Original Research Article

Development and Validation of an Arabic Version of Academic Self-Regulation Questionnaire: Implications for Advanced Academic Programming

Journal of Advanced Academics
1–44

DOI: 10.1177/1932202X261474402
journals.sagepub.com/home/joaa
Sage

Ahmad Yousef[1,*] and Abedalkarim Ayyoub[1,*]

Abstract

Academic self-regulation plays a crucial role in student achievement and talent development, yet culturally valid measures for Arabic-speaking populations remain limited. This study developed and validated an Arabic version of the Academic Self-Regulation Questionnaire (SRQ-A) and examined motivational patterns among middle school students. The original SRQ-A was translated using rigorous back-translation procedures and administered to 526 Arab students (Grades 7–9). Exploratory factor analysis on half the sample ($n = 263$) revealed a four-factor structure, confirmed by confirmatory factor analysis on the other half with excellent fit indices (*CFI* = .987, *TLI* = .986, *RMSEA* = .028, *SRMR* = .042). Internal consistency was strong ($\alpha = .943$–$.957$, *CR* = .953–.963), and validity was established via correlations and heterotrait-monotrait ratio. K-means analysis identified four profiles: Autonomous

[1]Faculty of Humanities and Educational Sciences, An-Najah National University, Nablus, Palestine

*Ahmad Yousef and Abedalkarim Ayyoub contributed equally to this work and share corresponding authorship.

Corresponding Authors:
Ahmad Yousef, Faculty of Humanities and Educational Sciences, An-Najah National University, An-Najah's Old Campus, Nablus 7707, Palestine.
Email: it.ahmadyousef@gmail.com

Abedalkarim Ayyoub, Faculty of Humanities and Educational Sciences, An-Najah National University, An-Najah's Old Campus, Nablus 7707, Palestine.
Email: ayyoub@najah.edu

Regulators (22.6%), High Engagers (25.1%), Moderate Regulators (20.9%), and Controlled Regulators (31.4%). Latent mean comparisons revealed female students exhibited significantly higher introjected regulation, and intrinsic motivation declined significantly across grades for all students. Findings support talent development and culturally responsive practices.

Keywords
SRQ-A, Arabic adaptation, self-determination theory, academic self-regulation, middle school, psychometric validation, advanced academics

Introduction

Academic self-regulation is the process by which the learner, in an active and goal-oriented manner, controls their thoughts, actions, and feelings toward the achievement of learning objectives (Zimmerman, 2008). Specifically, the said valuable skill is associated with academic performance enhancement, enhanced academic motivation, as well as enhanced overall educational attainment (Duckworth et al., 2019; Nunez et al., 2005). From this stance, researchers have developed a number of instruments for measuring and clarifying this concept, among them the Academic Self-Regulation Questionnaire (SRQ-A) (Ryan & Connell, 1989), one of the most used and respected instruments within the field of research. The SRQ-A provides descriptions about students' reasons for engaging in various academic behaviors and thus gives information about their motivational orientations and self-regulatory styles. Grounded in self-determination theory (SDT), the instrument has become invaluable in advancing the understanding of the way students regulate their learning processes and has informed many studies within educational psychology (Howard et al., 2021).

Despite its great contributions to the literature, there is a surprising paucity of validated Arabic versions of this tool. This is especially worrisome because of the large Arabic-speaking population worldwide (over 400 million people) and the increasing emphasis on evidence-based educational practices in Arabic-speaking countries (Karnouk et al., 2021). The availability of a culturally adapted and psychometrically sound Arabic version of the SRQ-A could open up research avenues and allow for the development of interventions better fitting Arabic-speaking students.

Developing culturally valid assessments of academic self-regulation plays an even more crucial role in ensuring equitable gifted identification among diverse populations, since relying on cognitive tests has resulted in the systematic underidentification of gifted students in diverse cultures and languages (Ford et al., 2008; Naglieri & Ford, 2003). Incorporating motivational assessments, especially autonomous regulation related to sustained high levels of achievement, fosters more comprehensive identification procedures and facilitates the development of programs for advanced learners

differentially sensitive to diverse motivational profiles (Dai & Chen, 2013; Gottfried & Gottfried, 2004; Hennessey & Amabile, 2010; Siegle & McCoach, 2005). The lack of valid assessments in Arabic culture, in this case, presents not only psychometric difficulties but also equity challenges with specific ramifications in talent development in speaking Arabic communities.

This is to say that adaptation of these psychological measures across cultures goes beyond translation. In other words, it requires linguistic nuances, cultural norms, and contextual factors with regard to whether an adapted instrument should hold up to both conceptual equivalence and its psychometric properties (Beaton et al., 2000). A number of issues related to the development of an Arabic SRQ-A offer a chance for detailed evaluation with respect to how academic self-regulation is manifested in an Arabic-speaking educational context.

The need to adapt the SRQ-A into Arabic goes beyond a mere translation issue and speaks to an interest in how the motivational constructs of interest function within distinctively different cultural educational contexts, given the oft-cited emphasis of Arabic systems on hierarchical authority, collective goals, and relational conceptions of autonomy as well (Dwairy, 2004; Joseph, 1994). Such differences raise critical empirical questions regarding the validity of the SRQ-A's factor structure, interrelations among regulatory styles, and their links to academic outcomes in Arabic-speaking populations. Thus, cross-cultural validation goes beyond technical concerns, as the purpose of such an endeavor is also crucially diagnostic of both the universal and culture-specific aspects of academic self-regulation (Chirkov et al., 2003; Iyengar & Lepper, 1999).

The cultural context determines motivational patterns and academic self-regulation because Arabic educational systems usually stress respect for authority, collective family goals, and external accountability rather than individual achievement (Dwairy, 2004; Joseph, 1994). In addition, autonomy, which is a core aspect of SDT, may be conceived of in collectivistic contexts as volitional action within social relationships rather than independence from others, as usually assumed in Western models (Chirkov et al., 2003; Iyengar & Lepper, 1999). Thus, the lack of empirically validated Arabic instruments has restricted research on those culturally distinctive self-regulation patterns. For these reasons, constructing a culturally adapted SRQ-A was both methodologically and practically imperative.

Original SRQ-A and SDT

The original SRQ-A (Ryan & Connell, 1989) assesses different kinds of motivation and regulations for student academic behaviors, including doing homework, doing classwork, and trying to answer complex questions in class. It is based on the principles of SDT and was first designed for late elementary and middle school students. The SRQ-A consists of 32 items divided into four subscales, each of which is made up of a few items that reflect different reasons or motivations to engage in an academic activity. The four types of motivation or regulation include:

1. External regulation: Engages in academic activities purely from the point of external pressures or requests, for example, in order not to be punished or to get rewards.
2. Introjected regulation: Engaging in academic activities to avoid guilt or shame or to feel that one is better than others.
3. Identified regulation: Engaging in academic activities because the student realizes their importance and has accepted them as personally meaningful.
4. Intrinsic motivation: Engaging in academic activities because they are inherently interesting and enjoyable.

These regulatory styles have been conceptualized along a continuum of self-determination that ranges from the least autonomous, external regulation, to the most autonomous, intrinsic motivation. SRQ-A has proved to contain good psychometric properties in several studies with regard to internal consistency, test-retest reliability, and construct validity (Ryan & Connell, 1989; Ryan & Deci, 2000b). The items on the SRQ-A were presented as separate subscale scores for each type of regulation. A 4-point Likert response scale for each item with "*Very true*" to "*Not at all true*" was used. Additionally, the Relative Autonomy Index (RAI) can be calculated by weighing the subscale scores as a function of relative autonomy or self-determination, with intrinsic motivation being the heaviest positive weighting and external regulation the heaviest negative weighting. Positive RAI scores indicate more autonomous self-regulation, while negative scores indicate more controlled regulation (Ryan & Connell, 1989). The SRQ-A is available in two forms: standard and an altered version for use with students who have learning disabilities. Altered items in the SRQ-A require modified item wording and a response format to facilitate student access (Deci et al., 1992).

Figure 1 shows the structure and scoring of the SRQ-A instrument that measures academic self-regulation. Through it, the following four major dimensions are represented: external regulation, introjected regulation, identified regulation, and intrinsic motivation. An example of a set of items follows, and it corresponds to the different reasons for which students may endorse involvement in academic activities. It also shows the score calculation for the total RAI, scoring, and combining the four dimensions into one composite score that would reflect the degree to which their motivation is controlled versus autonomous.

The knowledge of these regulatory patterns, however, is particularly important in gifted education, since autonomous motivation has always been found to be linked with high achievement and creativity in advanced academic areas. Thus, the following section, the relationships between self-regulation and advanced academic achievement are investigated.

Cross-Cultural Adaptations of SRQ-A

The SRQ-A has been widely translated and adapted for use in various cultural contexts: Chilean (Vergara-Morales et al., 2022), Spanish (Conesa & Duñabeitia, 2022), Russian

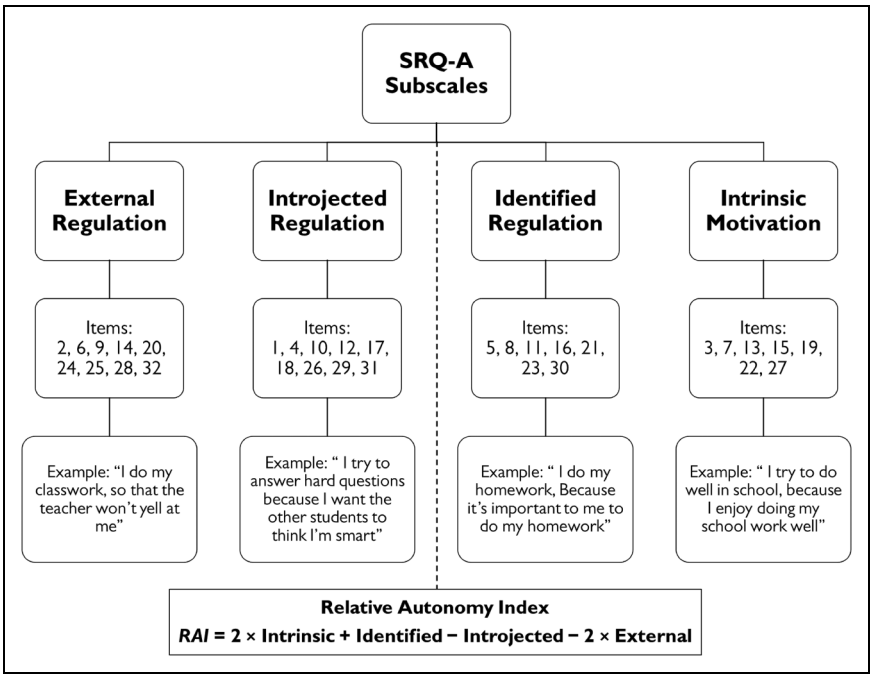

Figure 1. Conceptual structure and scoring mechanics of the Academic Self-Regulation Questionnaire (SRQ-A).

(Gordeeva et al., 2020), Portuguese (Gomes et al., 2019), German (Kröner et al., 2017), Turkish (Bagçeci & Kanadli, 2014), Italian (Alivernini et al., 2011), Korean (Jang et al., 2009), Belgium (Vansteenkiste et al., 2009), Chinese (Vansteenkiste et al., 2005), and Japanese (Yamauchi & Tanaka, 1998).

Overall, cross-cultural adaptations of the SRQ-A have confirmed the four-factor structure proposed by Ryan and Connell (1989) to a great extent. Most adaptations found evidence for external, introjected, and identified regulations, as well as intrinsic motivation as different factors. For example, the Portuguese adaptation found good fit indices for the four-factor model after the exclusion of four items that had problems. A four-factor structure was also supported by the Russian adaptation, although this latter varied somewhat, including two separate intrinsic motivation factors. The Turkish adaptation is a 17-item four-factor structure with a number of items that did not perform well psychometrically deleted.

Generally, the results of reliability analyses across these adaptations were acceptable, although most Cronbach's alpha values were in the .70−.80 range. Some studies measured test-retest reliability as well, and in general, it was satisfactory. For example, the test-retest reliability for the Turkish version was .85 (Bagçeci & Kanadli, 2014).

Validity was usually checked with convergent and discriminant validity examinations in which the SRQ-A subscales are related to related constructs that include basic psychological needs satisfaction (Vansteenkiste et al., 2005), academic attitudes (Conesa & Duñabeitia, 2022), and well-being measures (Kröner et al., 2017). In general, these analyses confirm the validity of the adapted scales. Besides, all adaptations confirm more or less the simplex pattern of the correlations between subscales assumed by SDT.

Of these, several adaptations tested for measurement invariance across gender or age/grade levels. For example, the Portuguese (Gomes et al., 2019) and Russian (Gordeeva et al., 2020) adaptations provided evidence of configural, metric, and scalar invariance across these demographic variables. This goes to prove that the SRQ-A functions similarly among these groups and, therefore, enables meaningful comparisons.

The adaptation process brought minor changes due to cultural considerations. While most adaptations kept the structure and content at least similar to that of the original SRQ-A, some changed wordings slightly to fit better with the culture. The Russian adaptation introduced several additional subscales in order to capture some motivational nuances relevant to their specific setting. Most of the adaptations targeted late elementary to middle school age ranges, around ages 8–14 years old, similar to the target population of the original SRQ-A.

Although generally successful, some adaptations showed low reliabilities, especially for external regulation, while factor structures often needed item removal or changes for good fit. Issues noted in this regard were low reliability for some subscales, mainly external regulation, and factor structures that sometimes required removal or changes of items for good fit. These results underline the careful psychometric evaluation that needs to be taken when adapting SRQ-A into new cultural contexts.

In other words, despite certain challenges found in this study, the SRQ-A appears to operate reasonably soundly across diverse cultural contexts provided that it is adapted appropriately. The four-factor core structure and theoretical relations between constructs are generally supported across these very diverse samples. However, researchers should always be prepared to make relevant modifications and conduct rigorous psychometric analyses once they adapt the SRQ-A into new populations or cultural settings (Yousef & Ayyoub, 2024).

