

I failed! And now? A study of the relationships between the senses attributed to failure and the intentions of persistence⁺*

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Abstract

Although some works argue that excessive failures and students' decisions to dropout or persist in their courses are directly related, evidence shows that this linkage is mediated by the senses they attribute to academic failures. The construction and attribution of such sense constitute a dynamic process of cognition reorganization and regulation. Students assess their actions, reflect on the determinant causes of their performance, and react by seeking success in their goals; in other words, they mobilize self-regulatory cognitive subfunctions of self-assessment, causal attribution, and self-reaction. Grounded in the Social Cognitive Theory and Bandura's conception of self-regulation, we investigate the main senses that students attribute to their academic failures and how such sense influence their decision to dropout or persist. To that end, we developed and administered an online questionnaire to 65 students enrolled in Physics courses or courses with a Physics emphasis, who have failed at least once. The results indicate that failures are predominantly conceived as a negative experience, leading some students to understand it as something intrinsic and insurmountable,

⁺ Fui reprovado! E agora? Um estudo das relações entre os sentidos atribuídos às reprovações e as intenções de persistência

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which contributes to a lower intention of persistence. However, students who performed negative self-assessments, but self-reacted positively, demonstrated a greater intention of persistence. The results highlight the potential of multidimensional analysis of senses for the planning and proposal of actions to reframe experiences considered stressful, such as academic failures.

Keywords: *Dropout; Persistence; Self-regulation; Physics.*

I. Introduction

The experiences lived in the institutional context are determining elements in students' decision to dropout or persist in their undergraduate courses (e.g., Evangelho *et al.*, 2019); Fernandes *et al.*, 2020; Lima Junior; Ostermann; Rezende, 2012; Tinto, 1975). What happens after entering the higher education system, therefore, plays an important role in the fate of University students. This does not mean that the previous life of undergraduates does not influence the decision to persist or dropout. The quality of students' integration into the University and, therefore, the experiences they have during their courses are dependent on their social origin (Franco; Espinosa; Heidemann, 2024; Lima Junior *et al.*, 2020b). Thus, the relationship between sociocultural markers and students' decision to dropout or persist is not direct, as is attested by studies that do not indicate a correlation between dropout and socioeconomic conditions (e.g., Daitx; Loguercio; Strack, 2016), but mediated by the experiences they have at university. These experiences even influence the social destiny of students who, depending on their conditions, may transfer to courses with greater social prestige or stop studying permanently (Lima Junior, 2013).

The importance of university experiences in student persistence is clear in the models proposed by Vincent Tinto (1975; 2017), an important theorist on university attrition. For him, these experiences impact the students' commitment to the institution and their goal of completing their degree, in addition to interfering with students' motivation, which is influenced, according to Tinto (2017), by the interaction between goals (commitment that the student have to graduate, complete their degree), self-efficacy beliefs (student's judgment about their ability to meet the demands of the course), sense of belonging (feeling of belonging, being integrated into the academic community, and being valued in the course in which they are enrolled), and perceptions of curricular relevance (perception of the relevance and value of the subjects foreseen in the course's curricular matrix and how the contents are covered).

The decision to dropout is often volitional, taken due to experiences considered frustrating within the university context. Among these experiences, one that stands out in the literature is excessive school failures. Although there are studies that show that the decision to dropout is not always related to failures (e.g., Rangel *et al.*, 2019), they are often linked to

students' decisions to dropout (Evangelho *et al.*, 2019; Daitx; Loguercio; Strack, 2016; Fritsch; Rocha; Vitelli, 2015). To deepen the debates about this relationship, a study by Moraes (2020), with Physics freshmen at the Federal University of Rio Grande do Sul, shows that students who saw their failures as a consequence of insufficient basic training, for instance, and not as an indication of incapacity or inadequacy to the university environment, were more motivated to remain on the course. This result shows that the relationships between such experiences (excessive school failures) and the decision to dropout are not direct, but mediated by the senses that students attribute to their university experiences, that is, by subjective, cultural, and emotional elements developed in the experience of failure.

In the academic literature, "sense making" is a polysemous term (Garcia; Montenegro, 2019; Odden; Russ, 2019). In this study, we assume the "sense" as the connotative dimension of concepts (Abbagnano, 2007), that is, as that which goes beyond meanings², being affected by subjective, cultural, and emotional aspects. The sense making is a dynamic, iterative, and critical process in which individuals judge/evaluate new knowledge and/or experiences based on their previous knowledge and experiences, reflecting on and reacting to them. It is a reorganization of thinking promoted by a new situation (Odden; Russ, 2019; Franco; Espinosa; Heidemann, 2023). For example, in social interactions, failure in Basic Education is often associated with a supposed "lack of intelligence" or lack of commitment to school. A dedicated student, having only had contact with the aforementioned notion, will have a hard time making sense of a situation of failure at university, unless he considers that he lacks "intelligence". Understanding that their failure may have been the result of a lack of adequate opportunities in Basic Education, which culminated in insufficient training as compared to their teachers' expectations, may enable them to give a new sense to this experience, which demands a reorganization of their knowledge, a change in their explanations, promoting transformations in their actions and behaviors in light of the newly constructed sense (Franco; Espinosa; Heidemann, 2023).

Thus, sense making is related to how the individual evaluates, reflects, and reacts to their experiences. Returning here to the example of school failure, which is the target of this study, we observe that students can react to such a situation by identifying that their learning in basic education was deficient, realizing that they need to dedicate themselves to alleviating training difficulties expected to be resolved before entering university. Others, however, may react by attributing failure to personal incapacity, and may even withdraw from the course because they feel unable to attend it. Therefore, as we wish to investigate the possible implications of university experiences (such as failures) on the decision to dropout or persist, we need to analyze how people in sense making by evaluating, reflecting, and reacting to their experiences.

² We emphasize that we understand meaning as the denotative part of concepts, that is, when we mobilize the concept of failure, for example, we relate it both to its meaning (e.g., failure to advance in the course), and to its sense (e.g., inability to learn).

Even in similar situations, each person reacts differently, as in the case exemplified regarding failures. Such a reaction depends on personal standards – that is, on the way the person judges and evaluates their own behavior –, as well as on their context. According to Bandura (2008), human beings' self-reaction and self-reflection capabilities are essential for individuals to consciously attribute and grasp the sense of their experiences, and even modify their thoughts and behaviors to achieve their goals.

Furthermore, the author highlights that these capabilities (self-reaction and self-reflection) are subfunctions of an internal and conscious mechanism called self-regulation. Therefore, when a person makes sense of a certain experience, they are generally going through a self-regulatory process, that is, they are going through a reorganization of their thinking with a focus on their behavior. By linking the attribution of sense to an individual process, however, we are not blaming students, for example, for their decision to dropout. On the contrary, we understand that the way students react is the result of personal, behavioral, and environmental/social factors so these elements need to act together to obtain satisfactory results when outlining actions to combat dropout and encourage persistence.

According to Bandura (2008), self-regulation is the internal and conscious capacity that an agent has to regulate their behavior, through personal initiative and persistence, even in the face of obstacles. It operates through three subfunctions or subprocesses, namely: *i.* self-observation, which consists of the individual's ability to monitor their behavior; *ii.* judgment processes³, which involves the individual's ability to evaluate their behavior, based on their standards and previous experiences, as well as consisting of the evaluation and attribution of performance-determining elements⁴ (i.e., causal attribution); and *iii.* self-reaction, which consists of the individual's ability to react to their experiences, changing their courses of action to achieve their goals.

In the present study, to analyze and understand the sense attributed by individuals to their experiences, we will focus on the subfunctions of *i.* judgment or self-evaluation processes (considering that, when evaluating their behaviors and actions, the agent is also observing themselves); *ii.* causal attribution or performance determinants (so that when attributing a cause to their experiences, the individual self-reflects on actions, behaviors, and events); and *iii.* self-reaction (which feeds back into the cyclical process of self-regulation, given that by reacting to experiences, behaviors, and actions the individual can modify their actions to achieve their goals or be proud of their actions, taking them as an example for subsequent actions). In other words, we consider that individuals mobilize such subfunctions (self-evaluation, causal attribution, and self-reaction) in the process of sense making regarding their experiences.

