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Bilingualism and Background Factors as Predictors of Perceived 21st-Century Skills in Higher Education

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Abstract

This study examines differences between monolingual and bilingual students' self-reported 21st-century skills in higher education, with attention to the contributions of demographic and academic factors. Drawing on data from a linguistically and socioeconomically diverse sample of higher education students, the study considers these skills as part of broader educational concerns related to students' preparation for academic, social, and labor market demands. Data were collected through an online questionnaire completed by 564 Israeli undergraduate students. The analysis focused on differences between monolingual and bilingual students and on the role of socioeconomic indicators, including family income and mother's education, as well as academic degree, year of study, and employment status. Results showed that bilingual students reported higher levels in selected subscales, including cognitive processes such as critical thinking and problem-solving, intellectual openness, and interpersonal skills such as teamwork. No significant differences were found for creativity. Hierarchical regression analyses showed that demographic, socioeconomic, academic, and employment variables were associated with perceived skill levels, with different patterns for monolingual and bilingual students. Overall, the findings point to domain-specific differences between bilingual and monolingual students and highlight the importance of contextual and demographic factors. They suggest that bilingual experience may be associated with specific cognitive, intrapersonal, and interpersonal skill domains, although these associations should be interpreted with caution, given the cross-sectional, self-report design. The findings also suggest the value of creating structured opportunities for multilingual engagement in educational settings as one possible way to support 21st-century skills among students from diverse linguistic and socioeconomic backgrounds.

Keywords: bilingualism; 21st-century skills; higher education; cognitive skills; demographic factors; academic factors

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1. Introduction

Higher education institutions are increasingly expected to prepare students for academic, social, and professional environments that require more than disciplinary knowledge. In this context, 21st-century skills, including critical thinking, problem-solving, communication, collaboration, and adaptability, have become central to discussions of students' preparation for contemporary life and work (Ball et al., 2016; Cevik & Senturk, 2019; Kelley et al., 2019; Martin, 2018; Murugiah, 2020). They include cognitive, intrapersonal, and interpersonal skills that enable individuals to navigate complex challenges, collaborate

effectively, and adapt to the dynamic demands of the workplace and society (National Research Council [NRC], 2012).

In this context, bilingualism has been examined as a language experience that may be associated with cognitive flexibility and attentional control (Bialystok, 2017). These associations have often been explained in relation to the ongoing management of two languages, which may engage executive functions such as inhibitory control and cognitive flexibility (Bialystok, 2017; Kroll & Bialystok, 2013). Recent studies suggest that bilingual experience may also be associated with interpersonal and intrapersonal domains, including cultural awareness and social adaptability (Bright & Filippi, 2019; Ikizer & Ramírez-Esparza, 2018). Within the three-domain framework outlined above, executive-control accounts of bilingual experience (Bialystok, 2017; Kroll & Bialystok, 2013; Miyake & Friedman, 2012) can be mapped onto the cognitive domain, whereas accounts emphasizing social flexibility and cultural frame switching among bilinguals and bicultural individuals (Ikizer & Ramírez-Esparza, 2018; Hong et al., 2000) can be mapped onto the interpersonal domain.

These cognitive and social attributes align with 21st-century skills, suggesting that bilingualism may be reflected in students' self-reported levels of selected skills. However, the relationship between bilingualism and 21st-century skills is shaped by a broader array of demographic and academic factors beyond socioeconomic status. Variables such as educational background (Han, 2012), parental education (van Steensel et al., 2012), employment (Okolie et al., 2020), and academic trajectory (Nichols et al., 2020) may play significant roles, either independently or in conjunction with bilingualism. These factors provide a more comprehensive framework for understanding students' perceived skill levels in relation to academic and labor-market demands and point to the importance of considering individual and contextual diversity in this area.

Evidence for bilingual advantage is inconsistent and context-dependent, with findings varying across studies and shaped by factors such as task type, participant demographics, and linguistic contexts (Antoniou, 2019; Nichols et al., 2020). This variability highlights the need to examine how demographic and academic variables are associated with bilingualism and 21st-century skills. Socioeconomic status and educational experiences are particularly important contextual factors that may shape differences between bilingual and monolingual students (Naeem et al., 2018; Van den Noort et al., 2019). Understanding these associations and their implications for broader competencies, such as 21st-century skills, remains an underexamined area of research.

In response to this gap, the present study examines how bilingualism and background factors are associated with students' perceived 21st-century skills in post-secondary education. By focusing on students' self-reported skill levels in relation to academic, social, and labor market demands, this research aims to contribute to understanding of the complex relationships between bilingualism, contextual factors, and these critical skills.

1.1. Twenty-First-Century Skills in Higher Education

Twenty-first-century skills refer to a broad set of skills that have been identified as essential for success in contemporary education, work, and society (Ball et al., 2016; Binkley et al., 2012; Greenhill, 2010; Kelley et al., 2019; Murugiah, 2020; National Research Council [NRC], 2012; Partnership for 21st Century Skills, 2009). These skills are often categorized into cognitive skills, including cognitive processes and thinking strategies, knowledge, information literacy, critical thinking, problem-solving, decision-making, and creativity. These skills enable individuals to analyze information effectively, develop solutions, and make informed decisions. They also include intrapersonal skills, such as intellectual openness and positive self-image, which support persistence, openness to challenge, and adaptive responses to change, as well as interpersonal skills, including

teamwork, leadership, and collaboration, which are central to working effectively with others in academic, professional, and social contexts (National Research Council [NRC], 2012).

Higher education institutions are expected to support the development of these skills as part of students' preparation for academic participation, professional life, and wider social engagement (Ahmad et al., 2020; Cevik & Senturk, 2019; Eisenberg & Selivansky Eden, 2019; Martin, 2018). This challenge is particularly pronounced among students with diverse learning and background characteristics, whose perceived skill levels may vary across academic, socioeconomic, and personal contexts (D'Intino, 2017; Wolf, 2001; for an extensive discussion, see Vaknin-Nusbaum & Rachevski, 2024). For this reason, examining perceived 21st-century skills in higher education requires attention to the linguistic, socioeconomic, academic, and employment-related backgrounds that students bring with them into higher education.

