# Implications of motivation in the application of technologists' learning strategies

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**Abstract**
This study aimed to investigate the association between intrinsic and extrinsic motivation for the use of cognitive and metacognitive learning strategies in technologists. Possible differences in both constructs in terms of sex and course were also analyzed. Participants were 96 students from two technological courses at a public education institution in the state of São Paulo. The Motivation to Learn Scale for University Students and the Scale for Learning Strategies for University Students were used. The results showed the prevalence of intrinsic motivation and metacognitive strategies. The motivational orientations were positively related to cognitive and metacognitive strategies. There were no differences regarding gender, or the course attended. New studies should broaden the knowledge about the characteristics of this public, whose course curricula are directed toward inclusion in the labor market and include practical activities as a reality.
*Keywords:* technology courses; motivation to learn; learning strategies

**Implicações da Motivação na Aplicação das Estratégias de Aprendizagem de Tecnólogos**

**Resumo**
O objetivo desta pesquisa foi investigar a associação existente entre a motivação intrínseca e extrínseca para o uso das estratégias de aprendizagem cognitivas e metacognitivas em tecnólogos. Foram analisadas também as possíveis diferenças em ambos os construtos em face do sexo e do curso. Participaram 96 estudantes de dois cursos tecnológicos de uma instituição de ensino pública do interior paulista. Foram utilizadas a Escala de Avaliação da Motivação para Aprender de Universitários e a Escala de Estratégias de Aprendizagem em Universitários. Os resultados apontaram a prevalência da motivação intrínseca e das estratégias metacognitivas e que as orientações motivacionais se relacionaram positivamente com as estratégias cognitivas e metacognitivas. Não houve diferenças em relação ao sexo e ao curso frequentado. Novos estudos devem ampliar os conhecimentos quanto às características desse público que em seus cursos tem objetividade dos seus currículos para a inserção no mercado de trabalho e as atividades práticas como uma realidade.
*Palavras-chave:* cursos de tecnologia; motivação para aprender; estratégias de aprendizagem

**Implicaciones de la motivación en la aplicación de estrategias de aprendizaje de los tecnólogos**

**Resumen**
El objetivo de este estudio fue investigar la asociación entre la motivación intrínseca y extrínseca para el uso de estrategias de aprendizaje cognitivo y metacognitivo en tecnólogos. También se analizaron las posibles diferencias en ambos constructos en cuanto a sexo y curso. Participaron 96 estudiantes de dos cursos tecnológicos de una institución de educación pública de la provincia de São Paulo. Se utilizó la Escala de Motivación para Aprender para Estudiantes Universitarios y la Escala de Estrategias de Aprendizaje para Estudiantes Universitarios. Los resultados mostraron la prevalencia de la motivación intrínseca y las estrategias metacognitivas y que las orientaciones motivacionales se relacionaron positivamente con las estrategias cognitivas y metacognitivas. No hubo diferencias con respecto al género y al año de escolarización. Nuevos estudios deben ampliar el conocimiento sobre las características de este público, cuyos planes de estudio se orientan para la inserción en el mercado laboral e incluyen las actividades prácticas como una realidad.
Palabras clave:formación tecnológica; motivación para aprender; estrategias de aprendizaje.

Technological courses are higher education courses for specialized training, characterized by technological axes, therefore maintaining a close relationship with scientific processes. Based on the 2019 Higher Education Census by the National Institute of Educational Studies and Research Anísio Teixeira (INEP, 2020), these courses showed the largest enrollment percentage increase, causing this academic degree participation to reach 14.3% of undergraduate enrollment. However, this percentage shows that the teaching modality in Brazil is still not very significant concerning bachelor and licentiate courses (Brasil, 2021).

In other countries, mainly from the Organization for Economic Co-operation and Development (OECD), this percentage reaches 70% of young people included in the Professional and Technological


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Education program. In the European Union, the Copenhagen Process, launched in 2002, aims to improve the performance, quality, and attractiveness of professional education, known as Vocational Education and Training (VET), through cooperation at the European level. In this training system, the student learns contents articulated with the demands of real life to propose new paths for a society based on innovation (European Commission, 2002; OCDE, 2015).

