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# Exploring the Gender Gap: Motivation, Procrastination, Environment, and Academic Performance in an Introductory Physics Course in a Human-Centered Private University in Northeast Mexico—A Case Study

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**Abstract:** Progress has been made in recent decades toward achieving gender equality, but today, the gender gap is still noticeable, especially in STEM fields. In support of Goal 5 of the 2030 Sustainable Development Agenda: achieve gender equality and empower all women and girls, we analyze the context of a private university in northeastern Mexico using a sample of 249 students (157 males and 92 females) enrolled in the first-year engineering course Physics I. The sample presents better academic performance in favor of women by the end of the course as reported through the final course score (F); thus, we explore potential gender differences in student profiles, such as their motivation and level of procrastination using Kruskal–Wallis correlation tests, and measuring the effect size with Cohen's *d*. Our tests reported here reveal significant differences in extrinsic motivation (EMO) and intrinsic motivation (IMO), where females obtained higher means in IMO, while males reported higher levels of procrastination (PRO). Contrary to other cases in the literature, the sample presents better academic performance in favor of women. Our findings here aim to encourage programs and strategies that strengthen women's intrinsic motivation to support women's empowerment and keep reducing the gender gap.

**Keywords:** gender gap; motivation; procrastination; STEM education

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## 1. Introduction

According to UNESCO, "globally, the percentage of girls and women studying engineering, manufacturing and construction or ICT in higher education is below 25% in over two-thirds of countries" [1]. Thus, this recognizes gender equality and the empowerment of women and girls as one of its two global priorities [2]. So, through equitable education without a gender gap, one promotes women's full and effective participation and equal leadership opportunities; this is sub-goal 5.5 in the 2030 Agenda for Sustainable Development Goal 5: achieve gender equality and empower all women and girls.

Efforts are being made in various parts of the world to reduce the gender gap [3]. Studying and understanding potential causes, such as perceiving engineering as an area dominated by men [4], parents' education or students' aptitude for mathematics and science [5], Mathematics Anxiety and Self-Efficacy in developing countries [6], among others, could help generate and concentrate programs and strategies that lower the gender gap. However, identifying all the factors and which are the most relevant is not trivial. Therefore, any clue revealed from the cases with evidence of no gender gap is essential for analysis because it may show the factors we must focus on to strengthen these programs and strategies.

**In this line of thought, this article examines the factors that may be related to the absence of a gender gap and explores the gender differences in academic performance, motivation, and procrastination.** Previous studies show that in physics courses, the male students tend to perform better [7–12] and are more motivated [7,13]. On the other hand, studies also show that female students tend to present lower behavioral tendencies to procrastination [14–18]. In this work, we analyze the context of a private university in northeastern Mexico enrolled in the first-year engineering course of Physics I. Similar to the above cases, women present lower behavioral tendencies to procrastination, but contrary to the above cases, the sample presents better academic performance in favor of women by the end of the course according to having a higher final course score (F); this means something changed.

In order to reveal the potential cause(s), in this work, we study the potential gender differences in student profiles of intrinsic motivation (IMO), extrinsic motivation (EMO), and procrastination (PRO) to compare with other cases. We describe these variables and the demographics, academic context, values, safe spaces, and other considerations in the next section. Section 2 develops the methods and the statistical treatment. Our results and discussion are presented in Sections 3 and 4, respectively. Finally, in Section 5, we show our conclusions.

### 1.1. Intrinsic Motivation (IMO)

It measures the extent to which students feel naturally interested and engaged in their studies and enjoy the learning process [19]. It is a genuine curiosity and a thirst for knowledge. Individuals are driven by the desire to explore, learn, and understand new concepts and ideas. They find satisfaction in gaining knowledge and expanding their understanding of the world. Individuals with dominant IMO may be self-driven to perform tasks and reach desired outcomes. They derive a sense of fulfillment and accomplishment from completing challenging tasks and attaining success. IMO may also be driven by the excitement and enjoyment of stimulating activities. Individuals with this motivation seek out experiences that provide a sense of novelty, variety, and excitement. Students are then motivated by the pleasure and intrinsic rewards that come from engaging in mentally or physically stimulating activities. Understanding intrinsic motivation can help individuals harness their inner drive and find fulfillment in their pursuits.

### 1.2. Extrinsic Motivation (EMO)

It evaluates motivation based on external rewards or social pressures, such as obtaining good grades to receive recognition or avoid punishments [19]. Individuals engage in an activity solely to receive a specific outcome or avoid negative consequences. For example, a student may study diligently only to earn a high grade or avoid parental disapproval. It also occurs when individuals engage in an activity to avoid guilt or enhance their self-esteem. They may feel pressured by internalized societal or personal standards, and their motivation is influenced by feelings of obligation, fear of failure, or a need to prove themselves to others. For instance, a person might participate in a charitable event to avoid feeling guilty or to enhance their self-image. In other cases, it involves adopting specific values or goals as being personally important. Individuals engage in activities because they align with their own beliefs and values or because they identify with a particular group or role. They see the activity as meaningful or personally relevant. For instance, people may join an environmental organization because they identify strongly with the cause and believe in its mission. While extrinsic motivation can effectively drive behavior, it is generally considered less autonomous and less likely to lead to long-term satisfaction than intrinsic motivation. The degree of self-determination and personal choice varies across different subtypes of extrinsic motivation, with identification being the closest to internal motivation.

