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The Impact of the Educational Environment of Behavioral Autonomy: An Investigation among Seafarers Participating in Professional Training Courses in Romania

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Abstract

This mixed-methods study investigates the impact of the professional educational environment on the development of personal autonomy, with a specific focus on behavioral autonomy, among adult learners enrolled in maritime training programs. The research is theoretically grounded in Self-Determination Theory (Ryan & Deci, 2000, 2017) and integrates contemporary models of the multidimensional structure of personal autonomy, including cognitive, emotional, behavioral, and value-related dimensions. The study combines a quantitative analysis with a theoretical synthesis. Quantitative data were collected through a 36-item questionnaire administered to a sample of 225 participants from Constanța, Romania. The results indicated a significant positive correlation between age and behavioral autonomy ($r = 0.166$, $p = 0.013$), as well as strong correlations among the dimensions of autonomy, particularly between behavioral and emotional autonomy ($r = 0.805$, $p < .001$). Repeated measures ANOVA revealed statistically significant differences among the dimensions ($F(3,672) = 117$, $p < .001$), with cognitive autonomy recording the highest mean score ($M = 3.14$), and value-based autonomy the lowest ($M = 2.74$). Findings support the general hypothesis that the structure and climate of the professional educational environment can facilitate the development of personal autonomy. Recommendations are offered for educators and trainers in vocational settings, focusing on the design of learner-centered interventions that foster choice, responsibility, and reflective learning. Future research should consider expanding the sample size and employing longitudinal and qualitative methods to gain a deeper understanding of how autonomy develops over time and across diverse educational contexts.

Keywords: adult education; andragogy, behavioral regulation; maritime training

1. Introduction

Personal autonomy, as a subject of study in educational sciences, has gained significant importance over the past decades, being regarded as an essential condition for lifelong learning and for the formation of individuals capable of making responsible decisions, managing their own development, and dynamically adapting to social and professional demands. Behavioral autonomy plays a fundamental role in professional training processes, where the ability to act independently and responsibly is directly correlated with work efficiency and safety in complex operational contexts, such as maritime navigation. Within this framework, investigating behavioral autonomy among adults participating in professional training becomes not only relevant but necessary for understanding and optimizing instructional design tailored to this audience.

Specialized literature supports the idea that an autonomy-supportive educational environment enhances learners' engagement and performance. For example, Deci and Ryan (1985) highlighted that supporting autonomy in educational contexts is associated with increased involvement, intrinsic motivation, and effective self-regulation. They emphasized that in the absence of an environment conducive to autonomy development, participants may become passive and demotivated, ultimately undermining the effectiveness of the training process (Deci & Ryan, 1985).

Building upon these theoretical and practical premises, the present study aims to answer the question: To what extent does the professional educational environment influence the development of behavioral autonomy among adults enrolled in professional training courses? The research examines how structural and relational characteristics of the educational context can facilitate or hinder the formation of autonomous competencies, beyond the content delivered.

The primary objective of this research is to investigate the relationship between the educational environment and the level of behavioral autonomy. The study adopts a mixed-methods approach, combining quantitative analysis of data collected through a validated questionnaire with a theoretical review of the existing literature, intended to ground and contextualize the quantitative findings.

The structure of the study is designed to ensure a comprehensive and coherent approach to the proposed hypotheses. It begins with the theoretical framework, followed by the presentation of methodology, instruments, and research context, then proceeds to the statistical and qualitative analysis of the data, and concludes with the interpretation and discussion of results in relation to current literature. The final section presents the conclusions and practical recommendations.

It is important to acknowledge the limitations of this study. The generalizability of the results is constrained by the specificity of the sample (navigators enrolled in training programs), and self-reported data may be influenced by subjective factors. Nonetheless, this study offers a significant contribution to understanding how formal education influences the development of personal autonomy and stands as a promising initial step for future, more extensive and in-depth research in the field of adult education.

The authors' personal motivation derives from a strong interest in applied educational interventions capable of producing positive changes in the self-regulatory structure of adult learners. This focus is not only theoretically relevant but also practically significant in the context of continuing education and specialized training in high-responsibility domains.t.

2. Theoretical Analysis

In analyzing the title "The Impact of the Educational Environment on Behavioral Autonomy: An Investigation Among Participants in Professional Training Courses", it is essential to provide a rigorous and up-to-date definition of the key concepts involved. This theoretical endeavor aims to establish the epistemological foundations of the research and to guide the empirical investigation along clearly delineated paths. The analysis begins with a conceptualization of behavioral autonomy, followed by an examination of the educational environment, and concludes with an exploration of the relationship between these two dimensions as reflected in recent academic literature.

2.1 Conceptual and Structural Landmarks of Personal Autonomy

Personal autonomy is considered one of the most fundamental dimensions of human functioning and is widely acknowledged in literature as a basic psychological need. Within the framework of Self-Determination Theory (SDT), autonomy is conceptualized as the feeling of volition and control over one's thoughts, emotions, and behaviors, aligned with one's personal values and goals. Ryan and Deci (1985) emphasize that autonomy is indispensable for healthy development and well-being, and that social experiences that support this psychological need directly impact motivation and personal adjustment (Deci & Ryan, 1985). In addition to the Self-Determination Theory framework, recent interdisciplinary contributions provide further insights into the mechanisms that foster personal autonomy in various educational and cultural contexts. For instance, empirical findings from neuroeducation indicate that autonomy-supportive instruction activates brain regions associated with executive functioning and motivation, such as the prefrontal cortex and anterior cingulate cortex (Scharf & Goldstein, 2022). This highlights the neurological underpinnings of autonomy-related behaviors in learning environments.

Furthermore, a global comparative study by Yoon and Ng (2023) emphasized that behavioral autonomy is differentially expressed across educational systems, depending on whether they prioritize collectivist or individualist values. Despite these cultural differences, autonomy remains a universally beneficial construct for learner engagement and well-being.

In digital education, Wang et al. (2022) found that online learners who experience autonomy through self-paced modules and personalized feedback report higher intrinsic motivation and course completion rates. These findings support the relevance of autonomy in adult learning platforms that increasingly rely on digital delivery.

In the medical education field, Hu and Morales (2021) argue that autonomy-supportive mentoring models enhance residents' confidence, clinical reasoning, and reflective capacity. Similarly, in workplace training environments, autonomy-promoting practices are linked with increased resilience and adaptive learning (Delgado et al., 2023).