It is also the mission of the Brazilian educational institution where this study was carried out, which is public and supported by the state. The courses listed are in the most sought after areas, according to the distribution of enrollments in technological graduation courses, by broad area and administrative category of the National Institute of Educational Studies and Research Anísio Teixeira (INEP, 2020), namely Computing and Information and Communication Technologies with 55.8% and Business, Administration and Law, with 16.0%.

The International Organization of the Inter-American Centre for Knowledge Development in Vocational Training (Cinterfor) highlights that the future of work requires developing so-called 21st-century skills, including basic skills (science, mathematics, and reading), critical thinking, and socio-emotional skills. The United Nations Educational, Scientific and Cultural Organization (UNESCO) report confirms the importance of these skills for the world of work and highlights the metacognitive abilities of future professionals (Cinterfor, 2017; UNESCO, 2015).

Social Cognitive Psychology constructs, precisely the motivation to learn and the learning strategies, meet this 21st-century academic and professional skills. Specifically, regarding the motivation to learn, individuals have a natural tendency towards more autonomous motivation. Therefore they get involved in activities to satisfy their three basic psychological needs: competence, autonomy, and bond. However, motivation is a characteristic of the student and mediated by the teacher, the classroom environment, and the school culture. Extrinsic motivation mobilizes the student's interest and engagement through external means, expressed by seeking rewards and the desire to successfully fulfill people's expectations (Boruchovitch, 2009; Bzuneck & Boruchovitch, 2019; Deci & Ryan, 2014).

Student motivation appears as one of the main themes related to the learning process in technological education and professional practice (Schaap et al., 2012). Both intrinsic and extrinsic motivation predict students' engagement with theoretical and practical activities (Bakar, 2014). By focusing on the planning and systematization of teaching processes, the application of student-centered pedagogical practices increases the motivational quality of students by providing greater levels of pleasure and effort, expanding the perception of autonomy, competence and ability in interpersonal relationships (Smith et al., 2013).

By characterizing the motivational profile of Brazilian students in technical education, Fontes and Duarte (2019) found that the learning process is reflected in a series of changes in student motivation. It can vary from intrinsic motivation to achievement-focused motivation, emphasizing the more extrinsic aspects, such as obtaining good results and instrumental motivation, in which little student involvement is identified, less value attributed to learning, and lack of interest. In a Brazilian sample of technological education, Mello and Leme (2016) showed that some of the students presented intrinsic motivation, indicating autonomy and interest in learning, while others indicated extrinsic motivation, associated with the need for external recognition. From this perspective, Júlio et al. (2020) considered that intrinsic and extrinsic motivation in technical education is interactive. Intrinsic motivation has a connotation of identification and interest of the student in the course, beneficial for quality learning. Extrinsic motivation is triggered by the possibility of entering the labor market, making the student dedicate themself to completing the course.

According to the definitions of Dembo (1994) and Garner and Alexander (1989), learning strategies are classified into two groups. Cognitive ones are related to thinking and behavior and allow information to be stored more effectively. In contrast, metacognitive ones are more complex, as they involve planning, monitoring, and regulation of thought for learning. Dembo (1994) explains that cognitive strategies are divided into three categories: rehearsal that involves actions such as repeating, copying, and underlining; elaboration that includes actions to summarize, create analogies and answer questions; and organization that involves selecting ideas and making diagrams and concept maps. Metacognitive knowledge involves three types of student knowledge: declarative, which corresponds to self-knowledge; procedural, which is knowledge about the task; and conditional, which is knowledge about the conditions that influence their learning.

A prevalence of cognitive strategies among students of technical education (Fontes & Duarte, 2020; Scacchetti et al., 2015) and technological education

(Engin & Korucuk, 2020; Scacchetti et al., 2015) has been recognized. Fontes and Duarte (2020) found that Brazilian students in technical education used more surface strategies based on the accumulation of information that is later reproduced without proper contextualization with prior knowledge. These authors also found intermediate strategies, which combine aspects of surface and depth strategies, centered on the combination of memorization with the understanding of aspects related to task execution and vice versa. Students also showed variations in the application of these strategies in their academic routine.