### *1.3. Procrastination (PRO)*

Procrastination, which refers to the deliberate postponement of tasks, is a prevalent phenomenon within college environments. It can have detrimental effects on learning, academic performance, self-efficacy, and overall quality of life. The test has been widely used to examine behavioral tendencies to procrastination [20,21].

### *1.4. Academic Performance (F)*

Academic performance refers to the level of achievement and success students demonstrate in their educational activities. It measures how well students acquire and apply knowledge, skills, and competencies in various academic areas, and the final grade indicates it.

### *1.5. Demographics, Academic Context, Values, Safe Spaces, and Other Considerations*

Studies have shown that variables, such as context, e.g., the parent's education, may be relevant to these studies since this has been shown to influence learning [22]. The parent's level of education has a significant correlation with students' ambition [23]. Parents with higher education could increase students' intention to learn [24].

The academic context in which students are developing in this study [25] firmly rejects all forms of privilege or discrimination. The university has been guided by humanism and has remained open to individuals of all creeds and conditions. The university community also adheres to seven universal values that serve as guiding principles for their actions and thoughts. These values include the search for truth, dignity, integrity, justice, freedom, respect, and transcendence [26]. Additionally, the university is guided by its founding principles of humanism, openness, and service [27]. In upholding these principles, the university is dedicated to creating a safe environment that is free from gender violence. It has established a comprehensive structure and mechanisms to prevent, address, denounce, and appropriately punish any behavior infringing upon its community members' dignity or hindering their complete development [28].

The university has demonstrated a commitment to creating a safe environment for the university community and established the "Center for Gender Equity and Inclusion" [29] in 2020 to gather professionally trained professionals experienced in preventing, caring for, and monitoring issues related to human dignity, gender equality, and inclusion. The main functions of the center include [30] (a) training, (b) case support, and (c) connections. (a) Conduct activities aimed at prevention, dissemination, guidance, awareness-raising, and education: these activities aim to raise awareness within the community, prevent acts of gender violence in any form, and reinforce the values that govern the institution; (b) Provide assistance, guidance, and support to individuals who have experienced gender violence throughout the entire institutional process, and (c) establish relationships and alliances with other organizations in society to investigate and advocate for issues of gender equality and inclusion. The university's interest lies in researching, providing training, and supporting the entire university community to foster an environment where students can fully develop.

In order to foster such safe spaces, the university is fully committed to consistently carrying out activities that promote awareness, provide guidance, and offer education within the community. Furthermore, the university ensures prompt attention and follow-up on any cases that may arise and highly promotes faculty gender equality.

In the Physics Department, the faculty members are half women and half men, whereas at the University level, until September 2022, it is made up of 45% men and 55% women [31]. Meanwhile, even in developed countries, such as Sweden, the percentage of women lecturers in physics faculties is about 20% [32], with a similar percentage in the European Union of 20% by 2010 and 26% in the United States [33].

## 2. Materials and Methods

### *2.1. Research Designs*

In order to explore the gender differences in this context, we address the following research questions:

**RQ1.** Do female first-year engineering students in this context exhibit different motivation levels than male students?

**RQ2.** Are there gender differences in the levels of procrastination among engineering students?

**RQ3.** Are female first-year engineering students at a disadvantage in academic performance in physics courses in this environment?

This research followed a quantitative approach, and the study is of an exploratory, descriptive field level. It was carried out as follows: we applied surveys to obtain the necessary datasets; then, we analyzed them with the corresponding statistical tests described and presented below; finally, conclusions were drawn from the comparison analysis of our results to answer the research questions presented in this section.

### 2.2. Participants and Application Procedure

We used a sample of 249 students (157 males and 92 females) from a private university in northeastern Mexico enrolled in the first-year engineering course of Physics I. The students participated voluntarily and were informed that by answering the questionnaires, they authorized the use of their responses for the research project confidentially and anonymously. They were assured that they were free to respond honestly and naturally, which would greatly benefit the study in obtaining accurate insights into the students' perceptions.

We applied the surveys described below in Section 2.3 at the beginning of the second semester of 2021. The sample consisted of students from various engineering programs offered at the university. In Table 1, we present the study sample by program and gender.