Advanced Academics and Self-Regulation

Self-regulation and advanced academic attainment have been well-documented as related within the literature. Autonomous motivated students are more likely to pursue deep learning strategies, withstand obstacles, and exhibit creative problem-solving skills—all traits linked to academic giftedness and talent development (Hennessey & Amabile, 2010). Research also points to the significance of autonomous motivation for long-term maintenance of high achievement and the prevention of underachievements for gifted students (Gottfried et al., 2001).

Various lines of research on giftedness and achievement have well documented the link between academic self-regulation and high achievement. Autonomous motivation —cemented by intrinsic interest and personal identification with achievement-related goals—is now found to be a reliable predictor for deep cognition processes and task persistence on complex tasks and superior creative problem-solving (Hennessey & Amabile, 2010; Ryan & Deci, 2000a). Studies focusing on gifted populations have found autonomous motivation to be a more reliable predictor for the sustained achievement of giftedness than ability alone (Gottfried et al., 2001).

In their longitudinal study spanning 17 years, Gottfried and colleagues showed that intrinsic motivation during childhood was predictive of adolescent educational attainment and educational aspirations and achievement in adulthood after controlling for intelligence and educational achievement. Such findings imply that the vital ingredient for gifted achievement may be less within the ability domain and more within the realm of motivation. In addition, autonomous motivation is critical for innovative and creative thinking processes that represent high achievement in complex subject areas (Amabile et al., 2018; Hennessey & Amabile, 2010). For instance, intrinsically motivated students can more readily take intellectual risk behaviors and press on through the failure and frustrations inherent within challenging intellectual endeavors.

Students with more controlled types of motivation (such as external and introjected regulation types of motivation) may be high achieving and still fail to be productively engaged and creatively accomplished within subject areas as they would with academic talent (Gottfried & Gottfried, 2004). Knowledge about students' motivational profiles can thus offer additional insight to traditional ability-based identification processes within gifted education. Students with high autonomous motivation and maybe lesser overt academic merit might form a hidden talent source and can be realized within culturally and linguistically diverse student populations for whom traditional identification processes may substantially underestimate potential (Dai & Chen, 2013). Students with high ability and a controlled motivational style might be at risk for underachievement and can be helped through approaches focusing on motivational internalization (Siegle & McCoach, 2005).

Advanced academic programs, such as acceleration, enrichment, and talent development, tend to necessitate students exhibiting strong self-direction, intrinsic motivation, and perseverance. Knowledge about students' motivational profiles can thus be used to inform identification procedures, program planning, as well as intervention strategies. For instance, students with autonomous regulation patterns can be most appropriate for independent research studies and self-paced learning, and those with controlled regulation patterns can be given motivational intervention prior to enrolling in advanced programs.

The Present Study

This research responds to an essential need within advanced academics and gifted education by offering cross-culturally appropriate measures for the identification and

nurturing of academically gifted Arab students. Self-regulation is a powerful predictor of long-term excellence, innovative productivity, and academic tenacity, all comprising critical aspects of advanced academic achievement (Gottfried & Gottfried, 2004; Hennessey & Amabile, 2010).

We decided to focus on children in the mid-level educational establishment (Grades 7–9, ages 12–15 years) for a variety of reasons that are sound from a theoretical angle. First, it is a crucial period in the maturation of motivation during which a high level of restructuring in self-perception, goal orientation, and regulation is observed (Wentzel & Miele, 2016). Studies have persistently shown that intrinsic academic motivation is known to decrease during this mid-level educational period (Gottfried et al., 2001; Lepper et al., 2005). It was also a period of importance to us, in that we wanted to examine the reasons behind this decrease. Secondly, studies carried out with a neurological approach have found that there is a point of optimal development at 12–15 years of age in those parts of a student's prefrontal cerebral areas involved in autonomous regulation and decision-making capabilities (Steinberg, 2005). The preteenage stage is, therefore, an important point of development at which autonomous learning strategies should be most effective for a student. Third, in the pursuit of talent development, the middle school level represents the point at which the differentiated patterns of student interest, ability, or performance begin emerging among the youngsters (Subotnik et al., 2011). Notably, gifted programs are typically initiated at such levels. Given the fact that the mentioned programs require certain learning capabilities, including the prerequisite of autonomy on the part of the learners, it is equally important at such levels to discriminate the motivational orientations among the students. Such students displaying autonomy might have the potential to excel in the gifted programs that require autonomy (Dai & Chen, 2013). Lastly, in terms of practical insight, Grades 7–9 can be regarded as a stage in development in which the learners will have sufficient awareness regarding their meta-cognition levels in order to provide accurate disclosure of motivational factors in young minds to impact learning in secondary schooling (Schunk & Zimmerman, 2012).

1. Does the Arabic version of the SRQ-A demonstrate adequate psychometric properties, including factor structure, reliability, and validity?
2. Are there gender or grade-level differences in self-regulation patterns?
3. What are the predominant self-regulation profiles among Arab middle school students?
4. How do self-regulation dimensions relate to overall motivational autonomy (RAI)?

By answering these questions, we seek to give researchers and educators a valid measure with which to examine academic motivation in Arabic contexts as well as shed light on cultural aspects of self-regulation growth. The results hold implications for educational practice, specifically with reference to talent identification, program development, and motivational intervention.

Method

Participants

Arab students from nine government public schools in Jerusalem were selected for the study through the multistage random cluster process in the academic years 2023–2024 and 2024–2025. All schools were situated in urban settings in East Jerusalem. Though detailed socioeconomic status (SES) data was not solicited because of cultural sensitivities concerning income disclosure, a general description might be made based on available municipality classifications: All participating schools primarily serve middle-to lower SES communities. The schools were diverse in various neighborhoods in East Jerusalem. This adds a degree of geographical diversity in a purely urban setting.

All 526 participants were middle school students from Grades 7 to 9. This ensured fair representation of all ages at the middle school level. There were 293 females (55.7%) females and 233 males (44.3%) in the sample, aged between 12 and 15 years ($M = 13.69$, $SD = 0.92$). Each participant spoke Arabic as a native language and used Arabic as the primary language of instruction.

The data was collected over two years (2023–2024 and 2024–2025) using entirely distinct samples. Also, no participant student contributed to data in both years. In Year 1 (2023–2024), data was collected among 258 students in five schools. Additionally, in Year 2 (2024–2025), data was collected among 268 students in four other schools. Specifically, one of the schools contributed data for two years but with distinct levels. The design utilized ensures distinct samples for better verification of data consistency among samples. Pretest analyses indicated no significance between samples for years 1 and 2 regarding demographic representativeness (gender: $\chi^2 = 1.23$, $p = .27$; grade distribution: $\chi^2 = 2.45$, $p = .29$) or mean SRQ-A subscale scores (all $|t| < 1.12$, all $p > .26$). Given these null findings, we pooled the data for all subsequent analyses, which increases statistical power while maintaining the independence assumption required for factor analysis and other inferential procedures.

We employed stratified random sampling for participant selection in each identified school. We did this by obtaining class lists for seventh-, eighth-, and ninth-grade levels in all schools. We then used a random number generator to pick entire classes until our target number of samples had been achieved. This was done using cluster sampling in which we picked entire classes instead of individuals. This was for ease of administration in those classes while still maintaining randomness. The student response rate in selected classes was 87%–94% (Table 1).

Power Analysis

We performed formal power analyses to justify our sample sizes for both exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). For structural equation modeling (SEM), we followed recommendations by Wolf et al. (2013) and Westland

Table 1. Demographic Characteristics of Participants (***N*** 526).

	Gender		
Grade	Male *n* (%)	Female *n* (%)	Total *N* (%)
Seventh	76 (32.6)	110 (37.5)	186 (35.4)
Eighth	85 (36.5)	98 (33.4)	183 (34.8)
Ninth	72 (30.9)	85 (29.0)	157 (29.8)
Totals	233 (100)	293 (100)	526 (100)

(2010), who supply precise formulas for the estimation of suitable sample sizes for SEM applications. In our power analysis for EFA, we used recommendations by MacCallum et al. (1999), computing the necessary sample size as a function of anticipated communalities of .60 or more (based on pilot results), four factors, and 7–9 items per factor. The power analysis confirmed that a participant group size of 200–250 would yield sufficient power for stable factor solutions. Our 263 participant EFA sample size exceeds this need. For CFA, we originally used Westland's (2010) formula $n \geq 50r^2 - 450r + 1100$, with r denoting the number of observed variables—to estimate that a 32-item model would need a minimum of 384 participants under the assumption of moderate effect sizes and standard conditions. However, more recent guidance (Kyriazos, 2018) suggests that the widely cited 10:1 participant-to-item ratio would require 320 participants for our 32-item scale**.** With the specific nature of our model in mind, though, including 32 observed variables, four latent factors, anticipated factor loadings of more than .70 (as per pilot studies), desired statistical power of .80, alpha level .05, and anticipated root mean square error of approximation (RMSEA) of .06, we did Monte Carlo simulations with the semTools package in R. Simulations revealed that a sample size of 250 participants would yield sufficient power ($\beta > .80$) for the detection of good model fit. Thus, our actual 263 participants per analysis are well above the minimum recommended and uphold the quality of our findings (Kline, 2023; MacCallum et al., 1999; Marsh et al., 2009; Westland, 2010; Wolf et al., 2013).

We split the sample in half randomly, with Subsample 1 (containing 263 participants) used for EFA and Subsample 2 (also totalling 263) used for the CFA. Researchers should split their sample when testing an instrument to reduce the risk of capitalizing on chance (Fabrigar et al., 1999; Worthington & Whittaker, 2006). No significant variation was found between the two groups in age, gender distribution, or grade level (all significance values are higher than .05).

Translation and Adaptation

To promote the validity and cultural appropriateness of the SRQ-A's Arabic version, we adhered to internationally accepted cross-cultural adaptation procedures (Beaton

et al., 2000; Van de Vijver, 2016). The process started with two independent translations by bilingual PhD educational psychologists, with one specializing in the domain of motivation and the other with considerable knowledge of Arabic educational settings. The translations were then consolidated during a consensus meeting to generate the following main adaptations, such as substituting "homework" with the most suitable terms within the culture, adjusting the language to represent the native authority frameworks within schools, and the use of simplified language for middle school students. Confirming the quality of the translation, an anonymous back-translation by a native English speaker with Arabic language skills revealed 94% conceptual equivalence with the original. The six items (19%) were considered for analysis using a reconciliation process. A translation team consisting of original translators, a back-translator, and a linguistic expert in Arabic language assembled to: (1) determine type of discrepancies: semantic, idiomatically based, and culture-specific; (2) assess several alternatives for each problematic item; (3) assess each alternative for semantic consistency, Arabic fluency, and appropriateness for 12–15 year old students; and (4) conduct microcognitive interviews with 3–5 students for each item with discrepancies. For instance, item 7 ("Because I enjoy doing my homework") had a discrepancy because the back translation was "Because I like completing my homework assignments," which indicated that the Arabic translation had a focus on completion rather than enjoyment. This was revised with a focus on the affective aspect of enjoyment in Arabic (استمتع instead of أحب), and this resolved the issue. All revised items achieved consensus agreement from the full translation team and were confirmed through cognitive interviews before inclusion in pilot testing.

The five members of an expert review committee, which included two educational psychologists, an expert in Arabic language, a middle school teacher, and a cultural advisor, reviewed all questionnaire versions. The committee achieved 100% agreement on the suitability and cultural acceptability of each item. The results were then followed by cognitive interviewing of 15 students aged 12–15 years using think-aloud protocols for measuring their comprehension, the cultural acceptability of the items, and the cognitive load. Subsequently, two pilot studies ($\_N\__1 = 30$ and $\_N\__2 = 34$) followed: one for the preliminary translation test, and the second for a revised version with a modified response type via a 5-point Likert scaling. The 4-point Likert scale was originally substituted by a 5-point scale with strong cultural and empirical rationales. Research shows that 5-point scales provide greater reliability ($\alpha = .89$ vs. .84) as well as more precise measurement (Østerås et al., 2008; Preston & Colman, 2000). They also exhibit superior convergent validity and lower method effects (Revilla et al., 2014), as well as increased quality in response by reducing satisficing behavior and increasing differentiation between responses, particularly for adolescents (Krosnick & Presser, 2010). Moreover, a neutral midpoint is essential when responding in Arabic-speaking countries, as subjects tend to avoid extremes (Harzing et al., 2013). Statistically, 5-point scales provide superior distributional characteristics for factor analysis (Lozano et al., 2008). Our pilot ($N = 64$) ensured that the students used all five response options appropriately, with no evidence of central tendency or response

set bias. Appendix A presented items with Arabic translations of clarity and comprehensibility tested through the pilot studies.

Procedures

After ethical approval and informed consent and assent had been sought from each student and guardian, with full verbal and written disclosure about the nature of the research study and their option to withdraw at any time, with data collected kept highly confidential, the participants completed the questionnaires. In the analysis procedures, the statistical tests were done with JASP software (Version 0.96.0.0; JASP Team, 2024) and using R (Version 2025.05.1) with the lavaan, psych, and cluster packages. Our analysis plan included: descriptive analysis, exploratory factor analysis, confirmatory factor analysis, reliability, validity, cluster analysis, and latent mean comparisons.

Data Analysis

Missing Data. Analysis of the data indicated that there were no missing values for any of the 32 questions of the SRQ-A among the 526 respondents. This indicates that among those who gave consent for participating in this research, no one left any questions unanswered. This was made possible by being considerate of how questions were asked during administration. Additionally, assistants were available to answer any questions the respondent may have had before leaving the test environment.