Collectively, these recent studies converge in highlighting that autonomy is not only a psychological need but also a dynamic outcome shaped by instructional design, social structure, technological mediation, and cultural norms. These findings reinforce the value of examining autonomy in vocational training contexts, particularly those as high-stakes and operationally complex as maritime education.

To fully grasp this concept, it is important to examine how personal autonomy is structured in literature. It is often discussed through the lens of Self-Determination Theory, which places it within a system of three fundamental psychological needs: autonomy, competence, and relatedness. These needs are interdependent and, collectively, they support intrinsic motivation and optimal functioning (Avakyan & Taylor, 2024). On an intrapsychic level, autonomy

involves the perception of volitional control over one's actions and is fostered by environments that provide freedom of choice and self-validation. Studies in the field of sports confirm this functional dimension: athletes who experience a high level of autonomy demonstrate more effective emotional self-regulation and a more positive evaluation of challenging situations (Robazza et al., 2025). From a neurocognitive perspective, autonomy activates cortical areas such as the dorsolateral prefrontal cortex (DLPFC), which are associated with decision-making and action planning (Zhang et al., 2024). Furthermore, the relational dimension is crucial to the structure of autonomy: qualitative studies on adolescents show that autonomy is expressed both as independence and as volitional functioning supported by social support (West et al., 2023). Overall, personal autonomy is structured across four core dimensions-interpersonal, relational, functional, and neurocognitive, which interconnect in an adaptive system that supports personal development and active engagement in diverse contexts.

From an applied perspective, recent qualitative studies in educational and social contexts reveal how autonomy is perceived and supported by individuals. For example, West et al. (2023), in a study on adolescents' use of social media, found that autonomy is experienced when individuals are able to make choices aligned with their own values and interests. Conversely, external control, social pressure, or environmental constraints may compromise this experience, generating internal conflict and affecting emotional regulation. The authors also highlight the importance of the conceptual distinction between autonomy as independence and autonomy as volitional functioning—the latter being favored by interdependent contexts in which individuals receive support in making their own choices (West et al., 2023).

Interestingly, the effects of autonomy are not dependent on cultural background. In a comparative study involving Chinese and Dutch students, Zhang et al. (2024) experimentally demonstrated that participants performed significantly better on memory tasks under autonomous conditions than in non-autonomous ones, regardless of their cultural background. This finding supports the idea that the benefits of autonomy in learning are universal, transcending cultural boundaries and reinforcing its essential role in motivation and cognitive engagement (Zhang et al., 2024).

From a psychological and functional perspective, studies in sports also offer compelling evidence on the relationship between autonomy satisfaction and well-being. Robazza et al. (2025) found that athletes perceiving a high degree of autonomy used more effective coping strategies, experienced more positive emotions, and reported functional psycho-bio-social states. In contrast, autonomy frustration was associated with dysfunctional emotions and negative evaluations of challenges (Robazza et al., 2025). These findings strengthen the view that autonomy plays a central role in behavioral self-regulation and in maintaining personal resilience in high-pressure, performance-driven environments.

In the educational field, the relevance of autonomy is supported by research on innovative pedagogical models. The flipped classroom model, for instance, has proven effective in meeting students' autonomy needs by engaging them actively in the learning process and allowing them to decide how and at what pace they engage with the content. Avakyan and Taylor (2024) found that students who studied in learner-centered environments reported higher autonomy satisfaction, as well as increased intrinsic motivation and self-esteem (Avakyan & Taylor, 2024).

Therefore, personal autonomy emerges as a complex construct encompassing psychological, social, and neurocognitive dimensions. From the perspective of Self-Determination Theory, it functions as a structural pillar of human motivation and is supported by both internal factors (personal values and preferences) and external factors (educational, social, or cultural environments). Its relevance extends beyond theories of personal development and applies to

various fields such as elite sports, medical education, and youth engagement with digital technologies. This conceptual versatility makes personal autonomy a solid starting point for a deeper analysis of how it is expressed and supported in adult education and in specific professional contexts, such as maritime training. Tables and figures should be numbered and references to them must be in the text. Acceptable labeling for a table is Tab.1 and Fig. 1 for a figure.

2.2 Personal Autonomy in Adult Education and the Context of Seafarer Training

Personal autonomy plays a central role in adult education, being associated with intrinsic motivation, authentic engagement in learning activities, and the capacity for self-regulation of cognitive and emotional processes. Scholarly literature highlights that, unlike younger learners, adults enter educational contexts with diverse life experiences and personal motivations, and the success of training depends largely on the extent to which their autonomy is acknowledged (Avakyan & Taylor, 2024).

According to the model of self-directed learning, adults naturally prefer to manage their own learning processes, selecting resources, pacing, and goals based on their personal interests and needs (Loeng, 2020). This form of autonomy fosters the development of self-assessment skills and reinforces the identity of a "lifelong learner." Moreover, personalized counseling, conducted one-on-one, can enhance levels of autonomy by tailoring the learning experience to the learner's age, cognitive style, and individual pace (Schiller, Dorner & Szabó, 2023).

Beyond the individual approach, autonomy is also supported by the educational climate. Creating a learner-centered environment that offers freedom of choice and constructive feedback leads to increased engagement and improved outcomes (Avakyan & Taylor, 2024). Intrinsic motivation develops when adults feel in control of their own training, and educators become facilitators of autonomy rather than sole authorities in the instructional process.

This perspective is particularly relevant in the context of vocational training for seafarers, a field deeply influenced by technological advances, automation, and digitalization. The emergence of Maritime Autonomous Surface Ships (MASS) has created an urgent need to update competencies, which requires not only the acquisition of technical knowledge but also a reconfiguration of the human-technology relationship (Meštrović, Pavić, Maljković & Androjna, 2024).

According to a study conducted on Swedish maritime pilots, the integration of predictive automated systems influences not only technical skills but also users' confidence and their willingness to assume responsibility for decision-making. In this case, autonomy is expressed as the ability to collaborate with technology rather than exclude it, and training should support adaptability and critical thinking (Håkansson, Lindblom & Lundh, 2025).

Thus, training for seafarers involves the development of a specific type of professional autonomy: taking responsibility in operationally uncertain environments, interpreting data provided by artificial intelligence, and making real-time decisions. These skills can be cultivated only in a flexible learning environment where autonomy is not merely allowed but actively stimulated through scenario-based learning, simulations, reflective practices, and structured feedback.

2.3 Behavioral Autonomy and the Educational Environment

Behavioral autonomy is a central dimension of personal autonomy, defined as the individual's ability to regulate actions according to personal values, interests, and goals, in the absence of external pressures or constraints imposed. It is closely linked to intrinsic motivation and the

sense of self-determination and is widely recognized in the literature as a fundamental condition for optimal functioning (Deci & Ryan, 1985).