1.2. Bilingual Experience and 21st-Century Skills

Research on bilingualism has examined whether bilingual experience is associated with the executive control system, particularly in specific contexts and tasks. This line of work has focused on areas such as conflict resolution and inhibitory control, which involve suppressing automatic or irrelevant responses (Baum & Titone, 2014; Bialystok, 2017; Kroll & Bialystok, 2013; Valian, 2015). However, evidence regarding advantages associated with bilingualism in executive control remains inconsistent and context-dependent, with findings often varying according to the cognitive tasks studied and the demographic or linguistic characteristics of participants (Antoniou, 2019). These inconsistencies suggest that bilingualism should not be treated as producing a uniform cognitive advantage. Instead, it is more useful to examine whether bilingual experience is related to specific executive-control outcomes, such as inhibitory control, conflict resolution, cognitive flexibility, or working memory (Miyake & Friedman, 2012; Miyake et al., 2000). Neurological network studies provide further insight into these mechanisms, highlighting how language experience, at different stages of life, may be related to cognition in different ways (for discussion, see Hernandez et al., 2018).

While some research reports better performance among bilinguals in these areas (Ali, 2023; Antón et al., 2014; Bialystok & Barac, 2012; Christoffels et al., 2015; Cockcroft et al., 2019; Dong & Li, 2015; Kazemeini & Fadardi, 2016; Seçer, 2016; Yang et al., 2011), others, such as Nichols et al. (2020), find limited or no advantages, particularly when confounding factors like SES are controlled for. Antoniou's (2019) review emphasizes that reported cognitive benefits depend on a range of factors, including the type of tasks used, SES, age, and language use patterns, highlighting the variability in outcomes. Such variability is also relevant to the framework of 21st-century skills, which includes cognitive skills such as thinking strategies, problem-solving, and decision-making, domains that partly overlap with the executive-control outcomes examined in bilingualism research.

Beyond cognitive processes, bilingualism may also be related to socio-emotional domains (Christoffels et al., 2015; Cockcroft et al., 2019; Ikizer & Ramírez-Esparza, 2018; Seçer, 2016), though findings are also inconsistent in this area. For example, multilingual speakers may develop greater adaptability in social contexts due to their ability to communicate with diverse groups and understand different cultures (Bright & Filippi, 2019). Such social adaptability corresponds to interpersonal skills, a key component of 21st-century skills. However, these social benefits might be shaped by factors such as cultural frame-switching (Hong et al., 2000) and SES, further highlighting their variability (Antoniou, 2019). Recent work in higher education conceptualizes plurilingual experience as intertwined with social participation, identity positioning, and competence in navigating culturally diverse settings

(Tang & Calafato, 2024a, 2024b). University students' plurilingual and pluricultural competence has been found to be associated with more fluid movement between languages and greater engagement in language negotiation practices, alongside individual characteristics such as acceptance of cultural differences and identity-related views (Tang & Calafato, 2024b). Moreover, profiles characterized by stronger plurilingual and pluricultural competence and richer multilingual experience have been associated with more constructive behavioral tendencies in intercultural scenarios (Tang & Calafato, 2024a). Together, these findings support viewing bilingual or plurilingual experience as both a cognitive-linguistic and a social and identity-related experience that may align with particular 21st-century skill clusters. Within the present conceptual framework, this line of evidence maps onto interpersonal functioning and intrapersonal dispositions such as intellectual openness.

Ikizer and Ramírez-Esparza (2018) examined whether bilingualism is associated with social flexibility compared to monolingualism, extending the concept of cognitive flexibility to the social domain. Social flexibility was defined as the ability to adapt to different social environments and accurately interpret social cues. The study involved 465 monolinguals and 206 bilinguals, with findings indicating that bilinguals reported higher levels of social flexibility than monolinguals. This increased social flexibility among bilinguals was associated with a higher frequency of social interactions, as demonstrated through mediation analyses.

The concept of social flexibility among bilinguals can be further understood through the lens of cultural frame-switching, as described by Hong et al. (2000). This dynamic constructivist approach to culture and cognition explains how bicultural individuals shift between cultural interpretive frames in response to contextual cues. This perspective provides one possible explanation for why bilingual and bicultural experience may be related to interpersonal skills such as adaptability, communication across contexts, and collaboration.

Managing communication in two languages may also be related to learners' self-confidence and positive academic self-image, offering a plausible pathway to intrapersonal resources relevant to self-awareness and perceived skill levels (Bright & Filippi, 2019). At the level of emotion and language, a recent systematic review concluded that bilinguals often process emotional information in ways that differ from monolinguals. In some contexts, this is reflected in advantages such as greater empathy or more effective emotion regulation, while in others no clear differences are observed (Sharif & Mahmood, 2023). Behavioral findings on socio-emotional outcomes remain mixed, with recent work reporting limited or null associations between bilingualism and traits such as empathy and emotional intelligence (Ward & Ragosko, 2025). Accordingly, the present study focuses on students' self-reported intrapersonal and interpersonal skills to better understand whether differences between bilingual and monolingual students are evident in these perceived skill domains.

Although significant research has examined the bilingual advantage (Cockcroft et al., 2019), findings remain inconsistent, with variability across cognitive tasks, demographic groups, and linguistic contexts (Antoniou, 2019; Nichols et al., 2020). When differences are observed, they may appear in selected cognitive, social, or personal domains. Because these domains align with core components of 21st-century skills, such as flexibility, adaptability, collaboration, and communication, this study examines how bilingualism is associated with students' self-reported 21st-century skills in post-secondary education. This focus provides a basis for examining bilingualism together with background factors in relation to students' perceived academic, social, and professional competencies.

1.3. Bilingualism and Background Factors

Examining socioeconomic factors can provide a deeper understanding of how elements like SES and education are related to bilingualism and selected cognitive outcomes. In their

2012 study, Engel de Abreu and colleagues investigated how bilingualism is associated with executive functions in low-income young immigrant children. The study aimed to determine whether the cognitive benefits of bilingualism, often observed in wealthier populations, also apply to economically disadvantaged groups. By controlling parental education and household income, the researchers found that bilingual children performed better than their monolingual peers in attention and task-switching tasks. However, no significant differences were observed in tasks involving complex information processing. These findings suggest that bilingualism may be associated with specific abilities related to attention management, even in children from low SES backgrounds.