**Table 1.** Participants.

| Engineering | Female | Male | Total |
|---|---|---|---|
| Automotive engineering | 2 | 5 | 7 |
| Biomedical engineering | 13 | 10 | 23 |
| Civil and environmental engineering | 3 | 12 | 15 |
| Business management engineering | 30 | 35 | 65 |
| Industrial and systems engineering | 15 | 25 | 40 |
| Engineering in sustainable innovation and energy | 5 | 7 | 12 |
| Administrative mechanical engineering | 2 | 2 | 4 |
| Mechatronics engineering | 4 | 17 | 21 |
| Engineering in robotics and intelligent systems | 0 | 5 | 5 |
| Computer science and technology | 10 | 29 | 39 |
| Other | 8 | 10 | 18 |
| Total | 92 | 157 | 249 |

### 2.3. Questionnaires

In order to acquire the relevant data for the analysis, we apply the following three questionnaires,

- **Academic Motivation Scale (AMS)** [19]**:** The survey has 28 items divided into seven sub-scales, including three types of intrinsic motivation, three extrinsic motivation, and one for motivation. The values obtained vary from 1 (does not correspond) to 7 (corresponds exactly). For the results of this study, we will only analyze the average obtained from the scores related to intrinsic and extrinsic motivation.
  Extrinsic Motivation (EMO) refers to the average of three types of extrinsic motivation: external regulation, introjection, and identification.
  Intrinsic Motivation (IMO) refers to the average of three types of intrinsic motivation: knowing, accomplishing things, and experiencing stimulation.

- **Procrastination:** In order to examine the level of procrastination, we use Lay (1986) [21]. The test was designed to measure individual and situational procrastination. It consists of 20 statements; in each, the student decides whether it is characteristic. One is the least characteristic, and five is the extremely characteristic.
  The final scores that students can obtain vary from 20 points, which is interpreted as students who would consider statements such as "I am continually saying: I'll do it tomorrow" are "Extremely uncharacteristic", up to scores of 100, where this same statement would be considered "totally characteristic". Values close to 60 would be regarded as neutral.
- **Demographics:** This questionnaire allows us to know the environment where the student has developed, knowing their parents' education and their impact on the STEM area. The article's authors developed the questionnaire with basic questions for the students.

In addition, we evaluated **Academic Performance (F)** through the final grades of the course determined by the cumulative scores obtained in the exams, in-class activities, and homework assignments throughout the course. The minimum passing score is 70, while the maximum score is 100.

### *2.4. Statistical Analysis and Data Processing*

For the statistical analysis, Kruskal–Wallis and correlation tests were performed to observe if there was a significant difference in the means of the students when they were divided into female and male genders, using Cohen's $d$ to measure the effect size. We used software R version 3.6.1 [34] to derive the statistical results presented in this work. It is worth noting that an ANOVA analysis was not performed because the assumptions of normality and equal variances were unmet. Therefore, the nonparametric Kruskal–Wallis test was chosen for this work.

## 3. Results

### *3.1. (RQ1, RQ2, and RQ3) Motivation, Procrastination, and Academic Performance*

All tables shown in this section maintain the following order in the first column: extrinsic motivation (EMO), intrinsic motivation (IMO), procrastination test (PRO), and final score (F).

The mean, standard deviation (SD), and standard error of the mean (SE) of each variable are shown in Table 2. In Table 3, we present them by gender.

In the full female and male sample, the EMO mean (4.8) is in the "corresponds moderately" range, which indicates that students feel moderately identified with extrinsic motivation. In contrast, the IMO mean (5.66) is in the "corresponds a lot" range. Therefore, we can see that students feel more intrinsically motivated. Regarding procrastination, the score is 47.5, which would be between the "extremely uncharacteristic" and "neutral" range, implying that, in general, the students in the sample do not identify with procrastinating attitudes. The final grade is on a scale of 100, so the average of 87.1 indicates students who have passed the course and have shown sufficient knowledge of physical concepts during their exams and activities in the Physics I course.

**Table 2.** Means, standard deviations, and standard deviations of the means.

| | **Mean** | **SD** | **SE** |
|---|---|---|---|
| EMO | 4.8 | 0.542 | 0.034 |
| IMO | 5.66 | 1.03 | 0.065 |
| PRO | 47.5 | 11.3 | 0.716 |
| F | 87.1 | 11.9 | 0.752 |

**Table 3.** Means, standard deviations, and standard deviations of the means by gender.

| | Female Mean ($n$ = 92) | SD | SE | Male Mean ($n$ = 157) | SD | SE |
|---|---|---|---|---|---|---|
| EMO | 4.91 | 0.421 | 0.044 | 4.73 | 0.593 | 0.047 |
| IMO | 6.1 | 0.825 | 0.086 | 5.41 | 1.05 | 0.084 |
| PRO | 45.2 | 11.7 | 1.23 | 48.9 | 10.8 | 0.865 |
| F | 89.9 | 10.2 | 1.06 | 85.4 | 12.5 | 0.995 |

We computed Kruskal–Wallis statistics and Cohen's $d$ to measure the effect size. We present our findings in Table 4. The four variables analyzed show significant differences ($p < 0.05$), with a small effect size for EMO, PRO, and F and a moderate effect size for IMO, probing RQ1, RQ2, and RQ3. For a discussion, please see the next section. We also performed a correlation test, where IMO has the higher correlation with a $p$-value of $1.82 \times 10^{-7}$; we present our findings in Table 5. Similarly, we can note that in this study case, IMO is the most correlated with F.