The study results by Fontes and Duarte (2020) converge with Engin and Korucuk (2020) since greater adherence to cognitive strategies of the rehearsal type and little use of organization strategies was identified in the investigated sample of Turkish students of technological education. Also, in the study by Engin and Korucuk (2020), the women applied more rehearsal, comprehension monitoring, and affective strategies than the male students. However, the elaboration and organization strategies did not differ between the sexes. There were also differences in the use of strategies due to the courses offered in Private Security and Protection, Public Relations, Occupational Health and Safety, Logistics, and Early Childhood.

The studies above show that, in general, there is less adherence to metacognitive strategies. It can be a problem when thinking about technical and technological teaching as a space for developing critical thinking, self-regulated learning, and creativity (Heong et al., 2019; UNESCO, 2015). In this context, Psychological and Educational Assessment contributes to the development of diagnoses about the motivational condition of students and how learning strategies are being applied in the academic routine. The results of this type of investigation can be used to propose improvements in teaching practices.

This study aimed to investigate the association between intrinsic and extrinsic motivation for the use of cognitive and metacognitive learning strategies. It was considered the importance of motivation and the appropriate use of strategies to optimize the learning of theoretical concepts linked to the practical procedures required in technological education. The study also aimed to analyze the differences in both constructs regarding the students' biological sex and the course. As hypotheses, it was considered that both intrinsic and extrinsic motivation correlate and predict cognitive and metacognitive strategies (Fontes & Duarte, 2019; Mello et al., 2016; Julio et al., 2020) and that they would possibly differ according to biological sex and course (Engin & Korucuk, 2020).

## Method

*Participants*

Study participants were 96 students from two technological courses, Financial Management ($n$ = 55) and Information Technology Management (IT; $n$ = 41), of a public education institution in the state of São Paulo. Of these students, 57 were female, representing 59.4% of the sample.

*Instruments*

Motivation to Learn Evaluation Scale for University Students *(Escala de Avaliação da Motivação para Aprender de Alunos Universitários* - EMA-U; Boruchovitch & Neves, 2005). This scale comprises 26 closed items, with a four-point Likert-type scale, with options ranging from "*strongly agree*" to "*strongly disagree*." The Intrinsic Motivation Factor is composed of 14 items, and the Extrinsic Motivation Factor 12. Higher scores denote a greater orientation of the student towards intrinsic motivation (IM). This score is inverted for the items related to the extrinsic motivation (EM) subscale. In this case, the lower the score, the more the individual is oriented to EM. The EMA-U has evidence of validity based on the internal structure and reliability estimates in a sample of Higher Education students (Boruchovitch, 2008). Reliability[1] was also verified in the sample evaluated through the coefficients ω total = .75; α = .71 in the Intrinsic Motivation Factor and ω total = .79; α = .78 in the Extrinsic Motivation Factor.

Learning Strategies Scale for University Students *(Escala de Estratégias de Aprendizagem em Universitários* EEA-U; Santos & Boruchovitch, 2008). This scale has 49 closed questions, 19 relating to cognitive strategies; 23 to metacognitive strategies; and 7 to the absence of metacognitive or dysfunctional strategies. The response alternatives are arranged on a 4-point Likert-type scale: *"always," "sometimes," "rarely," "never."* The EEA-U was constructed so that the higher the score obtained, the more strategic the student is. The instrument has reliability estimates for a sample of university students (Santos & Boruchovitch, 2008), and for the sample investigated in this study 1: Cognitive Strategies subscale: ω total =

[1] Reference values for interpreting the adequacy of McDonald's Omega (ω total) and alpha coefficient (α): >.70 (Dunn et al., 2014).

.76; α = .76; Metacognitive Strategies Subscale: ω total = .78; α = .75; Absence of Metacognitive or Dysfunctional Strategies Subscale: ω total = .73; α = .72.

*Data collection procedure*

All ethical recommendations were followed, based on Resolution No. 510/2016 (research project approved by the Research Ethics Committee of the institution to which it is linked, CAAE: 08775419.6.0000.5102). Participants were assured that the study would not influence their grades, affect their academic performance at the university, and be strictly confidential. The scales were applied collectively, in the classroom, according to the instructions that accompany and standardize their application. Before responding to scale items, the participants were asked to answer questions about their identification and complete the consent form. The time taken to complete each instrument ranged from 15 to 20 minutes.

*Data analysis procedure*

*Statistical software. Statistical Package for the Social Sciences* software (SPSS; V. 25.0); Jasp (Goss-Sampson, 2019).