Naeem et al. (2018) examined SES as a modulator of cognitive performance in bilingual and monolingual adults aged 18 to 30. Participants were divided into low- and high-SES groups to investigate the bilingual advantage within each SES category. Assessments of inhibitory control, planning, and problem-solving showed that bilingual individuals exhibited faster response times in inhibitory control tasks, with this advantage being more pronounced in low SES participants. However, this benefit did not extend to tasks requiring higher-order cognitive processing, such as planning and problem-solving. These findings identify SES as an important moderator and point to the need for further research into how demographic variables relate to bilingual advantage.

The interplay between SES and bilingualism is further complicated by studies such as those by Engel de Abreu et al. (2012) and Morton and Harper (2007), which show that controlling for SES and ethnicity can significantly change results. In some cases, the bilingual advantage observed in cognitive control tasks diminishes or disappears when these factors are accounted for (Van den Noort et al., 2019). Nichols et al. (2020) provided further evidence of this variability in a large-scale study of 11,041 participants aged 18 to 87. Their results showed a bilingual advantage in only one out of five executive tasks assessed, with monolinguals performing better in four other tasks. However, these differences disappeared when participants were matched for SES, education, and geographic background, suggesting a minimal overall association of bilingualism with cognitive abilities.

These findings emphasize the importance of situating bilingualism within its demographic and educational context. They also highlight that research on underrepresented populations, such as students from low SES backgrounds or young adults in higher education, remains limited (Naeem et al., 2018). This limitation is particularly relevant to the present study, which examines bilingualism and background factors in relation to students' perceived 21st-century skills among students in higher education.

1.4. The Current Study

Prior research demonstrates that findings on bilingual advantage are inconsistent (Antoniou, 2019), with positive associations reported in cognitive domains (Bialystok, 2017) and social domains (Ikizer & Ramírez-Esparza, 2018), whereas other research has found no general cognitive advantage (e.g., Nichols et al., 2020). This variability reinforces the need to examine how bilingualism is related to background and academic factors in shaping broader competencies. One domain that has received little direct attention is the set of 21st-century skills, which include cognitive, intrapersonal, and interpersonal skills regarded as essential for success in contemporary education and the labor market (National Research Council [NRC], 2012).

Post-secondary education provides a particularly relevant context for such an investigation, as students at this stage are preparing to transition into professional life. Their preparation involves not only academic knowledge but also competencies such as adaptability, collaboration, and problem-solving (National Research Council [NRC], 2012; Vaknin-Nusbaum & Rachevski, 2024). Because these skills overlap with areas where bilin-

gual differences have sometimes been observed, examining them in this setting offers an opportunity to connect research on bilingualism with broader educational questions about students' perceived competencies.

Israel provides a particularly informative context for examining these associations because its linguistic and cultural diversity has been shaped largely by immigration and by the continued use of different home and heritage languages (Eliyahu-Levi & Ganz-Meishar, 2019). In higher education, students from diverse linguistic and cultural backgrounds study together in Hebrew, while some also use other languages at home, including Arabic, Russian, English, French, and Spanish. This setting provides both monolingual and bilingual students with opportunities to encounter additional linguistic and cultural communities, making it relevant for examining how language background is associated with students' self-reported 21st-century skills (Altman et al., 2025).

The present study examines differences between bilingual and monolingual students in self-reported 21st-century skills in post-secondary education. Specifically, it examines cognitive, intrapersonal, and interpersonal domains and investigates how demographic, socioeconomic, and academic factors, together with employment status, account for students' perceived skill levels. This focus can clarify how language background and contextual factors are associated with students' perceptions of their academic, social, and professional competencies.

Research Questions

1. What are the differences in self-reported 21st-century skills between monolingual and bilingual students in post-secondary education?
2. What factors predict perceived levels of the examined 21st-century skills among monolingual and bilingual students?
3. How do demographic, socioeconomic, and academic factors, together with employment status, account for variance in perceived 21st-century skills among monolingual and bilingual students?

2. Materials and Methods

2.1. Participants

The study included 564 Israeli undergraduate students, of whom 408 (72%) were monolingual and 156 (28%) were bilingual. Within the bilingual group, 49% reported a European language as their mother tongue, including Russian (37%), English (11%), or French (1%), while the remaining participants reported Arabic. Exploratory subgroup comparisons within the bilingual sample (Hebrew–Arabic, Hebrew–Russian, and Hebrew–English) did not yield statistically significant differences on the examined 21st-century skills measures; therefore, bilingual participants were retained as a single group for the primary analyses. The Hebrew–French subgroup was not examined separately due to its very small size.

Overall, 372 participants (66%) were women and 192 (34%) were men. Fifty-two participants (9%) reported having a learning disability. Of these, 42 were monolingual (10%) and the remaining 10 were bilingual (6.5%). A two-proportion test showed that this difference was not statistically significant. The participants were aged 18 years and older (M = 32.9, SD = 9.91) and were recruited on a voluntary basis. They were enrolled across 19 academic colleges and six universities, pursuing either a bachelor's degree or vocational studies.

Socioeconomic background varied among participants, with 40% reporting a family income below the national median, 23% around the median, and 37% above the median. Mothers' education also showed diversity, with 7% having completed elementary school,

37% high school, 18% professional education, 22% a bachelor's degree, and 16% a master's degree or higher.

By year of study, 35% of participants were first-year students, 24% were in their second year, and 41% were in their final year, either third or fourth year. Employment status also varied, with 24% unemployed, 35% partially employed, and 41% employed full-time. Geographically, most participants (67%, n = 377) resided in peripheral areas, while 33% (n = 187) lived in central regions of the country. In terms of religiosity, 59.4% (n = 335) identified as secular, 21.6% (n = 122) as traditional, and 15.8% (n = 89) as religious or ultra-Orthodox, while 18 participants (3.2%) did not report their level of religiosity.

2.2. Research Tools

The questionnaire was delivered to participants in Hebrew, the language of instruction in most higher education institutions in Israel. It included a set of demographic questions about sociodemographic characteristics (eight questions) and a set of questions examining 21st-century skills, as detailed below.

