out on a small scale. More research at other German institutions would be necessary to capture the actual situation of philosophy in Germany and enable local generalizations. Research in other cultural and geographical contexts is equally needed to enable cross-country comparisons and further support generalizations. Moreover, we did not separate causes for gender differences that originate in the pre-university period from those that originate in the period when students begin their studies.<sup>33</sup>

Second, our focus was on exploring factors internal to philosophy and/or women that may explain gender differences among students. We particularly looked at a student's interests, abilities, beliefs, attitudes, perceptions, and goals with respect to philosophy as an academic discipline, while ignoring factors such as gender discrimination and/or sexism. Research suggests that such reasons might not always be apparent to the women themselves and are thus not (or only partly) reported (Saul 2013: 42; Brennan 2013). They tend to become harmful only when they accumulate and are therefore not easily detectable but instead might lead to an intangible feeling of not belonging or wanting to do

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33. An example for such a mechanism would be that students hold field-specific beliefs about their abilities before starting their university studies. Students could, for example, believe that philosophy requires natural brilliance that women lack, which could result in decreased confidence and interest of women in philosophy (Baron et al. 2015; Leslie et al. 2015).

something else. As such, they require an extensive and sophisticated design, which might also partly be based on qualitative methods.

Third, as the different indicators that we included in the questionnaire were part of different hypotheses, it might be worthwhile designing specific surveys to gather more in-depth information about individual hypotheses.

Fourth, we lack evidence for how much our results are unique to students of philosophy compared to students in other disciplines, such as in STEM fields. Study results about the factors that lead women to drop out of STEM fields in Germany would be particularly helpful with regard to whether women's underrepresentation has similar causes in those fields. Furthermore, it would allow for a discussion about whether remedial measures should be applied across disciplines or even at the university level, or be tailored specifically to the context of academic philosophy.

Finally, we want to address the worry that a self-selection bias might have partly driven the results when comparing the two different study environments (i.e., the mixed and the women-only tutorial), in that a particular set of women may have chosen to attend the women-only tutorial in the first place. This possible bias could go as follows: If there were pre-existing systematic differences in the groups regarding their feeling of fear, the women-only environment attracted women who were generally more afraid on average in a seminar environment than their colleagues (men and women) and they chose the tutorial to escape such a situation. If such self-selection occurred, we would consequently expect the women in the women-only tutorial to report feeling more afraid than women in the mixed tutorials. As our results state the opposite, namely, that women in the women-only tutorial felt less afraid than those in mixed tutorials, we assume that self-selection bias did not compromise this result.

## 8. Conclusion

In this paper, we studied the underrepresentation of women in philosophy at the undergraduate level Germany with a focus on five hypotheses currently discussed in the literature. We explored these hypotheses by analyzing factors related to the interests, abilities, beliefs, attitudes, perceptions, and goals of students in the context of their studies in a semester-long philosophy of science course at LMU, a major German university. Furthermore, we compared women-only learning environments with mixed learning environments and analyzed them with respect to students' feelings and performance differences. While our results could not support most of the proposed hypotheses explaining dropout rates, we found some gender differences in attitudes, perceptions and feelings in tutorials, which varied when we compared mixed-gender and women-only

study environments. Our results suggest that significant factors leading to an underrepresentation in philosophy are to be sought in the social and institutional environment within which philosophy is taught. Finally, our results point towards the potential usefulness of women-only learning environments that should be implemented parallel to mixed learning environments. Given that we present an exploratory study, we see our results as opening avenues for future hypothesis development and for a systematic study of such hypotheses on a large scale to empirically support and justify concrete measures that encourage women to stay in philosophy.

With our study, we want to encourage researchers to conduct studies in different geographical and educational contexts. While research has shown that dropout rates of women are particularly high (Paxton et al. 2012; Thompson et al. 2016), exploring reasons why women leave philosophy at all levels is important. High dropout rates of more advanced female philosophers also mean a loss of role models for younger generations. A survey of former students who have already left the field could further reveal why women turn away from philosophy. However, while this step might seem like the most obvious, one must remain cautious. As causal factors resulting in dropout rates are complex and interrelated, it cannot be expected that students who quit their studies are necessarily able to identify the exact reasons. We therefore think that it is particularly promising to study students' perceptions, attitudes, preferences, interests, feelings and experiences in and with regard to philosophy as extensively as possible and thereby create a realistic picture of female students' reasons for dropping out of philosophy

