

Article

21st-Century Skills in Israeli Post-Secondary Education: Predictors Among Students with and Without Learning Disabilities

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Abstract

This study examined self-reported 21st-century skill differences between students with learning disabilities (LD) and their typical peers and tested how personal, socioeconomic, and employment factors predict these skills in both groups. Differences in 21st-century skills between first-year and upper-year students within each group were also examined. Participants were 739 students who completed a demographic questionnaire and a three-part 21st-century skills measure covering cognitive, intrapersonal, and interpersonal domains. The findings showed significant skill gaps, with typical students scoring higher in most domains. Higher mother's education and income were correlated with better skills in both groups; however, these correlations were stronger among typical students, suggesting that SES advantages may not fully compensate for the specific challenges associated with LD. Whereas typical students reported higher 21st-century skill levels in upper years than in the first year, students with LD did not show comparable differences, suggesting that higher education environments may not provide adequate support for developing these skills among students with LD. Overall, the results highlight persistent barriers for students with LD and underscore the need for tailored institutional interventions to promote 21st-century skills, thereby supporting social integration and employment.

Keywords: 21st-century skills; higher education institutions; students; learning disabilities; social mobility



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1. Introduction

21st-century skills are defined in the National Research Council (NRC) framework and subsequent syntheses as a set of core competencies that individuals require to navigate rapid and ongoing change (NRC, 2012; Ball et al., 2016; Kelley et al., 2019). The NRC identifies three clusters of these skills: cognitive, intrapersonal, and interpersonal. All three are essential for coping with the rapid and unpredictable changes and inherent uncertainties of daily life. Each cluster includes a broad range of skills. The cognitive cluster encompasses cognitive processes and strategies, information literacy, critical thinking, problem-solving, decision-making, and cognitive management. The intrapersonal cluster includes intellectual openness, professional integrity, diligence, and a positive self-image, whereas the interpersonal cluster comprises skills such as teamwork, leadership, and collaboration (NRC, 2012). These clusters are developmental and shaped by personal characteristics, socioeconomic background, and educational experiences (Cepeda et al., 2021; Fleming et al., 2018; Grigorenko et al., 2020; Klassen et al., 2013; Showers & Kinsman, 2017).

Students with learning disabilities are at elevated risk for slower development of these skills. According to the American Psychiatric Association, a specific learning disorder refers to persistent difficulties in reading, writing, or mathematics that vary in severity and often endure across the lifespan (American Psychiatric Association, 2013; D’Intino, 2017; L. E. Wolf, 2001). Consequently, students with LD face distinct challenges in meeting academic expectations (D’Intino, 2017; Graham et al., 2017; Grigorenko et al., 2020; Zeng et al., 2018) and show higher dropout rates in post-secondary education (Cortiella & Horowitz, 2014; Kim & Aquino, 2017; Polk, 2021). Adjusting to the demands of post-secondary education requires adaptation to new learning structures, increased independence, and higher academic standards, which often intensify their difficulties (Patterson, 2022; Showers & Kinsman, 2017). This stage has been identified as a critical juncture for identifying students with LD who may be at risk of academic failure (Gresham & Karatekin, 2023). Without appropriate support, they are disadvantaged in developing the 21st-century skills that are essential for future employment (Johnson et al., 2007; Kim & Aquino, 2017).

A poor socioeconomic background adds academic challenges for students with LD, as parental education and income are consistently linked to success in post-secondary education (Showers & Kinsman, 2017). Limited financial and social resources can restrict access to support in higher education and increase the risk of academic difficulties (Dong et al., 2023). Research on general student populations has shown that family economic status is a significant predictor of students’ ability to adapt academically and socially to higher education (Dong et al., 2023). Given that post-secondary education plays a critical role in fostering social and economic mobility (Goegan & Daniels, 2021; Pingry O’Neill et al., 2012) and in developing 21st-century skills (Graesser et al., 2022; Stephan & Dieker, 2022), it is essential to examine both the protective and risk factors that influence outcomes for students with LD. Despite the recognized importance of these skills, research gaps remain in understanding how students with LD perceive their own skill levels and the barriers they face (Johnson et al., 2007; Kim & Aquino, 2017; Vaknin-Nusbaum & Rachevski, 2023).

The present study is based on data collected through online questionnaires voluntarily completed by participants from academic institutions across Israel. Its objectives are three-fold. First, the study aims to examine self-reported 21st-century skills among students with LD compared to their typical peers and to assess how these differences manifest between first-year and upper-year students (second year and beyond). Second, it aims to examine how personal characteristics (gender, age), learner type (LD vs. typical), socioeconomic background (mother’s education and family income), and employment status predict each of the eight 21st-century skills across these groups. Third, it aims to examine whether the gaps in 21st-century skills between students with LD and their typical peers widen, narrow, or remain stable as students progress academically from the first year to later years of study.