EFA. An EFA was conducted to examine the underlying structure of the adapted SRQ-A. Kaiser-Meyer-Olkin measure and Bartlett's test of sphericity were used to evaluate data suitability for factor analysis. Principal Axis Factoring (PAF) instead of Maximum Likelihood was employed for factorial analysis because PAF tends to be more robust when data deviate much from multivariate normality and does not necessarily implicate a particular population distribution (Fabrigar et al., 1999). This type of factorial analysis would be more ideal for our case because our emphasis would be more on extracting factors associated with common variables instead of investigating particular population distributions. Additionally, because SDT indicates presupposes intercorrelations among various types of motivational regulation along a continuum of self-determination levels (Ryan & Deci, 2000b). A Promax Oblique Rotation Technique would be more ideal than other methods such as Varimax. This would be much more ideal because SDT conceptualizes intercorrelations among various levels of external, introjected, identified, and intrinsic motivation more realistically than other techniques (Fabrigar et al., 1999). The number of factors to retain was ascertained from multiple criteria: Kaiser's criterion, eigenvalues greater than 1, scree plot examination, parallel analysis, and theoretical considerations. Items with factor loadings $\geq .60$ on their primary factor were retained. Item content and alignment with SRQ-A theoretical constructs guided factor interpretations.

CFA. CFA was performed to develop an Arabic version of the SRQ-A measurement model, testing the hypothesized four-factor structure using maximum likelihood estimation with robust standard errors. Model fit was evaluated using multiple indices with the following a priori criteria: (1) chi-square statistic (χ^2); this needs to be considered in terms of degrees of freedom because large samples lead to larger chi-square values. Thus, a χ^2/df ratio of less than 3 would be considered an acceptable fit, while less than 2 would be a very excellent fit (Ullman & Bentler, 2003); (2) RMSEA; this should be < .08 for an acceptable fit and < .06 for a good fit with a 90% confidence interval (Hu & Bentler, 1998); (3) standardized root mean square residual (SRMR); a measure under .08 would be considered a good fit (Hu & Bentler, 1998); and (4) Comparative Fit Index (CFI) and Tucker-Lewis Index (TLI), with values >.90 indicating acceptable fit and >.95 indicating excellent fit (Bentler, 1990; Hu & Bentler, 1998). These thresholds follow current best practices in psychometric validation research (Kline, 2023; Schreiber et al., 2006).

Reliability and Validity. Cronbach's alpha and composite reliability were run to provide evidence for the reliability of constructs, while AVE and heterotrait-monotrait (HTMT) ratio were used for convergent and discriminant validity.

Cluster Analysis

For cluster analysis, we considered both subsamples together ($N = 526$), instead of only using those who took part in either EFA or CFA. This helped us maximize statistical power for cluster analysis while preventing overspecification of those particular samples regarding factor structure. Applying cluster analysis to the total sample represents a valid approach because cluster analysis addresses a distinct research question (person-centered profiles) compared with factor analysis (variable-centered factorial structure) (Spurk et al., 2020). K-means clustering to identify distinct self-regulation profiles, with optimal cluster number determined through elbow plots and theoretical considerations.

To further validate the derived cluster structure and examine differences across the self-regulation profiles, a one-way multivariate analysis of variance (MANOVA) was conducted with cluster membership as the independent variable and the four self-regulation dimensions (External, Introjected, Identified, and Intrinsic) as the dependent variables. Prior to running the MANOVA, preliminary assumptions were examined: (a) *Multivariate normality* was evaluated by inspecting univariate skewness and kurtosis statistics within each cluster; values were within acceptable limits ($|\text{skewness}| \leq 0.88$; $|\text{excess kurtosis}| \leq 0.72$). Given the large group sizes ($ns = 110$–165), the central limit theorem supports robustness against minor departures from normality (Tabachnick & Fidell, 2019). (b) *Homogeneity of covariance matrices* (Box's *M* assumption) was assessed via Levene's test of variance equality for each dependent variable; most variables showed nonsignificant results, and the large, roughly equal

group sizes further support MANOVA's robustness to this assumption (Hair et al., 2019). (c) *Absence of multicollinearity* was confirmed by inspecting the correlation matrix among dependent variables; interscale correlations ranged from .14 to .41, indicating that the subscales were related yet sufficiently distinct to warrant separate dependent variables.

Measurement Invariance and Latent Mean Comparisons. To investigate group differences regarding gender and grade levels, we utilized a multigroup CFA (MGCFA) framework. First, measurement invariance was tested sequentially (configural, metric, scalar, and strict) to ensure the SRQ-A constructs functioned equivalently across different demographic groups (Putnick & Bornstein, 2016). Upon establishing scalar measurement invariance, group differences were evaluated using standardized latent mean comparisons rather than traditional independent samples *t*-tests and one-way ANOVAs. This structural equation modeling approach provides a more rigorous estimation of true construct differences by explicitly accounting for measurement error (Lowry & Gaskin, 2014; Tse et al., 2023). In these analyses, male students and seventh-grade students were constrained to a latent mean of zero to serve as the reference groups for gender and grade-level comparisons, respectively, allowing us to estimate the standardized mean differences (ΔM) and their associated standard errors.

Results

Descriptive Statistics

The descriptive statistics for the self-regulation dimensions among the 526 participants revealed varying levels across subscales, providing important insights into motivational patterns among Arab middle school students. External Regulation had a mean score of 2.85 ($SD = 0.85$), with values ranging from 1.00 to 4.89. Introjected Regulation averaged 3.08 ($SD = 0.79$), spanning the full scale from 1.00 to 5.00. Identified Regulation demonstrated a higher mean of 3.80 ($SD = 0.72$), with scores between 1.44 and 5.00. Intrinsic Motivation had a mean of 3.67 ($SD = 0.81$), with responses ranging from 1.29 to 5.00. Finally, the RAI, which reflects overall autonomy in motivation, had a mean score of 1.58 ($SD = 2.28$), ranging from −4.48 to 7.88. These results indicate that students generally reported moderate to high levels of autonomous motivation, particularly on the identified and intrinsic subscales, suggesting a generally positive motivational climate in the studied schools.

RQ1: Psychometric Properties of the Arabic SRQ-A

Psychometric Properties and four-factor questionnaire structure were examined to match the theoretical structure of the original SRQ-A by:

1. EFA Results. The value obtained for the Kaiser-Meyer-Olkin Measure of Sampling Adequacy was .950, which reads as meritorious sampling adequacy based on Kaiser's classification. The KMO value of individual items is in the range of .920–.966, which shows the acceptability limit. Bartlett's Test of Sphericity came out to be significant, χ^2 (496) = 7168.66, $p < .001$, meaning it does not match up with the identity matrix and is very appropriate for factor analysis (Field, 2024).

The EFA converged on a four-factor solution matching the theoretical structure of the original SRQ-A. In other words, the chi-squared test of model fit was, χ^2 348.07, *df* 374, $p = .828$, such that the appropriate fit was between the observed data and the factor model. The four factors accounted for a total of 69.8% of the variance. The factor loadings after the promax rotation are displayed in Table 2.

As reported in Table 2, observed communalities (calculated as 1 − uniqueness) ranged from .61 to .77, with most items exceeding .65. These values support the adequacy of our sample size per MacCallum et al.'s (1999) criteria, which indicate that samples of 200–250 are sufficient when communalities exceed .60.

A four-factor solution was the result of this EFA. Factor 1 showed the highest eigenvalue (11.05) and explained 33.6% of the variability. Variances of 17.4%, 11.1%, and 7.7% were caused by Factors 2, 3, and 4, which had eigenvalues totaling 5.86, 3.85, and 2.79. There was 69.8% total variance explained by the four factors before rotation. Once the data was rotated, changes in the distribution of variance were observed on the factors. The variance explained by Factors 1 through 4 was 20.3%, with 19.2%, 15.9%, and 14.4% explained by the sums of squared loadings of 6.49, 6.15, 5.09, and 4.61, respectively. Even though the pattern of the factors was improved, the four factors still explained 69.8% of the variance after rotation. All four factors had eigenvalues > 1.0. A summary table of the characteristics of each factor is included in Appendix B.

The scree plot (Figure 2) also confirmed the four-factor solution, as it clearly shows where the "elbow" in the drop of eigenvalues started to flatten out at the fourth factor. Also, the parallel analysis line crossed the real data line at the fourth factor, thus confirming that four factors have eigenvalues higher than would be expected by chance. All this graphical illustration also aligns with Kaiser's criterion, since all four retained factors had eigenvalues higher than 1.0.

These results confirm the EFA of a four-factor structure for the adapted Arabic version of SRQ-A, accordingly aligning with the theoretical structure from which it had been derived. Besides that, it reflects the good psychometric properties of these extracted factors, as indicated by adequate factor loadings. The results are foundational to the subsequent CFA.

2. CFA Results. A CFA was conducted on the SRQ-A Questionnaire, which comprised 32 observed items and four latent factors: External Regulation, Introjected Regulation, Identified Regulation, and Intrinsic Motivation. The sample consisted of 263 participants.

Table 2. Exploratory Factor Analysis Loadings for the Arabic Academic Self-Regulation Questionnaire (SRQ-A).

Factor	Item	Statement	Loadings	Uniqueness
External Regulation	24	Because I want the teacher to say nice things about me.	.828	.293
	28	Because I will get in trouble if I don't do well.	.861	.274
	2	Because I'll get in trouble if I don't.	.820	.330
	25	Because that's what I'm supposed to do.	.843	.304
	9	So that the teacher won't yell at me.	.850	.306
	14	Because that's the rule.	.845	.277
	6	Because that's what I'm supposed to do.	.857	.230
	20	Because that's what I'm supposed to do.	.843	.249
	32	Because I might get a reward if I do well.	.869	.228
Identified Regulation	11	Because I want to learn new things.	.783	.356
	21	To find out if I'm right or wrong.	.776	.388
	8	Because it's important to me to do my homework.	.818	.355
	30	Because it's important to me to try to do well in school.	.800	.321
	5	Because I want to understand the subject.	.793	.365
	16	Because it's important to me to work on my classwork.	.827	.310
	23	Because it's important to me to try to answer hard questions in class.	.828	.326
Introjected Regulation	1	Because I want the teacher to think I'm a good student.	.812	.331
	29	Because I'll feel really bad about myself if I don't do well.	.851	.307
	18	Because I feel ashamed of myself when I don't try.	.796	.321
	12	Because I'll be ashamed of myself if it didn't get done.	.781	.335
	10	Because I want the teacher to think I'm a good student.	.815	.317
	17	Because I want the other students to think I'm smart.	.832	.313
	26	So my teachers will think I'm a good student.	.831	.307
	31	Because I will feel really proud of myself if I do well.	.846	.286
	4	Because I will feel bad about myself if I don't do it.	.836	.326
Intrinsic Motivation	3	Because it's fun.	.850	.256
	27	Because I enjoy doing my school work well.	.870	.254
	22	Because it's fun to answer hard questions.	.840	.318

(continued)

Table 2. Continued.

Factor	Item	Statement	Loadings	Uniqueness
	7	Because I enjoy doing my homework.	.814	.294
	15	Because I enjoy doing my classwork.	.856	.251
	13	Because it's fun.	.842	.285
	19	Because I enjoy answering hard questions.	.871	.248

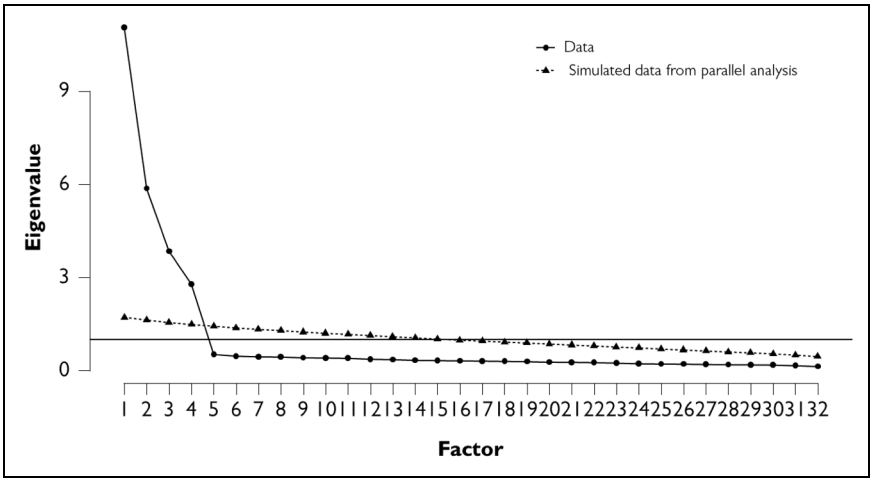

Figure 2. Scree plot and parallel analysis for factor extraction of the Arabic Academic Self-Regulation Questionnaire (SRQ-A).
Note: The solid line with circles indicates eigenvalues of the real data, and the dotted line with triangles refers to eigenvalues of the simulated data from parallel analysis.

Several indices of the model demonstrated excellent fit to the data, as shown in Figure 3. The chi-square statistic in the model was significant: $\chi^2(458) = 551.74$, $p = .002$, with a value of the ratio of the chi-square to degrees of freedom of $\chi^2 / df = 1.20$, which implies excellent fit (Bagozzi & Yi, 1988; Ullman & Bentler, 2003). The *RMSEA* was .028, with its 90% confidence interval, good fit to data (Hu & Bentler, 1998); test statistics of the $CFI = .987$; $TLI = .986$ produced an excellent fit since they were greater than the universally accepted threshold of .90 (Bentler, 1990). $SRMR = .042 < .05$; all fit indices met or exceeded recommended thresholds (Hu & Bentler, 1998).

As shown in Figure 4, the structural model confirmed the four-factor structure, with interfactor correlations ranging from $r = .093$ (External–Identified) to $r = .415$ (Identified–Intrinsic). Average loadings were robust on all dimensions: External Regulation (.86), Introjected Regulation (.86), Identified Regulation (.85), and Intrinsic Motivation (.88).