³ In this study, we use the terms “judgment processes” and “self-evaluation” interchangeably when referring to the first subfunction mobilized by individuals to attribute sense to their experiences.

⁴ In this study, we use the terms “performance determinants” and “causal attribution” interchangeably when referring to the second subfunction mobilized by individuals to attribute sense to their experiences.

Having the hypothesis that the sense attributed to experiences can mediate the individual's decision to persist or drop out of the course, and assuming that this process of sense making is the result of self-regulatory subfunctions, we have the following research questions in this investigation:

i. What are the main senses (resulting from the mobilization of self-regulatory subfunctions) that students attribute to their failure experiences?

ii. How is students' intention to persist or drop out of their undergraduate Physics courses influenced by the sense they attribute to their failure experiences?

In the following sections, we begin by detailing the concept of self-regulation proposed by Bandura (2001; 2008), as well as the self-regulatory subfunctions of self-evaluation, causal attribution, and self-reaction, which are mobilized in the process of sense making. Next, we present the research methodology, exposing the questionnaire used to collect data in a way linked to the assumed theoretical framework. Finally, we present the obtained results.

II. Sense making through the mobilization of self-regulatory subfunctions

According to Bandura (1999; 2001; 2008), individuals are agentic beings who actively influence their own behavior, to contribute to their own motivation and self-regulate their actions towards their desired objectives. Furthermore, according to the Social Cognitive Theory (SCT), human functioning is the result of interactions and influences between behavioral, personal, and contextual/environmental aspects, called triadic reciprocity or reciprocal determinism (Bandura, 2008).

Thus, the use of TSC allows us to carry out a comprehensive analysis of the phenomena of attrition and persistence, in which these three aspects (behavioral, personal, and contextual/environmental) act, being considered together in the development of proposals and actions to combat dropout/promote persistence (Franco; Espinosa; Heidemann, 2023; Franco; Espinosa; Heidemann, 2024). In this study, through TSC, we analyzed the main senses (personal aspect, given that it involves the mobilization of self-regulatory subprocesses) that students of undergraduate courses in Physics or with an emphasis on Physics attribute to their experiences of failure in the institutional context (contextual/environmental aspect), and the influence of these senses on their decisions to evade or persist in their courses (behavioral aspect).

As agentic beings, individuals are not simply subject to their experiences; they also evaluate, reflect, and react to these experiences in light of their life history, based on their social context and previous experiences (Bandura, 1999; 2008). Such capacities for self-evaluation/self-judgment, self-reflection, and self-reaction are essential for the individual to consciously attribute and grasp the sense of their experiences, and even modify their thoughts and behaviors to achieve their goals, in addition to being subfunctions of an internal and conscious mechanism called self-regulation by Bandura (2008).

Self-regulation is understood as the agent’s ability to regulate their behavior (Bandura, 2008; Polydoro; Azzi, 2008). Furthermore, it consists of a conscious internal mechanism that governs personal behavior, thoughts, and feelings, taking personal goals and standards of conduct as a reference, being composed of actions, feelings, and self-generated thoughts to achieve a goal (Polydoro; Azzi, 2008). According to Bandura, when setting goals for themselves, individuals create states of imbalance (as they desire something they do not yet have) that are essential for them to take action in the world, regulating their behavior and actions in the search for achieving their goals. These states of imbalance are essential for the attribution and apprehension of sense, as the sense making is a dynamic, iterative, and critical process, in which individuals, based on their knowledge and previous experiences, judge new knowledge, reflecting and reacting to them (i.e., continually changing their explanations until reaching one that is satisfactory), seeking to connect them to previous knowledge and checking whether there is coherence between the constructed argumentation and the integration of new knowledge (i.e., checking whether the explanation “makes sense”) (Odden; Russ, 2019). Thus, we can infer that, when attributing sense to their experiences, individuals are going through a process of reorganization of their knowledge and explanations, self-regulating their actions, thoughts, emotions, and behaviors.

This exercise of partial control over thoughts, feelings, and actions, in addition to the conception of the individual’s active role, is used by Bandura (2008) to systematize the discussion about self-regulation mechanisms. According to the author, it is self-regulation that offers conditions for monitoring, evaluating, and controlling (by the agent) behavior, towards personal objectives, operating through subsidiary cognitive subfunctions that include self-observation, judgment processes of self-evaluations and self-reactions, known as the three subfunctions (Fig. 1) or subprocesses of self-regulation.

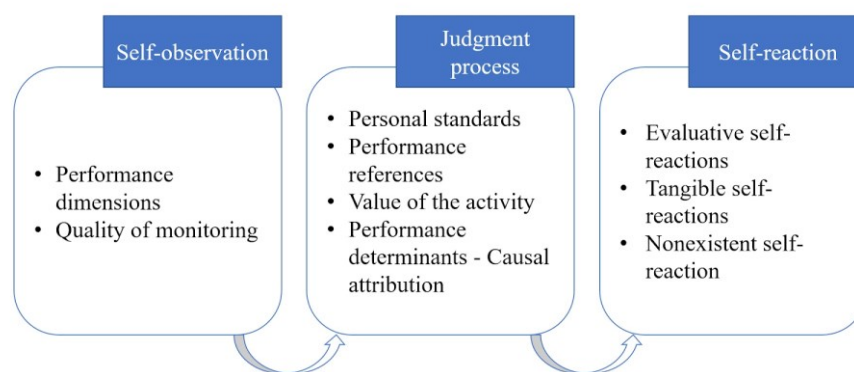


Fig. 1 – *Self-regulatory subfunctions or subprocesses*. Source: adapted from Bandura (1978; 1991; 1996; 2008); Polydorus; Azzi (2009).

The first subfunction of self-regulation is self-observation, which consists of the individual's ability to monitor and identify their own behavior, based on the dimensions of performance (which provides information that can be used as references by the individual) and the quality of monitoring (its precision, feedback, and temporality are essential for successful self-regulation). The information obtained from self-observation will be evaluated through judgment processes, in which individuals evaluate their actions and behaviors based on their standards, their performance references, the value of the proposed activity, and the determining factors and causes of their performance (causal attribution). In other words, individuals evaluate their actions, behaviors, and experiences, and attribute causes that, according to their conception, were determinants of their performance. Finally, after monitoring and evaluating their actions, behaviors, and experiences, individuals self-react, for example, being satisfied with successfully achieving the established objective or changing their behaviors and actions when they realize that they have not been successful in their established objectives. This subfunction feeds back into the self-regulation process, as it serves as a basis for making future decisions.

According to Zimmerman (2000), subfunctions must be activated, developed, and mobilized so that there are self-directive changes aimed at achieving personal goals, given that the more an individual modifies what they have learned, applies this learning in different situations and reflects on the results of their actions, the more improved the subfunctions tend to become.

When giving sense to a specific experience, individuals use cognitive factors that are part of but do not exhaust the subfunctions of self-regulation. More specifically, they employ *i.* their self-assessment skills/judgment processes; *ii.* the elements and causes determining their performance (i.e. causal attribution); and *iii.* their self-reaction skills. In other words, sense making involves the mobilization of personal aspects related to self-regulatory subfunctions, consisting of a multidimensional analysis (Franco; Heidemann e Espinosa, 2023), as shown in Fig. 2.

Based on this, we developed and applied a questionnaire, in whose third section we propose open questions aimed at each of the subfunctions mobilized for the attribution of sense, to identify the main senses that students of Physics courses (and with an emphasis on Physics) attribute to their experiences of failure. Below we detail the preparation of the questionnaire, the procedures used to analyze the data collected, as well as the results achieved from this study.