**Table 4.** Kruskal–Wallis statistics and Cohen's d to measure the effect size (effsize). $n$ represents the number of students tested, df for degrees of freedom, and $p$ for the $p$-values.

| | $n$ | Statistic | df | $p$ | Effsize |
|---|---|---|---|---|---|
| EMO | 249 | 4.87 | 1 | 0.027 3 * | 0.0157 (small) |
| IMO | 249 | 29.4 | 1 | $5.93 \times 10^{-8}$ * | 0.115 (moderate) |
| PRO | 249 | 7.9 | 1 | 0.00494 * | 0.0279 (small) |
| F | 249 | 10.2 | 1 | 0.00139 * | 0.0373 (small) |

* $p$-values less than 0.05.

**Table 5.** Correlation test results for correlation with all the variables. We include the $p$-values in the parenthesis. IMO shows the higher correlations.

| | GENDER | PRO | IMO | EMO | F |
|---|---|---|---|---|---|
| GENDER | 1 | −0.16 (0.0117 *) | **0.32** **(**$1.82 \times 10^{-7}$ ****)** | 0.16 (0.0103 *) | **0.19 (0.00323)** |
| PRO | −0.16 (0.0117 *) | 1 | −0.48 ($1.98 \times 10^{-15}$ **) | −0.11 (0.0948) | −0.09 (0.176) |
| IMO | **0.32** ($1.82 \times 10^{-7}$ **) | −0.48 ($1.98 \times 10^{-15}$ **) | 1 | 0.52 ($1.24 \times 10^{-18}$ **) | **0.20 (0.00123 *)** |
| EMO | 0.16 (0.0103 *) | −0.11 (0.0948) | 0.52 ($1.24 \times 10^{-18}$ **) | 1 | 0.06 (0.34) |
| F | **0.19 (0.00323 *)** | −0.09 (0.076) | **0.20 (0.00123)** | 0.06 (0.04 *) | 1 |

* $p$-values less than 0.05. ** $p$-values less than 0.001.

In the analysis by gender, it is observed that in the EMO and IMO variables, females are above the mean, while males are below average. Therefore, we can say that women feel more motivated both intrinsically (F: 6.1; M: 5.41) and extrinsically (F: 4.91; M: 4.73). Conversely, in the procrastination test, the opposite effect occurs; male students show a higher level of procrastination (48.9) than female students (45.2). While in the final grade of the Physics I course, we can see that females obtained a higher average than males—(F: 89.9, M: 85.4).

For comparison, Table 6 shows our findings in intrinsic and extrinsic motivation by gender with other studies. In our sample, female students show higher scores on both the intrinsic and extrinsic motivation scale, while in the other studies, male students show higher scores on the motivation scale.

In order to compare the levels of procrastination between men and women from different contexts, Table 7 shows the results obtained between this article and similar ones. Our results are consistent with findings in the existing literature, and using questionnaires similar to the ones employed in our study, male students exhibit a higher level of academic procrastination across different contexts.

**Table 6.** Comparison of our motivation results with other studies.

| Study | Variable Output | *n* | Female Mean | SD | *n* | Male Mean | SD | Scale | *p* | d |
|---|---|---|---|---|---|---|---|---|---|---|
| This work | EMO<br>IMO | 92<br>92 | **4.91**<br>**6.1** | 0.421<br>0.825 | 157<br>157 | 4.73<br>5.41 | 0.593<br>1.05 | (1–7)<br>(1–7) | 0.0273<br>$5.93 \times 10^{-8}$ ** | 0.157<br>0.115 |
| Barthelemy [13] | EMO<br>IMO | 93<br>92 | **17.27**<br>20.67 | 3.47<br>2.67 | 227<br>229 | 16.4<br>**21.14** | 3.48<br>2.93 | (5–25)<br>(5–25) | 0.042 *<br>0.19 | 0.25<br>- |
| Nissen [7] | IMO | 82 | 1.25 | 0.56 | 148 | **1.61** | 0.69 | (0–3) | <0.001 ** | 0.53 |
| Ng [35] | EMO<br>IMO | 178<br>178 | 3.18<br>3.17 | -<br>- | 167<br>167 | **4.0**<br>**3.69** | -<br>- | (1–5)<br>(1–5) | <0.01 *<br><0.01 * | -<br>- |
| Naz [36] | EMO<br>IMO | 81<br>81 | 36.68<br>63.44 | 6.702<br>9.726 | 81<br>81 | **41.10**<br>**64.54** | 8.494<br>9.788 | -<br>- | 0.011*<br>0.612 | -<br>- |

* *p*-values less than 0.05. ** *p*-values less than 0.001.