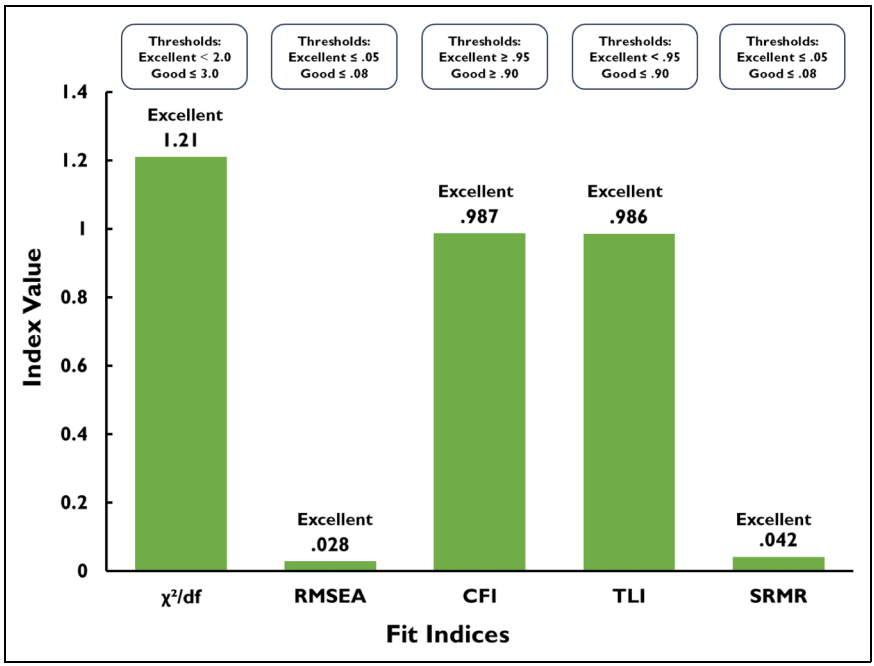

Figure 3. Global fit indices for the four-factor confirmatory measurement model of the Arabic Academic Self-Regulation Questionnaire (SRQ-A).

The heatmap of factor loadings depicted in Figure 5 represents the strength of item-factor relationships, where nearly all items have robust loadings (>.80) on each of the factors. Item-by-item loadings on factors (Figure 6) also reflect the measurement reliability across all items of the scale.

Measurement Invariance Testing. To check whether the Arabic SRQ-A works the same way for different genders and school grades, researchers ran multigroup confirmatory factor analyses (Putnick & Bornstein, 2016). Instead of just one approach, they tried four tough tests using a reliable maximum likelihood (MLR) method: (1) configural = identical factor structure, (2) metric = equal factor loadings, (3) scalar = equal intercepts, and (4) strict = equal residual variances. Model fit was assessed using χ^2, *CFI*, *TLI*, *RMSEA* (90% CI), and *SRMR*. Invariance was mainly $|\Delta CFI| <$ .010 (Cheung & Rensvold, 2002).

Gender. Fit index outcomes demonstrated configural, metric and scalar invariance ($CFI = .98–.98$; $RMSEA \approx .03$; $\Delta CFI \leq .002$; all S–B$\Delta\chi^2$ $p > .96$), suggesting that the SRQ-A measures comparable constructs for both males and females.

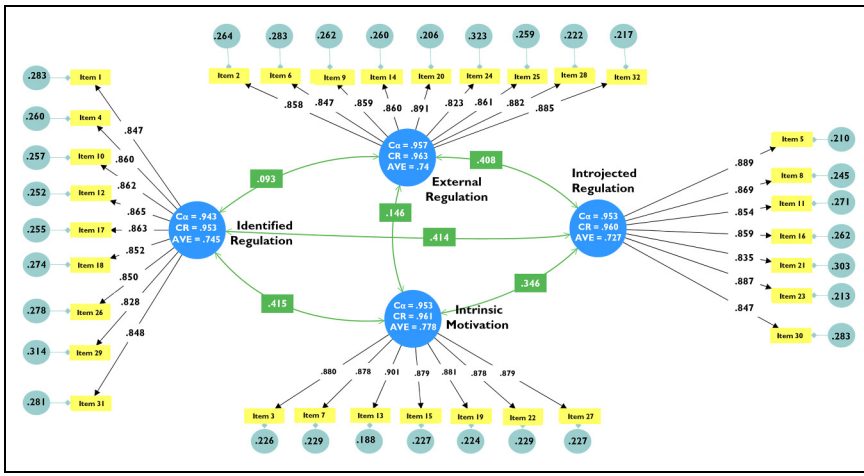

Figure 4. Standardized parameter estimates for the four-factor Academic Self-Regulation Questionnaire (Arabic SRQ-A) confirmatory model.

Nevertheless, the strict model showed a decline in fit ($\Delta CFI = -.002, p = .018$), which does not affect disparities, in latent means.

Grade (Seventh vs. Ninth). Every fit model is satisfactory ($CFI \approx .96$; $RMSEA \approx .05$; all $\Delta CFI < .003$; all S–B$\Delta\chi^2$ $p > .43$), indicating invariance across grades. Therefore, the observed mean variations represent latent differences instead of measurement bias. See Table 3 for full measurement invariance statistics across gender and grade.

3. Reliability and Validity. Reliability tests also indicated excellent internal consistency across each of the factors (see Table 4), with Cronbach's alpha ranging from .943 (Introjected Regulation) to .957 (External Regulation), surpassing the advised .70 cutoff (Nunnally & Bernstein, 1994). Composite reliability was also high (.953–.963), significantly above the threshold of .70, thereby another support for good reliability (Sarstedt et al., 2022), and convergent validity was supported by the Average Variance Extracted (AVE) values, which ranged from .727 to .778, all above the .50 minimum criterion (Fornell & Larcker, 1981). This indicates that each construct explains a substantial portion of the variance in its respective indicators

Discriminant validity was confirmed based on the HTMT ratio as shown in Table 5, and all HTMT values < .44 were far below the conservative .85 threshold (Henseler et al., 2015), confirming that factors measure distinct constructs. This result lends substantial support to the presence of discriminant validity among subscales, thus measuring clearly distinguished conceptual domains as intended.

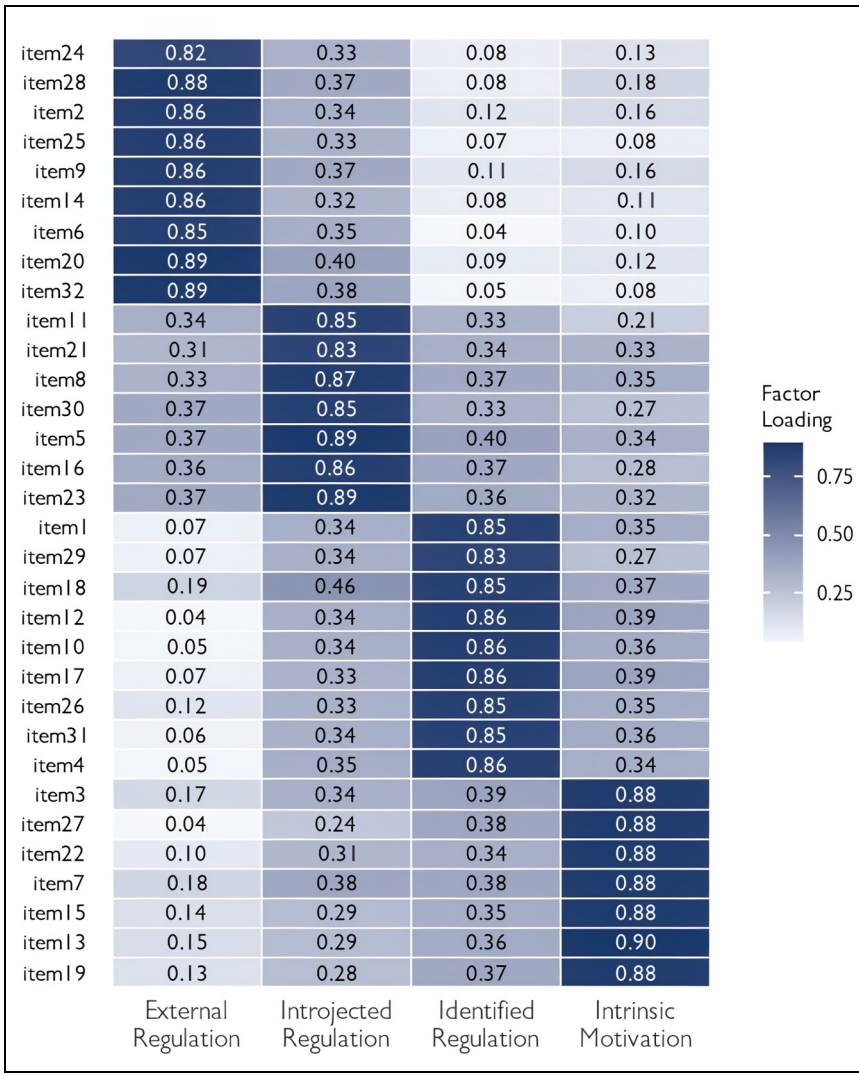

Figure 5. Heatmap of the standardized factor loading pattern matrix for the Arabic Academic Self-Regulation Questionnaire (SRQ-A).
Note: Pattern matrix heatmap showing standardized loadings of all 32 items on all four factors. Darker cells indicate stronger loadings. Primary loadings appear along the diagonal blocks. Near-zero cross-loadings confirm simple structure.

In particular, the CFA results indicate very strong confirmation of this four-factor structure from the Arabic version of the SRQ-A. The model has a good fit to data, with all items loading significantly on their respective factors. Reliability and validity

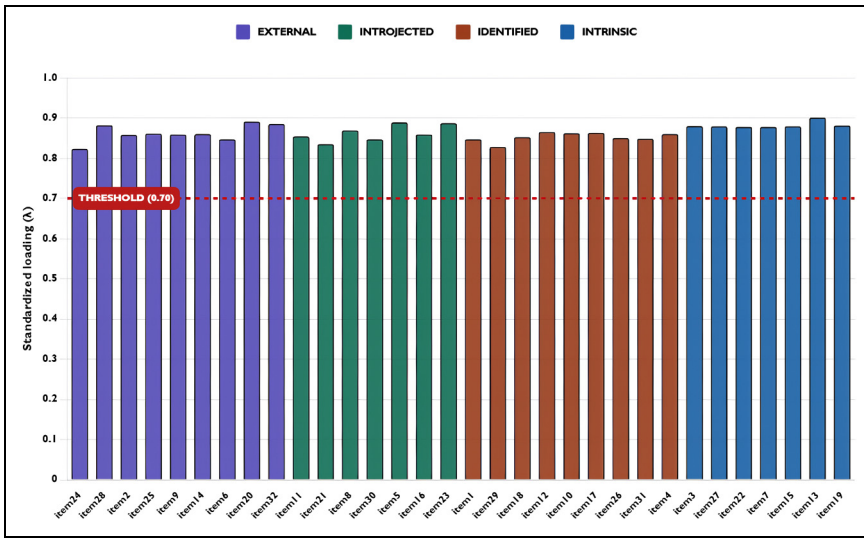

Figure 6. Distribution of standardized item loadings across the Arabic Academic Self-Regulation Questionnaire (SRQ-A) latent factors.
Note: Bar chart shows standardized factor loadings (λ) for all 32 items of the Arabic SRQ-A grouped by factor. The red dashed line represents the standard .70. All items demonstrated strong local convergent validity, significantly exceeding the cutoff.

measures prove that the instrument has sound psychometric properties. Such findings suggest an adapted Arabic SRQ-A is a valid and reliable instrument for measuring academic self-regulation in Arab middle school students.

RQ2: Are There Gender or Grade-Level Differences in Self-Regulation Patterns?

To answer this question and address measurement error inherent in observed composite scores, we estimated and compared standardized latent factor means within the structural equation modeling framework (Tse et al., 2023). This was permissible having established scalar measurement invariance across both gender and grade level (see Table 3).

For gender comparisons, with male students set as the reference group (mean constrained to 0), female students exhibited a significantly higher latent mean on introjected regulation (ΔM 0.87, SE 0.10, p <.001). No significant latent mean differences were observed between genders for external regulation, identified regulation, or intrinsic motivation.

For grade-level comparisons, with seventh-grade students serving as the reference group, intrinsic motivation showed a statistically significant and practically meaningful

Table 3. Measurement Invariance of the Arabic SRQ-A Across Gender and Grade Level.

Grouping	Model	χ^2 (*df*)	*CFI*	*RMSEA* (90% CI)	Δ*CFI*	Δ*RMSEA*	*S-B*Δχ^2 (*df*)	*p*	Interpretation
Gender	Configural	1065.84 (916)	.980	.035 (.025–.044)	–	–	–	–	Good fit
	Metric	1079.51 (944)	.982	.033 (.022–.042)	+.002	−.002	15.85 (28)	.968	Metric supported
	Scalar	1092.70 (972)	.984	.031 (.019–.040)	+.002	−.002	13.11 (28)	.992	Scalar supported
	Strict	1140.22 (1004)	.982	.032 (.021–.041)	−.002	+.001	50.90 (32)	.018	Not supported
Grade (seventh vs. ninth)	Configural	1120.33 (916)	.959	.051 (.040–.061)	–	–	–	–	Acceptable fit
	Metric	1135.00 (944)	.962	.049 (.037–.059)	+.003	−.002	16.42 (28)	.959	Metric supported
	Scalar	1163.81 (972)	.962	.048 (.036–.058)	−.000	−.001	28.50 (28)	.438	Scalar supported
	Strict	1199.42 (1004)	.961	.0478 (.036–.058)	−.001	−.000	37.24 (32)	.241	Strict supported

Note: $|\Delta CFI| < .010$ and nonsignificant *S-B*Δχ^2 tests confirm measurement equivalence across gender and grade groups. *S-B*Δχ^2 Satorra-Bentler scaled chi-square difference test. Strict invariance is often difficult to obtain in psychological research and is generally considered optional for establishing measurement equivalence necessary for latent mean comparisons (Tse et al., 2023). SRQ-A = Academic Self-Regulation Questionnaire; CFI = Comparative Fit Index; RMSEA = Root Mean Square Error of Approximation.

Table 4. Internal Consistency and Convergent Validity of the Arabic SRQ-A Factors.

Factor	Items	α	*CR*	*AVE*	Interpretation
External Regulation	9	.957	.963	.745	Excellent
Introjected Regulation	7	.943	.953	.745	Excellent
Identified Regulation	9	.953	.960	.727	Excellent
Intrinsic Motivation	7	.953	.961	.778	Excellent

Note: α = *Cronbach's alpha; CR = composite reliability; AVE = average variance extracted;* SRQ-A = Academic Self-Regulation Questionnaire. *AVE values* >.50 indicate that factors explain more than half the variance in their indicators, confirming convergent validity (Fornell & Larcker, 1981).