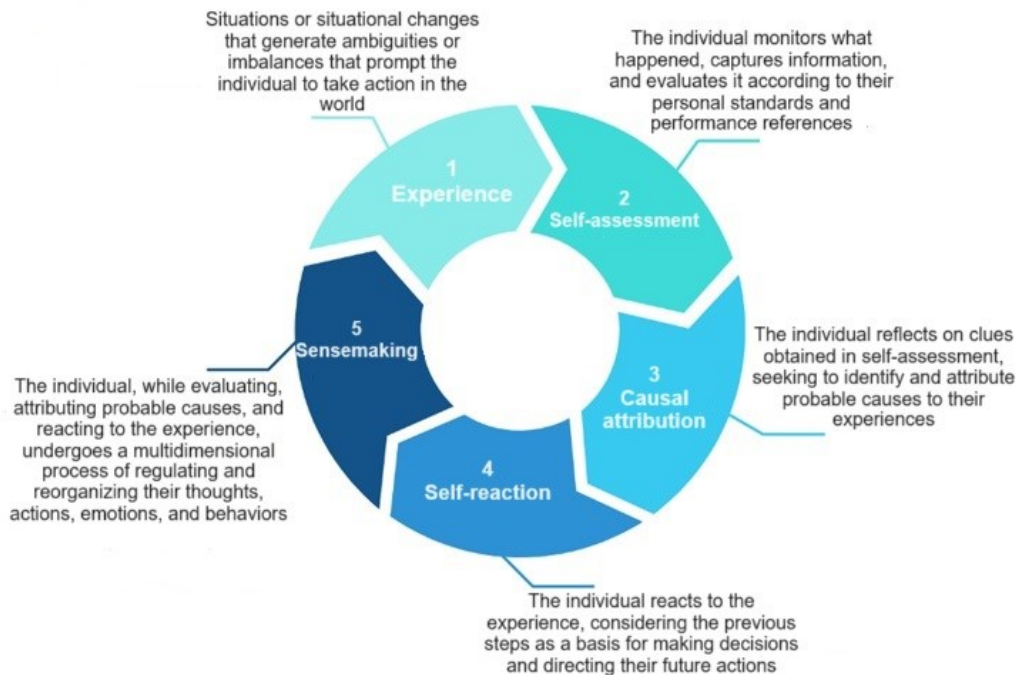


Fig. 2 – Multidimensional process of sense making.

III. Development and analysis of the instrument used to identify the sense making process among students regarding their failure experiences

To identify the main senses that students attribute to their failure experiences and how these sense making processes influence their decision to persist in the course, we created an online questionnaire consisting of 24 questions. Data collection related to this sense making occurred through three open questions, which are detailed in Table 1, and a point distribution question, in which we listed some factors that could have been considered by the students as possible causes of the experiences of disapproval, as well as through two statements whose level of agreement, on a scale between 1 (strong disagreement) and 5 (strong agreement), indicated the respondents' intention to persist. These two statements were: i. I am seriously thinking about giving up the Physics course; and ii. I am fully determined to stay in the Physics course.

Sixty-five people who had previously experienced failure at least once responded to the questionnaire. It is worth noting that all respondents agreed to a free and informed consent form, which informed about the objectives and risks of the research, as well as the confidentiality and secrecy of the respondents' data. The responses of these students to the questions presented in Table 1 were analyzed in qualitative and quantitative stages.

Table 1 – Open questions proposed to identify how students interpret academic experiences of failure, through the mobilization of the self-regulatory subfunctions of self-evaluation, causal attribution, and self-reaction.

Purpose	Question
Understand how the self-regulation mechanism, especially the self-evaluation subfunction, was mobilized during the experience	In general, how did you feel when you failed? Comment in detail on your answer.
Investigate the causal attribution made by students regarding their failures	Describe, in detail, what cause(s) you attribute to your failure.
Investigate how students self-reacted to the experience of failure	How did failure influence your actions/decisions/behaviors/experiences on the course? Comment.

To answer the first question proposed, “*What are the main senses (resulting from the mobilization of self-regulatory subfunctions) that students attribute to their failure experiences?*”, we consider the sense making as a result of self-evaluation, causal attribution, and self-reaction, and categories were constructed for each of these subfunctions based on individuals’ responses. It is worth noting that the categories were constructed following the guidelines of Yin (2018), being conducted in five distinct and non-linear stages: *i.* compilation (data systematization); *ii.* degrouping (data fragmentation); *iii.* regrouping (data coding); *iv.* interpretation (creation of a new narrative); and *v.* conclusion (reflection by the researcher and elaboration of conclusions). The participants’ responses were classified into just one category for each of the subfunctions mobilized for sense making. For example, we analyzed students’ answers to the first question (i.e., how they felt when they experienced failure) and classified them according to their centrality.

The categorization proposed in the **self-assessment** subfunction originated from the analysis of the data collected on how students felt/evaluated themselves when experiencing failure. When carrying out a self-assessment, individuals take into account: their standards and what they expected of themselves; standards of reference, such as self-comparisons with peers; as well as the determinants of performance, that is, the causes (Bandura, 2008). Based on the students’ responses, we constructed seven categories for the self-assessment subfunction, namely: *i.* Academic incapacity (when the individual considered himself unfit/incapable because he was unable to achieve success in the subject); *ii.* Failure (when the individual evaluated himself as a failure for not obtaining approval, often presenting a personal performance reference when carrying out such an evaluation); *iii.* Normality (when the individual judged a failure as “natural”); *iv.* Unpreparedness (when the individual believed that they had not studied or had not dedicated themselves enough, expressing a feeling of unpreparedness); *v.* Inability to belong (when the individual considered himself incapable of

belonging to the course because, according to his conception, there are “suitable profiles” to belong to the institution/course); *vi.* Sadness (when the individual expressed feeling sad, a fact that may be due to disapproval being something negative according to our standards of judgment); and *vii.* Injustice (when the individual felt wronged due to teaching methods and systems, which they considered unfair).

When constructing the categorization regarding **causal attribution**, we were based on the dimensions proposed by Tinto (2012), namely: *i.* individual (when the individual attributed the failure to personal causes, such as psychological and emotional factors; poor previous schooling); *ii.* external (when the individual attributed the failure to factors that are beyond what we can reduce and combat with university policies, although the university should not be exempt, such as family issues; location of the institution); and *iii.* institutional (when the individual attributed the failure to formal and/or structural aspects of the course and the university, such as assessment and teaching methods; infrastructure, and structural issues), plus a behavioral dimension (when the individual attributed the failure to causes that involve their behavior in their study routine, such as lack of an adequate study routine; insufficient personal effort – lack of dedication to studies) arising from Bandura’s Social Cognitive Theory⁵ (2008).

The categorization presented in the **self-reaction** subfunction was proposed based on Zimmerman’s model (2000). According to this author, self-reaction can be of an emotional and/or behavioral nature, and both the emotional and behavioral reactions can be positive or negative, in the sense of bringing the individual closer to or further away from achieving their goals. Therefore, for the self-reaction subfunction, five categories were constructed: *i.* Positive adaptive behavioral (when the individual self-reacted in a way that generated practical implications in their behaviors, that is, there were modifications/adjustments in their objectives and/or strategies to achieve success in their objectives); *ii.* Positive emotional (when the individual self-reacted in a positive emotional way to the results of the self-assessment carried out so that this reaction did not necessarily involve an action); *iii.* Negative emotional (when the individual self-reacted in a negative emotional way to the results of the self-assessment carried out); *iv.* Negative adaptive behavioral (when the individual self-reacted in a way that generated practical implications in their behaviors, which distanced them from their objectives); and *v.* Unidentified (when the individual did not know or did not want to give an opinion).

Next, aiming to complement our analysis, we identified the main senses attributed by students to the experience of failure, relating the subfunctions self-evaluation, causal attribution, and self-reaction to each other, that is, analyzing the relationships between the

⁵ In Social Cognitive Theory (SCT), elements related to the institution and the university context would be covered by the environmental/contextual dimension. However, because this dimension is very broad, based on Tinto (2012), we analyzed the institutional dimension and the external dimension separately.

categories proposed for each of these subfunctions. To this end, we use the *Iramuteq*⁶ software to carry out a Similarity Analysis. This analysis follows a qualitative design and aims to identify co-occurrence and connectivity between words (Camargo; Justo, 2013) so that the size of the word indicates the frequency of its appearance, that is, the larger the word, the more times it was evoked in the analyzed text. The thickness of the lines gives us clues about the frequency with which the words appeared correlated, that is, thicker lines mean a greater number of correlations between words, while thinner lines indicate small correlations.