The educational environment plays a crucial role in supporting or inhibiting behavioral autonomy. A setting that promotes freedom of choice, emotional support, and personal validation fosters the development of autonomy, leading to authentic engagement and long-term commitment (West, Rice & Vella-Brodrick, 2023). In contrast, rigid, authoritarian, or standardized educational practices can reduce the sense of control, negatively impacting learners' motivation and well-being (Robazza et al., 2025).

Studies involving both adolescents and adults demonstrate that behavioral autonomy is supported by the presence of an empathetic educational climate characterized by supportive relationships, constructive feedback, and real opportunities for self-expression (Schiller, Dorner & Szabó, 2023; Avakyan & Taylor, 2024). Additionally, learning environments based on the flipped classroom model or student-centered approaches have been shown to enhance behavioral autonomy by encouraging learners to take active responsibility for their educational journey.

Adult education provides a privileged context for fostering autonomy, due to the experiential nature of learning and the specific need for self-actualization. According to Loeng (2020), self-directed learning promotes the development of self-regulation skills and the assumption of responsibility for one's own training. When these processes are supported by adaptive educational counseling and authentic educational relationships, behavioral autonomy develops naturally (Schiller, Dorner & Szabó, 2023).

Research in specialized educational fields, such as maritime training, indicates that behavioral autonomy is essential for adapting to new technological demands, making quick decisions, and working in multidisciplinary teams (Meštrović et al., 2024). The introduction of predictive systems and artificial intelligence into navigation requires not only technical skills but also the ability for self-regulation, reflection, and autonomous decision-making (Håkansson, Lindblom & Lundh, 2025).

More broadly, cross-cultural studies show that behavioral autonomy is supported by environments that stimulate intrinsic motivation, encourage personal choice, and avoid excessive control. Zhang et al. (2024) demonstrated that autonomy positively influences learning performance across different cultural contexts, confirming the universal nature of this psychological need.

Thus, behavioral autonomy should not only be seen as an outcome of the educational environment but also as a formative component that must be strategically cultivated throughout all stages of the educational process. It serves as the foundation for sustainable motivation, personal responsibility, and the capacity to adapt to the complexity of the contemporary world.

2.4 Recent Contributions to Vocational Training

Vocational training is a dynamic field, constantly adapting to social, technological, and educational changes. Recent contributions in the specialized literature emphasize that the development of professional competencies can no longer be conceived exclusively within formal settings, but instead requires a flexible, autonomous, and continuous approach, anchored in the realities of today's digital landscape (Morris & Rohs, 2021).

The digitalization of training has opened new opportunities for self-directed learning, and digitally literate adults can access a wide range of educational resources that are personalized and adapted to their own pace of development. According to a systematic review, information

literacy and digital skills facilitate autonomous engagement in training processes and lifelong learning (Morris & Rohs, 2021).

Professional education is increasingly influenced by the integration of artificial intelligence into instructional processes. A recent study indicates that AI literacy is becoming a key competence in adult education and higher education, necessitating the adaptation of curricula and teaching strategies (Laupichler et al., 2022).

Another significant contribution comes from studies examining teachers' preferences for online professional development. Findings suggest that online development programs are more effective when they provide flexible options, interactive activities, and content that is relevant to teachers' actual professional contexts (Ansyari, Groot & De Witte, 2022).

Beyond these technological trends, vocational training remains closely linked to the need for autonomy, self-regulation, and personal development. The studies of Deci and Ryan (1985) laid the theoretical foundation for integrating autonomy into the design of educational processes, demonstrating that intrinsic motivation is supported by educational environments that enable personal control and value learners' interests.

More recently, Avakyan and Taylor (2024) have shown that learner-centered pedagogical strategies, such as the flipped classroom model, significantly contribute to meeting psychological needs for autonomy, competence, and relatedness—leading to increased engagement and improved academic outcomes.

Similarly, Loeng (2020) emphasizes the importance of self-directed learning as a central element in adult education, and Schiller, Dorner, and Szabó (2023) show how personalized counseling can support autonomy and self-regulated learning among older adult learners.

These recent contributions outline a clear direction in which vocational training is becoming more autonomous, more digital, and more tailored to individual needs. They offer a solid foundation for redefining educational policies and pedagogical practices in a society undergoing technological and cultural transition.

This theoretical analysis underpins the present study by offering a robust conceptual framework for interpreting the collected data and reinforcing the relevance of the research topic in contemporary academic discourse.

3. Research Methodology

3.1 Type of Research

The present study adopts a mixed-methods approach, integrating both quantitative and qualitative methods to investigate the impact of the educational environment on the behavioral autonomy of adults enrolled in vocational training programs. The quantitative component involves the application of a psychometrically validated questionnaire, while the qualitative part includes a theoretical meta-analysis of the relevant literature, aimed at deepening the understanding of how participants perceive the educational environment's influence on their personal autonomy development.

3.2 Participants and Context

The research participants were adults enrolled in professional training programs for seafarers conducted in the city of Constanța, Romania, between 2023 and 2025. The sample consisted of 225 individuals, mostly male, with ages ranging from 25 to 67 years old (mean ≈ 40). This population was selected due to the specific characteristics of the professional educational environment and the high demands for decision-making autonomy in maritime contexts. The sample was heavily gender-imbalanced, with an overwhelming majority of male participants

and only one female participant. Consequently, it was not methodologically appropriate to test for gender differences in behavioral autonomy using comparative statistical tests (e.g., t-tests for independent samples), as such results would be statistically irrelevant. This limitation is acknowledged and contextualized by the specific nature of maritime training, which predominantly involves male participants.

3.3 Research Objectives

The general objective of this study is to examine the relationship between the professional educational environment and the development of personal autonomy, with a focus on behavioral autonomy, considered the functional core component in training adults for high-responsibility professions such as seafaring.

From this general objective, the following specific objectives were derived:

1. To analyze the levels of the four types of personal autonomy (cognitive, emotional, value-based, and behavioral) among participants in vocational training courses.

2. To investigate the relationship between age and the scores obtained in the four dimensions of personal autonomy, with a focus on behavioral autonomy.

3. To conduct a theoretical analysis of recent studies addressing behavioral autonomy in similar educational contexts, aiming to identify current trends and convergence in literature.