Table 5. Discriminant Validity Assessment of the Arabic SRQ-A Based on HTMT Ratios.

Factor	External Regulation	Introjected Regulation	Identified Regulation	Intrinsic Motivation
External Regulation	–			
Introjected Regulation	.429	–		
Identified Regulation	.097	.436	–	
Intrinsic Motivation	.153	.366	.436	–

Note: All HTMT values <.44, well below the conservative .85 threshold (Henseler et al., 2015), confirming that factors measure distinct constructs. SRQ-A = Academic Self-Regulation Questionnaire; HTMT = heterotrait-monotrait.

decline. The latent mean for intrinsic motivation decreased monotonically for eighth graders (ΔM −0.35, *SE* 0.11, p =.001) and continued to decline for ninth graders (ΔM −0.73, *SE* 0.11, p <.001, calculated as the cumulative difference). No significant latent mean differences were observed across grades for external regulation, introjected regulation, or identified regulation. Because scalar invariance was established, these latent mean differences are interpretable as true group differences unconfounded by differential item functioning.

Note: Using the calculated composite scores, overall autonomous motivation as indexed by the RAI favored female students (t 3.25, p =.001, d 0.29) and declined significantly across grades (F 9.17, p <.001, η^2 =.034; Grade 7: M 2.08, Grade 8: M 1.54, Grade 9: M 1.04) (Table 6).

RQ3: What Are the Predominant Self-Regulation Profiles Among Arab Middle School Students?

To identify distinct self-regulation profiles, we performed K-means cluster analysis on the four self-regulation dimensions (External, Introjected, Identified, and Intrinsic). We

Table 6. Standardized Latent Mean Differences in Arabic Academic Self-Regulation Questionnaire (SRQ-A) Dimensions Across Gender and Grade Level.

Construct	Female vs. male ΔM (SE)	*p*	Eighth vs. seventh ΔM (SE)	*p*	Ninth vs. seventh ΔM (SE)	*p*
External Regulation	−0.03 (0.09)	.762	0.03 (0.10)	.809	0.01 (0.11)	.963
Introjected Regulation	**0.87 (0.10)**	**<.001**	−0.08 (0.10)	.428	0.01 (0.11)	.946
Identified Regulation	0.05 (0.10)	.640	−0.08 (0.11)	.479	−0.03 (0.11)	.831
Intrinsic Motivation	0.10 (0.09)	.257	**−0.35 (0.11)**	**.001**	**−0.73 (0.11)**	**<.001**

Note: Male students and Grade 7 students served as the reference groups for gender and grade-level comparisons, respectively, with their latent means fixed at zero. ΔM represents the standardized latent mean difference, and SE represents the standard error. Positive values indicate higher latent means for females relative to males and for the comparison grade relative to Grade 7. Statistically significant differences ($p < .05$) are bolded.

Table 7. Mean Profiles of Arabic SRQ-A Dimensions by Motivational Cluster.

Cluster Profile	External	Introjected	Identified	Intrinsic	*RAI*
Cluster 1 ($n = 110$, 20.9%)	2.17	2.27	3.04	2.83	1.33
Cluster 2 ($n = 119$, 22.6%)	2.23	2.71	3.93	4.16	4.04
Cluster 3 ($n = 132$, 25.1%)	3.39	3.81	4.52	4.32	1.95
Cluster 4 ($n = 165$, 31.4%)	3.39	3.31	3.64	3.35	−0.33

Note: RAI = Relative Autonomy Index; SRQ-A = Academic Self-Regulation Questionnaire.

standardized data prior to clustering to ensure equal weighting of variables. Based on theoretical considerations and examination of the elbow plot, we selected a four-cluster solution as optimal. We used chi-square tests to examine the distribution of gender and grade level across the identified clusters. As shown in Table 7, K-means cluster analysis identified four distinct self-regulation profiles with important implications for educational practice:

Cluster 2—Autonomous Regulators (22.6% of students): Characterized by low external and introjected regulation with moderate identified and high intrinsic motivation, resulting in the highest RAI ($RAI = 4.04$). These students represent the ideal motivational profile associated with optimal learning outcomes.

Cluster 3—High Engagers (25.1% of students): Showed high levels across all dimensions, but particularly strong identified and intrinsic motivation ($RAI = 1.95$). These students demonstrate strong overall engagement but may benefit from reducing reliance on external pressures.

Table 8. Cross-Tabulation of Gender and Grade Level by Arabic Academic Self-Regulation Questionnaire (SRQ-A) Cluster Membership.

Category		Cluster 1 (Moderate Regulators)	Cluster 2 (Autonomous Regulators)	Cluster 3 (High Engagers)	Cluster 4 (Controlled Regulators)	Total
Gender	Female	47	67	90	89	293
	Male	63	52	42	76	233
Grade	Seventh	30	53	54	49	186
	Eighth	44	39	47	53	183
	Ninth	36	27	31	63	157
	Total	110	119	132	165	526

Cluster 1—Moderate Regulators (20.9% of students): Exhibited low external and introjected regulation with moderate identified and intrinsic motivation ($RAI = 1.33$). These students show balanced motivation but could benefit from interventions to enhance autonomous forms of regulation.

Cluster 4—Controlled Regulators (31.4% of students): Marked by high external regulation with moderate other dimensions, resulting in the only negative *RAI* (-0.33). This largest group represents students at risk for motivational difficulties and academic burnout.

The identification of these profiles has significant implications for advanced academics, as autonomous regulators (Clusters 1 and 2) are more likely to sustain high achievement and demonstrate characteristics associated with academic giftedness (Gottfried & Gottfried, 2004).

Chi-square analyses revealed significant associations between cluster membership and both gender, $\chi^2\,(3) = 12.76$, $p = .005$, and grade level, $\chi^2\,(6) = 15.32$, $p = .018$. As shown in Table 8, males were overrepresented in Cluster 1 (low regulation), while females were overrepresented in Clusters 1 and 2 (high autonomous motivation). Additionally, ninth graders were overrepresented in Cluster 4 (controlled motivation), suggesting developmental differences in self-regulation patterns.

Figure 7 illustrates the self-regulation profiles of the four clusters, highlighting the distinct patterns of motivation across groups (Figure 8).

The validity of the obtained cluster structure was examined through multiple indices simultaneously. The Davies-Bouldin Index ($DBI = 1.38$) satisfied the threshold of acceptable cluster separation and compactness ($DBI < 1.50$); hence, it was valid (Davies & Bouldin, 1979). The Silhouette Measure had a value of .21, passing the threshold of about .20 needed for valid clustering in psychological studies, where the theoretical concepts studied are always continuous and partly overlapped (Rousseeuw, 1987). The Calinski-Harabasz Index ($CH = 173.87$) indicated that the

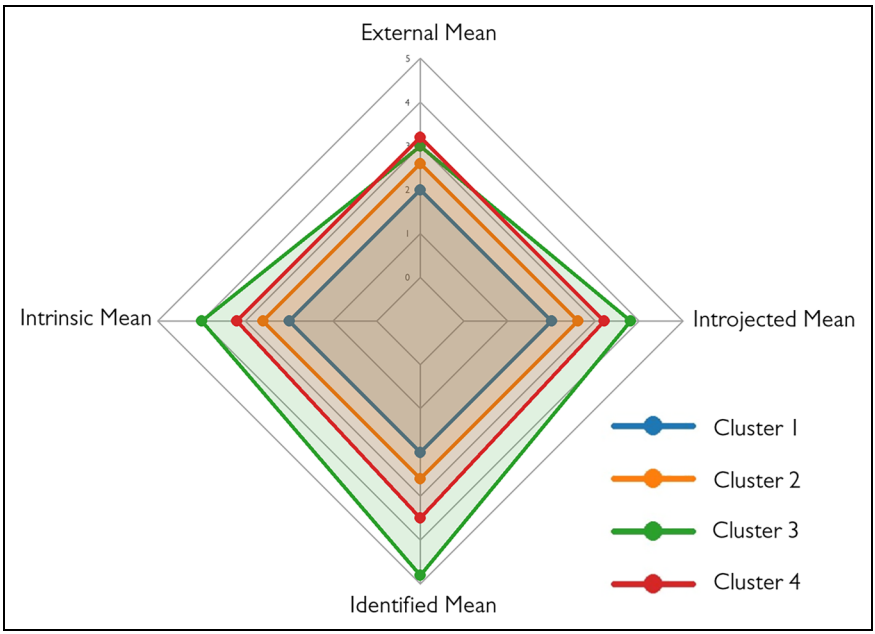

Figure 7. Radar chart displaying standardized academic self-regulation profiles by cluster.

ratio of between-clusters to within-clusters variance was favorable, therefore valid, for a four-cluster solution (Calinski & Harabasz, 1974).

To check if clusters varied across on the combined set of self-regulation dimensions, a one-way MANOVA was run—using cluster membership as the predictor and the four SRQ-A scales as outcomes. Results showed a strong overall effect (Wilks' $\lambda = .101$, $F(12, 678.91) = 78.25$, $p < .001$, partial $\eta^2 = .90$), which suggests clear differences in motivation patterns between clusters. Follow-up univariate ANOVAs showed clear differences between clusters across each scale: External Regulation, $F(3, 522) = 146.80$, $p < .001$, $\eta^2 = .46$, Introjected Regulation, $F(3, 522) = 179.87$, $p < .001$, $\eta^2 = .51$; yet, for Identified Regulation, results were also significant, $F(3, 522) = 188.07$, $p < .001$, $\eta^2 = .52$, similarly with Intrinsic Motivation, $F(3, 522) = 183.97, p < .001$, $\eta^2 = .51$. Taken together, all four dimensions contributed uniquely and substantially to cluster differentiation, with effect sizes ranging from $\eta^2 = .46$ to .52, all of which exceed the threshold for large effects (Cohen, 2013).

RQ4: How Do Self-Regulation Dimensions Relate to RAI?

We computed Pearson correlations to examine relationships between self-regulation dimensions and the RAI, as shown in Table 9. As expected from SDT, external

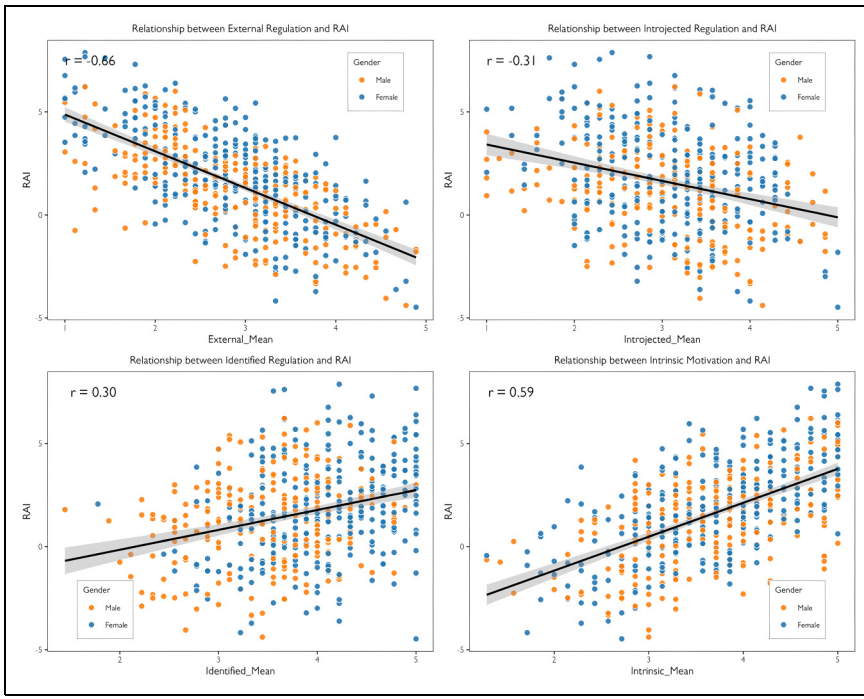

Figure 8. Scatterplots displaying the relationship between Arabic Academic Self-Regulation Questionnaire (SRQ-A) regulatory dimensions and the Relative Autonomy Index.

regulation showed a strong negative correlation with *RAI* ($r = -.66$), while intrinsic motivation showed a strong positive correlation with *RAI* ($r = .59$). This pattern confirms that the *RAI* effectively captures the self-determination continuum, with more autonomous forms of regulation associated with higher *RAI* scores.

The correlation matrix in Table 9 reveals theoretically consistent patterns that support discriminant validity. External and introjected regulation show moderate positive correlation ($r = .41$), reflecting their shared controlled nature along the self-determination continuum. Likewise, identified regulation and intrinsic motivation demonstrate moderate positive correlation ($r = .40$), reflecting their shared autonomous characteristics. Importantly, the correlations between controlled and autonomous forms of regulation are significantly lower (ranging from $r = .14$ to .41), suggesting these subscales assess motivational constructs instead of one overarching motivation factor. The highest correlation observed between any two subscales is $r = .41$ (External-Introjected), which is substantially under the .85 cutoff indicating construct overlap (Brown, 2015). This pattern of correlations—moderate within regulatory categories, weaker between categories—is precisely what SDT predicts and what

Table 9. Bivariate Correlations Among the Arabic SRQ-A Dimensions.

Variable	External Regulation	Introjected Regulation	Identified Regulation	Intrinsic Motivation	RAI
External Regulation	–				
Introjected Regulation	.406	–			
Identified Regulation	.167	.405	–		
Intrinsic Motivation	.136	.254	.401	–	
RAI	−.661	−.306	.302	.587	–

Note: RAI = Relative Autonomy Index; SRQ-A = Academic Self-Regulation Questionnaire.

discriminant validity requires. These findings support the validity of our Arabic adaptation and confirm the theoretical structure of SDT in this cultural context.

Discussion

This study successfully developed and validated an Arabic version of the SRQ-A, providing researchers and educators with a culturally appropriate tool for assessing academic motivation among Arabic-speaking students. Our comprehensive validation demonstrated strong psychometric properties, supported the cross-cultural validity of SDT, and revealed important patterns of self-regulation with significant implications for educational practice and advanced academic programming.