**Table 7.** Comparison of our findings in procrastination by gender with similar studies. (*) Shows the procrastinating activity measure for the academic procrastination test in [37].

| Study | Variable Output | *n* | Female Mean | SD | *n* | Male Mean | SD | Scale | *p* | d |
|---|---|---|---|---|---|---|---|---|---|---|
| This work | PRO | 92 | 45.2 | 11.7 | 157 | **48.9** | 10.8 | (20–100) | 0.00494 * | 0.0279 |
| Dominguez [14] | PRO * | 298 | 8.896 | 2.467 | 688 | **9.608** | 2.155 | (5–15) | - | 0.30 |
| Kassim [15] | PRO | 26 | 3.00 | 0.43 | 25 | **3.27** | 0.35 | (1–5) | 0.017 * | - |
| Roy [16] | PRO | 337 | 209.181 | 21.599 | 330 | **214.470** | 21.042 | - | 0.02 * | - |
| Balkis [17] | PRO | 218 | 32.66 | 9.11 | 223 | **39.71** | 10.03 | (19–95) | - | - |
| Garcia [18] | PRO | 46 | 2.885 | 0.833 | 50 | **3.130** | 0.586 | (1–5) | 0.172 | - |

* *p*-values less than 0.05.

For a comparison of academic performance, Table 8 illustrates the outcomes achieved by students after the physics course, categorized by gender. The table also includes studies that share similar variables, showcasing the final grades obtained in the Physics courses, denoted as "F", or scores on assessments evaluating the knowledge of physics concepts, such as CSEM (Conceptual Survey of Electricity and Magnetism), FCI (Force Concept Inventory), or FMCE (Force and Motion Conceptual Evaluation).

**Table 8.** Academic performance by gender.

| Study | Variable Output | *n* | Female Mean | SD | *n* | Male Mean | SD | Scale | *p* | d |
|---|---|---|---|---|---|---|---|---|---|---|
| Our Study | F | 92 | **89.9** | 10.2 | 157 | 85.4 | 12.5 | (0–100) | 0.00139 * | 0.0373 |
| Andersson [8] | F | 348 | 3.35 | 0.03 | 791 | **3.64** | 0.03 | (0–5) | <0.001 ** | - |
| Kalender [9] | F<br>CSEM | 469<br>469 | 2.36<br>0.48 | 0.98<br>0.19 | 998<br>998 | **2.48**<br>**0.55** | 1.06<br>0.19 | (0–4)<br>(0–1) | 0.08<br><0.001 ** | 0.11<br>0.40 |
| Henderson [10] | CSEM | 323 | 60 | 16 | 1084 | **66** | 16 | (0–100) | <0.001 ** | 0.37 |
| Traxler [11] | FCI | 1088<br>146<br>82 | 65<br>45<br>51 | 18<br>18<br>19 | 3628<br>464<br>361 | **73**<br>**57**<br>**64** | 17<br>24<br>20 | (0–100)<br>(0–100)<br>(0–100) | <0.001 **<br><0.001 **<br><0.001 ** | 0.46<br>0.56<br>0.69 |
| Nissen [7] | FMCE<br>F | 28<br>29 | 48.1<br>**2.34** | 27.5<br>1.35 | 145<br>162 | **63.2**<br>2.31 | 28.7<br>1.31 | (0–100)<br>(0–4) | -<br>- | -<br>- |
| Kost [12] | FMCE<br>F | 533<br>848 | 56.8<br>2.41 | 29<br>0.92 | 1566<br>2715 | **67.3**<br>**2.53** | 27<br>0.99 | (0–100)<br>(0–4) | <0.001 **<br><0.05 * | 0.38<br>0.11 |
| Naz [36] | F | 81 | **68.17** | 8.270 | 81 | 64.73 | 6.667 | - | 0.04 * | - |

* *p*-values less than 0.05. ** *p*-values less than 0.001.

Contrary to the findings in the literature, our study reveals that, in this study case, female students achieved a superior overall score in the physics course. This final grade encompassed various exams assessing different aspects of the course, and in each of them, the average score of female students surpassed that of their male counterparts. Existing studies commonly indicate that women tend to outperform men in academic performance overall [38], but within the domain of physics, a gender gap becomes apparent where women face a disadvantage; this disparity is evident in Table 8.

### 3.2. Demographics.

In Table 9, we can see the educational level of the parents of the students in the course; most of them are university graduates (Mother: 66.3%; Father: 53%). Followed by a master's degree, with 14.9% for Mothers and 32.9% for Fathers.

**Table 9.** Demographics: Parents' educational level in the sample.

| | Mother | | | Father | | |
|---|---|---|---|---|---|---|
| **Educational Level** | **F** | **M** | **Total** | **F** | **M** | **Total** |
| Middle School | 1 (1.1%) | 4 (2.5%) | 5 (2.0%) | 2 (2.2%) | 3 (1.9%) | 5 (2.0%) |
| High School | 10 (10.9%) | 20 (12.7%) | 30 (12.0%) | 2 (2.2%) | 12 (7.6%) | 14 (5.6%) |
| University | 66 (71.7%) | 99 (63.1%) | 165 (66.3%) | 57 (62.0%) | 75 (47.8%) | 132 (53.0%) |
| Master | 12 (13.0%) | 25 (15.9%) | 37 (14.9%) | 27 (29.3%) | 55 (35.0%) | 82 (32.9%) |
| Doctorate | 1 (1.1%) | 4 (2.5%) | 5 (2.0%) | 1 (1.1%) | 3 (1.9%) | 4 (1.6%) |
| Other | 2 (2.2%) | 5 (3.2%) | 7 (2.8%) | 3 (3.3%) | 9 (5.7%) | 12 (4.8%) |
| **Total** | **92 (100%)** | **157 (100%)** | **249 (100%)** | **92 (100%)** | **157 (100%)** | **249 (100%)** |

Table 10 shows how many of the students reported having engineer parents. Of the 249 students, 25 (10%) have an engineer mother (Female: 13%; Male: 8.3%), and 110 (44.2%) have an engineer father (Female: 40.2%; Male: 46.5%).