3.4 Research Variables

The variables used in the study were defined in relation to the research goals:

- Independent variables: age, participation in vocational training.
- Dependent variables: cognitive autonomy, emotional autonomy, value-based autonomy, behavioral autonomy.
- Control variables: educational level, previous professional experience.

The variable "gender" was excluded from comparative analysis due to the highly unbalanced gender distribution (only one female participant), which would have compromised the statistical validity of any comparative test. This methodological limitation is acknowledged and justified by the specific context of seafarer professional training, where male participation is dominant.

3.5 Research Hypotheses

General Hypothesis (GH): The professional educational environment has a significant impact on the development of personal autonomy, particularly behavioral autonomy, among adults participating in vocational training programs.

Derived from this hypothesis and the specific objectives, the following research hypotheses were formulated:

H1: There is a statistically significant relationship between participants' age and their perceived level of behavioral autonomy.

H2: Participants will show significantly different scores across the four dimensions of personal autonomy.

H3: There are positive and significant correlations between behavioral autonomy and the other three dimensions (emotional, cognitive, and value-based).

H0: There are no statistically significant relationships among the variables investigated in objectives O1 and O2, and any observed associations are due to chance.

3.6 Ethical Considerations

The study was conducted with the approval of "Ovidius" University of Constanța, based on an official authorization document. Additionally, approval was obtained from the partner institution where the training courses were held. Participants were informed at the beginning of the questionnaire about the purpose of the study, the anonymity of the data, and the voluntary nature of participation. Completion of the questionnaire was considered equivalent to informed consent.

3.7 Researcher Positioning

The authors adopt a reflexive stance, considering the exploration of personal autonomy within the professional educational context a valuable approach for understanding how educational interventions contribute to the development of personal competencies. The contextual roles and subjective experiences of participants are acknowledged as significant elements in the interpretation of results.

3.8 Research Methods and Instruments

Quantitative method: Use of the Personal Autonomy Assessment Questionnaire (Cognitrom, 2010), a validated instrument in Romanian educational research. The decision to use the Personal Autonomy Assessment Questionnaire developed by Cognitrom (2010) was based on both conceptual alignment and empirical validation in Romanian adult education contexts. This instrument was specifically chosen for its multidimensional structure, which reflects four distinct yet interrelated aspects of autonomy: behavioral, emotional, cognitive, and value-based. These dimensions map onto the Self-Determination Theory's emphasis on volitional functioning, emotional regulation, and alignment with personal values (Ryan & Deci, 2000).

The questionnaire has previously been used in studies with adult learners in continuing education and vocational settings, where its internal consistency and factorial structure were demonstrated to be stable (Cognitrom, 2012; Băban et al., 2014). In particular, the behavioral subscale aligns closely with the demands of maritime training, where independent action and decision-making are critical competencies. The inclusion of the value-based dimension was retained despite moderate reliability scores because of its theoretical relevance to self-determined behavior and the formation of professional identity.

Furthermore, the instrument's familiarity among Romanian psychologists and educators facilitated its implementation in this study. Participants were able to relate to the items, which were phrased in accessible yet theoretically grounded language. Given the lack of alternative tools validated within the same cultural-linguistic context, the Cognitrom questionnaire represented the most appropriate choice for capturing nuanced differences in personal autonomy among adult learners in Romania.

Qualitative method: A meta-analytic review of recent studies on behavioral autonomy in adult vocational training.

3.8.1 Questionnaire Survey

The questionnaire used consists of 36 items rated on a five-point Likert scale. Based on the theoretical model developed by Cognitrom (2010), the instrument includes four dimensions: behavioral, emotional, cognitive, and value-based autonomy. Each dimension consists of nine items selected through internal validation:

•Behavioral Autonomy: Items I1, I5, I9, I13, I17, I21, I25, I29, I33 – representing the ability to make decisions and act independently in line with personal values and intentions.

•Emotional Autonomy: Items I2, I6, I10, I14, I18, I22, I26, I30, I34 – assessing emotional self-regulation and affective independence.

•Cognitive Autonomy: Items I3, I7, I11, I15, I19, I23, I27, I31, I35 – evaluating critical thinking and independent reasoning.

•Value-Based Autonomy: Items I4, I8, I12, I16, I20, I24, I28, I32, I36 – reflecting the individual's capacity to build, maintain, and follow a personal value system.

Abbreviations:

•AC– Behavioral Autonomy

•AE– Emotional Autonomy

•ACog – Cognitive Autonomy

•AV – Value-Based Autonomy

These dimensions were created and processed in the Jamovi statistical platform, with each being aggregated from its corresponding items according to the theoretical model. This structure enabled the calculation of composite scores for each dimension and the application of specific statistical analyses aligned with the study objectives.

3.8.2 Statistical Analysis Tools

The Jamovi open-source platform was used for:

•Importing Excel datasets.

•Performing descriptive statistics (means, SD).

•Pearson correlation tests (age–autonomy dimensions).

•Internal consistency estimates (Cronbach's Alpha).

•Repeated-measures ANOVA, t-tests, and exploratory factor analysis as needed.

4. Results

4.1 Quantitative Results

To ensure the internal validity of the instrument used for measuring personal autonomy, internal consistency analysis was conducted using Cronbach's Alpha and McDonald's Omega coefficients, both for the entire questionnaire and for each conceptual dimension individually. The applied questionnaire consists of 36 items structured on a 5-point Likert scale, aligned with a theoretical framework that includes four fundamental dimensions: behavioral autonomy, emotional autonomy, cognitive autonomy, and value-based autonomy. This structure reflects the multidimensional approach to the concept of personal autonomy and allows for the differentiated investigation of each component within the context of professional training for seafarers.

The internal consistency of the entire questionnaire, calculated based on all 36 items, reached a high level, with a Cronbach's Alpha of $\alpha = 0.891$ and a McDonald's Omega of $\omega = 0.890$, indicating very good overall homogeneity of the instrument. Satisfactory item-rest correlations were recorded for most items, except for a few (I1, I18, I36), which showed lower correlations but did not significantly reduce the overall reliability. Thus, the questionnaire can be considered suitable for measuring personal autonomy in this specific educational context.

Separate analyses of the dimensions revealed differences in internal consistency levels. The behavioral dimension, consisting of 9 items, recorded $\alpha = 0.620$ and $\omega = 0.624$, corresponding

to a moderate level of reliability. The emotional dimension showed lower values, $\alpha = 0.576$ and $\omega = 0.579$, reflecting low consistency, while the cognitive dimension registered $\alpha = 0.677$ and $\omega = 0.700$, approaching the acceptable threshold. The value-based dimension obtained $\alpha = 0.615$ and $\omega = 0.629$, also indicating moderate internal consistency. In all cases, although some items showed correlations below 0.20, their removal would not have significantly improved the overall Alpha coefficient, supporting the decision to maintain the original scale structure.