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## 10. Appendix

**Table A1** *Students' Participation in Discussions*

Question	Value	Gender	N	Percent	Chi-square test
How often do you normally participate in discussions in seminars?	several times in one session	women men	13 19	25% 42%	$\chi^2(2, 97)$ = 3.593 p = .17
	every third session up to once in one session	women men	18 14	35% 31%	
	rarely/never	women men	21 12	40% 27%	
On average, how often did you participate in discussions in the tutorial "Philosophy of Science"?	several times in one session	women men	10 14	21% 39%	$\chi^2(2, 83)$ = 7.916 p = .02
	every third session up to once in one session	women men	14 15	30% 42%	
	rarely/never	women men	23 7	49% 19%	

**Table A2** Students' Reported Attitudes towards Discussion in Seminar by Gender

How would you describe your attitude towards a discussion in a seminar?	Value	Gender	N	Percent	Chi-square test
Open	fully applies	women men	31 30	62% 70%	$\chi^2(2,93)$ = 0.636 p = .728 <sup>a</sup>
	applies in parts	women men	15 10	30% 23%	
	does not apply	women men	4 3	8% 7%	
Not interested	fully applies	women men	3 3	6% 7%	$\chi^2(2,93)$ = 0.652 p = .722 <sup>a</sup>
	applies in parts	women men	15 16	30% 37%	
	does not apply	women men	32 24	64% 55%	
Engaged	fully applies	women men	11 8	22% 19%	$\chi^2(2,93)$ = 2.464 p = 0.292
	applies in parts	women men	25 28	50% 65%	
	does not apply	women men	14 7	28% 16%	
Communicative	fully applies	women men	16 18	32% 42%	$\chi^2(2,93)$ = 1.314 p = 0.518
	applies in parts	women men	22 18	44% 42%	
	does not apply	women men	12 7	24% 16%	

Note. \* Chi-square statistics are significant at the .05 level. <sup>a</sup> In this sub-table more than 20% of the cells have expected cell frequencies of less than 5. Therefore, the results of Chi-Square may be invalid.

**Table A3** Students' Reported Feelings during Discussions in Seminars by Gender

How do you feel during discussions in seminars?	Value	Gender	N	Percent	Chi-square test
Bored	fully applies	women	1	2%	$\chi^2(2,93)$ = 1.82 p = .403 <sup>a</sup>
		men	3	7%	
	applies in parts	women	26	52%	
		men	24	56%	
	does not apply	women	23	46%	
		men	16	37%	
Afraid	fully applies	women	3	6%	$\chi^2(2,92)$ = 6.847 p = .033 <sup>*a</sup>
		men	1	2%	
	applies in parts	women	20	41%	
		men	8	19%	
	does not apply	women	26	53%	
		men	34	79%	
Excited	fully applies	women	9	18%	$\chi^2(2,91)$ = 0.018 p = 0.991
		men	8	19%	
	applies in parts	women	31	63%	
		men	26	62%	
	does not apply	women	9	18%	
		men	8	19%	
Relaxed	fully applies	women	18	36%	$\chi^2(2,92)$ = 1.841 p = 0.398
		men	21	50%	
	applies in parts	women	24	48%	
		men	16	38%	
	does not apply	women	8	16%	
		men	5	12%	

Note. \* Chi-square statistics are significant at the .05 level

<sup>a</sup> In this sub-table more than 20% of the cells have expected cell frequencies of less than 5. Therefore, the results of Chi-Square may be invalid.

Table A4 Correlations of Students' Reported Feelings and Attitudes in Seminar Discussions

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10	Q11	Q12	Q13	Q14	Q15	Q16	Q17	Q18
Q1. Bored	1.00																	
Q2. Afraid	-.08	1.00																
Q3. Excited	-.24*	.02	1.00															
Q4. Relaxed	.03	-.47**	.12	1.00														
Q5. Open	-.02	-.26*	.41**	.36**	1.00													
Q6. Not interested	.36**	-.07	-.25*	-.02	-.09	1.00												
Q7. Engaged	-.15	-.16	.39**	.30**	.30**	-.13	1.00											
Q8. Communicative	-.08	-.27**	.36**	.41**	.41**	-.01	.67**	1.00										
Q9. Aggressive	.05	.06	-.13	-.12	-.11	.01	-.05	-.09	1.00									
Q10. Competitive	.11	.09	-.05	.04	.06	.12	.07	.06	.37**	1.00								
Q11. Consent-oriented	-.21*	-.21*	.10	.09	-.13	-.01	.31**	.29**	-.08	-.24*	1.00							
Q12. Comfortable	-.17	-.12	.16	.20	.09	-.08	.27*	.28**	-.38**	-.44**	.31**	1.00						
Q13. Result-oriented	-.20	.03	.10	.07	.09	-.09	.15	.15	-.31**	-.06	.18	.47**	1.00					
Q14. Friendly	-.09	-.11	.14	.21*	.12	-.08	.23*	.10	-.52**	-.28**	.04	.55**	.29**	1.00				
Q15. Uncomfortable	.14	.08	-.15	-.12	-.13	.20	-.07	-.17	.47**	.40**	-.15	-.54**	-.24*	-.44**	1.00			