Thus, the senses that students attributed to their failure experiences were identified through similarity analysis, more precisely based on the relationships between the categories identified for each self-regulatory subfunction. For example, the sense attributed to failure by a student who was classified in the academic inability (self-assessment), individual (causal attribution), and positive adaptive behavioral (self-reaction) categories will be one of difficulty/incapacity to be overcome, since he initially understands failure as something negative (incapacity), but reacts positively, seeking to overcome this initial assessment.

Finally, to answer the second question investigated, “*How are students’ intentions to persist or dropout of their undergraduate Physics courses influenced by the senses they attribute to their failure experiences?*”, we carried out statistical correlation analyses between the subfunctions (self-assessment, causal attribution, and self-reaction), mobilized for sense making, and the students’ intention to persist. To this end, we transformed the categorical variables self-evaluation, causal attribution, and self-reaction into numerical variables, considering that the intention to persist consists of a numerical variable. In other words, taking the causal attribution subfunction as an example, we assigned the value 4 to the responses that were classified in the individual category (indicating greater intention to persist); the value 3 for responses linked to the external category; the value 2 for responses classified in the behavioral category; and the value 1 for responses classified in the institutional category (indicating lower intention to persist).

Firstly, we used the Kruskal-Wallis⁷ non-parametric test to identify the existence of statistically significant differences in persistence intentions depending on the types of self-regulatory subprocesses mobilized by students. We also used the Spearman⁸ correlation

⁶ Free and open source software that allows similarity analyzes to be carried out on textual corpus, among other features. Available at: <http://sourceforge.net/projects/iramuteq/>.

⁷ A nonparametric test does not depend on the assumption that the data or residuals show any specific distribution. The Kruskal-Wallis test is a non-parametric test used to compare three or more independent samples and indicate whether there is a difference between them. In this method the data are initially ordered in a ranking from highest value to lowest, so that if there are only random differences, the data set is expected to be distributed approximately homogeneously and, if there is a preponderance of high or low, there are likely to be significant differences due to the independent variable (Field, 2018).

⁸ The correlation coefficient allows us to measure the intensity of the relationship between two variables. This intensity is presented through numerical values between -1 and 1, with the direction of the correlation expressed by the sign of the coefficient. Thus, when the coefficient has a negative sign it means that one variable decreases with the increase of another. When the coefficient has a positive sign, it means that an increase in one variable generates an increase in the other (Field, 2018).

matrix to identify the occurrence of statistically significant correlations between the variables investigated, calculating the Spearman correlation coefficient between the variables of interest, adopting a significance level of 5% ($p < 0.05$). Furthermore, we performed a linear regression, aiming to investigate the explanatory capacity of the subfunctions about the intention to persist in the course. Continuing with the quantitative analysis, we based ourselves on the main senses obtained through the relationships identified between the categories proposed for each of the self-regulatory subfunctions (from the similarity analysis) and considered the transformation of the categorical variables to carry out a Cluster Analysis, to analyze the links and relationships between the main sense and the intention of persistence. To carry out this analysis, we used the *K-means Clustering*⁹ method. The next section will present the results obtained for each question investigated.

IV. Results

Conducted by the two guiding questions, we first carried out a categorization for each of the self-regulatory subfunctions mobilized in the sense making process (self-evaluation, causal attribution, and self-reaction). The constructed categories were analyzed through a similarity analysis, to identify the co-occurrence, connectivity, and relationships between them and between the analyzed subfunctions, obtaining four main senses that students attribute to their failure experiences: *i. Frustration to be overcome (n=16, 24.6%); ii. Intrinsic individual inability (n=12, 18.5%); iii. Difficulty to be overcome (n=9, 13.8%); and iv. Compliance with the Injustice of the educational system (n=4, 6.1%),* which will be detailed below. Next, we carried out statistical analyses that highlighted the correlations between the variables related to sense making, that is, the categories constructed for each self-regulatory subfunction and the variable intention to persist.

IV.1 What are the main senses (resulting from the mobilization of self-regulatory processes) that students attribute to their failure experiences?

From the categorization of responses to the questionnaire, we identified that students, in general, evaluate their failure experiences as something negative. However, some students manage to overcome these initial feelings through positive self-reactions (emotional or behavioral). Others react negatively, becoming unmotivated and, in some cases, disconnecting from the university environment. Below we present the categorization and analysis of each of the self-regulatory subfunctions (self-evaluation, causal attribution, and self-reaction) mobilized in the sense making, as well as the similarity analysis carried out to identify the multidimensionality of sense making.

⁹ A widely used method for finding groupings of objects, with the objective of allocating similar elements into groups, so that these groups are heterogeneous among themselves, enabling the investigation of the interrelationship that exists between the researched variables (Valli, 2002).

IV.1.1 Analysis of the self-assessment subfunction

Seeking to understand how the self-evaluation subfunction was mobilized by students during the failure experience, in Table 1, we present the categories constructed for this self-regulatory subfunction, based on the students' responses to the questionnaire. It is worth highlighting that self-assessment is one of the dimensions mobilized in the sense making.

Chart 1 – Categorization of students' responses regarding the self-regulatory subfunction of self-evaluation mobilized in the sense making.

Subfunction	Category	Respondents (N)	%
Feeling/ Self-evaluation	Academic inability	16	24,6%
	Failure	11	16,9%
	Normalcy	10	15,4%
	Unpreparedness	8	12,3%
	Inability to belong	7	10,7%
	Sadness	7	10,7%
	Injustice	6	9,2%

Based on Chart 1, we can identify that “failing” is mostly associated with a negative **self-evaluation**, such as *i.* inability to achieve success in the subject (n=16, 24.6%), which was expressed by Student 38 when pointing out: “*I felt incompetent, unable to understand the content covered*”; *ii.* failure for feeling capable, but still not having achieved approval (n=11, 16.9%), as in the case of Student 20, who emphasized: “*I felt disappointed with myself, because I can improve more and I know that I am capable of this*”; *iii.* not having an adequate profile for the course/institution (non-belonging, n=7, 10.7%), as indicated by Student 7, when reporting: “*I felt like I wasn't good enough, especially when most of my colleagues passed in discipline and I did not. It was as if at that first moment the course was telling me that I was not part of it*”; and *iv.* not having dedicated (studied) themselves enough to the subject (n=8, 12.3%), as in the case of Student 37, who reported: “*I felt that there was a lack of commitment and preparation on my part*”.

However, other students assessed the situation as normal, which may be derived from the perception that was created and which, according to Lima Junior et al., (2020a), is cultivated in institutions as a way of ennoblement, that the Physics course is one of the most difficult. Furthermore, students who self-assessed themselves as not having a suitable profile for the course (not belonging) may have been influenced by this perception that the course is

extremely difficult, which is why it is “for a few”. Such results are also corroborated by studies by Silva (2016), who, when researching the senses and meanings that students, with a history of failing Calculus I, in Environmental Engineering, Agronomy, Biology, Chemistry, Physics, and Mathematics, attribute to their experiences of failure, created categories such as lack of dedication to studies, not studying enough, and not having the basic knowledge to get approval. These categories proposed by the author are similar to the categories of unpreparedness, incapacity, and non-belonging, which we identified in our study referring to the self-assessment subfunction.

Therefore, if we only considered the analysis of the **self-evaluation** subfunction for the sense making, we would arrive at the result that all students attribute negative senses to their failure experiences. This finding is in line with what we observed both in the literature (e.g., Moraes, 2020) and in our study, given that students attribute different senses to similar situations¹⁰.

IV.1.2 Analysis of the causal attribution subfunction

To investigate the causes attributed by students to their failures, in Table 2, we present the categories constructed for this subfunction, based on students’ responses to the questionnaire.

Chart 2 – Categorization of students’ responses regarding the self-regulatory subfunction of causal attribution mobilized in the sense making.