In this context, the instrument can be considered sufficiently stable to support future quantitative investigations, with the caveat that results related to the emotional and value-based dimensions should be interpreted with increased methodological caution. With these benchmarks for internal reliability established, the analysis will proceed with the descriptive examination of the main variables, allowing for the profiling of score distributions within the sample and the identification of relevant variations for interpreting subsequent results.

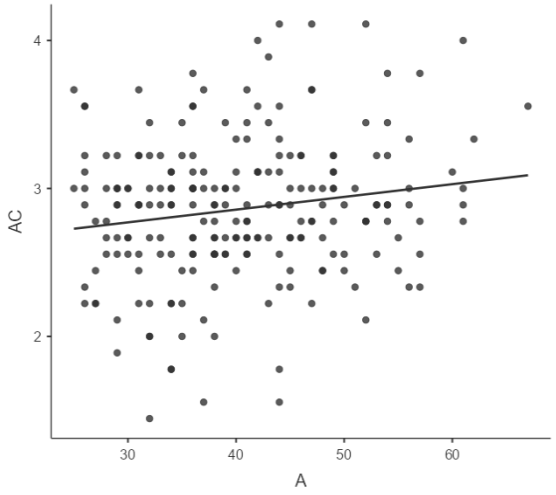
4.2 Statistical Interpretation and Discussion of Results in Relation to the Specialized Literature

The statistical analysis was based on the previously formulated hypotheses and aimed to test the significance of the relationships between the investigated variables—age and personal autonomy across its dimensions—using Pearson correlation coefficients, repeated-measures ANOVA, paired-sample t-tests, and effect size estimation. This approach allowed for the identification of statistically significant patterns regarding the impact of the educational environment on the development of behavioral autonomy among participants in vocational training programs.

Before testing the directional hypotheses, the null hypothesis (H0) was evaluated, which stated that there are no significant differences among the four dimensions of personal autonomy and no significant associations between age and the perceived level of autonomy. The results of the ANOVA test ($F(3,672) = 117$, $p < .001$, $\eta^2p = 0.343$) indicated significant differences between dimensions, while the positive and significant correlation between age and behavioral autonomy ($r = 0.166$, $p = 0.013$) led to a partial rejection of the null hypothesis. These results support the validity of the proposed research directions and partially confirm the applicability of the theoretical model used.

For **Hypothesis H1**—concerning the existence of a relationship between age and behavioral autonomy—the Pearson correlation analysis revealed a statistically significant positive association ($r = 0.166$, $p = 0.013$), suggesting that behavioral autonomy tends to increase with age. Although the coefficient indicates a weak effect size, the statistical significance supports the notion of a real relationship. Knowles, Holton, and Swanson (2020) showed that maturation is associated with the development of self-regulation and the assumption of responsibility in autonomy-centered educational contexts. **Figure 1** illustrates this relationship through a scatter plot with a regression line that highlights the upward trend between the two variables.

Figure 1. Correlation between Age and Behavioral Autonomy (Scatter Plot with Regression Line)



The graph supports the identified statistical direction, illustrating a slight upward trend between age and the perceived level of behavioral autonomy. This association may be interpreted to suggest that, with the accumulation of personal and professional experience, participants become more capable of regulating their autonomous behavior in learning contexts.

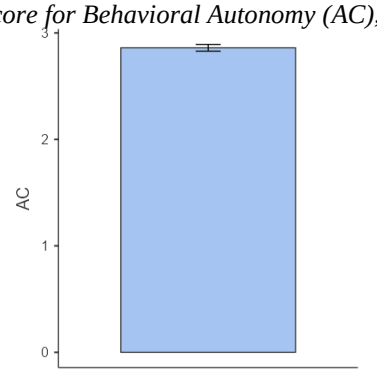
Hypothesis H2 tested the differences among the four dimensions of personal autonomy. The ANOVA test confirmed statistically significant differences between dimensions ($F(3,672) = 117$, $p < .001$). The score for cognitive autonomy ($M = 3.14$, $SD = 0.46$) was significantly higher than that for emotional autonomy ($M = 2.85$, $SD = 0.51$), while value-based autonomy ($M = 2.74$, $SD = 0.46$) recorded the lowest mean score. These differences were further supported by paired-sample t-tests.

To support the interpretation of this hypothesis, a graphical representation was generated using data processed in the Jamovi platform and statistical visualization tools. **Figure 2** synthesizes the mean scores and standard deviations for the four dimensions, providing a clear perspective on their internal variation.

Table 1. Descriptive Data – Autonomy Dimensions

Descriptives				
	AC	**AE**	**ACog**	**AV**
N	225	225	225	225
Missing	0	0	0	0
Mean	2.86	2.85	3.14	2.74
Median	2.89	2.78	3.11	2.67
Standard deviation	0.475	0.473	0.539	0.481
Minimum	1.44	1.33	1.22	1.33
Maximum	4.11	4.11	4.67	4.22

Figure 2. Mean Score for Behavioral Autonomy (AC), with Standard Error

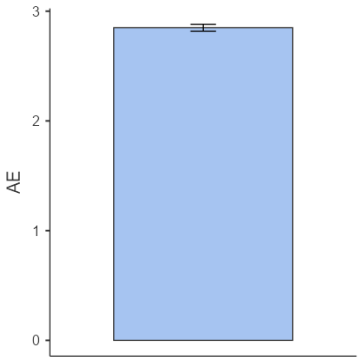


The graph shows that participants achieved a mean score of approximately 2.9 in behavioral autonomy, which reflects a moderate-to-high level of ability to make decisions and act independently in educational contexts. The very small error bar indicates low dispersion of scores among participants, suggesting homogeneity in perceptions of behavioral autonomy.

This result aligns with the Self-Determination Theory model (Ryan & Deci, 2000), which posits that behavioral autonomy is fostered by educational experiences that provide opportunities for choice and personal responsibility. Specifically, Reeve (2016) demonstrated that autonomy support in the classroom promotes the development of behavioral self-regulation, while Knowles et al. (2020) argued that adults engaged in self-directed learning tend to exhibit increased control over their behavior, particularly in career-relevant learning contexts.