Q16. Degrading	.07	.27 <sup>**</sup>	-.16	-.18	-.07	.05	-.03	-.10	.46 <sup>**</sup>	.23 <sup>*</sup>	-.13	-.31 <sup>**</sup>	-.04	-.50 <sup>**</sup>	.43 <sup>**</sup>	1.00		
Q17. Intimidating	.06	.40 <sup>**</sup>	-.04	-.36 <sup>**</sup>	.00	.04	-.07	-.24 <sup>*</sup>	.27 <sup>**</sup>	.23 <sup>*</sup>	-.22 <sup>*</sup>	-.29 <sup>**</sup>	-.01	-.23 <sup>*</sup>	.35 <sup>**</sup>	.54 <sup>**</sup>	1.00	
Q18. Suitable for the discipline	-.20	.11	.14	.18	.06	-.12	.14	.08	-.35 <sup>**</sup>	-.03	.04	.39 <sup>**</sup>	.24 <sup>*</sup>	.28 <sup>**</sup>	-.33 <sup>**</sup>	-.21 <sup>*</sup>	-.05	1.00

Note. Spearman's rho correlation coefficients.

\*\* . The correlation is significant at the 0.01 level (two-sided).

\* . The correlation is significant at the 0.05 level (two-sided).

**Table A5** Students' Reported Feelings during Discussions in Seminars by Tutorial

How do you feel during discussions in seminars?	Value	Tutorial	N	Percent	Chi-square test
Bored	fully applies	mixed	0	0%	$\chi^2(1,47)$ = 0.013 p = .908 <sup>a</sup>
		women-only	0	0%	
	applies in parts	mixed	15	52%	
		women-only	9	50%	
	does not apply	mixed	14	48%	
		women-only	9	50%	
Afraid	fully applies	mixed	2	7%	$\chi^2(2,46)$ = 9.495 p = .009 <sup>a</sup>
		women-only	1	6%	
	applies in parts	mixed	17	61%	
		women-only	3	17%	
	does not apply	mixed	9	32%	
		women-only	14	78%	
Excited	fully applies	mixed	5	18%	$\chi^2(2,46)$ = 0.133 p = .936 <sup>a</sup>
		women-only	3	17%	
	applies in parts	mixed	18	64%	
		women-only	11	61%	
	does not apply	mixed	5	18%	
	women-only	4	22%		
Relaxed	fully applies	mixed	7	24%	$\chi^2(2,47)$ = 7.154 p = .028 <sup>a</sup>
		women-only	9	50%	
	applies in parts	mixed	14	48%	
		women-only	9	50%	
	does not apply	mixed	8	28%	
		women-only	0	0%	

Note. \* Chi-square statistics are significant at the .05 level

<sup>a</sup> In this sub-table more than 20% of the cells have expected cell frequencies of less than 5. Therefore, the results of Chi-Square may be invalid.

**Table A6** Students' Reported Attitudes towards Seminar Discussions by Gender

How would you describe your attitude towards a discussion in a seminar?	Value	Tutorium	N	Percent	Chi-square test
Open	fully applies	mixed women-only	16 12	55% 67%	$\chi^2(2,47)$ = 1.337 p = .513 <sup>a</sup>
	applies in parts	mixed women-only	11 4	38% 22%	
	does not apply	mixed women-only	2 2	7% 11%	
Not interested	fully applies	mixed women-only	3 0	10% 0%	$\chi^2(2,47)$ = 2.566 p = .277 <sup>a</sup>
	applies in parts	mixed women-only	6 6	21% 33%	
	does not apply	mixed women-only	20 12	69% 67%	
Engaged	fully applies	mixed women-only	3 8	10% 44%	$\chi^2(2,47)$ = 7.439 p = .024 <sup>*a</sup>
	applies in parts	mixed women-only	18 6	62% 33%	
	does not apply	mixed women-only	8 7	28% 22%	
Communicative	fully applies	mixed women-only	7 9	24% 50%	$\chi^2(2,47)$ = 5.254 p = 0.072
	applies in parts	mixed women-only	16 4	55% 22%	
	does not apply	mixed women-only	6 5	20% 28%	