Our analyses obtained a four-factor structure, demonstrating consistency with the theoretical formulation of SDT (Ryan & Deci, 2000b) and the original structure of the SRQ-A (Ryan & Connell, 1989). What this represented among the four factors was a continuum of motivational types moving from controlled to autonomous forms of regulation, including external regulation, introjected regulation, identified regulation, and intrinsic motivation. The finding therefore suggests that the core structure of academic self-regulation, as conceptualized in SDT, holds true within an Arab cultural context. Distinguishing these four factors in our findings therefore supports the universality of the SDT framework across cultures, as suggested by previous studies (Jang et al., 2009; Vansteenkiste et al., 2005). This confirms the increasing volume of data suggesting basic psychological needs and motivational processes posited within SDT might be universal, although their manifestation or relative priorities may differ across cultural contexts (Chirkov et al., 2003; Yu et al., 2016).

Results indicate instances of convergence and divergence with existing SRQ-A validations across other cultural settings, pointing towards the universal and distinct aspects of academic self-regulation across different cultures. The four-factor structure

that emerged also fits the Portuguese (Gomes et al., 2019), Russian (Gordeeva et al., 2020), and Korean (Jang et al., 2009) validations, thereby providing evidence that SDT is correct about its claim that the basic regulatory model has pancultural validity across all cultures. However, the alpha values that emerged (.94–.96) are higher compared to other adaptation scores, which range between .70 and.85 (Alivernini et al., 2011; Bagçeci & Kanadli, 2014), possibly reflecting cultural tendencies toward more consistent response patterns or the benefits of our enhanced 5-point scale.

Our stringent translation process, including multiple panels of experts, back-translation protocols, and rigorous pilot testing, allowed for linguistic accuracy as well as cultural suitability. The change from a 4-point to a 5-point Likert rating was advantageous, facilitating more precise measurement and increased reliability without sacrificing conceptual similarity with the original measure. The implications of this discovery for cross-cultural translations of psychological scales are critical for future applications.

The Arabic SRQ-A showed excellent psychometric properties. The internal consistency reliability, expressed as Cronbach's alpha (α), was high for each factor, ranging from .94 to .96. In the same vein, composite reliability (*CR*) ranged from .95 to .96 for each factor. These suggest that the items within each subscale are consistently measuring the same construct. Indeed, these reliability coefficients compare with, and in most cases surpass, those reported in previous validations of the SRQ-A in other languages (Alivernini et al., 2011; Gomes et al., 2019). The results of convergent validity are supported by the high factor loadings of .79–.89, accompanied by corresponding acceptable average variance extracted values ranging from .73 to .78, thus implying that the items were good indicators of their respective factors. Each of the factors explains a substantial amount of variance in its indicators. A discriminant validity between the four factors is evidenced by the fact that all factors intercorrelate at moderate levels, results of the HTMT ratio analyses. This shows that while the factors are related, as might be expected with theoretical relationships between them, they do represent distinct constructs within the breadth of academic self-regulation.

Our establishment of measurement invariance across both gender and grade level through formal multigroup CFA allows for valid comparisons across groups and facilitates the employment of the Arabic SRQ-A for research investigating individual differences in academic motivation. This is a notable step in the provision of valid measures of motivation for Arabic-speaking populations.

Regarding gender profiles, our latent mean comparisons revealed a significant and substantial difference, with female students scoring much higher on introjected regulation ($\Delta M = 0.87$) rather than identified regulation as initially observed in raw composite scores. By utilizing structural equation modeling to control for measurement error, this finding provides a more precise understanding of the motivational drivers for female students in this context. While adaptations in other cultures, such as the Portuguese (Gomes et al., 2019) and Russian (Gordeeva et al., 2020) versions, found that females endorsed broader autonomous regulation more than males, our results suggest that in the Arabic educational context, this internalization is heavily driven by introjection. This is highly consistent with cultural socialization patterns where

educational attainment for young women is often deeply intertwined with family honor, parental approval, and the fulfillment of familial expectations (Dwairy, 2004). Consequently, female students may internalize these cultural expectations as strong internal pressures, driven by a desire to evoke pride or avoid the guilt and shame associated with academic failure.

The large effect size we obtained for female students on introjected regulation is particularly revealing. While it demonstrates that female students have successfully internalized academic values—moving beyond purely external regulation (e.g., studying just to avoid punishment)—it highlights that their motivation relies heavily on ego-involvement and internal pressure. This pronounced level of introjected motivation is likely an outgrowth of cultural socialization practices that strongly encourage girls' compliance and sensitivity to familial approval. However, because introjected regulation is a controlled form of motivation, it carries a psychological cost. High levels of introjected regulation are often correlated with academic anxiety and vulnerability to burnout, particularly in high-stakes testing environments. This underscores a critical need for educators to recognize that while female students may appear highly engaged and self-regulated, their engagement may be fueled by pressure rather than genuine personal value or interest. Therefore, pedagogical efforts must be made to help female students transition their motivational orientation from introjection toward true identified and intrinsic regulation.

The reduction of intrinsic motivation across grades seventh to ninth could also be attributed to certain culture-related transitions. In many Arabic countries, middle school generally symbolizes intensified academic pressure with a focus on large exams and a family expectation of educational achievement (Kirdar, 2017). As children go through middle school, a strictly entertainment-related component of the educational experience might start to get secondary priority to more goal-related aspects, not because of oppression but because of a recognition that education is becoming a crucial determining factor of their future.

Concerning motivational profiles, our cluster analysis showed both points of similarity with and differences from other cultures. Similar to the study by Vansteenkiste et al. (2009) on Belgian participants, we found about 20%–25% to have highly autonomous motivational profiles (Cluster 2). However, our level for the controlled regulation type (31.4%, Cluster 4) is appreciably higher than the 18% found in the Belgian sample, but comparable to the 29% level found in the Chinese adaptation by Vansteenkiste et al. (2005). This could denote some cultural specifics in the education systems that are more prevalent in collectivist cultures with strong external systems of accountability.

The 31.4% of students who evidence controlled regulation patterns (Cluster 4) is especially interesting against the backdrop of Arabic educational systems, which tend to uphold external authority and compliance. While such strategies do promote short-term compliance, our findings indicate that perhaps there is a lack of internalized motivation required for long-term academic excellence and creativity. Conversely, the identification of 47.7% of students with autonomous regulation patterns (Clusters 1 and 2) demonstrates that many Arab students do develop self-determined motivation

despite potentially controlling educational environments. This finding challenges stereotypes about motivation in collectivistic cultures and supports the universality of basic psychological needs proposed by SDT.

Our results encourage consideration of how constructs in motivational psychology might be interpreted or felt differently across cultural contexts. The successful validation of the four-factor solution for the SRQ-A on the Arabic sample offers support for the idea that SDT's basic taxonomy for regulation is generally applicable across cultures. However, the interpretation or significance of these constructs, especially the concept of autonomy, may have cultural variations. In Western, individualistic sociocultural contexts, autonomy can and often does overlap with independence, autonomy, and freedom from external control (Markus & Kitayama, 1991). However, in other sociocultural settings that are collectivist in nature, autonomy can be seen as involving volition and endorsement, which can be compatible with interdependence and taking into account the views of important others (Chirkov et al., 2003; Iyengar & Lepper, 1999).

In the Arabic educational context, identified regulation, or personal endorsement of academic goals, can occur in that students value their academic goals specifically because those goals are tied to the honor of one's family, the group, and fulfillment of relational obligations (Joseph, 1994). This would qualify as autonomous regulation in SDT because students would be truly endorsing those academic goals but would relate far more deeply than in typical individualistic approaches. Equally, the substantial number of students who have been classified as having controlled regulation patterns (Cluster 4: 31.4%) has also been noted. Although controlled patterns have been found linked with results which are not entirely optimal within the Western educational paradigm, the emphasis on the role of external authority and the provision of structural support may have a different role within the Arabic educational system.

The values and practices of the educational institution, as expressed through the school authorities and parental influence, can also be construed as representations of nurturing and guidance rather than a suppression of personal autonomy and freedom (Dwairy, 2004). However, the fact that autonomous regulation remained a predictor for higher *RAI* scores and that female students demonstrated greater identified regulation indicates that the subjective experience of autonomy still plays a role in motivation even for collectivistic societies. This supports the universalist assertion that the satisfaction of certain psychological needs—autonomy, competence, and relatedness—has a universal basis according to SDT despite the path to satisfaction being culture-specific (Ryan & Deci, 2017).

Implications for Advanced Academics and Gifted Education

Our findings have several important implications for advanced academics and gifted education in Arabic contexts. Self-regulation profiles can complement traditional ability measures in identifying academically gifted students, as the 47.7% of students showing autonomous regulation patterns (Clusters 1 and 2) may represent a pool of students with potential for advanced academic achievement. Research demonstrates that

autonomous motivation is essential for sustained high achievement and creative productivity (Hennessey & Amabile, 2010), and our identification of students with these motivational characteristics provides a foundation for talent development programs. Additionally, the 31.4% of students showing controlled regulation patterns (Cluster 4) may be at risk for underachievement, even if they possess high ability, making early identification of these motivational patterns critical for preventive interventions. Finally, the Arabic SRQ-A can be used to evaluate the effectiveness of gifted education programs by monitoring changes in students' motivational profiles over time.

Culturally-Specific Practical Implications for Arabic Educational Contexts

Findings from our research have multiple implications particularly pertinent within the Arabic-speaking world, specifically regarding their current schooling structures and their learners:

1. Culturally Responsive Talent Identification: The talent search model currently widely used for gifted identification in some Arab countries tends to emphasize achievement and nominations, leaving students with high autonomy to some extent but possibly low achievement on the table. The 47.7% with autonomy regulation profiles, including Clusters 1 and 2, might actually encompass a larger talent pool than ability alone. Teachers in the Arabic culture are encouraged to integrate motivational profiles with cognitive profiles, focusing, for example, on students with high levels of identified regulation, who appreciate learning as connected to family honor, contribution to the community, religious ideals, or similar concepts, reflecting the autonomy construct that is native to the culture.
2. Reframing Authority Relations: The 31.4% of the student participants who displayed controlled regulation profiles (Cluster 4) could also be understood in a Western deficit approach. In Arabic educational settings, it is possible that teachers' authority and submission to parental demands do not necessarily undermine autonomous regulation once the external constructs are viewed in the care rather than control framework (Dwairy, 2004). However, it appears that, regardless of the collectivistic setting, promotion of volitional regulation and self-endorsement leads to higher levels of motivational regulation. This might imply that teachers could reinforce their relevant authority position while, at the same time, promoting choices within the structural framework and presenting reasons concerning learning tasks in terms of the learners' own learning goals.
3. Gender-Responsive Interventions: The finding that female students exhibit significantly higher introjected regulation ($\Delta M = 0.87$) dictates a shift in how educators approach gender-based motivational support. While female students are internalizing academic goals, their reliance on guilt, shame, and ego-enhancement makes them susceptible to academic anxiety. Interventions

for female students should focus on reducing this internal pressure by decoupling their personal worth and family standing from their academic performance. Counselors and educators should provide safe environments where female students can explore academic interests without the immediate burden of expectation. Conversely, the finding that male students exhibit lower introjected regulation suggests they are less responsive to this specific type of internal pressure. Male students may therefore benefit from interventions that focus on building identified regulation by explicitly connecting academic tasks to future career utility, community leadership, and personal relevance, while offering more experiential and choice-based learning opportunities that resonate with male socialization practices.

4. Dealing with Declines in Motivation: The dramatic drop in intrinsic motivation from seventh grade through ninth grade is probably due to the growing pressure of examinations, which is prevalent within the typical Middle Eastern education system. Since within Arabic societies, family prestige is deeply interconnected with success, this age may be highly challenging there too. Some measures that may be useful within this context would be talking to the students about the contradictions between enjoyment and utility within learning, providing safe havens for learning exploration and creativity within an examination-based curriculum, guiding students within examination preparation to more personal, family-expectation-transcendent goals, and counseling students suffering from academic pressure-related anxieties.
5. Family Engagement Strategies: Because Arabic culture is so highly collectivist in nature, strategies aimed at promoting autonomous regulation on the part of the student might incorporate the entire family, rather than pitting autonomy against the influence of the family. This could include strategies such as educating parents on the difference between controlling and autonomy-supporting behaviors, constructs that would enable families to articulate educational visions that respect both the overall family dreams and the developing personal visions of the students, and understanding that the student's commitment to the family through achievements might well be a form of identified regulation.
6. Advanced Program Design: Students in Clusters 1 and 2 may also find advanced academic programming important, with a focus on autonomy, problem-solving, and inquiry as necessary aspects of academic growth and success. Yet, a consideration of independence as a culturally valued construct may also inform advanced program design, where Arabic students are encouraged to exercise autonomy with others, as through collaborative research, guided independent studies, or service-learning projects linking students' advanced abilities to communal needs.

These culturally informed implications combined show that it is possible to adequately operationalize self-determination theory constructs within the context of the Arabic education system in a way that is supportive of autonomous learning.

Limitations and Future Directions

Despite the valuable insight our research contributes, there are a number of limitations that need to be noted. The cross-sectional nature of our design makes causal inference with regard to the development of motivational profiles across time impossible, and we look to longitudinal research in the future to elucidate the development of such profiles throughout adolescence.

A key factor affecting the generalizability of our results concerns dialectic variation. Data collection occurred in Jerusalem. The adapted instrument reflects the linguistic characteristics and cultural contexts of Levantine Arabic. Arabic is a highly dialectically variable language across regions that differ in their vocabulary, syntax, and pragmatic conventions, among the Levantine, Gulf, Egyptian, and Maghrebi dialects (Ferguson, 1959). While Modern Standard Arabic provides a formal *lingua franca*, students' everyday communication and comprehension are heavily influenced by their regional dialect. More subtly, the cultural context of Jerusalem-including specific educational practices, authority relations, and attitudes about the value of achievement-could influence how self-regulation constructs are expressed and best measured. We suggest that researchers who use this scale in other Arabic-speaking contexts conduct cognitive interviews with local students to check item interpretations and cultural relevance and conduct confirmatory psychometric testing to test the stability of factor structure. Future research should investigate measurement invariance across dialects to establish cross-dialect generalizability of the instrument.