Subfunction	Category	Respondents (N)	%
Causal Attribution	Individual	20	30,7%
	External	18	27,7%
	Behavioral	15	23,1%
	Institutional	12	18,5%

Based on Chart 2, we identified among the causes attributed by students a large part (n=20, 30.7%) is related to **individual causes** such as: *i.* psychological and emotional factors (n=8, 12.3%); *ii.* poor previous schooling (n=6, 9.2%); and *iii.* difficulty understanding the content (n=6, 9.2%). This can be observed in the responses of Students 6, 7, and 3. Student 6 had his response categorized as “individual cause” related to the dimension “psychological and emotional factors” based on the following statement: “*Moment of personal fragility,*

¹⁰ For example, two individuals entering the Physics course, when they both fail the same initial semester in Physics I, although they have the same experience (failure; beginning of graduation), they may attribute different senses to these situations. This occurs because the sense making involves the mobilization of self-regulatory processes that are built based on the individual’s life history and the context in which they are inserted, as well as involving the level of development and improvement of these self-regulatory processes.

anxiety disorder". Student 7, in turn classified in the dimension "deficient previous schooling" in "individual causes", argued: "*Lack of experience with basic mathematics, I often had to halt studying the undergraduate content to study elementary and secondary mathematics*". Student 3, whose speech was classified as an "individual cause", related to the dimension "*difficulty in understanding the content*", expressed: "*I believe that the main cause was the difficulty in understanding the content*".

Some students (n=18, 27.7%) pointed to **external** factors as causes of their failure, namely: *i.* family issues (n=5, 7.7%); *ii.* location of the institution (n=1, 1.6%); *iii.* impact of the pandemic (n=9, 13.8%); and *iv.* difficulty reconciling work and study (n=3, 4.6%). Through the responses of Students 23, 8, 31, and 1, we can identify examples referring to **external causes**. Student 23 had her response categorized as "external cause" related to the "family issues" dimension with the following excerpt: "*All the tests in this subject took place on days when something bad happened at home (I have a sister with psychiatric problems, and something bad is usually her attacking someone, most of the time attacking me)*". Student 8's response was also classified in the "external causes", but in the "location of the institution" dimension, based on the following statement: "*[...] I think an important [cause] was the fact that I live far away from the university, so I had to wake up at 5:30 in the morning to catch the bus. The subject [course subject] I took, Calculus A, was the first of the day and I ended up being so exhausted from waking up at 5:30 am that I ended up sleeping in class.*" Student 31, in a speech labeled in the "external causes" category in the "impact of the pandemic" dimension, said: "*Material resources such as lack of a computer at home, Internet access, no physical structure to study as a specific area of study*". Student 1 had his response categorized as "external cause" related to the dimension "difficulty reconciling work and study" when he argued: "*I worked all day and didn't study properly after class due to sleep and tiredness*".

The **behavioral causes** reported by 15 students (23.1%), in general, refer to their behavior in their studies, such as *i.* lack of an adequate study routine (n=3, 4.6%) and *ii.* insufficient personal effort – lack of dedication to studies (n=12, 18.5%). Some examples referring to such causes can be observed in the responses of Students 50 and 14. Student 50 had his response categorized as "behavioral causes" related to the dimension "lack of an adequate study routine" with the following statement: "*Lack of organizing myself with schedules.*" Student 14, whose speech was classified as "behavioral causes" referring to the dimension "insufficient personal effort – lack of dedication to studies" expressed: "*Lack of study, little engagement in staying connected with the content*".

Finally, the **institutional causes**, highlighted by 12 students (18.5%), are related to the formal and/or structural aspects of the course and the university: *i.* assessment and teaching methods (n=9, 13.8%) and *ii.* infrastructure and structural issues (n=3, 4.6%). The answers from Students 4 and 11 allow us to exemplify excerpts referring to institutional causes. Student 4 had his speech categorized as an "institutional cause" related to the

“evaluation and teaching methods” dimension based on the following statement: “[...] being failed by 0.1, 0.2 is s*** and then you go through days studying for something and end up being failed for tiny things and also the factor that the professor teaches one thing and demands another is rubbish”. Student 11, in his speech labeled in the “institutional cause” category in the “infrastructure and structural issues” dimension, pointed out: “The delay in enrolling at the University in 2018”.

Our analyses of the causes attributed by students to the experience of failure are in line with data obtained by Silva (2016), in which the author reports that the reasons for failure, according to the students, are associated with actions carried out by them or by professors and other members of the academic community, as well as by the absence of these actions. Among the reasons presented by Silva are: *i.* the methodology used by teachers; *ii.* difficulties in reconciling study activities and personal life; among others. Again, it is worth highlighting that looking only at the causes pointed out by students as determinants of their performance would not allow us to identify the main senses they attribute to the experiences of failure, as it would only allow us to analyze with greater precision which elements stand out the most and require special attention during the students’ experiences.

IV.1.3 Analysis of the self-reaction subfunction

Aiming to investigate how students self-reacted in the face of failure experiences, in Chart 3, we present the categories constructed for the self-reaction subfunction, based on students’ responses to the questionnaire.

Chart 3 – Categorization of students’ responses referring to the self-regulatory subfunction of self-reaction mobilized in the sense making.

Subfunction	Category	Respondents (N)	%
Self-reaction	Positive Adaptive Behavior	23	35,4%
	Positive Emotional	16	24,6%
	Negative Emotional	12	18,5%
	Negative Adaptive Behavioral	9	13,8%
	Not identified	5	7,7%

Regarding the **self-reaction** categories, presented in Chart 3, we noticed that a large part of the students (n=23, 35.4%) reported having a **positive adaptive behavioral self-reaction**, that is, a reaction with practical implications for individuals’ behaviors, involving modifications/adjustments to objectives and strategies to achieve success, such as: *i.* greater dedication to study practices (n=10, 15.4%); *ii.* adoption of teaching strategies (n=7, 10.7%); and *iii.* changes in decisions for new enrollments (n=6, 9.2%). Examples referring to this

category can be found in the speeches of Students 38, 16, and 7. Student 38 had her speech categorized, in the self-reaction subfunction, as “positive adaptive behavior” related to the dimension “greater dedication to study practices” based on the excerpt: “*It made me dedicate myself more to that subject*”. Student 16, whose speech was categorized in the “adoption of teaching strategies” dimension, expressed: “*I decided to focus so that it wouldn’t happen again and I looked for more online classes on the subjects*”. Student 7’s response was classified in the dimension “changes in decisions for new enrollments” due to the following statement: “*I started taking fewer subjects than before and making decisions about in which subjects to enroll based on their lecturer.*”

Some students (n=16, 24.6%) demonstrated a **positive emotional self-reaction**, that is, their reaction did not necessarily involve an action but may have led to: *i.* motivation to continue (n=9, 13.8%); and *ii.* changes in students’ conception of failure (n=7, 10.7%). Such self-reactions can be observed in the assertions of Students 20 and 25. In her speech, Student 20 reported: “*My failure influenced the way I think and reflect on what I want and that I can achieve my goals*”, that is, the failure served as motivation for the student to reflect on her goals and capabilities to continue her studies. Another report is that of Student 25, who claimed that failing “[...] *made me more mature and worry more about learning than failing*”. Based on this student’s response, we can see that there was possibly a change in her conception of failure. For her, now, the most important thing is not whether or not she fails, but having good quality learning.

Understood and socially transmitted as a negative experience, failure is not limited to positive self-reactions. Some students (n=12, 18.5%) reacted **negatively emotionally**, expressing: *i.* insecurity/lack of motivation to continue with their studies (n=8, 12.3%); and even *ii.* willingness to give up the course (n=4, 6.1%). Such self-reactions are clear in the response of Student 55, who expressed: “[...] *failing a subject made me feel very sad and low, making me reevaluate continuing the course, having several thoughts of giving up*”. There were also several negative behavioral reactions (n=9, 13.8%), that is, self-reactions with practical implications for individuals’ behaviors, which, in most cases, distanced them from their objectives, generating a disconnection between the student and the academic environment and/or future profession. An example is the case of Student 45, who argued: “[*failing*] *influenced me to drop my enrollment, rethink whether I will be able to move forward*”. Finally, in the unidentified self-reaction category (n=5, 7.7%), some students do not know how they self-reacted to the experience of failure, as is the case of Student 27, who responded “I don’t know” when asked.