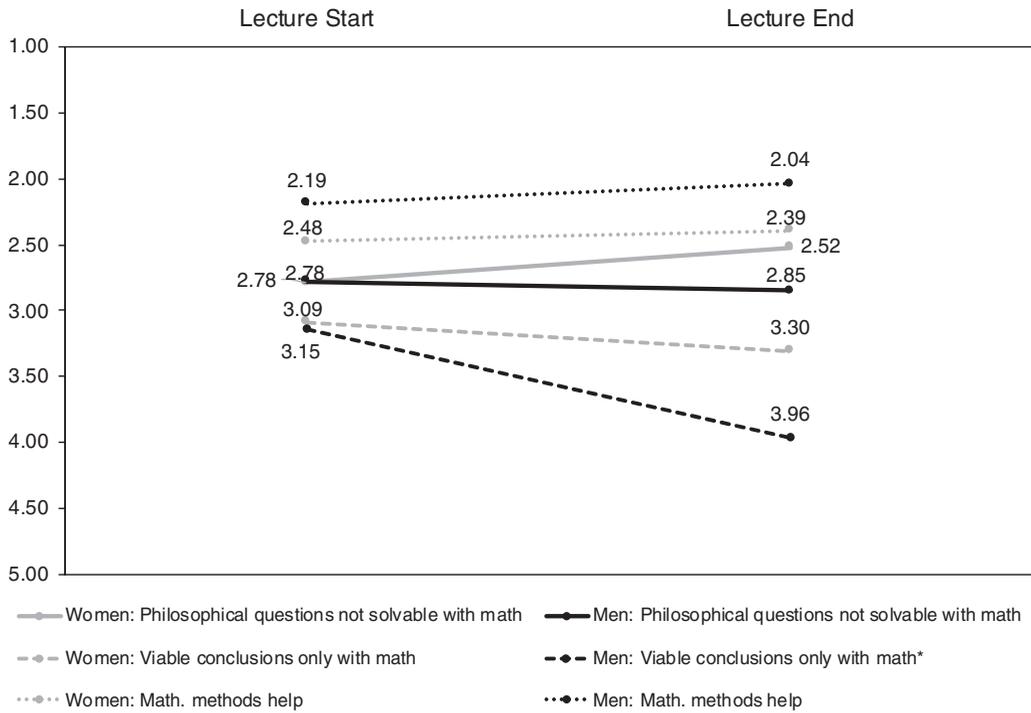
Note. \* Chi-square statistics are significant at the .05 level

<sup>a</sup> In this sub-table more than 20% of the cells have expected cell frequencies of less than 5. Therefore, the results of Chi-Square may be invalid.