**Table 10.** Demographics: Engineer parents by gender. F and M stand for female and male.

| | | **F** | **M** | **Total** |
|---|---|---|---|---|
| Mother | Yes | 12 (13.0%) | 13 (8.3%) | 25 (10.0%) |
| | No | 80 (87.0%) | 144 (91.7%) | 224 (90.0%) |
| Father | Yes | 37 (40.2%) | 73 (46.5%) | 110 (44.2%) |
| | No | 55 (59.8%) | 84 (53.5%) | 139 (55.8%) |

## 4. Discussion

### 4.1. Motivation

RQ1. Do female first-year engineering students in this context exhibit different motivation levels than male students? Yes. In this case, female students feel more motivated than male students, both intrinsically and extrinsically, so it is important to recognize and work on external and internal elements that may intervene in their motivation and, thus, contribute to their academic performance. As mentioned before, female students in our sample and this context show higher scores on both the IMO and EMO scales, especially IMO (see Table 4), while in the other studies, male students tend to show higher scores on the motivation scale.

### 4.2. Procrastination

RQ2. Are there gender differences in the levels of procrastination among engineering students? Yes. However, generally, students do not identify with procrastinating attitudes. In this study, male students obtained a higher mean, so we can say that they tend to postpone school activities more. This is consistent with the findings reported in the existing literature, as we showed in the previous section and Table 4, where male students exhibit a higher level of academic procrastination across different contexts.

### 4.3. Academic Performance

RQ3. Are female first-year engineering students disadvantaged in academic performance in physics courses in this environment? No. Although there is still a gender gap in our country, mainly in STEM, we observed that in our sample, women showed better academic performance than men (see Table 4), contrary to findings in the literature, as shown in the previous section. In our correlation test (see Table 5), IMO presents a higher correlation between gender and academic performance. As a possible explanation, we suppose that, in this case, the family and university context where these female students develop allows them to overcome the difficulties that females usually face in engineering and enrich their motivations.

### 4.4. Demographics and Other Considerations

At a personal level, over half of the students in our sample come from families where both parents have completed their university education. Additionally, many students reported feeling that they grew up in an environment that fostered an interest in STEM subjects. This suggests that they feel a sense of familiarity and support for this discipline within their personal context. At the institutional level, we observed that the university strives to provide safe spaces for all students, specifically addressing the challenges faced by women, who often experience disadvantages in the field of engineering. The university aims to create an environment where female students can thrive and feel secure in their academic pursuits; furthermore, the Physics Department is half and half made up of female and male faculty members, whereas at the University level, until September 2022, it is made up of 45% men and 55% women [31]. Meanwhile, in other countries, the percentage of female lecturers in physics faculties is about 20% [32] and 26% [33].

### 4.5. Limitations of the Study

The sample consisted of first-year engineering students in the industrialized northern region of Mexico in a human-centered institution, which limits the generalizability of the findings to the entire university population. It would be valuable for future research to include higher levels of education as well. Additionally, it is essential to note that the study utilized a cross-sectional design and relied on student perceptions, making it difficult to establish direct causality based on the results.

## 5. Conclusions

In this work, we explored IMO, EMO, PRO, and demographics as potential factors that may be related to the absence of a gender gap in a first-year engineering course in Physics I, contrary to other cases in the literature where women present lower behavioral tendencies to procrastination but lower academic performance. In this case, our tests revealed significant differences in EMO and IMO, where females obtained higher means in IMO and males reported higher levels of PRO. We also show that there is a correlation between gender and IMO and between academic performance (F) and IMO. Thus, from these results, we encourage programs and strategies that strengthen women's intrinsic motivation (IMO) to contribute to the reduction of the gender gap in science and engineering courses. As a possible explanation, we suppose that, in this case, the family and university context where these female students develop allows them to overcome the difficulties that females usually face in engineering and enrich their motivations, so not failing to attend to the appropriate context for women's healthy development and empowerment is essential, including faculty equity and a safe environment, which contribute to their motivation.

On the other hand, other studies suggest considering that women may be disadvantaged in physics because of differences between instructors and course idiosyncrasies [39], the level of culture and discourse in a wider sense [8], women's self-efficacy traits and performance undermined by physics instruction [7], collaborative and feminist pedagogies to tackle gender disparity and influence students' motivation [35], or that male students seem to respond more positively to extrinsic motivation, while female students tend to have more intrinsic motivations [36].