As well as self-evaluations and causal attributions, student reactions are also important. According to Zimmerman (2000), they are essential for motivation, affecting self-efficacy beliefs, and even their future decisions and actions to achieve their goals. Through our analyses, we identified that 60% of participants (n=39) self-reacted positively, changing their conceptions about failure and how to face it, starting to dedicate themselves more to

studies, seeking new teaching strategies, reflecting on which and how many subjects to take to get the most out of them, and understanding failure as a form of motivation to try again and continue advancing in the chosen course. On the other hand, 32.3% of students (n=21) self-reacted negatively to the experience of failure, becoming unmotivated, wanting to give up on the course, withdrawing/abandoning the subject, questioning whether they were in the right course for them, among other factors that impacted their behaviors and actions in a negative way, which could cause a high intention to evade, that is, self-reactions that took students away from their desired goals.

IV.1.4 Understanding the multidimensional character of the sense making

All our analyses reinforce the multidimensional character of the sense making, that is, when attributing sense to their experiences, students are *i.* evaluating their actions and behaviors based on their life history and previous experiences; *ii.* reflecting and attributing causes that were decisive for their performance; as well as *iii.* reacting to such experiences, evaluations/judgments, changing the course of their actions, and seeking to achieve success in their established objectives.

Therefore, to investigate the main senses that students attribute to their failure experiences, we carried out a similarity analysis, which allowed us to identify the co-occurrences between the categories and the interrelations between the mobilized subfunctions¹¹. From this analysis, it was possible to identify four main senses attributed to disapproval. Among them, two are related to overcoming the initial negative self-evaluation and two others corroborated this negative self-evaluation. In Fig. 3, we present the graph constructed through similarity analysis.

Analyzing the groupings of categories in Fig. 3, we can enumerate the main senses that students attribute to their failure experiences.

In the central grouping present in Fig. 3 (represented by the color green), we observe two of the main senses attributed to disapproval. The first, we will call **Difficulty to be overcome**, and it includes students (n=9, 13.8%) who assessed themselves as incapable or non-belonging, but had positive reactions that allowed them to overcome this initial assessment, as is the case of Student 25, who reported: “*I felt frustrated and incapable, as I thought I would not succeed again*” (self-assessment – academic incapacity), attributing her failure to “*Lack of content understanding*” (cause – individual), highlighting that this experience “*[...] made me more mature and worry more about learning than failing*” (self-reaction – positive emotional).

¹¹ As previously highlighted, we used the Iramuteq software to carry out the similarity analysis presented in Fig. 3. To construct this figure, we inserted into the program the categories in which the students' responses were allocated. As the size of the words indicates the frequency of their appearance in the analyzed text and the thickness of the lines indicates the frequency with which they appeared correlated, in Fig. 3, for example, we can identify that the “individual” category appears more prominently than the “inability” category; however both are frequently correlated (the line that connects the two categories is thick).

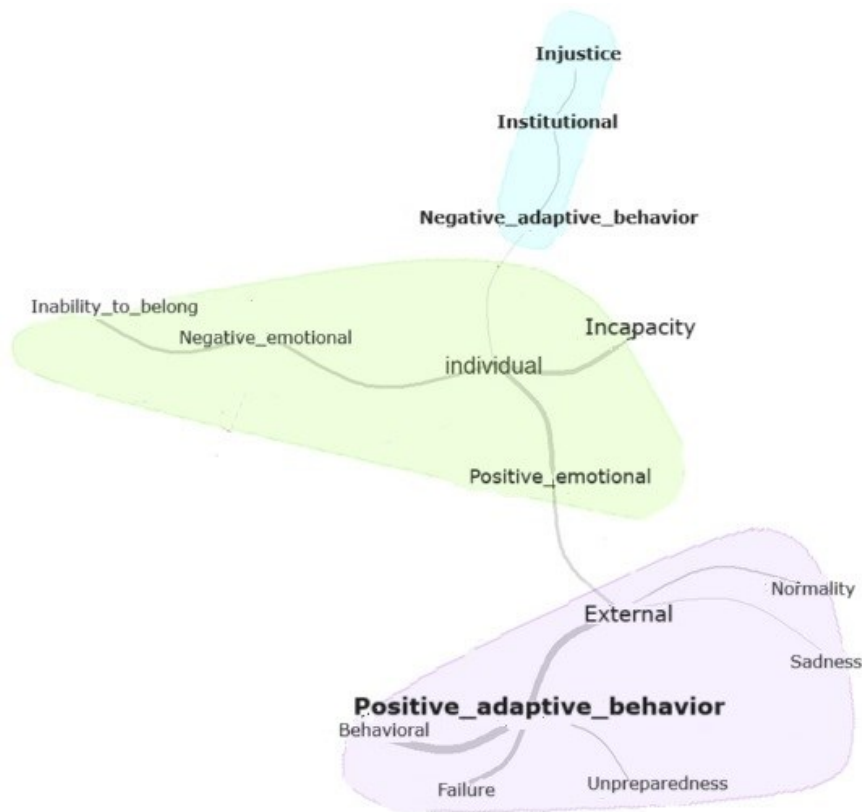


Fig. 3 – Similarity analysis carried out to identify the links between the categories proposed for each self-regulatory subfunction (self-assessment, causal attribution, and self-reaction).

The second main sense (which is also found in the green grouping in Fig. 3), we will call **Intrinsic Individual Incapacity**, and it includes students (n=12, 18.5%) who assessed themselves as incapable or non-belonging. and they assumed this assessment as something intrinsic that shook their physics self-efficacy and made them react negatively, that is, they became unmotivated, unable to overcome the failure. An example is the case of Student 6, who states that he initially assessed himself as “[...] *incapable, stupid, I felt as if the institution was indicating that this is not my place*” (self-assessment – inability linked to the feeling of not belonging), attributing as a determining factor the “*Moment of personal fragility, anxiety disorder*” (cause – individual) and, demonstrating having reacted in such a way as to become “*Unmotivated*” (self-reaction – negative emotional) from such experience.

In the lower part of Fig. 3, we can identify another main sense, represented (by the lilac color), which we will call **Frustration to be overcome** (n=16, 24.6%), in which students, when experiencing failure initially demonstrated some sadness and frustration, but due to adjustments and positive changes in their behavior, they overcame this negative self-evaluation, as we can see in the responses of Student 37, who described that “[...] *there was a lack of commitment and preparation on my part*” (self-assessment - unpreparedness), due to

“*Work and family routine [...] dedicating more time to my son*” (cause - external), but he decided that he would react by “**studying more**” (self-reaction – positive behavioral).

Finally, we have as the fourth and last main sense what we will call **Conformity with the Injustice of the educational system** (n=4, 6.1%), which is found in the upper part of Fig. 3 (represented by the color blue). There are groups of students who assessed themselves as being wronged, being convinced that they could do nothing to change this situation, which contributed to the occurrence of negative reactions, as highlighted by Student 45, who in his responses pointed out that he had been “*Harmed by the large curriculum full of prerequisites, and because there are subjects available only annually*” (self-assessment - unfairly), considering that “*It takes time for such courses to appear*” (cause - institutional), which was decisive and “*Influenced [his decision] to lock [the discipline] rethink whether I will be able to move forward*” (self-reaction – negative behavioral). We summarize these main identified senses in Table 2.

Table 2 – Summary of the main senses attributed by students to their experiences of failure.

Main sense	Self-regulation subfunction	Characteristics
Failure is a frustration to be overcome (n=16, 24,6%)	Self-evaluation	Failure; Normality; Sadness; Unpreparedness
	Causal attribution	External; Behavioral
	Self-reaction	Positive
Failure is a result of my intrinsic individual incapacity (n=12, 18,5%)	Self-evaluation	Academic inability; Inability linked to the feeling of not belonging
	Causal attribution	Individual
	Self-reaction	Negative
Failure is the result of my difficulties to be overcome (n=9, 13,8%)	Self-evaluation	Academic inability; Inability linked to the feeling of not belonging
	Causal attribution	Individual
	Self-reaction	Positive
Failure is a result of injustices I have come to accept (n=4, 6,1%)	Self-evaluation	Injustice
	Causal attribution	Institutional
	Self-reaction	Negative

In summary, students initially tend to attribute a negative value to their experiences of failure based on negative self-evaluations (e.g., evaluating themselves as incapable), and it is possible to see that when experiencing such experiences they feel sadness, discouragement, guilt, shame, disappointment, frustration, they question their capabilities, and even think about dropping out of the course, corroborating what Sá (2018) found in her study. However, sense making will also be strongly impacted by how students react to these experiences. When reacting positively, students tend to give new senses to their failures, continuing with the course and starting to understand these experiences as something that results in greater and better learning, maturity, and the search for overcoming. Others react negatively, that is, they become demotivated, adopt behaviors that distance them from their degree, and begin to understand these experiences as something even more negative, frustrating, and even intrinsic.