**Table A7** Female Students' Perceptions of the Discussion Style by Type of Tutorium

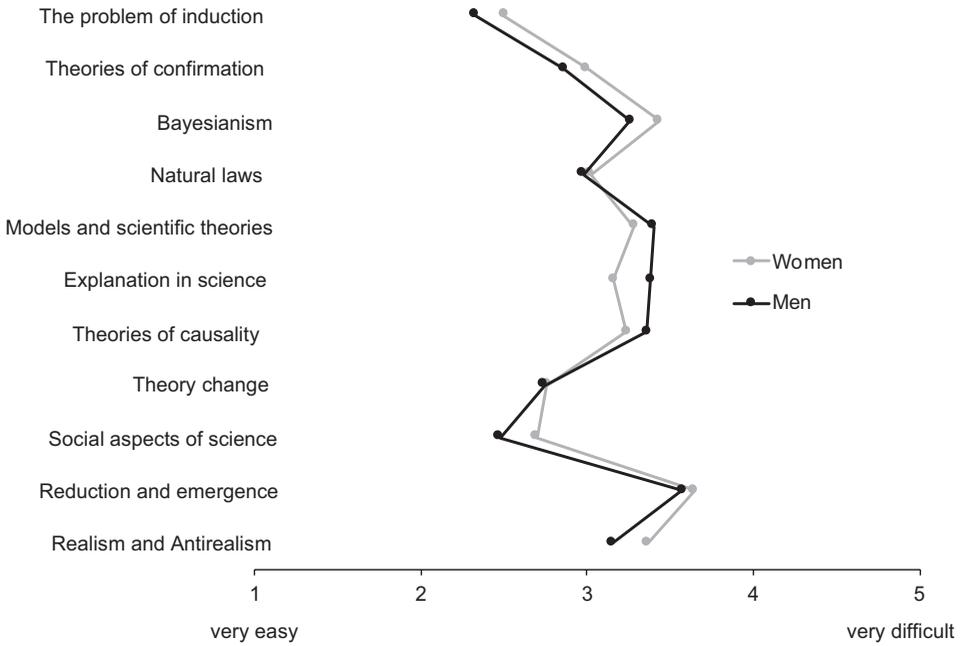
How do you experience the style of discussion in philosophy in general?	Tutorium	N	Mean <sup>a</sup>	T-test
Aggressive	mixed	30	3.93	t(46) = -0.92, p = 0.362
	women-only	18	4.22	
Competitive	mixed	27	2.59	t(42) = -2.076, p = 0.044*
	women-only	17	3.29	
Consent-oriented	mixed	27	3.26	t(42) = 0.415, p = 0.68
	women-only	17	3.12	
Comfortable	mixed	28	2.68	t(44) = 1.197, p = 0.238
	women-only	18	2.33	
Result-oriented	mixed	28	2.96	t(44) = -0.1, p = 0.92
	women-only	18	3.00	
Friendly	mixed	28	2.46	t(44) = 1.015, p = 0.316
	women-only	18	2.17	
Uncomfortable	mixed	28	4.14	t(44) = -0.297, p = 0.768
	women-only	18	4.22	
Degrading	mixed	28	4.61	t(44) = 0.197, p = 0.845
	women-only	18	4.56	
Intimidating	mixed	28	3.89	t(44) = -0.733, p = 0.467
	women-only	18	4.17	
Suitable for the discipline	mixed	27	2.41	t(42) = -0.224, p = 0.824
	women-only	17	2.47	

Note. <sup>a</sup> Scale: 1=always and 5= never; \* T-test statistics are significant at the .05 level



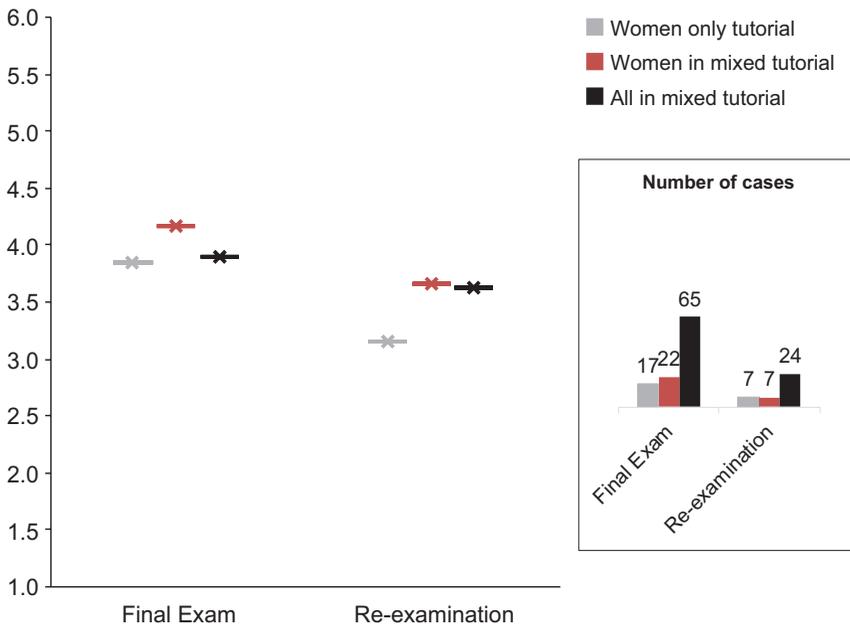
**Figure A1** Relationship between Philosophy and Mathematics before and after the Lecture

Note: 1=totally agree and 5=totally disagree. Mean by gender; \* significant mean difference,  $p < 0.05$ ; n Men = 27, n Women = 23.



**Figure A2** Perceived Difficulty of Course Topics by Gender

Note: Question: How would you rate the level of difficulty of the topics covered? Mean by Gender. \*  $p < 0.05$ , \*\*  $p < 0.01$ ; N between 88 and 95.



**Figure A3.** Mean Grades of Final Exam by Gender and Tutorial