2.2.1. Demographic Questionnaire

In the demographic section, participants were asked to provide information regarding their gender, age, mother tongue, family income, mother's education, academic degree, academic year, and employment status. Family income was examined in comparison to the median family income in Israel, which, according to the Central Bureau of Statistics (2024), is about 15,000 NIS (New Israeli Shekel) per month. The answer options included three levels: above this income, around this income, and below this income. The answer options for mother's education included five levels: elementary school, high school, vocational, BA, and MA or higher. Maternal education was selected as a focal predictor because Israeli evidence shows a robust, age-widening association with early language milestones (Akiva et al., 2024) and identifies it as a strong predictor of youths' later educational success (Ayalon et al., 2019).

2.2.2. Twenty-First-Century Skills Questionnaire

To examine a wide range of skills presented in the literature review, the set of questions on 21st-century skills was constructed for this study from several questionnaires that were previously used and validated in various studies. This construction was informed by a factor analysis conducted in our previous research (Rachevski & Vaknin-Nusbaum, 2025), which categorized the questionnaire items into distinct sets corresponding to the 21st-century skills. Based on this structure, the questionnaire used in the present study comprised 32 items assessing seven subscales across three clusters. A detailed description of the questionnaire structure is presented in Table 1. Accordingly, the present study adopts this previously validated factor structure to examine group differences and predictors of self-reported 21st-century skills. The need to create such a questionnaire arises from the scarcity of research examining a range of 21st-century skills among a single group of participants who are preparing to enter the labor market.

2.3. Procedure

Data were collected over two years using an online questionnaire, which was distributed via a link sent to students who were invited to participate anonymously and voluntarily after approval was obtained from the ethics committee of our academic institution. The questionnaire had no time limit, and participants were introduced to the general purpose of the study, that is, to examine students' self-reported 21st-century skills in Israeli higher education. Participants were informed that their contributions would help illuminate the challenges academic institutions face in preparing students for the

needs of the 21st century. Students completed the questionnaire based on their perceptions and understanding, with an emphasis that there were no right or wrong answers. The completion of the questionnaire was estimated to take approximately 20 min. Participants had the option to withdraw from the questionnaire at any time.

Table 1. Description of the Revised 21st-Century Skills Questionnaire.

Cluster	Subscale	Items in Cluster	Items in Subscale	Cronbach's α	Example Item
Cognitive skills	Cognitive processes and thinking strategies	14	7	0.84	"I am confident in my ability to gather relevant and sufficient information from different sources."
	Knowledge (literacy and information technology)		4	0.81	"I am confident in my ability to present all information clearly, concisely, and logically."
	Creativity		3	0.73	"I am confident in my ability to elaborate and improve on ideas."
Intrapersonal skills	Intellectual openness	11	4	0.86	"I view challenging situations as an opportunity to grow and learn."
	Positive self-image		7	0.87	"On the whole, I am satisfied with myself."
Interpersonal skills	Teamwork and collaboration	7	4	0.71	"I offer assistance to others in their work when needed."
	Leadership		3	0.76	"I put all my energy into accomplishing my goals."

Note. Items were rated on scales ranging from 1 (strongly disagree) to either 5 or 7 (strongly agree), depending on the subscale.

2.4. Statistical Analysis

The statistical analysis aimed to address the research questions concerning the differences in 21st-century skills between monolingual and bilingual students, as well as the factors predicting perceived levels of these skills. Initially, we employed multivariate analysis of variance (MANOVA) to examine whether there were differences in self-reported 21st-century skills between monolingual and bilingual students across a combination of dependent variables simultaneously (for a detailed explanation of this method, see Field, 2024). This method helped determine whether the mean scores of cognitive, intrapersonal, and interpersonal skills differed significantly between the two groups, thereby addressing the first research question effectively.

To examine what factors contribute to the explained variance of these skills, hierarchical regression analyses were employed for both monolingual and bilingual groups. This approach allowed for an examination of how different layers of variables (demographic, socioeconomic, academic, and employment) contribute to perceived levels of each skill category. The hierarchical analyses examined the incremental variance explained by each category of predictors, thereby addressing the second and third research questions.

3. Results

3.1. Assessing Differences in 21st-Century Skills: Monolingual vs. Bilingual

Table 2 presents a comparison of self-reported 21st-century skills between monolingual and bilingual students in post-secondary education, using mean scores and standard deviations (SD). These skills are categorized into three clusters: Cognitive Skills, Intrapersonal Skills, and Interpersonal Skills. Each cluster is further broken down into specific skills.

Table 2. Means, Standard Deviations, and Group Comparisons for Self-Reported 21st-Century Skills by Language Group (N = 564).

	Monolingual Mean (*SD*) (*n* = 408)	**Bilingual Mean (*SD*) (*n* = 156)**	**DV: Mean Diff. (Score)**	***p* Value**	***F***
Cognitive processes	4.00 (0.67)	4.13 (0.62)	−0.13	0.037	4.365
Knowledge	4.11 (0.74)	4.20 (0.66)	−0.09	0.179	1.813
Creativity	4.17 (0.68)	4.17 (0.73)	0.00	0.956	0.030
Total cognitive skills	4.06 (0.54)	4.15 (0.52)	−0.09	0.070	3.285
Intellectual openness	3.94 (0.78)	4.12 (0.75)	−0.18	0.013	6.182
Positive self-image	3.75 (0.85)	3.71 (1.00)	0.04	0.661	0.193
Total intrapersonal skills	3.81 (0.66)	3.85 (0.76)	−0.04	0.501	0.453
Teamwork and collaboration	4.35 (0.56)	4.48 (0.54)	−0.13	0.013	6.199
Leadership	4.50 (0.55)	4.46 (0.67)	0.04	0.463	0.540
Total interpersonal skills	4.40 (0.47)	4.47 (0.51)	−0.06	0.163	2.015

To determine whether the differences in 21st-century skills observed between monolingual and bilingual students were statistically significant, we conducted Hotelling's Trace test for multivariate multiple comparisons using the Multivariate General Linear Model. The analysis revealed a significant difference (F = 3.351, $p \leq 0.001$). The results of this analysis are presented in Table 2.

Significant differences were observed in several skills, favoring bilingual students. These include cognitive processes and thinking strategies in the Cognitive Skills cluster, intellectual openness in the Intrapersonal Skills cluster, and teamwork and collaboration in the Interpersonal Skills cluster. These findings suggest that bilingual students may perceive themselves as having stronger abilities in these specific areas.