*Descriptive analyses.* Sample characterization and verification of means and standard deviations of instrument scores. The weighted sum of items based on the answer key was applied, with a minimum score of 1 point and a maximum of 4 points for both instruments used in the study. The result of the Shapiro-Wilk (*S-W*) test indicated that practically none of the factors of the scales deviated from normality: EMA-U, Intrinsic Motivation Factor, $S\text{-}W$ (96) = .977, $p$ = .10; Extrinsic Motivation Factor, $S\text{-}W$ (96) = .989, $p$ = .60; EEA-U: Cognitive Strategies Subscale, $S\text{-}W$ (96) = .968, $p$ = .02; Metacognitive Strategies Subscale, $S\text{-}W$ (96) = .975, $p$ = .06; Absence of Metacognitive or Dysfunctional Strategies Subscale, $S\text{-}W$ (96) = .975, $p$ = .07.

*Association between motivation constructs and learning strategies.* Pearson's moment product correlation and multiple linear regression analysis (forward method). Interpretation of the magnitude of the correlations: $r \leq .29$, weak; ≅ .30 to .69, moderate; $r \geq .70$, strong (Dancey & Reidy, 2013). Residual autocorrelation values between 1.5 and 2.5 were considered acceptable (Field, 2013). It is noteworthy that, as shown in Table 1, the result of the Chi-square test of independence ($\chi^2$ 2x2) showed no relationship between the course attended and biological sex. Therefore, these variables were not controlled in the correlation and multiple linear regression analyses.

*Comparison of groups.* Student's *t*-test. The size of the statistical significance effect was calculated through Cohen's *d*, with its interpretation based on $d \leq .20$, small effect; $d \leq .40$, medium effect; $d \leq .80$, large effect (Cohen, 1992).

## Results

Table 2 presents the mean and standard deviation values obtained by the students in the EMA-U factors and the EEA-U subscales and the correlations identified between the constructs. Based on the scores on the instruments, intrinsic motivation and recognition of metacognitive strategies prevailed among the students. The statistically significant, positive correlations indicate that the intrinsic and extrinsic motivational level is linked to learning strategies and vice versa. Analogous interpretation applies to the correlations between extrinsic and intrinsic motivation and the correlations identified between the learning strategies. In intrinsic motivation, correlations of moderate magnitude were obtained with cognitive and metacognitive strategies and extrinsic motivation. Furthermore, extrinsic motivation showed a weak correlation with the absence of metacognitive or dysfunctional strategies. Correlations of moderate magnitude were also identified between metacognitive strategies and cognitive strategies, and metacognitive strategies and the absence of metacognitive or dysfunctional strategies.

Table 1.
*χ2 Test (2x2) between the Course and Gender Variables*

| | Course | | $\chi^2(df)$ | *p* |
|---|---|---|---|---|
| Biological sex | Financial Management | IT Management | | |
| Male | 32 | 25 | .076 (1) | .8 |
| Female | 23 | 16 | | |

Legend. $\chi^2$ = Chi-square test; *df* = degrees of freedom.

After verifying the correlations between the constructs, the predictive effect of intrinsic and extrinsic motivation for learning strategies was analyzed. The results of this analysis are presented in Table 3. Initially, it was found that the residual autocorrelation in the multiple regression model remained within the acceptable limit. Intrinsic motivation explained 20% of the variance in the use of cognitive strategies ($F$ [1, 94] = 25.249, $p$ < .001) and 17% of the variance in the use of metacognitive strategies ($F$ [1, 94] = 20.451, $p$ < .001). The positive direction of the standardized $\beta$ values indicates that the increase in intrinsic motivation contributed to using both learning strategies, especially those of a cognitive order (.46). Extrinsic motivation was not a predictor of cognitive strategies ($\beta$ = -.094, $t$ = -.892, $p$ = .37) or metacognitive strategies ($\beta$ = -.086, $t$ = -.795, $p$ = .43).

The absence of metacognitive or dysfunctional strategies had 7% of its variance explained by extrinsic motivation ($F$ [1, 94] = 7.527, $p$ < .01), suggesting that the increase in external motivation had repercussions of .14 points in students' comprehension of the appropriate use of metacognitive strategies. Intrinsic motivation was not a predictor of this aspect of learning strategies ($\beta$ = -.074, $t$ = -.648, $p$ = .52).