Our sample was drawn only from urban public schools in Jerusalem serving middle-to-lower SES communities. Generalization to rural Arabic-speaking populations, private schools, or higher SES communities is made cautiously due to the possible substantial difference in educational contexts, parental educational levels, and resource availability.

While our sample size of 263 per analysis exceeds minimum requirements based on our specific model characteristics and Monte Carlo simulations, some researchers advocate for larger samples following the 10:1 participant-to-item ratio (Kyriazos, 2018). Future replications with larger samples would further strengthen confidence in the factor structure's stability.

Although this study offers strong evidence for internal consistency, convergent validity, and discriminant validity, it did not assess criterion-related validity, such as associations with academic achievement or other theoretically related constructs. According to the *Standards for Educational and Psychological Testing* (AERNA et al., 2014), validity is one concept supported by many sources of evidence. Future studies should extend this work of validation by looking into how the Arabic SRQ-A subscales are related to academic achievement, the persistence in challenging coursework, creative productivity, and other achievements relevant to advanced academics. Such criterion-related evidence would further support the applied utility of the Arabic SRQ-A in educational contexts and make stronger claims on the educational significance of different motivational profiles.

Whereas we used the full pooled sample for cluster analysis to maximize power, this means cluster profiles were identified from the same data used to establish factor structure. It is important for future research to validate these cluster profiles in independent samples to ensure they represent replicable motivational patterns rather than sample-specific artefacts.

Further research should also investigate the stability of motivational profiles across school years, the correspondence between motivational profiles and particular academic outcomes, the efficacy of interventions targeting autonomous motivation, cross-cultural comparative studies of motivational profiles in Arabic and other cultural communities, the influence of teachers' practices on students' motivational profiles, and the transfer of motivational profiling to talent identification and development.

Conclusion

This study contributes in a number of critical ways to academic motivation and cross-cultural psychology research. We have facilitated access for researchers and educators to a well-established Arabic adaptation of the SRQ-A with excellent psychometric quality and cultural fit. With a complete analysis of self-regulation patterns, we gain new understanding of motivational diversity in Arabic populations and have practical recommendations for educational interventions. The identification of different motivational profiles is especially relevant to advanced academics and gifted education, as it provides a useful framework for the identification of talent, program planning, and intervention. Through the identification and management of the motivational needs of different student profiles, educators can enhance the learning environment so that academic excellence is supported for all.

Our results affirm the cross-cultural generalizability of self-determination theory as well as the relevance of cultural considerations for educational practice. Our successful adaptation of the SRQ-A for Arabic settings sets the stage for further investigation and application with this neglected population. With educational systems across the globe turning attention towards enhancing students' motivation and achievement, our research contributes to the creation of evidence-based strategies that are respectful of cultural diversity and supportive of universal human needs for competence, relatedness, and autonomy.

Acknowledgments

The authors would like to thank the participating schools, students, and their families for their cooperation.

ORCID iDs

Ahmad Yousef https://orcid.org/0000-0002-1924-1811
Abedalkarim Ayyoub https://orcid.org/0000-0001-9111-4465

Authors Contribution

Ahmad Yousef: conceptualization, methodology, formal analysis, investigation, writing–original draft, writing–review and editing, and project administration. Abedalkarim Ayyoub: conceptualization, methodology, investigation, writing–review and editing, and supervision.

Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Supplemental Material

Supplemental material for this article is available online.

References

AERNA, APA, & NCME. (2014). *Standards for educational and psychological testing*. American Educational Research Association.

Alivernini, F., Lucidi, F., & Manganelli, S. (2011). Psychometric properties and construct validity of a scale measuring self-regulated learning: Evidence from the Italian PIRLS data. *Procedia - Social and Behavioral Sciences*, *15*, 442–446. https://doi.org/10.1016/J.SBSPRO.2011.03.118

Amabile, T. M., Collins, M. A., Conti, R., Phillips, E., Picariello, M., Ruscio, J., & Whitney, D. (2018). *Creativity in context*. Routledge. https://doi.org/10.4324/9780429501234

Bagçeci, B., & Kanadli, S. (2014). The study of adapting self-regulation questionnaire into Turkish. *Journal of Education and Human Development*, *3*(3), 271–281. https://doi.org/10.15640/JEHD.V3N3A22

Bagozzi, R. P., & Yi, Y. (1988). On the evaluation of structural equation models. *Journal of the Academy of Marketing Science*, *16*(1), 74–94. https://doi.org/10.1007/BF02723327

Beaton, D. E., Bombardier, C., Guillemin, F., & Ferraz, M. B. (2000). Guidelines for the process of cross-cultural adaptation of self-report measures. *Spine*, *25*(24), 3186–3191. https://doi.org/10.1097/00007632-200012150-00014

Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin*, *107*(2), 238–246. https://doi.org/10.1037/0033-2909.107.2.238

Brown, T. A. (2015). *Confirmatory factor analysis for applied research* (2nd ed.). Guilford Press.

Calinski, T., & Harabasz, J. (1974). A dendrite method for cluster analysis. *Communications in Statistics - Theory and Methods*, *3*(1), 1–27. https://doi.org/10.1080/03610927408827101

Cheung, G. W., & Rensvold, R. B. (2002). Evaluating goodness-of-fit indexes for testing measurement invariance. *Structural Equation Modeling*, *9*(2), 233–255. https://doi.org/10.1207/S15328007SEM0902_5;ISSUE:ISSUE:DOI

Chirkov, V., Ryan, R. M., Kim, Y., & Kaplan, U. (2003). Differentiating autonomy from individualism and independence: A self-determination theory perspective on internalization of cultural orientations and well-being. *Journal of Personality and Social Psychology*, *84*(1), 97–110. https://doi.org/10.1037/0022-3514.84.1.97

Cohen, J. (2013). *Statistical power analysis for the behavioral sciences*. Routledge.

Conesa, P. J., & Duñabeitia, J. A. (2022). Adaptation and validation to Spanish elementary school children of the Academic Self-Regulation Questionnaire (SRQ-A). *Electronic Journal of Research in Education Psychology*, *20*(57), 403–426. https://doi.org/10.25115/EJREP.V20I57.6013

Dai, D. Y., & Chen, F. (2013). Three paradigms of gifted education. *Gifted Child Quarterly*, *57*(3), 151–168. https://doi.org/10.1177/0016986213490020

Davies, D. L., & Bouldin, D. W. (1979). A cluster separation measure. *IEEE Transactions on Pattern Analysis and Machine Intelligence*, *PAMI-1*(2), 224–227. https://doi.org/10.1109/TPAMI.1979.4766909

Deci, E. L., Hodges, R., Pierson, L., & Tomassone, J. (1992). Autonomy and competence as motivational factors in students with learning disabilities and emotional handicaps. *Journal of Learning Disabilities*, *25*(7), 457–471. https://doi.org/10.1177/002221949202500706

Duckworth, A. L., Taxer, J. L., Eskreis-Winkler, L., Galla, B. M., & Gross, J. J. (2019). Self-control and academic achievement. *Annual Review of Psychology*, *70*(2019), 373–399. https://doi.org/10.1146/ANNUREV-PSYCH-010418-103230/1

Dwairy, M. (2004). Parenting styles and mental health of Palestinian–Arab adolescents in Israel. *Transcultural Psychiatry*, *41*(2), 233–252. https://doi.org/10.1177/1363461504043566

Fabrigar, L. R., MacCallum, R. C., Wegener, D. T., & Strahan, E. J. (1999). Evaluating the use of exploratory factor analysis in psychological research. *Psychological Methods*, *4*(3), 272–299. https://doi.org/10.1037/1082-989X.4.3.272

Ferguson, C. A. (1959). Diglossia. *WORD*, *15*(2), 325–340. https://doi.org/10.1080/00437956.1959.11659702

Field, A. (2024). *Discovering statistics using IBM SPSS Statistics*. Sage Publications Limited.

Ford, D. Y., Grantham, T. C., & Whiting, G. W. (2008). Culturally and linguistically diverse students in gifted education: Recruitment and retention issues. *Exceptional Children*, *74*(3), 289–306. https://doi.org/10.1177/001440290807400302

Fornell, C., & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, *18*(1), 39–50. https://doi.org/10.1177/002224378101800104

Gomes, M., Monteiro, V., Mata, L., Peixoto, F., Santos, N., & Sanches, C. (2019). The academic self-regulation questionnaire: A study with Portuguese elementary school children. *Psicologia: Reflexão e Crítica*, *32*(1), 8. https://doi.org/10.1186/s41155-019-0124-5

Gordeeva, T. O., Sychev, O. A., & Lynch, M. F. (2020). The construct validity of the Russian version of the modified academic self-regulation questionnaire (SRQ-A) among elementary and middle school children. *Psychology in Russia: State of the Art*, *13*(3), 16–34. https://doi.org/10.11621/PIR.2020.0308

Gottfried, A. E., Fleming, J. S., & Gottfried, A. W. (2001). Continuity of academic intrinsic motivation from childhood through late adolescence: A longitudinal study. *Journal of Educational Psychology*, *93*(1), 3–13. https://doi.org/10.1037/0022-0663.93.1.3

Gottfried, A. E., & Gottfried, A. W. (2004). Toward the development of a conceptualization of gifted motivation. *Gifted Child Quarterly*, *48*(2), 121–131. https://doi.org/10.1177/001698620404800205;JOURNAL:JOURNAL:GCQB;PAGE:STRING:ARTICLE/CHAPTER

Hair, J. F., Babin, B. J., Black, W. C., & Anderson, R. E. (2019). *Multivariate data analysis* (8th ed.). Cengage Learning.

Harzing, A. W., Sebastian Reiche, B., & Pudelko, M. (2013). Challenges in international survey research: A review with illustrations and suggested solutions for best practice. *European Journal of International Management*, *7*(1), 112–134. https://doi.org/10.1504/EJIM.2013.052090

Hennessey, B. A., & Amabile, T. M. (2010). Creativity. *Annual Review of Psychology*, *61*(2010), 569–598. https://doi.org/10.1146/ANNUREV.PSYCH.093008.100416/CITE/REFWORKS

Henseler, J., Ringle, C. M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science*, *43*(1), 115–135. https://doi.org/10.1007/s11747-014-0403-8

Howard, J. L., Bureau, J., Guay, F., Chong, J. X. Y., & Ryan, R. M. (2021). Student motivation and associated outcomes: A meta-analysis from self-determination theory. *Perspectives on Psychological Science*, *16*(6), 1300–1323. https://doi.org/10.1177/1745691620966789/SUPPL_FILE/SJ-XLSX-1-PPS-10.1177_1745691620966789.XLSX

Hu, L., & Bentler, P. M. (1998). Fit indices in covariance structure modeling: Sensitivity to underparameterized model misspecification. *Psychological Methods*, *3*(4), 424–453. https://doi.org/10.1037/1082-989X.3.4.424

Iyengar, S. S., & Lepper, M. R. (1999). Rethinking the value of choice: A cultural perspective on intrinsic motivation. *Journal of Personality and Social Psychology*, *76*(3), 349–366. https://doi.org/10.1037/0022-3514.76.3.349

Jang, H., Reeve, J., Ryan, R. M., & Kim, A. (2009). Can self-determination theory explain what underlies the productive, satisfying learning experiences of collectivistically oriented Korean students? *Journal of Educational Psychology*, *101*(3), 644–661. https://doi.org/10.1037/A0014241

JASP Team. (2024). *JASP (Version 0.96.0.0) [Computer software]*. https://jasp-stats.org/

Joseph, S. (1994). Brother/sister relationships: Connectivity, love, and power in the reproduction of patriarchy in Lebanon. *American Ethnologist*, *21*(1), 50–73. https://doi.org/10.1525/ae.1994.21.1.02a00030

Karnouk, C., Böge, K., Lindheimer, N., Churbaji, D., Abdelmagid, S., Mohamad, S., Hahn, E., & Bajbouj, M. (2021). Development of a culturally sensitive Arabic version of the Mini International Neuropsychiatric Interview (M.I.N.I.-AR) and validation of the depression module. *International Journal of Mental Health Systems*, *15*, 24. https://doi.org/10.1186/s13033-021-00447-1

Kirdar, S. (2017). *Education in the Arab world*. Bloomsbury. https://unesdoc.unesco.org/ark:/48223/pf0000266132

Kline, R. B. (2023). *Principles and practice of structural equation modelling* (5th ed.). Guilford Press.

Kröner, J., Goussios, C., Schaitz, C., Streb, J., & Sosic-Vasic, Z. (2017). The construct validity of the German academic Self-Regulation Questionnaire (SRQ-A) within primary and secondary school children. *Frontiers in Psychology*, *8*(1032), 1–13. https://doi.org/10.3389/fpsyg.2017.01032

Krosnick, J. A., & Presser, S. (2010). Question and questionnaire design. In P. V. Marsden & J. D. Wright (Eds.), *Handbook of survey research* (2nd ed., pp. 263–314). Emerald Group Publishing.