Conversely, no significant differences were found in knowledge, creativity, and the overall cognitive skills within the Cognitive Skills cluster. Similarly, in the Intrapersonal Skills cluster, positive self-image and the total intrapersonal skills did not show significant differences. In the Interpersonal Skills cluster, both leadership and the overall interpersonal skills scores were comparable between monolingual and bilingual students, indicating no significant group differences.

3.2. Predictors of 21st-Century Skill Readiness in Monolingual and Bilingual Students

To test the relationships among the research variables, Pearson's correlation coefficients were calculated for all groups of variables. The results, presented in Table 3, indicate weak correlations between the variables.

To examine the predictors contributing to the examined 21st-century skills in monolingual and bilingual students, a hierarchical regression analysis was conducted. This analysis identified factors that contribute to predicting the examined 21st-century skills in monolingual and bilingual students. Table 4 presents the results of hierarchical regression

analyses for 21st-century skills within the learner type: Monolingual and Bilingual. The first column outlines the hierarchical regression steps. The subsequent columns display the change in R-squared (ΔR^2), the beta coefficients (β), and the total R-squared (R^2) for each skill, categorized by learner type.

The first step in the regression indicates that demographic variables, age and gender, were entered. In the second step, socioeconomic variables, income and mother's education, were entered. In the third step, academic variables, such as academic degree and study year, were entered. In the fourth step, employment status was entered. Table 4 presents the findings of the change in R-squared (ΔR^2), the beta coefficients (β), and the total R-squared (R^2) for each skill, categorized by learner type.

The table is organized into three main clusters: cognitive, intrapersonal, and interpersonal skills, each addressing different sets of skills. The predictive model results provide insights into the relationships between demographic, socioeconomic, academic variables, employment, and 21st-century skills for each group of learners, offering a deeper understanding of the dynamics among students in bilingual contexts. The hierarchical regression analyses clarify how these variables predict each of the 21st-century skills.

3.3. Cognitive Skills

3.3.1. Cognitive Processes

Demographic factors were significant in explaining the variance in cognitive processes, accounting for 4.3% in monolingual and 6.9% in bilingual students. The inclusion of socioeconomic block, family income and mother's education added another 1.2% to the explained variance for monolingual students and 0.6% for bilingual students. Additionally, the inclusion of academic background (degree and academic year) contributed an additional 1.0% to the explained variance for both groups. Employment status had a more significant contribution to the explained variance, 2.8% for monolinguals and 0.8% for bilingual students, leading to a total variance explained of 9.3% for both groups.

3.3.2. Knowledge

Similar to cognitive processes and thinking strategies, demographic factors were the main contributors, accounting for 2.3% in monolinguals with no significant contribution found in bilingual students. Adding the socioeconomic factors explained an additional 2.7% of the variance among monolingual students and 5.0% among bilingual students. Further, the inclusion of academic background (degree and academic year) added 1.3% for monolinguals and 1.2% for bilinguals. Employment status further contributed to the explained variance, 1.5% for monolingual students and 0.6% for bilingual students, leading to a total variance explained of 7.7% for monolingual students and 10% for bilingual students.

Table 3. Correlation matrix between all study's variables.

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Gender	—												
2. Age	−0.009	—											
3. Income	−0.071	0.198 **	—										
4. Mother Education	0.011	−0.172 **	0.029	—									
5. Academic Degree	−0.295 **	−0.008	0.032	0.010	—								
6. Academic year	−0.063	0.229 **	−0.012	−0.058	0.076	—							
7. Employment Status	−0.096 *	0.329 **	0.096 *	−0.141 **	0.119 **	0.204 **	—						
8. Cognitive processes and thinking strategies	−0.065	0.168 **	0.084 *	−0.008	0.012	0.075	0.195 **	—					
9. Knowledge	0.081	0.103 *	0.152 **	−0.050	0.035	0.085 *	0.169 **	0.389 **	—				
10. Creativity	−0.016	0.154 **	0.153 **	−0.106 *	−0.009	−0.014	0.158 **	0.401 **	0.404 **	—			
11. Intellectual openness	−0.059	0.176 **	0.064	−0.167 **	−0.069	0.060	0.148 **	0.387 **	0.322 **	0.410 **	—		
12. Positive self-image	−0.017	0.150 **	0.153 **	−0.195 **	0.015	0.071	0.249 **	0.210 **	0.388 **	0.256 **	0.230 **	—	
13. Teamwork and collaboration	0.066	0.085 *	−0.009	−0.093 *	−0.011	0.019	0.113 **	0.279 **	0.229 **	0.329 **	0.242 **	0.177 **	—
14. Leadership	0.014	0.054	0.033	−0.100 *	−0.022	0.065	0.094 *	0.257 **	0.361 **	0.316 **	0.309 **	0.310 **	0.374 **

** $p < 0.01$, * $p < 0.05$.

Table 4. Hierarchical Regression Analysis of Explained Variance 21st-Century Skills in Each Group.

Cluster (i) Cognitive skills																
Predictor	**Cognitive Processes and Thinking Strategies**				**Knowledge**				**Creativity**				**Total Cognitive Skills**			
	Monolingual		**Bilingual**		**Monolingual**		**Bilingual**		**Monolingual**		**Bilingual**		**Monolingual**		**Bilingual**	
	ΔR^2	**β**	**ΔR^2**	**β**	**ΔR^2**	**β**	**ΔR^2**	**β**	**ΔR^2**	**β**	**ΔR^2**	**β**	**ΔR^2**	**β**	**ΔR^2**	**β**
Step 1	0.043 ***		0.069 **		0.023 **		0.031		0.029 **		0.030		0.043 **		0.072 **	
Gender		−0.048		−0.141		0.200 **		−0.047		0.038		−0.137		0.041		−0.113
Age		0.269 ***		0.303 *		0.140		0.231 *		0.234 **		0.224		0.226 ***		0.262 **
Step 2	0.012 ***		0.006 *		0.027 **		0.050 *		0.045 **		0.028		0.046 **		0.023 **	
Income		0.149 **		0.078		0.227 **		0.321 **		0.281 ***		0.196		0.199 ***		0.174
Mother Education		0.043		0.068		0.124		0.098		0.131		0.195		0.084		0.032
Step 3	0.010 ***		0.010 **		0.013 **		0.012 *		0.000 **		0.016		0.008 **		0.020 **	
Academic Degree		0.109 *		0.088		0.072		0.111		0.014		0.108		0.077		0.104
Academic year		0.012		−0.070		0.152 **		−0.069		0.001		−0.155		0.048		−0.088
Step 4	0.028 ***		0.008 *		0.015 **		0.006 *		0.003 **		0.006		0.023 **		0.011 **	
Employment Status		0.258 ***		0.125		0.208 **		0.120		0.090		0.131	0.194 **	0.207 ***	0.194 **	0.122
Total R^2	0.093 ***		0.093 *		0.077 **		0.100 **		0.078 **		0.081		0.120 **		0.126 **	