Moreover, Vansteenkiste et al. (2019) emphasize that behavioral autonomy develops within a learning climate characterized by collaboration and accountability, which is typical of vocational training programs—such as those attended by participants in the current sample.

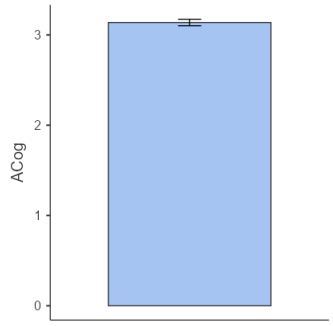
Figure 3. Mean Score for Emotional Autonomy (AE), with Standard Error



Participants achieved a mean score of approximately 2.85 in emotional autonomy, reflecting a moderate level of control and awareness of their own emotions in educational situations. The presence of low score dispersion (indicated by a small standard error) suggests relatively homogeneous perceptions within the group regarding this dimension. This result supports findings in the specialized literature, which recognizes emotional autonomy as being sensitive to the educational context and the quality of interpersonal relationships. Reeve (2016) emphasizes that an autonomy-supportive educational climate contributes to reducing emotional tension and fostering authentic engagement. Additionally, Kramer et al. (2024) report that daily psychological support and reduced educational stress are correlated with higher levels of emotional autonomy among learners, including adult participants.

In the context of vocational training for seafarers—where decision-making pressure and emotional self-control are key components of performance, this level of emotional autonomy can be considered both adaptive and relevant for the participants' professional trajectories.

Figure 4. Mean Score for Cognitive Autonomy (ACog), with Standard Error

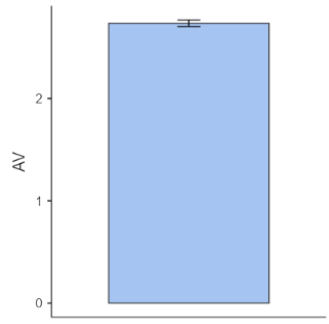


The graph shows that participants achieved a mean score of approximately 3.14 in cognitive autonomy, the highest among all the dimensions analyzed. This result indicates a high level of analytical capacity, reasoning, and autonomous decision-making within educational processes. The low dispersion (small standard error) reflects a relatively strong consensus among participants regarding their perception of cognitive autonomy.

According to Self-Determination Theory (Ryan & Deci, 2000), cognitive autonomy is essential for the development of self-regulation, and the educational context should encourage reflection, conscious choice, and active participation. This result is also supported by Vansteenkiste et al. (2019), who found that vocational training based on problem-solving and immediate applicability fosters the development of autonomous thinking.

In the case of the participants analyzed—adult maritime professionals, the elevated level of cognitive autonomy may be correlated with the high cognitive demands of the field, which requires planning, anticipation, and rapid decision-making in critical contexts.

Figure 5. Mean Score for Value-Based Autonomy (AV), with Standard Error



Participants recorded a mean score of approximately 2.74 in value-based autonomy, making it the lowest among the four dimensions of personal autonomy investigated.

This suggests a relatively low level of alignment between participants' educational behavior and their personal values and moral beliefs. The low dispersion, as indicated by the minimal standard error, points to a consensus within the sample regarding this perception.

Value-based autonomy is often less developed in standardized or highly technical educational contexts, where the emphasis is placed on instrumental competencies rather than value reflection. Reeve (2016) and Vansteenkiste et al. (2019) argue that the development of personal

values in education requires formative activities centered around meaning and personal purpose-an aspect less visible in strictly vocational training.

Furthermore, in seafarer training programs, where the focus is on practical instruction, strict regulations, and protocol compliance, there is limited room for the expression of personal values in decision-making. This result can be interpreted as an indication of the need to integrate reflective and ethical dimensions into the design of professional education.

The comparison of the four dimensions of personal autonomy reveals a differentiated profile, reflecting how the educational environment influences the development of each component. The highest average score was recorded for cognitive autonomy, followed by behavioral and emotional autonomy, while value-based autonomy scored significantly lower. This hierarchy can be explained by the practical and applied nature of vocational training programs, which favor the development of critical thinking and decision-making capacities (Vansteenkiste et al., 2019), which are often at the expense of value components, which tend to be overlooked in standardized educational settings (Reeve, 2016).

These findings confirm Hypothesis H2, which posited significant differences between the dimensions of personal autonomy and are consistent with the Self-Determination Theory proposed by Ryan and Deci (2000), which asserts that autonomy manifests in diverse forms, each distinctly influenced by the formative context. Additionally, studies by Kramer et al. (2024) and Knowles et al. (2020) support the idea that educational support, life experience, and maturity level shape how individuals self-regulate and engage in the learning process.

From this perspective, it can be concluded that personal autonomy, while functionally unified, develops differentially depending on the dimension analyzed and the types of educational interactions provided in the training context.

Hypothesis H3 assumed the existence of statistically significant correlations between behavioral autonomy and the other dimensions of personal autonomy. The results obtained through Pearson correlation analysis confirmed this hypothesis, indicating strong and significant relationships between:

- Behavioral Autonomy (AC) and Emotional Autonomy (AE): $r = 0.805$
- AC and Cognitive Autonomy (ACog): $r = 0.767$
- AC and Value-Based Autonomy (AV): $r = 0.783$ (all at $p < .001$)

To illustrate these associations, Table 2 presents the Pearson correlation coefficients for all pairs of personal autonomy dimensions, supplemented by the visual representation in Figure 6.

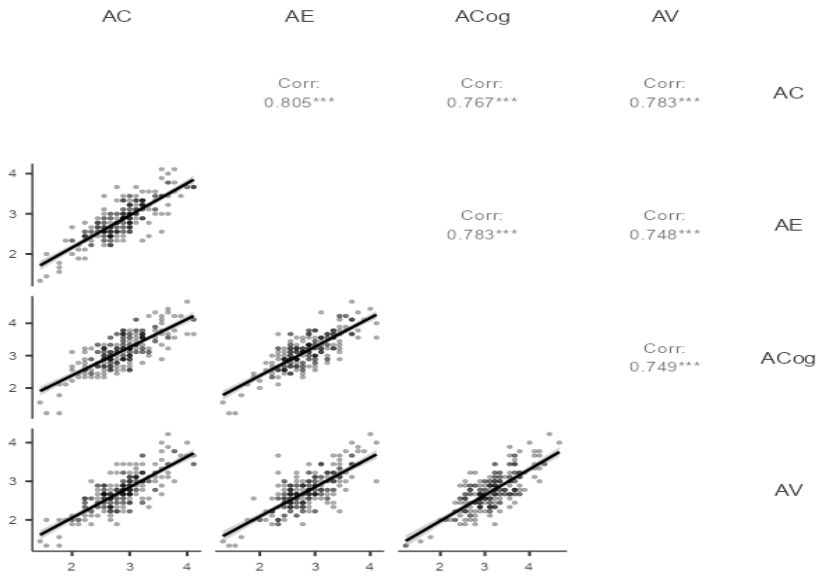
Table 2. Pearson Correlations between Dimensions of Personal Autonomy

	AC	**AE**	**ACog**	**AV**
AC	—			
AE	0.805***	—		
ACog	0.767***	0.783***	—	
AV	0.783***	0.748***	0.749***	—

Note. Values represent Pearson correlation coefficients. ***p < .001.
AC = Behavioral Autonomy; AE = Emotional Autonomy; ACog = Cognitive Autonomy; AV = Value-Based Autonomy.