In previous works, we have also observed notable gender differences, particularly in the development of multiple intelligence among students [40], which, in conjunction with this study, reaffirms the importance of further investigating observable differences among students to reduce the gender gap. Therefore, gaining a deeper understanding of our students through study allows us to identify their needs and create an environment of equity, respect, and social responsibility, aligning with the university's founding principles. This contributes to narrowing the gender gap that still exists within our society.

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## References

1. UNESCO. UNESCO in Action for Gender Equality, 2020–2021. Francia. 2022. Available online: https://unesdoc.unesco.org/ark:/48223/pf0000380680 (accessed on 25 June 2023).
2. UNESCO. UNESCO Moving Forward the 2030 Agenda for Sustainable Development. 2022. Available online: https://es.unesco.org/creativity/sites/creativity/files/247785en.pdf (accessed on 25 June 2023).
3. Hasti, H.; Amo-Filva, D.; Fonseca, D.; Verdugo-Castro, S.; García-Holgado, A.; García-Peñalvo, F.J. Towards Closing STEAM Diversity Gaps: A Grey Review of Existing Initiatives. *Appl. Sci.* **2022**, *12*, 12666. [CrossRef]
4. Hardtke, M.; Khanjaninejad, L.; Lang, C.; Nasiri, N. Gender Complexity and Experience of Women Undergraduate Students within the Engineering Domain. *Sustainability* **2022**, *15*, 467. [CrossRef]
5. Chauke, T.A. Gender Differences in Determinants of Students' Interest in STEM Education. *Soc. Sci.* **2022**, *11*, 534. [CrossRef]
6. Morán-Soto, G.; González-Peña, O.I. Mathematics Anxiety and Self-Efficacy of Mexican Engineering Students: Is There Gender Gap? *Educ. Sci.* **2022**, *12*, 391. [CrossRef]
7. Nissen, J.M.; Shemwell, J.T. Gender, experience, and self-efficacy in introductory physics. *Phys. Rev. Phys. Educ. Res.* **2016**, *12*, 020105. [CrossRef]
8. Andersson, S.; Johansson, A. Gender gap or program gap? Students' negotiations of study practice in a course in electromagnetism. *Phys. Rev. Phys. Educ. Res.* **2016**, *12*, 020112. [CrossRef]
9. Kalender, Z.Y.; Marshman, E.; Schunn, C.D.; Nokes-Malach, T.J.; Singh, C. Damage caused by women's lower self-efficacy on physics learning. *Phys. Rev. Phys. Educ. Res.* **2020**, *16*, 010118. [CrossRef]
10. Henderson, R.; Stewart, G.; Stewart, J.; Michaluk, L.; Traxler, A. Exploring the gender gap in the conceptual survey of electricity and magnetism. *Phys. Rev. Phys. Educ. Res.* **2017**, *13*, 020114. [CrossRef]
11. Traxler, A.; Henderson, R.; Stewart, J.; Stewart, G.; Papak, A.; Lindell, R. Gender fairness within the force concept inventory. *Phys. Rev. Phys. Educ. Res.* **2018**, *14*, 010103. [CrossRef]
12. Kost, L.E.; Pollock, S.J.; Finkelstein, N.D. Characterizing the gender gap in introductory physics. *Phys. Rev. Spec. Top.-Phys. Educ. Res.* **2009**, *5*, 010101. [CrossRef]
13. Barthelemy, R.S.; Knaub, A.V. Gendered motivations and aspirations of university physics students in Finland. *Phys. Rev. Phys. Educ. Res.* **2020**, *16*, 010133. [CrossRef]
14. Dominguez-Lara, S.; Prada-Chapoñan, R.; Moreta-Herrera, R. Gender differences in the influence of per-sonality on academic procrastination in Peruvian college students. *Acta Colomb. Psicol.* **2019**, *22*, 125–136. [CrossRef]
15. Kassim, F.; Samiun, N.S.; Ahmad, N.; Zamri, N.A.A.Z.A.; Kamarulzaman, W. Gender Difference in Procrastination Among University Students. *Asian J. Res. Educ. Soc. Sci.* **2022**, *4*, 11–22.
16. Roy, R.; Banerjee, D.D. Procrastination amongst Undergraduate Students in Relation to Gender and Stream. *J. Posit. Sch. Psychol.* **2022**, *6*, 8808–8817.
17. Balkis, M.; Erdinç, D.U.R.U. Gender differences in the relationship between academic procrastination, satifaction with academic life and academic performance. *Electron. J. Res. Educ. Psychol.* **2017**, *15*, 105–125. [CrossRef]
18. Garcia, M.I.; Caraig, D.J.; Carator, K.; Oyco, M.T.; Tababa, G.A.; Linaugo, J.; De Oca, P.R. The Influence of Gadget Dependency on the Academic Procrastination Levels of Grade 12 STEM Students. *Int. J. Multidiscip. Appl. Bus. Educ. Res.* **2022**, *3*, 1197–1210. [CrossRef]
19. Vallerand, R.J.; Pelletier, L.G.; Blais, M.R.; Briere, N.M.; Senecal, C.; Vallieres, E.F. The Academic Motivation Scale: A measure of intrinsic, extrinsic, and amotivation in education. *Educ. Psychol. Meas.* **1992**, *52*, 1003–1017. [CrossRef]
20. Rabin, L.A.; Fogel, J.; Nutter-Upham, K.E. Academic procrastination in college students: The role of self-reported executive function. *J. Clin. Exp. Neuropsychol.* **2011**, *33*, 344–357. [CrossRef]
21. Lay, C.H. At last, my research article on procrastination. *J. Res. Personal.* **1986**, *20*, 474–495. [CrossRef]