Finally, Table 4 shows no statistically significant differences in the students' intrinsic and extrinsic motivation or learning strategies due to biological sex

Table 2.
*Means, Standard Deviations and Correlations between Motivation and Learning Strategies (N = 96)*

| | *M* | *SD* | 1. IM | 2. EM | 3. $S_{Cog}$ | 4. $S_{Metac}$ | 5. $Abs_s$ |
|---|---|---|---|---|---|---|---|
| 1. IM | 3.35 | .32 | - | | | | |
| 2. EM | 2.88 | .42 | **.49*** ** | - | | | |
| 3. $S_{Cog}$ | 2.86 | .38 | **.46*** ** | .15 | - | | |
| 4. $S_{Metac}$ | 3.18 | .32 | **.42*** ** | .14 | **.60*** ** | - | |
| 5. $Abs_s$ | 2.81 | .57 | .19 | **.27**** | .03 | **.32**** | - |

*Legend.* IM = Intrinsic Motivation; EM = Extrinsic Motivation; $S_{Cog}$ = Cognitive Strategies; $S_{Metac}$ = Metacognitive Strategies; $Abs_s$ = Absence of Metacognitive or Dysfunctional Strategies.

*Note.* Values in bold indicate statistically significant correlations.

* $p$ < .05; ** $p$ < .01; *** $p$ < .001

Table 3.
*Intrinsic and Extrinsic Motivation as Predictors of Learning Strategies*

| DV: Cognitive Strategies | | | | | |
|---|---|---|---|---|---|
| VI predictor | $\beta$ | $t$ | $p$ | $\Delta R^2$ | Durbin-Watson |
| (Constant) | - | 2.755 | < .01 | - | 1.797 |
| Intrinsic Motivation | .46 | 5.025 | < .001 | .20 | |
| DV: Metacognitive Strategies | | | | | |
| VI predictor | $\beta$ | $t$ | $p$ | ΔR2 | Durbin-Watson |
| (Constant) | - | 5.399 | < .001 | - | 1.632 |
| Intrinsic Motivation | .09 | .4522 | | .17 | |
| DV: Absence of Metacognitive or Dysfunctional Strategies | | | | | |
| VI predictor | $\beta$ | $t$ | $p$ | $\Delta R^2$ | Durbin-Watson |
| (Constant) | - | 4.349 | < .001 | - | 2.235 |
| Extrinsic Motivation | .14 | 2.744 | < .01 | .07 | |

or course. In comparisons by sex, Cohen's *d* values indicate a negligible effect. The same was observed for the course variable regarding extrinsic motivation, metacognitive strategies, and the absence of metacognitive or dysfunctional strategies. There was also a small effect size in the comparisons between courses for intrinsic motivation and cognitive strategies. Therefore, internal or external regulation motivation and the types of learning strategies (cognitive/metacognitive/absence of metacognitive or dysfunctional strategies) do not differ between male and female students, nor between students studying Financial Management and IT Management. However, when focusing on the practical importance of these comparisons, there was a small effect in the differences identified between courses regarding intrinsic motivation and the recognition of metacognitive strategies.

## Discussion

This study found both intrinsic and extrinsic motivation in the sample of students from technologist courses, as indicated by studies on technical education (Júlio et al., 2020) and technological education (Mello & Leme, 2016). Intrinsic motivation was prevalent, which denotes the mobilization of internal resources aimed at interest, autonomy, and engagement in the course. Metacognitive strategies stood out concerning the other learning strategies, in disagreement with studies that commonly identify the recognition of cognitive strategies by students of technical (Fontes & Duarte,