Figure 6 provides a comprehensive visual representation of these relationships, displayed as a correlation matrix accompanied by scatter plots and regression lines. This format allows for the observation of linear trends and the degree of association between dimensions, confirming the positive and consistent direction of the statistically identified relationships.

Figure 6. Pearson Correlation Matrix Between Dimensions of Personal Autonomy, with Scatter Plots and Regression Lines



The graph highlights the internal coherence of the personal autonomy construct. The strong correlations between behavioral autonomy and the other dimensions support Hypothesis H3 and reinforce the idea of a unified yet differentiated functioning of autonomous dimensions. This result aligns with the Self-Determination Theory (Ryan & Deci, 2000), which emphasizes the interdependence of autonomy components in supportive educational contexts (Vansteenkiste et al., 2019).

The results obtained for Hypotheses H1, H2, and H3 provide robust empirical support for the general research hypothesis—that the professional educational environment significantly influences the development of personal autonomy, especially behavioral autonomy. The positive correlation between age and behavioral autonomy (H1), significant differences among autonomy dimensions (H2), and strong interdimensional correlations (H3) outline a coherent participant profile, highlighting the formative role of the educational context.

Specifically, the highest scores recorded for cognitive and behavioral autonomy—strongly interrelated and correlated with the other dimensions—suggest that applied educational experiences, typical of vocational training, foster the development of self-regulated, conscious, and responsible behavior. This finding aligns with the theoretical perspectives offered by Ryan and Deci (2000) and with the recent studies of Vansteenkiste et al. (2019), which underline the positive effects of an autonomy-supportive educational climate.

Thus, the general hypothesis is supported both statistically and theoretically, confirming that personal autonomy—especially behavioral autonomy—can be significantly strengthened in educational contexts oriented toward applicability, responsibility, and active engagement.

4.3 Theoretical Meta-Analysis Synthesis

The analysis of the specialized literature, correlated with the results of this research, consistently highlights the importance of autonomy-centered educational interventions in

developing the four dimensions of personal autonomy: behavioral, emotional, cognitive, and value-based. According to Self-Determination Theory (SDT), autonomy develops when the educational environment supports the fundamental psychological needs: autonomy, competence, and relatedness (Ryan & Deci, 2000, 2017). Educational interventions that encourage choice, active involvement, and personal reflection promote self-regulation and self-determined behavior.

Recent studies confirm the effectiveness of autonomy-promoting strategies, especially in adult education settings. Reeve (2016) argues that autonomy-supportive teaching—by offering real choices, encouraging personal expression, and avoiding excessive control—has direct effects on the development of behavioral and emotional autonomy. Similarly, Vansteenkiste et al. (2019) highlight that experiential and collaborative training stimulates both cognitive engagement and the development of value-based autonomy by anchoring learning in personal meaning.

In the adult education domain, Knowles, Holton, and Swanson (2020) emphasize that self-directed learning is a key component of educational maturity, and that interventions based on exploration, reflection, and problem-solving strengthen cognitive autonomy. Additionally, Kramer et al. (2024) show that autonomy support in educational settings positively influences the reduction of educational stress and increases emotional engagement, reinforcing the importance of the emotional dimension in formative contexts.

The results of the present study support these findings: cognitive and behavioral autonomy had the highest participant scores, and the strong correlations between dimensions validate the coherence of the applied theoretical model. Behavioral autonomy was directly influenced by the professional educational context—an empirical validation of the general hypothesis.

Thus, both the theoretical meta-analysis and the synthesis of empirical findings converge in supporting the idea that educational interventions that encourage choice, responsibility, and personal reflection significantly contribute to the development of personal autonomy among adults.

These findings have direct implications for the instructional design of vocational training programs, particularly in high-stakes environments such as maritime education. To foster behavioral autonomy among adult learners, training institutions should incorporate learning strategies that prioritize choice, responsibility, and active reflection.

For example, scenario-based learning that simulates real-life decision-making at sea can empower learners to act independently while understanding the consequences of their choices. Additionally, providing consistent and constructive feedback throughout training supports emotional and behavioral self-regulation.

The integration of digital self-assessment tools and autonomy-supportive mentoring models can further enhance learner engagement. Trainers should be encouraged to adopt facilitative roles that allow learners to explore content at their own pace, reflect on their progress, and connect new knowledge with prior experiences. Embedding structured moments of choice within the curriculum, such as optional assignments or problem-solving paths, reinforces volitional functioning and contributes to the development of professional identity.

These autonomy-enhancing strategies are not only theoretically grounded but also practically feasible in vocational and technical education settings, where learners benefit from a balance between structure and independence.

5. Research Limitations

Every research endeavor carries methodological and contextual limitations that must be acknowledged to maintain scientific rigor and define the generalizability of the results. In this study, several aspects can be considered limiting.

Firstly, the sample size and structure may influence data interpretability. Participants were recruited exclusively from a professional training program for seafarers in a geographically limited area (Constanța, Romania), reducing the generalizability to the broader adult population. Additionally, the gender imbalance—with a strong predominance of male participants—limits the ability to draw gender-based comparative conclusions.

The instrument used (a questionnaire), though adapted and validated for this study, is based on self-reporting, which introduces risks of subjectivity, socially desirable responses, and difficulty in assessing personal dimensions such as value-based or emotional autonomy.

Another limitation is the cross-sectional nature of the research. Data were collected at a single point in time, which does not allow observation of how autonomy evolves in response to different long-term educational interventions. Consequently, the identified relationships are correlational, not causal, and must be interpreted within the methodological constraints of the quantitative approach.