Table 4. *Cont.*

Cluster (ii) Intrapersonal skills												
Predictor	**Intellectual Openness**				**Positive Self-Image**				**Total Intrapersonal Skills**			
	Monolingual		**Bilingual**		**Monolingual**		**Bilingual**		**Monolingual**		**Bilingual**	
	ΔR^2	**β**	**ΔR^2**	**β**	**ΔR^2**	**β**	**ΔR^2**	**β**	**ΔR^2**	**β**	**ΔR^2**	**β**
Step 1	0.035 **		0.028		0.042 **		0.025		0.061 ***		0.038	
Gender		−0.028		−0.201		0.076		−0.239		0.040		−0.226
Age		0.288 ***		0.170		0.347 ***		0.232		0.330 ***		0.211
Step 2	0.015 **		0.068 **		0.014 **		0.103 ***		0.022 ***		0.130 ***	
Income		0.035		0.284 *		0.037		0.603 **		0.034		0.491 ***
Mother Education		0.203 *		0.330 **		0.208 *		0.399 *		0.205 **		0.371 **
Step 3	0.004 **		0.003 *		0.017 **		0.030 ***		0.009 ***		0.026 ***	
Academic Degree		0.023		0.060		0.114		0.205		0.081		0.154
Academic year		−0.095		−0.034		0.186 *		−0.278		0.086		−0.184
Step 4	0.020 **		0.017 *		0.019 **		0.086 ***		0.030 ***		0.039 ***	
Employment Status		0.255 **		−0.222		0.271 **		0.663 ***	0.194 **	0.267 ***	0.194 **	0.337 **
Total R^2	0.075 **		0.116 **		0.091 **		0.244 ***		0.122 ***		0.233 ***	
Cluster (iii) Interpersonal skills												
Predictor	**Teamwork and Collaboration**				**Leadership**				**Total Interpersonal Skills**			
	Monolingual		**Bilingual**		**Monolingual**		**Bilingual**		**Monolingual**		**Bilingual**	
	ΔR^2	**β**	**ΔR^2**	**β**	**ΔR^2**	**β**	**ΔR^2**	**β**	**ΔR^2**	**β**	**ΔR^2**	**β**
Step 1	0.021 *		0.007		0.004		0.007		0.018 *		0.009	
Gender		0.136 *		−0.039		0.056		0.076		0.106 *		−0.054
Age		0.109 *		0.087		0.055		0.094		0.082		0.089
Step 2	0.003 *		0.047		0.007		0.024		0.006 *		0.030	
Income		0.044		−0.213		0.013		0.082		0.031		−0.093
Mother Education		0.054		0.142		0.095		0.209		0.069		0.167
Step 3	0.000		0.015		0.007		0.005		0.002		0.012	
Academic Degree		−0.002		0.029		−0.013		0.036		−0.006		0.033
Academic year		0.017		−0.141		0.095		−0.097		0.047		−0.118
Step 4	0.005		0.005		0.009		0.003		0.009 *		0.006	
Employment Status		0.090		0.085		0.122		0.082		0.103		0.092
Total R^2	0.029		0.075		0.027		0.039		0.035 *		0.057	

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

3.3.3. Creativity

The explained variance was observed only in the monolingual group. Demographic factors alone explained 2.9% of the variance. Incorporating SES factors, academic background, and employment status increased the total explained variance to 7.8%.

3.3.4. Total Cognitive Skills

Demographic factors were significant in explaining the variance in total cognitive skills, accounting for 4.3% in monolingual and 7.2% in bilingual students. The inclusion of SES, such as mother's education and income, added another 4.6% to the explained variance for monolinguals and 2.3% for bilingual students. Additionally, the inclusion of academic background (degree and academic year) contributed an additional 0.8% to the explained variance for monolinguals and 2.0% for bilingual students. Employment status had a significant contribution to the explained variance, 2.3% for monolinguals and 1.1% for bilingual students, leading to a total variance explained of 12.0% for monolinguals and 12.6% for bilinguals.

3.4. Intrapersonal Skills

3.4.1. Intellectual Openness

Demographic factors accounted for about 3.5% of the variance, only in monolinguals. The addition of SES factors and other predictors increased the final explained variance to 7.5% for monolinguals and 11.6% for bilinguals.

3.4.2. Positive Self-Image

Demographic factors accounted for 4.2% of the variance, but only among monolinguals. The complete model, including all predictors, raised the explained variance to 9.1% for monolinguals and 24.4% for bilinguals.

3.4.3. Total Intrapersonal Skills

Demographic factors accounted for 6.1% of the variance, only in monolinguals. The complete model, including all predictors, raised the explained variance to 12.2% for monolinguals and 23.3% for bilinguals.

3.5. Interpersonal Skills

3.5.1. Teamwork and Collaboration

Explained variance was observed only in the monolingual group. Demographics acted as the primary explanatory factor, accounting for 2.1% of the variance in monolinguals. The inclusion of SES factors contributed to the final explained variance by an additional 0.3%.

3.5.2. Leadership

No significant variance was explained for either monolinguals or bilinguals.

3.5.3. Total Interpersonal Skills

The explained variance was observed only in the monolingual group. Demographic factors accounted for 1.8% of the variance in monolinguals. The addition of SES factors and employment status factors led to a total variance explained of 3.5%.