Table 4.
*Extrinsic and Intrinsic Motivation and Learning Strategies according to Biological Sex and Course*

| Constructs | Biological sex | *N* | *t** | *p* | *M* | *SD* | *d* |
|---|---|---|---|---|---|---|---|
| Intrinsic Motivation | Men | 57 | -.561 | .58 | 3.34 | .33 | .10 |
| | Women | 39 | | | 3.37 | .29 | |
| Extrinsic Motivation | Men | 57 | .224 | .82 | 2.88 | .44 | .05 |
| | Women | 39 | | | 2.86 | .39 | |
| Cognitive Strategies | Men | 57 | -.797 | .43 | 2.83 | .37 | .19 |
| | Women | 39 | | | 2.90 | .39 | |
| Metacognitive Strategies | Men | 57 | -.779 | .44 | 3.16 | .31 | .16 |
| | Women | 39 | | | 3.21 | .34 | |
| Absence of Metacognitive or Dysfunctional Strategies | Men | 57 | .816 | .42 | 2.85 | .50 | .18 |
| | Women | | | | 2.75 | .63 | |
| Constructs | Course | *N* | *t** | *p* | *M* | *SD* | *d* |
| Intrinsic Motivation | Fin. Man. | 55 | -1.115 | .27 | 3.32 | .33 | .23 |
| | IT Man. | 41 | | | 3.39 | .29 | |
| Extrinsic Motivation | Fin. Man. | 55 | .564 | .57 | 2.90 | .41 | .12 |
| | IT Man. | 41 | | | 2.85 | .43 | |
| Cognitive Strategies | Fin. Man. | 55 | .207 | .25 | 2.90 | .40 | .24 |
| | IT Man. | 41 | | | 2.81 | .35 | |
| Metacognitive Strategies | Fin. Man. | 55 | .220 | .50 | 3.16 | .35 | .16 |
| | IT Man. | 41 | | | 3.21 | .28 | |
| Absence of Metacognitive or Dysfunctional Strategies | Fin. Man. | 55 | .902 | .92 | 2.81 | .59 | .02 |
| | IT Man. | 41 | | | 2.82 | .56 | |

*Legend.* Fin. Man. = Financial Management; IT Man. = Information Technology Management; *M* = Mean; *SD* = Standard deviation; *d* = Cohen's *d* effect value.

*Note.* *degrees of freedom = 2

2020; Scacchetti et al., 2015) and technological courses (Engin & Korucuk, 2020; Scacchetti et al., 2015). The evidence of adherence to metacognitive strategies suggests that the students evaluated in this study intentionally reflected on what was learned, as well as on the applicability of theoretical concepts in practical activities, which presupposes optimization in the development of technical skills (Bakar, 2014; Heong et al., 2019; Jossberger et al., 2019; Schaap et al., 2012).

Regarding the main aim of this study, to investigate the associations between intrinsic and extrinsic motivation and learning strategies, it was found that both motivational orientations were positively related to cognitive and metacognitive strategies. This finding converges with studies that indicate that high levels of motivation, whether intrinsic or extrinsic, denote active participation in the course, demonstrated in the interest and pleasure in learning, as well as in the engagement to obtain the certificate of completion and a good position in the labor market (Júlio et al., 2020; Smit et al., 2013). The use of cognitive and metacognitive strategies follows the motivational quality of students, being necessary for the presentation of good academic performance and the exercise of practical activities in a simulated and practical environment (Bakar, 2014; Heong et al., 2019; Schaap et al., 2012). The extrinsic motivation was associated with the absence of metacognitive or dysfunctional strategies. It indicates that more effort and engagement in the course, motivated by the desire to obtain rewards and recognition from others, indicates more excellent student perception of the problematic use of metacognitive strategies.

It was also found that intrinsic and extrinsic motivations manifest themselves mutually, in agreement with the interaction perspective raised by Mello and Leme (2016) and Júlio et al. (2020). In turn, cognitive strategies were positively associated with metacognitive strategies, suggesting that they act reciprocally. Jossberger et al. (2019) stated that students use cognitive strategies to help them manage their time and mobilize resources to meet the demands of the course, while metacognitive strategies are developed due to the need for self-monitoring of the effectiveness of these procedures.

Although intrinsic and extrinsic motivations were correlated with cognitive and metacognitive strategies, the pattern of predictive relationships indicates that only motivation through internal regulation was a predictor of both learning strategies. This finding indicates that the encouragement of autonomy and exploratory behavior in solving problems identified in real situations fosters the interest of students and the notion of the relationships present in theoretical and technical concepts, increasing the adherence of cognitive and metacognitive strategies for the fulfillment of these tasks (Smit et al., 2013).