IV.2 How is students' intention to persist or dropout of their undergraduate Physics courses influenced by the senses they attribute to their failure experiences?

Based on the main identified previously senses attributed by students to their failure experiences, we investigated how they relate to students' intention to persist. To this end, we carried out four stages of quantitative data analysis: i. Kruskal-Wallis non-parametric test; ii. correlation analysis between the intention to persist and the subfunctions mobilized to make sense of failures; iii. linear regression analysis of students' intention to persist as a function of the constructs researched; and iv. Cluster analysis.

As the persistence intention variable is numerical, we transformed the categorical variables of self-evaluation, causal attribution, and self-reaction into numerical variables, so that we could relate them. To transform the variables, we ordered the data by constructing a ranking of the categories about the persistence intention variable, assigning the highest numbers to the categories with the highest mean persistence intention, and the lowest numbers to those with the lowest mean persistence intention¹².

Using the **Kruskal-Wallis non-parametric test**, we evaluate whether there are statistically significant differences in students' persistence intentions depending on the types of self-regulatory subprocesses mobilized by them (self-evaluations, causal attributions, and self-reactions), making it possible to identify that there is a statistically significant difference, at the level of $p=0.019^{13}$, between the persistence intentions of the groups encompassed in

¹² In addition to the ranking of the causal attribution subfunction, we constructed a ranking for the other subfunctions. For example, for the self-reaction subfunction, we assigned a value of 5 to responses that were classified in the positive emotional category (indicating greater intention to persist); a value of 4 for responses linked to the positive adaptive behavioral category; a value of 3 for responses classified in the unidentified category; the value 2 for responses classified in the negative adaptive behavioral category; and the value 1 for responses linked to the negative emotional category (indicating less intention to persist).

¹³ In statistical tests, the p-value indicates whether the statistical evidence allows the null hypothesis to be refuted, and the lower the p-value, the safer the evidence for rejecting the null hypothesis. In this case, a p-value lower than 2% indicates that the test performed refutes, at the 2% level, the null hypothesis that there is no

each of the causal attribution categories (individual, external, behavioral and institutional) and between the persistence intentions of the groups established in terms of self-reaction (positive emotional, positive adaptive behavioral, negative emotional, negative adaptive behavioral and others), at the level of $p=0.044$ (i.e., when comparing the samples, we identified that there are differences between them at the level of 5%).

Therefore, groups that attribute failure to individual or external factors have a greater intention to persist, while those that attribute this experience to behavioral or institutional causes have a lower intention to persist. Furthermore, the groups that self-reacted positively, whether emotionally or behaviorally, demonstrated a greater intention to persist than those that self-reacted negatively (emotional or behavioral), which demonstrated a lower intention to persist. It is worth noting that we did not identify statistically significant differences between the persistence intention of the groups included in the self-assessment categories. In Table 4 we present these data.

Table 4 – Ranking of causal attribution and self-reaction categories concerning intention to persist.

Subfunction	Category	Average persistence intention¹⁴
Causal attribution	Individual	4,4
	External	4,1
	Behavioral	3,4
	Institutional	3,3
Self-reaction	Positive emotional	4,3
	Comportamental adaptativa positiva	4,2
	Not identified	4,1
	Negative adaptive behavior	3,6
	Negative emotional	3,0

From Table 4 we can identify that, of the categories present in the causal attribution subfunction, we have that “individual causes” and “external causes” are strongly related to a high intention of persistence, a result that is corroborated by the literature review of Franco et al. (2022), in which individual factors were more relevant to students’ intention to persist, whereas factors such as academic performance resulted in implications for dropout. Furthermore, according to Frison *et al.*, (2021), personal attributions tend to be decisive in

difference between the groups investigated, providing support for the affirmative hypothesis that there is a difference in intention of persistence between groups.

¹⁴ This average was calculated based on the values (from 1 – lowest intention - to 5 – highest intention) attributed by students to their intention to persist.

defining goals, guiding behaviors, and future reactions, influencing students' motivation. It is important to highlight that care must be taken not to blame the student and/or the university. We aim to understand the factors that affect the intention to persist or evade and, based on them, propose actions that help encourage persistence. "Institutional causes" and "behavioral causes" are strongly related to a low intention to persist. In this way, we can infer that factors involving the institution, such as assessment, teaching methods, and infrastructure, demonstrate a strong impact on the student's intention to dropout, as well as the lack of an adequate routine and dedication to studies.

Analyzing the categories of the self-reaction subfunction, we can observe that positive reactions, whether emotional or behavioral, are strongly related to a greater intention to persist. In other words, students who, after going through stressful experiences, modified their behaviors and actions, dedicated themselves more to their studies and sought strategies to achieve their goals, often demonstrated a high intention to persist. On the other hand, students who, when experiencing these experiences, manifested negative (emotional or behavioral) reactions, such as demotivation and abandonment/withdrawal from the subject, in most cases demonstrated a low intention to persist.

Aware of the existence of significant differences due to the independent variable, we used the Spearman correlation matrix, presented in Table 5, to evaluate the intensity of statistically significant correlations between the variables studied.

Table 5 – Spearman correlation matrix between self-assessment variables, causal attribution, self-reaction, and intention to persist. Two asterisks (**) indicate significance levels lower than 1%; an asterisk (*) denotes a significance level lower than 5%.

Correlation Matrix		i.	ii.	iii.	iv.
i. Persistence Intent	<i>R</i>	X			
	Sig.	X			
ii. Persistence Intent	<i>R</i>	0,22	X		
	Sig.	0,08	X		
iii. Causal Attribution	<i>R</i>	0,37**	-0,25*	X	
	Sig.	0,002	0,044	X	
iv. Self-reaction	<i>R</i>	0,34**	0,10	0,04	X
	Sig.	0,006	0,40	0,75	X

As we can see in Table 5, the variables "causal attribution" and "self-reaction" have a statistically significant moderate correlation with the variable "intention to persist", which indicates that the values of these variables tend to change consistently when the variable "intention of persistence" changes. In other words, there is a relationship between these variables that does not occur by chance, but which indicates that people who mobilize certain

causal attributions or self-reactions tend to have a greater intention to persist. Although the variable “self-assessment” does not have a statistically significant correlation with “intention to persist”, it does have a statistically significant negative correlation with the variable “causal attribution”. This correlation can be explained by the fact that, when carrying out self-assessment, individuals also consider what were their performance determinants (i.e., the causes), that is, these subfunctions already present relationships since their origin, and, through analysis correlation, we corroborate this correlation. The negative coefficient indicates that these variables are inversely related.

Furthermore, we performed a linear regression analysis, using persistence intention as the dependent variable and the three subfunctions analyzed (self-evaluation, causal attribution, and self-reaction) as independent variables. The results obtained indicate that the regression coefficient is statistically significant for the three constructs, namely: i. self-assessment $p=0.023$; ii. causal attribution $p<.001$; and iii. self-reaction $p<.001$. In other words, the effects of these three constructs on persistence intention are unlikely to occur by chance; they affect students’ intention to persist in a real and measurable way. The three subfunctions are responsible for explaining 35% of the variance in persistence intention. Therefore, we can conclude that, if sense making is the result of the mobilization of these self-regulatory mechanisms, the sense that students attribute to their failure experiences influences their intentions to persist or dropout of the course.