Overall, the pattern emerging from Table 4 reflects the differential contribution of contextual factors across skill domains. Variables such as age, employment status, and socioeconomic indicators (family income and mother's education) demonstrated stronger and more consistent predictive relationships with cognitive skills (e.g., cognitive processes, knowledge) and intrapersonal skills (particularly intellectual openness and positive self-

image) than with interpersonal skills (e.g., teamwork, leadership). This pattern was evident in both monolingual and bilingual groups.

4. Discussion

This study examined self-reported 21st-century skills among monolingual and bilingual students in Israeli higher education. It aimed to examine differences between the two groups across cognitive, intrapersonal, and interpersonal domains and to identify demographic, socioeconomic, academic, and employment factors associated with perceived skill levels. Based on data from 564 undergraduate students, this research focused on cognitive, intrapersonal, and interpersonal skills, which are central to students' academic, social, and professional preparation.

Our findings showed a domain-specific pattern in 21st-century skills between monolingual and bilingual students, with bilinguals reporting higher levels in cognitive processes and thinking strategies, intellectual openness, and teamwork and collaboration. The significant mean differences ranged from 0.13 to 0.18 points. However, no significant differences were observed in creativity, positive self-image, leadership, or the total cognitive, intrapersonal, and interpersonal scores. This suggests that while bilingualism may be associated with higher self-reported levels in specific domains, it is not uniformly reflected in all 21st-century skills. Additionally, the regression analyses showed that demographic, socioeconomic, academic, and employment factors accounted for variance in perceived skill levels in different ways across the monolingual and bilingual groups. Factors such as age, gender, family income, mother's education level, academic degree, year of study, and employment status were included in these models, allowing the study to examine how background factors contributed to perceived 21st-century skills in each group.

The domain-specific differences in self-reported 21st-century skills between monolingual and bilingual students found in this study are consistent with research suggesting that bilingual experience may be associated with selected cognitive outcomes, including cognitive flexibility (Bialystok, 2017; Kroll & Bialystok, 2013), and social outcomes, including social adaptability (Bright & Filippi, 2019; Ikizer & Ramírez-Esparza, 2018). The contribution of this study lies in its broader examination of how these cognitive and social associations may relate to several domains of 21st-century skills, an area that has not been extensively explored in previous research. The higher self-reported levels found among bilingual students in selected areas suggest that bilingual experience may be reflected in students' perceptions of their 21st-century skills, especially those related to cognitive flexibility, intellectual openness, and social adaptability. These findings add to previous work by linking bilingual experience to students' self-reported skills in an educational context shaped by academic, social, and professional demands. These cognitive and social findings might also be viewed through the lens of cultural frame-switching, where bilingual individuals' ability to navigate multiple cultural contexts may be related to perceived competence in interpersonal and real-world challenges (Hong et al., 2000).

In addition to cognitive and social domains, a growing body of research suggests that bilingualism may also relate to emotional processes. Evidence points to potential advantages in areas such as empathy and emotion regulation, although findings remain mixed and context-dependent (Sharif & Mahmood, 2023; Ward & Ragosko, 2025). In our study, the higher self-reported levels of intellectual openness and teamwork among bilingual students could partly reflect these emotional dimensions, even though our measures were not designed to assess them directly. This possibility broadens the discussion of bilingualism and perceived 21st-century skills beyond cognitive outcomes alone.

The absence of significant differences in creativity and leadership skills is also important, because it shows that the observed differences were limited to selected skill domains

(Miyake & Friedman, 2012; Miyake et al., 2000). This null finding suggests that creativity should be examined separately, with attention to the distinction between students' self-perceptions, performance-based indicators of creative thinking, and their participation in bilingual educational experiences. Considering that the participants are studying within an educational environment aimed at cultivating 21st-century skills, it is possible that this setting plays a significant role in shaping these self-perceptions. Overall, the findings support a cautious, domain-specific interpretation of the differences observed between bilingual and monolingual students.

The regression findings further show that perceived 21st-century skills should be considered in relation to students' background characteristics, not only in relation to bilingualism. Age emerged as a relevant predictor of 21st-century skills among both monolingual and bilingual students. This relationship suggests that as students mature, they may accumulate academic, work, and life experiences that are reflected in cognitive, intrapersonal, and interpersonal skills. However, while SES factors, including income and mother's education, were significant predictors of 21st-century skills among monolingual students, the contribution of the socioeconomic block entered in the second step (income and mother's education) differed across outcomes in the bilingual models. Specifically, in the second step, the socioeconomic block accounted for a smaller share of explained variance in the bilingual models for cognitive processes and total cognitive skills, whereas it accounted for a larger share of explained variance in the bilingual models for knowledge and for intrapersonal skills (intellectual openness, positive self-image, and total intrapersonal skills). This pattern suggests that socioeconomic background remains relevant, but its role is not uniform across skill domains or language groups.

From a cognitive perspective, managing two linguistic systems has been linked to sustained engagement of executive processes such as attentional control and cognitive flexibility (Bialystok, 2017; Kroll & Bialystok, 2013), which may be related to certain cognitive and intrapersonal skills across varying socioeconomic conditions. From a sociocultural perspective, bilingualism often involves navigating multiple communicative and cultural frameworks, which may foster adaptive strategies and social flexibility that are not fully captured by conventional SES indicators (Ikizer & Ramírez-Esparza, 2018; Hong et al., 2000). In addition, bilingualism in the present sample may be correlated with contextual resources that were not measured in this study, such as family-based or community-based support networks and educational navigation strategies, which could buffer socioeconomic constraints. These possibilities are consistent with previous findings suggesting that bilingualism may be associated with selected cognitive advantages even under socioeconomic disadvantage (Engel de Abreu et al., 2012; Naeem et al., 2018). In the present study, however, the findings are best understood as indicating that bilingualism and socioeconomic background are connected to perceived 21st-century skills in domain-specific ways.

This interpretation should also be situated within the broader literature showing that bilingual advantage is inconsistent and context-dependent (Antoniou, 2019). This variability may stem from contextual factors, including differences in educational systems, cultural attitudes toward bilingualism, and the quality of bilingual education. This study contributes to this ongoing discussion by situating these findings within the broader framework of 21st-century skills and highlighting the demographic and academic factors that may shape these outcomes.