Finally, despite the inclusion of a theoretical meta-analytic component and a broad selection of recent scholarly sources, the bibliographic selection may be a limitation. Not all relevant studies were accessed, and the research primarily draws from Western educational literature, which may not fully reflect the realities of Romanian education.

Despite these limitations, the study provides a solid foundation for exploring the relationship between the professional educational environment and personal autonomy, opening avenues for broader, longitudinal, and comparative investigations.

6. Conclusions

This study investigated the impact of the professional educational environment on the development of personal autonomy, with a particular emphasis on behavioral autonomy. Through a mixed-methods approach, supported by a solid theoretical framework and rigorous quantitative analysis, the research identified several findings relevant to the field of adult education.

From a theoretical standpoint, personal autonomy was conceptualized as a multidimensional construct comprising cognitive, emotional, value-based, and behavioral dimensions (Ryan & Deci, 2000, 2017). The literature supports the view that autonomy develops in educational contexts that promote self-determination, choice, and active engagement (Reeve, 2016; Vansteenkiste et al., 2019; Knowles et al., 2020). This view was validated by data obtained through a questionnaire administered to participants in a maritime professional training program.

Statistical results support the hypothesis that the professional educational environment facilitates autonomy development. A significant positive correlation was found between age and behavioral autonomy ($r = 0.166$, $p = 0.013$), confirming that maturity is associated with self-regulation and educational decision-making (Knowles et al., 2020). Furthermore, the comparative analysis of the four autonomy dimensions revealed statistically significant differences ($F(3,672) = 117$, $p < .001$), with the highest average score recorded for cognitive autonomy ($M = 3.14$) and the lowest for value-based autonomy ($M = 2.74$), reflecting the

influence of applied curricular structures that prioritize cognitive functions over value-based development.

The strong correlations identified between behavioral autonomy and the other dimensions—EA (r = 0.805), CAog (r = 0.767), VA (r = 0.783)—validate the theoretical model and emphasize the functional interdependence of these components. These results confirm the general hypothesis and support the idea that autonomy can be effectively cultivated in structured yet learner-centered educational environments (Ryan & Deci, 2000; Vansteenkiste et al., 2019).

Based on these findings, it is recommended that adult vocational training programs incorporate strategies that encourage decision-making, personal reflection, active engagement, and the integration of personal values into the learning process. Trainers can contribute to the development of autonomy by using instructional methods that offer real choice, constructive feedback, and emotional support—conditions that are both theoretically and empirically validated as conducive to self-determined learning.

For future research, it is recommended to expand the investigation to larger and more diverse samples, including different vocational domains, as well as to conduct longitudinal studies that track the evolution of autonomy over time.

Additionally, integrating a more consistent qualitative component (e.g., narrative analysis of individual learning trajectories) could offer deeper insights into how autonomy is perceived and experienced by learners in real-world training contexts.

References

Avakyan, E. I., & Taylor, D. C. M. (2024). The effect of flipped learning on students' basic psychological needs and its association with self-esteem. *BMC Medical Education, 24*(1127), 1-11. https://doi.org/10.1186/s12909-024-06113-7

Deci, E.L., Ryan, R.M. (1985). Conceptualizations of Intrinsic Motivation and Self-Determination. În R. M. Edward L. Deci, *Intrinsic Motivation and Self-Determination in Human Behavior. Perspectives in Social Psychology* (pg. 11-40). Boston, MA: Springer. https://doi.org/10.1007/978-1-4899-2271-7_2

Håkansson, M., Lindblom, J., & Lundh, M. (2025). A survey on Swedish maritime pilots' trust, training, understanding, and use of predictive systems. *Cognition, Technology & Work, 27*(1), 45–58. https://doi.org/10.1007/s10111-025-00793-x

Knowles, M. S., Holton, E. F., & Swanson, R. A. (2020). *The adult learner: The definitive classic in adult education and human resource development* (ed. 9th ed). London: Routledge. https://doi.org/10.4324/9780429299612

Kramer, A.-W., Huizenga, H. M., Van Duijvenvoorde, A. C. K., & Krabbendam, L. . (2024). Do I want to learn today? Day-to-day variations in adolescents' academic motivation and effort. *Learning and Motivation, 85* (101957). https://doi.org/10.1016/j.lmot.2023.101957

Loeng, S. (2020). Self-directed learning: A core concept in adult education. *Education Research International, 2020*(1), 1-12. https://doi.org/10.1155/2020/3816132

Meštrović, T., Pavić, I., Maljković, M., & Androjna, A. (2024). Challenges for the education and training of seafarers in the context of autonomous shipping: Bibliometric analysis and systematic literature review. *Applied Sciences, 14*(3). https://doi.org/10.3390/app14083173

Reeve, J. (2016). Autonomy-supportive teaching: What it is, how to do it. În J. W. W. C. Liu, *Building autonomous learners* (pg. 129–152). Springer. https://doi.org/10.1007/978-981-287-630-0_7

Robazza, C., Vitali, F., Bortoli, L., & Ruiz, M. C. (2025). Basic psychological needs satisfaction, coping functions, and emotional experiences in competitive athletes: A multi-states theory perspective. *Scientific Reports, 1854* (2025). https://doi.org/10.1038/s41598-025-86072-1

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, *55*(1), 68–78. https://doi.org/10.1037/0003-066X.55.1.68

Schiller, E., Dorner, H., & Szabó, Z. A. (2023). Developing older adults' learner autonomy through one-to-one counselling: Results of an exploratory investigation. *System, 115*. https://doi.org/10.1016/j.system.2023.103030

Vansteenkiste, M., Aelterman, N., De Muynck, G.-J., Haerens, L., Patall, E. A., & Reeve, J. (2019). Seeking stability in stormy educational times: A need-based perspective on (de)motivating teaching grounded in self-determination theory. În E. N. Lemos, *Advances in Motivation and Achievement* (Vol. 20, pg. 53–80). Emerald Publishing. https://doi.org/10.1108/S0749-742320190000020004

West, M., Rice, S., & Vella-Brodrick, D. (2023). Mid-adolescents' social media use: Supporting and suppressing autonomy. *Journal of Adolescent Research*, *40*(2), 448–482. https://doi.org/10.1177/07435584231168402

Zhang, Z., van Lieshout, L. L. F., Colizoli, O., Hommel, B., & Qin, S. (2024). A cross-cultural comparison of intrinsic and extrinsic motivational drives for learning. *Cognitive, Affective, & Behavioral Neuroscience, 24*(1), 25–44. https://doi.org/10.3758/s13415-024-01228-2