Thus, so that we can better understand the influence of the sense attributed to failures on the student’s intention to persist or dropout, we carried out a **Cluster analysis** using the K-means method, through which we can group data according to criteria of homogeneity and heterogeneity, enabling the identification of predominant characteristics in each group and how these characteristics relate to the persistence intention of the students analyzed. To this end, we analyzed the persistence intention variable, the categories proposed for each of the three subfunctions of self-regulation (self-evaluation, causal attribution, and self-reaction), and the main senses identified through similarity analysis (Fig. 3).

These elements, in particular the similarity analysis, carried out with the Iramuteq software, allowed us to conclude that there were terms, linked to the answers obtained, which were grouped into three islands (colored groupings highlighted in Figure 3), which gave us evidence that there are three senses linked to these groupings of words, so we estimate that the existence of three clusters would be relevant.

“Cluster 1” was called **Intrinsic Individual Inability** due to its similarity with the second main sense identified through similarity analysis. The students ($n=17$, 26.2%) included in this cluster attribute a negative sense to failure, evaluating themselves, in general, as “[...] *unable to understand the content to pass*” (e.g., Student 62) or “[...] *incapable, stupid, I felt as if the institution was indicating that this is not my place*” (e.g., Student 6). Faced with these negative self-evaluations, their self-efficacy beliefs may have been impacted, and they

may have viewed this academic incapacity or non-belonging as something intrinsic, which led to negative self-reactions (e.g., demotivation). Furthermore, this cluster has the lowest mean value of persistence intention (3.1, out of a total of 5 points, with a standard deviation of 1.4), which may be mainly related to predominantly negative self-reactions, given that this subfunction feeds back into the self-regulation process.

We named “Cluster 2” **Impotence to be overcome**, given that the students who make up this group (n=21, 32.3%), in general, reported that, when experiencing the experience of failure, they understood that *“it’s ok that I have difficulties and that I won’t always be able to do my best in my studies and always understand the content”* (e.g., Student 3). Thus, even though failures are something “natural” in the Physics course (and can sometimes be the result of factors that some point out as “injustices” on the part of the university), these students did not let their self-efficacy beliefs be shaken and, through positive self-reactions (e.g., adoption of new study strategies and reflections on upcoming enrollments) sought to give new sense to their failures. This cluster has the highest mean value of persistence intention (4.2 with a standard deviation of 1.1), which may be linked to emotional self-reactions (e.g., greater concern about learning the content than about approval) and behavioral (e.g., adoption of new strategies to achieve success) of individuals, that is, their predominantly positive self-reactions.

Finally, “Cluster 3” was called **Frustration to be overcome**, due to its similarity with the third main sense observed in Figure 3. This group includes students (n=27, 41.5%) who, initially, felt *“[...] as if I had failed”* (e.g., Student 56). However, even though the students had self-evaluated negatively, becoming frustrated for having failed, they sought to overcome this initial perception and self-reacted by adopting positive behaviors (e.g., greater dedication to studies). These factors may be responsible for the mean value of the intention to persist (4.1 with a standard deviation of 0.8) of this group being similar to that of the second cluster, corroborating our hypotheses that positive self-reactions may be influencing the students’ intention to persist. We synthesize the relationships between the main senses attributed by students to their failure experiences (the sense making resulting from the mobilization of the self-regulatory subfunctions of self-evaluation, causal attribution, and self-reaction) and the intention of persistence or dropout, detailing the main characteristics of each cluster in Table 3.

Chart 3 – Summary of the main characteristics of the three clusters (Intrinsic individual incapacity; Impotence to be overcome; Frustration to be overcome) that relate the main senses attributed to failures with the intention of persistence.

Main senses	Self-regulation subfunction	Characteristics	Persistence intention average value
Failure is the result of my intrinsic individual incapacity, which contributes to a lower intention to persist (n= 17, 26,2%)	Self-evaluation	Academic inability; Inability linked to the feeling of not belonging	3,1 (standard deviation of 1,4)
	Causal attribution	Individual; External	
	Self-reaction	Negative emotional; Negative Adaptive Behavioral	
Failure is a powerlessness to be overcome, which contributes to a greater intention to persist (n=21, 32,3%)	Self-evaluation	Normality; Sadness; Wrongful	4,2 (standard deviation of 1,1)
	Causal attribution	External; Institutional	
	Self-reaction	Positive Adaptive Behavior; Positive Emotional	
Failure is a frustration to be overcome, which contributes to a greater intention to persist. (n=27, 41,5%)	Self-evaluation	Failure; Normality; Sadness; Unpreparedness	4,1 (standard deviation of 0,8)
	Causal attribution	External; Behavioral	
	Self-reaction	Positive	

In the first cluster, there is a predominance of negative emotional and behavioral self-reactions, which is the group with the lowest persistence intentions. In the second and third clusters, whose average values are higher and closer to each other, we can observe that there is a predominance of positive emotional and behavioral self-reactions. Finally, seeking to assess whether there are statistically significant differences in students' persistence intentions depending on the sense attributed to their failure experiences (intrinsic individual incapacity, impotence to be overcome and frustration to be overcome), we used Kruskal-Wallis's non-parametric test, which made it possible to verify that there is a statistically significant difference, at the level of $p=0.012$, between the persistence intentions of students grouped in each cluster.

These results indicate that students who modify their strategies and behaviors to achieve success in their objectives tend to have a greater intention of persistence, while students who demonstrate negative reactions, adopting behaviors and actions that distance them from achieving their objectives, in general, have lower intention to persist. They corroborate, once again, the research data by Sá (2018), which indicates that, although negative feelings linked to failures have been identified, in general, they are considered a form of motivation for greater dedication to studies. Furthermore, our analyses highlight the need to propose actions that help students give new sense to their failures.

V. Final considerations

More than being passively subjected to experiences within the institutional scope, students attribute sense to these experiences. When constructing and assigning sense, individuals are going through a process of reorganization and regulation of their actions, emotions, thoughts and behaviors. To do so, they mobilize some of their cognitive and psychological capacities and abilities for self-evaluation, causal attribution and self-reaction, known as self-regulatory subfunctions.

In our study, these subfunctions were identified through an online questionnaire and were categorized according to students' responses. The categories obtained were analyzed using similarity analysis, which allowed us to identify groupings of hegemonic thoughts, that is, groupings referring to the main senses that students attributed to their failure experiences.

By investigating the main senses that Physics students attribute to their failure experiences and how these senses influence their intentions to persist or drop out of their courses (through statistical analyses, such as Kruskal-Wallis tests, correlation analysis and Cluster analysis), we identified that students who understand their failures as an academic inability and/or inability to belong to the course, and self-reacted negatively, taking these initial perceptions as something intrinsic and impossible to overcome (the main sense attributed by them being what we call "intrinsic individual incapacity"), demonstrated lower intentions of persisting in the course. On the other hand, students who initially understood failure as something frustrating or as a difficulty/impotence, but self-reacted positively, seeking to overcome these perceptions (the main senses attributed by them being what we call "impotence to be overcome" and "frustration to be overcome") demonstrated that they had given new sense to their initial conceptions, which contributed to these students' greater intention to persist.

When analyzing sense making as a result of the mobilization of self-regulatory subfunctions, our results reinforce the fact that the construction and attribution of sense consists of a multidimensional process, which involves how the students initially evaluate their actions and experiences, the causes they understand as determinants of their performance and their reactions to such experiences. Furthermore, this multidimensional analysis of sense

is not limited to experiences of failure, although in our research we explored only this experience. It can be used to analyze various institutional experiences of both a social nature (involving the integration and interaction of students with their colleagues, teachers, and members who are part of the university) and academic ones (encompassing their performance, their learning), which can and will be investigated in future research. A limitation of our study is that the data were collected only through a questionnaire, making it necessary, in future studies, to deepen our analysis through interviews.

Finally, we highlight the importance of institutions considering, when proposing and implementing actions to encourage persistence/combat dropout, the experiences of students and the sense attributed by them to these experiences as determining elements of their intention to persist or evade the course. Furthermore, institutional actions must be proposed (e.g., academic support actions and guidance) that enable students to give new sense to their stressful experiences, such as failure, just as it is necessary to promote actions (e.g., proposing and systematizing a mentoring program through proposed meetings between mentors and mentees) aimed at developing and improving students' self-regulation.

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