22. Rudolph, A.L.; Lamine, B.; Joyce, M.; Vignolles, H.; Consiglio, D. Introduction of interactive learning into French university physics classrooms. *Phys. Rev. Spec. Top.-Phys. Educ. Res.* **2014**, *10*, 010103. [CrossRef]
23. Halim, L.; Abd Rahman, N.; Zamri, R.; Mohtar, L. The roles of parents in cultivating children's interest towards science learning and careers. *Kasetsart J. Soc. Sci.* **2018**, *39*, 190–196. [CrossRef]
24. Józsa, G.; Oo, T.Z.; Amukune, S.; Józsa, K. Predictors of the Intention of Learning in Higher Education: Motivation, Self-Handicapping, Executive Function, Parents' Education and School Achievement. *Educ. Sci.* **2022**, *12*, 906. [CrossRef]
25. Universidad de Monterrey. UDEM Essence. Available online: https://www.udem.edu.mx/en/conoce/esencia-udem (accessed on 27 April 2022).
26. Universidad de Monterrey. Valores. Available online: https://www.udem.edu.mx/es/conoce/valores (accessed on 27 April 2022).
27. Universidad de Monterrey. Principios Fundacionales. Available online: https://www.udem.edu.mx/es/conoce/principios-fundacionales (accessed on 27 April 2022).
28. Centro de Equidad de Género e Inclusión (CEGI) Informe Anual 2021–2022. Available online: https://www.udem.edu.mx/sites/default/files/2022-12/Reporte_Anual_CEGI_2022.pdf (accessed on 27 April 2023).
29. Centro de Equidad de Género e Inclusión (CEGI) Informe Anual 2020–2021. Available online: https://www.udem.edu.mx/sites/default/files/2021-09/CEGI-Informe-anual-2020-2021.pdf (accessed on 27 April 2023).
30. Centro de Equidad de Género e Inclusión (CEGI). Available online: https://www.udem.edu.mx/es/institucional/cegi-centro-de-equidad-de-genero-e-inclusion (accessed on 27 April 2022).
31. Universidad de Monterey, Informe Anual 2022. Available online: https://www.udem.edu.mx/es/institucional/informe-anual-2022 (accessed on 22 November 2023).
32. Viefers, S.F.; Christie, M.F.; Ferdos, F. Gender equity in higher education: Why and how? A case study of gender issues in a science faculty. *Eur. J. Eng. Educ.* **2006**, *31*, 15–22. [CrossRef]
33. Cama, M.G.; Jorge, M.L.; Peña, F.J.A. Gender differences between faculty members in higher education: A literature review of selected higher education journals. *Educ. Res. Rev.* **2016**, *18*, 58–69. [CrossRef]
34. The R Foundation. The R Project for Statistical Computing. Available online: https://www.r-project.org/ (accessed on 29 April 2022).
35. Ng, D.T.K.; Chu, S.K.W. Motivating students to learn STEM via engaging flight simulation activities. *J. Sci. Educ. Technol.* **2021**, *30*, 608–629. [CrossRef]
36. Naz, S.; Shah, S.A.; Qayum, A. Gender Differences in Motivation and Academic Achievement: A Study of the University Students of KP, Pakistan. *Glob. Reg. Rev.* **2020**, *5*, 67–75. [CrossRef]
37. Busko, D.A. Causes and Consequences of Perfectionism and Procrastination: A Structural Equation Model. Master's Thesis, University of Guelph, Guelph, ON, USA, 1998. Available online: https://atrium.lib.uoguelph.ca/items/e42af446-ed92-44b7-9ebe-d842068fe363 (accessed on 24 November 2023).
38. Pilotti, M.A.E. What Lies beneath Sustainable Education? Predicting and Tackling Gender Differences in STEM Academic Success. *Sustainability* **2021**, *13*, 1671. [CrossRef]
39. Sanders, W.L.; Horn, S.P. The Tennessee value-added assessment system (TVAAS): Mixed-model methodology in educational assessment. *J. Pers. Eval. Educ.* **1994**, *8*, 299. [CrossRef]
40. Chavarría-Garza, W.X.; Santos-Guevara, A.; Morones-Ibarra, J.R.; Aquines-Gutiérrez, O. Assessment of Multiple Intelligences in First-Year Engineering Students in Northeast Mexico. *Sustainability* **2022**, *14*, 4631. [CrossRef]