Extrinsic motivation proved to predict the students' perception of the absence of metacognitive or dysfunctional strategies. It is conjectured that characteristics of this motivational orientation, focused on external aspects, tend to broaden students' understanding of strategies that can disadvantage both academic success and future placement in the labor market. Accordingly, the absence of metacognitive strategies in the students' repertoire or the presence of dysfunctions in the functioning of these strategies, expressed by the lack of attention, concentration, and engagement, among other aspects, are not compatible with good academic performance or with attributes valued in the job recruitment and selection processes.

Therefore, it is assumed that extrinsic motivation helps students assess aspects that are not expected and valued by people and institutions, which did not occur with intrinsic motivation, as it did not predict the absence of metacognitive or dysfunctional strategies. However, unlike intrinsic motivation, which predicted cognitive and metacognitive strategies, extrinsic motivation was not a predictor of the recognition of these strategies. This result indicates that intrinsic and extrinsic motivations complement each other (Júlio et al., 2020) and should be continuously monitored and encouraged in technological education (Mello & Leme, 2016). Accordingly, among the various ways to promote motivation, the main one is the teacher being a model of a motivated person and at the same time a facilitator in seeking and assimilating information, as well as in the practical application of the knowledge acquired in the technological training (Smit et al., 2013).

The hypothesis of the specific aim was refuted since the students' intrinsic and extrinsic motivation levels did not differ due to their biological sex. Furthermore, no differences were identified in the use of learning strategies between the men and women. As mentioned in the introduction, Engin and Korucuk (2020) did not find gender distinctions in using cognitive strategies of the elaboration and organization type. However, other types of strategies have shown differences in favor of women. It is assumed that the result of this type of comparison is subject to the particularities of the evaluated sample. It involves subjectivity in

the perception and impact of gender roles, especially in students' motivation, manifested in the academic and social context, going beyond the scope of this study (Almeida, 2019). However, it is considered relevant to investigate and monitor possible differences in these constructs to minimize the negative impacts of gender stereotypes in technological education since there is no consensus on this topic (Engin & Korucuk, 2020).

Unlike what was found in the study conducted by Engin and Korucuk (2020), the comparison involving intrinsic and extrinsic motivations and the use of cognitive and metacognitive learning strategies in Financial Management and Information Technology Management students did not demonstrate differences due to the course. This type of investigation should consider the impact of the specifics of the technological course, the conditions offered by the educational institution, and the socioeconomic status of the profession in the motivational orientation of students and, consequently, in the types of learning strategies that are acquired throughout the training to fulfill the academic and professional demands. This proposal does not fall within the scope of this study; however, it is suggested that these aspects be included in future studies, aiming to investigate the effect of the contextual variables related to the technological course types on motivational differentiations and the application of learning strategies.

This study has the limitation of being carried out with a sample of two courses from a single public technological education institution. Therefore, the expansion of the sample of students in the field of technological education would enable the application of more robust data analysis, which would allow for an expansion in the investigation of the phenomena. These are students who have been increasing due to public policies both in the international and national context and that prioritize the job market. This focus on practical activities and the immediate application of acquired knowledge seem to favor specific motivational orientations and some learning strategies concerning bachelor's and licentiate's degree courses.

Future studies should select instruments that assess the most current forms of motivation to learn, as assessing it only in the intrinsic and extrinsic dimensions can be seen as a limitation. Even from this theoretical perspective, the inclusion of motivational aspects manifested in the Self-Determination Theory is recommended. This theory establishes levels for extrinsic motivation (external regulation, introjected regulation, and extrinsic motivation through identification and identified regulation) and encompasses intrinsic motivation and demotivation (Bzuneck & Boruchovitch, 2019).

It is also pertinent to consider the role of instrumental motivation and intrinsic and extrinsic motivation. This component of the Students' Approaches to Learning (SAL) Theory has been identified in Brazilian technical education students (Fontes & Duarte, 2019). It is conjectured that with the expansion of the list of motivational approaches, it will be possible to deepen the existing relationships between the motivation for learning of the technological education students and how they employ learning strategies in their study routine.

The practical nature attributed to most subjects of this type of teaching must be considered, and the constant contact with the labor market through internships, and the concurrence, on the part of their professors, teaching, and insertion into companies. New research should be carried out to expand knowledge about the characteristics of this public, which, despite having a variety of course options, has in common the objectivity of their curricula for inclusion in the labor market and practical activities as a necessity.

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