Students' employment provides another opportunity to examine how background and life-context variables are related to perceived 21st-century skills. Employment, often seen as a practical context for the use and application of both cognitive and interpersonal skills, appeared to have different predictive patterns for 21st-century skills within our participant groups. For monolinguals, employment status significantly contributed to the

variance in cognitive processes and thinking strategies, knowledge, and total cognitive skills, as well as positive self-image and total intrapersonal skills. This aligns with findings from previous studies, which suggest that practical work experience can support professional skills critical for career success (Okolie et al., 2020). Conversely, the contribution of employment status among bilingual students was less evident, with a significant contribution noted in the domain of positive self-image within the intrapersonal skills cluster. It is possible that, while employment during studies can be a meaningful context for skill development among monolingual students, bilingual students might draw on linguistic, social, or cultural experiences that are not fully captured by employment status alone. However, this interpretation should be approached with caution, as the type of work and work environment, factors not examined in this study, are likely influential in skills development. If students are engaged in roles that make use of their linguistic and cultural skills, they may experience a different set of challenges and opportunities for skill development compared to their peers.

These findings should also be situated within the specific context of Israeli higher education, which provides access to students from diverse socioeconomic, linguistic, and cultural backgrounds, partly because tuition is subsidized and students finance only part of the cost. Israel constitutes a particularly informative context for examining bilingualism and self-reported 21st-century skills because higher education operates within a multilingual social reality, and many students maintain additional home languages alongside Hebrew. This context creates a naturalistic setting in which bilingual experience is intertwined with diverse sociolinguistic trajectories and with everyday academic and social interactions across linguistic and cultural backgrounds, including trajectories shaped by immigration and by minority language communities alongside Hebrew-dominant academic environments. In such settings, bilingual experience may co-occur with ongoing intercultural contact that can support openness and adaptive communication. Bilingual trajectories may also co-occur with forms of social support that are not captured by income and mother's education alone, such as family-based or community-based networks that facilitate educational navigation and persistence. Such contextual resources are not measured in the present study, but they offer one plausible explanation for why socioeconomic indicators account for a smaller share of variance in some bilingual models. Another relevant contextual feature is that many students begin their academic studies after completing national service, which may delay entry into higher education and provide additional life experiences. These experiences, together with work during studies, may be reflected in intrapersonal skills such as self-regulation and resilience, as well as interpersonal skills such as teamwork and leadership. This may help explain why age and employment status were associated with selected perceived skills in the present study. At the same time, these contextual explanations should be interpreted with care, because the study did not directly assess students' national service, type of employment, or specific forms of linguistic and community support.

While the present findings provide important information about perceived 21st-century skills among monolingual and bilingual students, several limitations should be noted. First, the study did not assess neurodevelopmental conditions such as attention-deficit disorder or autism spectrum disorder, which may interact with bilingualism in ways not captured here. Second, the study used a dichotomous categorization of participants as either monolingual or bilingual rather than treating bilingualism as a spectrum. Although exploratory subgroup comparisons by mother tongue were not statistically significant in the present sample, future research with larger subgroup samples should examine these populations separately to better capture heterogeneity within bilingual experience. Third, the reliance on self-reported data introduces the potential for subjective bias, as students'

perceptions of their skills might not fully reflect their actual abilities. In addition, the cross-sectional design does not allow conclusions about change over time in students' perceived skills. Moreover, although the items asked students to rate their perceived abilities, the introductory reference to challenges in higher education may have led some participants to think about such challenges while responding. Future studies could examine whether different introductory framings influence students' self-reported 21st-century skills. Finally, the study recognizes the ongoing debate regarding the existence and extent of the bilingual advantage and acknowledges that such advantages may vary depending on factors such as language proficiency and educational context. For example, distinguishing between sequential and simultaneous bilinguals may be relevant for further understanding the relationship between bilingualism and 21st-century skills.

Conclusions

Taken together, the findings highlight the importance of considering bilingualism together with demographic, socioeconomic, academic, and employment-related factors when examining perceived 21st-century skills in higher education. The results do not indicate a broad bilingual advantage across all domains. Instead, they point to a domain-specific pattern, with bilingual students reporting higher levels in cognitive processes and thinking strategies, intellectual openness, and teamwork and collaboration. These findings suggest that selected cognitive, intrapersonal, and interpersonal skills should be considered when examining bilingualism in higher education. By examining these domains jointly, the present study extends previous work focused on selected cognitive or social outcomes and situates bilingual experience within the broader framework of 21st-century skills in higher education.

From an educational perspective, the findings suggest the value of creating structured opportunities for multilingual engagement in academic settings. Such opportunities may include learning tasks, peer interaction, and collaborative activities that allow students to draw on linguistic and cultural diversity while practicing communication, collaboration, and reflective learning. In the Israeli context, where students from multiple linguistic and cultural backgrounds often study within the same institutions, higher education may be particularly well positioned to build on existing multilingual resources. More broadly, similar opportunities may exist in other diverse higher-education systems, where attention to students' linguistic and socioeconomic backgrounds can support institutional efforts to cultivate 21st-century skills.

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Institutional Review Board Statement: This study was approved by the Ethics Committee of Western Galilee College on 23 January 2025 (Confirmation number: 1233). All procedures involving human participants were conducted in accordance with the Declaration of Helsinki, the principles of the Belmont Report, and relevant institutional and national guidelines and regulations.

Informed Consent Statement: Informed consent was obtained from all participants prior to their participation in the study. The research questionnaire was distributed on a voluntary basis. All participants provided their consent to participate voluntarily. The opening of the questionnaire included the following statement: "Completion of the questionnaire indicates your consent to participate in the study. You may withdraw from the questionnaire at any time and discontinue your

participation without any negative consequences and without providing an explanation. Thank you for your cooperation."

Data Availability Statement: Due to privacy and ethical concerns, neither the data nor the source of the data can be made available.

Conflicts of Interest: The authors declare that they have no competing interests.

Abbreviations

The following abbreviations are used in this manuscript:

BA	Bachelor's Degree
MA	Master's Degree
MANOVA	Multivariate Analysis of Variance
NIS	New Israeli Shekel
NRC	National Research Council
SD	Standard Deviation
SES	Socioeconomic Status

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