Kyriazos, T. A. (2018). Applied psychometrics: Sample size and sample power considerations in factor analysis (EFA, CFA) and SEM in general. *Psychology (Savannah, GA)*, *09*(08), 2207–2230. https://doi.org/10.4236/psych.2018.98126

Lepper, M. R., Corpus, J. H., & Iyengar, S. S. (2005). Intrinsic and extrinsic motivational orientations in the classroom: Age differences and academic correlates. *Journal of Educational Psychology*, *97*(2), 184–196. https://doi.org/10.1037/0022-0663.97.2.184

Lowry, P. B., & Gaskin, J. (2014). Partial least squares (PLS) structural equation modeling (SEM) for building and testing behavioral causal theory: When to choose it and how to use it. *IEEE Transactions on Professional Communication*, *57*(2), 123–146. https://doi.org/10.1109/TPC.2014.2312452

Lozano, L. M., García-Cueto, E., & Muñiz, J. (2008). Effect of the number of response categories on the reliability and validity of rating scales. *Methodology*, *4*(2), 73–79. https://doi.org/10.1027/1614-2241.4.2.73;PAGEGROUP:STRING:PUBLICATION

MacCallum, R. C., Widaman, K. F., Zhang, S., & Hong, S. (1999). Sample size in factor analysis. *Psychological Methods*, *4*(1), 84–99. https://doi.org/10.1037/1082-989X.4.1.84

Markus, H. R., & Kitayama, S. (1991). Culture and the self: Implications for cognition, emotion, and motivation. *Psychological Review*, *98*(2), 224–253. https://doi.org/10.1037/0033-295X.98.2.224

Marsh, H. W., Muthén, B., Asparouhov, T., Lüdtke, O., Robitzsch, A., Morin, A. J. S., & Trautwein, U. (2009). Exploratory structural equation modeling, integrating CFA and EFA: Application to students' evaluations of university teaching. *Structural Equation Modeling*, *16*(3), 439–476. https://doi.org/10.1080/10705510903008220;PAGE:STRING:ARTICLE/CHAPTER

Naglieri, J. A., & Ford, D. Y. (2003). Addressing underrepresentation of gifted minority children using the Naglieri nonverbal ability test (NNAT). *Gifted Child Quarterly*, *47*(2), 155–160. https://doi.org/10.1177/001698620304700206

Nunez, J. C., Gonzalez-Pienda, J. A., Gonzalez-Pumariega, S., Roces, C., Alvarez, L., Gonzalez, P., Cabanach, R. G., Valle, A., & Rodriguez, S. (2005). Subgroups of attributional profiles in students with learning difficulties and their relation to self-concept and academic goals. *Learning Disabilities Research and Practice*, *20*(2), 86–97. https://doi.org/10.1111/J.1540-5826.2005.00124.X

Nunnally, J. C., & Bernstein, I. H. (1994). *Psychometric theory* (3rd ed.). McGraw-Hill.

Østerås, N., Gulbrandsen, P., Garratt, A., Benth, JŠ, Dahl, F. A., Natvig, B., & Brage, S. (2008). A randomised comparison of a four- and a five-point scale version of the Norwegian function

assessment scale. *Health and Quality of Life Outcomes*, *6*(1), 1–9. https://doi.org/10.1186/1477-7525-6-14/TABLES/5

Preston, C. C., & Colman, A. M. (2000). Optimal number of response categories in rating scales: Reliability, validity, discriminating power, and respondent preferences. *Acta Psychologica*, *104*(1), 1–15. https://doi.org/10.1016/S0001-6918(99)00050-5

Putnick, D. L., & Bornstein, M. H. (2016). Measurement invariance conventions and reporting: The state of the art and future directions for psychological research. *Developmental Review*, *41*, 71–90. https://doi.org/10.1016/J.DR.2016.06.004

Revilla, M. A., Saris, W. E., & Krosnick, J. A. (2014). Choosing the number of categories in agree-disagree scales. *Sociological Methods and Research*, *43*(1), 73–97. https://doi.org/10.1177/0049124113509605/SUPPL_FILE/DS_10.1177004912411350960 5.PDF

Rousseeuw, P. J. (1987). Silhouettes: A graphical aid to the interpretation and validation of cluster analysis. *Journal of Computational and Applied Mathematics*, *20*, 53–65. https://doi.org/10.1016/0377-0427(87)90125-7

Ryan, R. M., & Connell, J. P. (1989). Perceived locus of causality and internalization: Examining reasons for acting in two domains. *Journal of Personality and Social Psychology*, *57*(5), 749–761. https://doi.org/10.1037/0022-3514.57.5.749

Ryan, R. M., & Deci, E. L. (2000a). Intrinsic and extrinsic motivations: Classic definitions and new directions. *Contemporary Educational Psychology*, *25*(1), 54–67. https://doi.org/10.1006/ceps.1999.1020

Ryan, R. M., & Deci, E. L. (2000b). 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

Ryan, R. M., & Deci, E. L. (Eds.). (2017). *Self-determination theory: Basic psychological needs in motivation, development, and wellness*. Guilford Press. https://doi.org/10.1521/978.14625/28806

Sarstedt, M., Ringle, C. M., & Hair, J. F. (2022). Partial least squares structural equations modeling. In *Handbook of market research* (Vol. 6, 2, pp. 587–632). Springer International Publishing. https://doi.org/10.1007/978-3-319-57413-4_15

Schreiber, J. B., Nora, A., Stage, F. K., Barlow, E. A., & King, J. (2006). Reporting structural equation modeling and confirmatory factor analysis results: A review. *The Journal of Educational Research*, *99*(6), 323–338. https://doi.org/10.3200/JOER.99.6.323-338

Schunk, D. H., & Zimmerman, B. J. (Eds.). (2012). *Motivation and self-regulated learning*. Routledge. https://doi.org/10.4324/9780203831076

Siegle, D., & McCoach, D. B. (2005). Making a difference: Motivating gifted students who are not achieving. *Teaching Exceptional Children*, *38*(1), 22–27. https://doi.org/10.1177/004005990503800104

Spurk, D., Hirschi, A., Wang, M., Valero, D., & Kauffeld, S. (2020). Latent profile analysis: A review and "how to" guide of its application within vocational behavior research. *Journal of Vocational Behavior*, *120*, 103445. https://doi.org/10.1016/j.jvb.2020.103445

Steinberg, L. (2005). Cognitive and affective development in adolescence. *Trends in Cognitive Sciences*, *9*(2), 69–74. https://doi.org/10.1016/j.tics.2004.12.005

Subotnik, R. F., Olszewski-Kubilius, P., & Worrell, F. C. (2011). Rethinking giftedness and gifted education. *Psychological Science in the Public Interest*, *12*(1), 3–54. https://doi.org/10.1177/1529100611418056

Tabachnick, B. G., & Fidell, L. S. (2019). *Using multivariate statistics* (7th ed.). Pearson.

Tse, W. W.-Y., Lai, M. H. C., & Zhang, Y. (2023). Does strict invariance matter? Valid group mean comparisons with ordered-categorical items. *Behavior Research Methods*, *56*(4), 3117–3139. https://doi.org/10.3758/s13428-023-02247-6

Ullman, J. B., & Bentler, P. M. (2003). Structural equation modeling. In *Handbook of psychology* (pp. 607–634). Wiley. https://doi.org/10.1002/0471264385.wei0224

Van de Vijver, F. J. R. (2016). Test adaptations. In *The ITC international handbook of testing and assessment* (pp. 364–376). Oxford University Press. https://doi.org/10.1093/med:psych/9780199356942.003.0025

Vansteenkiste, M., Sierens, E., Soenens, B., Luyckx, K., & Lens, W. (2009). Motivational profiles from a self-determination perspective: The quality of motivation matters. *Journal of Educational Psychology*, *101*(3), 671–688. https://doi.org/10.1037/a0015083

Vansteenkiste, M., Zhou, M., Lens, W., & Soenens, B. (2005). Experiences of autonomy and control among Chinese learners: Vitalizing or immobilizing? *Journal of Educational Psychology*, *97*(3), 468–483. https://doi.org/10.1037/0022-0663.97.3.468

Vergara-Morales, J., Rodríguez-Vera, M., & Del Valle, M. (2022). Evaluación de las propiedades psicométricas del cuestionario de autorregulación académica (SRQ-A) en estudiantes universitarios chilenos. *Ciencias Psicológicas*, *16*(2), e-2837. https://doi.org/10.22235/cp.v16i2.2837

Wentzel, K. R., & Miele, D. B. (Eds.). (2016). *Handbook of motivation at school*. Routledge. https://doi.org/10.4324/9781315773384

Westland, J. C. (2010). Lower bounds on sample size in structural equation modeling. *Electronic Commerce Research and Applications*, *9*(6), 476–487. https://doi.org/10.1016/j.elerap.2010.07.003

Wolf, E. J., Harrington, K. M., Clark, S. L., & Miller, M. W. (2013). Sample size requirements for structural equation models: An evaluation of power, bias, and solution propriety. *Educational and Psychological Measurement*, *73*(6), 913–934. https://doi.org/10.1177/0013164413495237/SUPPL_FILE/DS_10.1177_0013164413495237.PDF

Worthington, R. L., & Whittaker, T. A. (2006). Scale development research. *The Counseling Psychologist*, *34*(6), 806–838. https://doi.org/10.1177/0011000006288127

Yamauchi, H., & Tanaka, K. (1998). Relations of autonomy, self-referenced beliefs, and self-regulated learning among Japanese children. *Psychological Reports*, *82*(3), 803–816. https://doi.org/10.2466/pr0.1998.82.3.803

Yousef, A., & Ayyoub, A. (2024). Rubric development and validation for assessing educational robotics skills. *Frontiers in Education*, *9*, 1496242. https://doi.org/10.3389/FEDUC.2024.1496242

Yu, C., Li, X., Wang, S., & Zhang, W. (2016). Teacher autonomy support reduces adolescent anxiety and depression: An 18-month longitudinal study. *Journal of Adolescence*, *49*(1), 115–123. https://doi.org/10.1016/J.ADOLESCENCE.2016.03.001;REQUESTEDJOURNAL:JOURNAL:10959254;WGROUP:STRING:PUBLICATION

Zimmerman, B. J. (2008). Investigating self-regulation and motivation: Historical background, methodological developments, and future prospects. *American Educational Research Journal*, *45*(1), 166–183. https://doi.org/10.3102/0002831207312909

Author Biographies

Ahmad Yousef, PhD, is an educational measurement researcher based in Jerusalem. He received his doctorate in Teaching and Learning from An-Najah National University, Nablus, Palestine. His research interests include the development and validation of assessment instruments, rubric-based performance assessment in STEM and educational robotics, and the cross-cultural adaptation of psychological scales for Arabic-speaking populations. He is an ICT pedagogical instructor with the Ministry of Education and serves as a reviewer for several international journals.

Abedalkarim Ayyoub, PhD, is an associate professor in the Faculty of Educational Sciences at An-Najah National University, Nablus, Palestine. He holds a doctorate in measurement and evaluation, and his academic background spans physics and science education. His research interests include educational measurement and assessment, quantitative research methodology, self- and peer-assessment, and the integration of artificial intelligence and extended reality in learning environments.

Appendix

Appendix A: Translated and Culturally Adapted Arabic Version of the Academic Self-Regulation Questionnaire (SRQ-A)

A. Why do I do my homework? أ. لماذا أقوم بواجباتي المنزلية؟

Item	Original English Statement	Arabic Adaptation
1	Because I want the teacher to think I'm a good student.	حتى يرى المعلم أنني مجتهد.
2	Because I'll get in trouble if I don't.	لأنني سأعاقب إذا لم أقم بها.
3	Because it's fun.	لأنها ممتعة.
4	Because I will feel bad about myself if I don't do it.	لأنني سأشعر بالذنب إذا لم أقم بها.
5	Because I want to understand the subject.	حتى أفهم الدروس بشكل أفضل.
6	Because that's what I'm supposed to do.	لأن هذا ما يجب علي فعله.
7	Because I enjoy doing my homework.	لأنني أحب القيام بواجباتي المنزلية.
8	Because it's important to me to do my homework.	لأنه من المهم بالنسبة لي أن أقوم بواجباتي المنزلية.

B. Why do I work on my classwork? ب. لماذا أعمل على واجباتي الصفية؟

Item	Original English Statement	Arabic Adaptation
9	So that the teacher won't yell at me.	كي لا يغضب المعلم مني.
10	Because I want the teacher to think I'm a good student.	حتى يرى المعلم أنني مجتهد.
11	Because I want to learn new things.	لأنني أريد تعلم أشياء جديدة.
12	Because I'll be ashamed of myself if it didn't get done.	لأنني سأشعر بالذنب إذا لم أقم بها.
13	Because it's fun.	لأنها ممتعة.
14	Because that's the rule.	لأنها قوانين المدرسة هكذا.

(continued)

C. Why do I try to answer hard questions in class? ج. لماذا أحاول الإجابة على الأسئلة الصعبة في الصف؟

Item	Original English Statement	Arabic Adaptation
17	Because I want the other students to think I'm smart.	لأنني أريد أن يعتبرني زملائي ذكياً.
18	Because I feel ashamed of myself when I don't try.	لأنني سأشعر بالخجل عندما لا أحاول.
19	Because I enjoy answering hard questions.	لأنني أستمتع بالإجابة على الأسئلة الصعبة.
20	Because that's what I'm supposed to do.	لأن هذا ما يجب علي فعله.
21	To find out if I'm right or wrong.	لأعرف إذا كانت إجابتي صحيحة أم خاطئة.
22	Because it's fun to answer hard questions.	لأنه من الممتع الإجابة على الأسئلة الصعبة.

(continued)

D. Why do I try to do well in school? د. لماذا أحاول تحقيق نتائج جيدة في المدرسة؟

Item	Original English Statement	Arabic Adaptation
25	Because that's what I'm supposed to do.	لأن هذا ما يجب علي فعله.
26	So my teachers will think I'm a good student.	حتى يرى المعلم أنني مجتهد.
27	Because I enjoy doing my school work well.	لأنني أستمتع بإنجاز نتائج جيدة.
28	Because I will get in trouble if I don't do well.	لأنني سأعاقب إذا لم أحقق نتائج جيدة.
29	Because I'll feel really bad about myself if I don't do well.	لأنني سأشعر بالذنب إذا لم أحقق نتائج جيدة.
30		

(continued)

Appendix B: Exploratory Factor Analysis (EFA) Characteristics and Explained Variance for the Arabic SRQ-A

		Unrotated Solution			Rotated Solution		
Factor	Eigenvalues	*SumSq Loadings*	*Proportion var*	*Cumulative*	*SumSq Loadings*	*Proportion var*	*Cumulative*
1	11.05	10.75	.336	.336	6.49	.203	.203
2	5.86	5.58	.174	.510	6.15	.192	.395
3	3.85	3.55	.111	.621	5.09	.159	.554
4	2.79	2.46	.077	**.698**	4.61	.144	.698

Note: SumSq = sum of squared loadings; *var* = variance; SRQ-A = Academic Self-Regulation Questionnaire. Cumulative values for the rotated solution represent the total variance accounted for by the set of factors. Total explained variance is consistent at 69.8%.