1.1. 21st-Century Skills, Higher Education, and Students with LD: Barriers and Needs

21st-century skills, grouped into cognitive, interpersonal, and intrapersonal clusters, are fundamental for adapting to rapid social and technological change (NRC, 2012). They encompass critical thinking, problem-solving, collaboration, and self-management (Ball et al., 2016; Kelley et al., 2019; Martin, 2018) and develop through interactions among personal, socioeconomic, and educational factors (Fleming et al., 2018; Grigorenko et al., 2020; Klassen et al., 2013; Showers & Kinsman, 2017). Research with general higher education populations demonstrate uneven patterns of skill acquisition: while students often report adequate information literacy, persistent gaps remain in domains such as critical thinking and problem-solving (Ahmad et al., 2020; Cevik & Senturk, 2019; Hursen et al., 2023; Karaca-Atik et al., 2024). Evidence further suggests that these gaps endure across educational contexts and require explicit pedagogical intervention (Lang & Šorgo, 2024).

In this context, higher education plays a central role in preparing students for the labor market and promoting long-term social and economic mobility (Ball et al., 2016; Binkley et al., 2010; Goegan & Daniels, 2021; Murugiah, 2020; NRC, 2012; Pingry O'Neill et al., 2012). Nevertheless, students from low socioeconomic backgrounds and those with LD continue to face barriers that hinder the development of these skills (Eisenberg & Selivansky Eden, 2019; Horton, 2015). There is ongoing concern regarding the extent to which higher education institutions are adequately equipped to respond to these challenges and to evolving labor market demands (Ahmad et al., 2020; Cevik & Senturk, 2019; Eisenberg & Selivansky Eden, 2019).

The first year of post-secondary education is a critical stage for developing 21st-century skills, as students need to adjust to new academic and social demands while becoming more independent (Bewick et al., 2010; Garratt-Reed et al., 2016). This period is often accompanied by academic and emotional challenges, particularly among students who experience psychological distress, which has been shown to predict poorer academic performance (Gresham & Karatekin, 2023). For students with LD, these transitions are especially demanding due to their academic and emotional vulnerabilities (Johnson et al., 2007; Kim & Aquino, 2017; Patterson, 2022).

Students with LD are at particular risk of lower academic achievement and limited social and economic mobility. They face persistent difficulties in learning, self-regulation, and social integration (Ben-Naim et al., 2017; Connor, 2012; D'Intino, 2017; Horton, 2015; Kochhar-Bryant et al., 2009; Theobald et al., 2019). Low self-efficacy, ineffective learning strategies, and reduced motivation increase the likelihood of academic disengagement and dropout (Alesi et al., 2012; Klassen & Lynch, 2007). They also often struggle to establish supportive peer relationships, which can intensify academic challenges (Ben-Naim et al., 2017; Kochhar-Bryant et al., 2009). After graduation, students with LD frequently experience unstable employment and continued social barriers (Gebhardt et al., 2011; Wagner et al., 2005).

Background factors such as low socioeconomic status and adverse early learning experiences further increase risk (Dong et al., 2023; Showers & Kinsman, 2017). Psychological well-being plays a pivotal role in both academic and social outcomes and highlights the need to examine how these background conditions relate to the development of 21st-century skills among students with LD (Gresham & Karatekin, 2023).

Finally, although interventions are essential for supporting the development of 21st-century skills among students with LD, current initiatives remain limited in both scope and accessibility (Horton, 2015; Kim & Aquino, 2017; Vaknin-Nusbaum & Rachevski, 2023). Early and targeted programs that strengthen cognitive, intrapersonal, and career-related skills can ease students' transitions into academic and professional settings (Horton, 2015; Johnson et al., 2007; LD Resources Foundation, Inc., 2020; Nancarrow, 2007). A clearer understanding of students' needs within higher education is therefore essential for designing effective and sustainable institutional support.

1.2. Students with LD: A Multi-Component Holistic Approach

Socio-ecological perspectives view learning outcomes and well-being as the result of dynamic interactions between individuals and multiple layers of context that operate simultaneously, including immediate learning settings, family resources, institutional supports, and broader sociocultural conditions (Grigorenko et al., 2020; Klassen et al., 2013). Within this framework, risk and protective factors at different levels interact over time, shaping both academic achievement and psychological adjustment. This perspective underscores the importance of background conditions such as socioeconomic resources and employment, which shape access to opportunities for developing 21st-century skills. Recent empirical evidence consistent with this approach demonstrates that disability-

related services, accommodations, and academic or social integration in higher education support persistence and achievement for students with disabilities (Römhild & Holleder, 2024). Similarly, longitudinal findings show that resilience among individuals with reading disabilities is fostered by internal strengths together with supportive social environments and flexible educational practices (Aro et al., 2025).

Within this broader framework, Margalit's Multi-Component Holistic approach (Margalit, 2003; Idan & Margalit, 2014) provides an LD-specific perspective that explains how outcomes develop through the dynamic interplay between personal and contextual factors. The model emphasizes that academic, social, and emotional adjustment in LD depends not only on cognitive and linguistic skills but also on family climate, peer relations, hopeful thinking, and institutional support. These components may operate as risk factors that intensify learning and emotional difficulties or as protective conditions that enable success. By distinguishing between proximal and distal influences, the model highlights how resilience in LD is shaped by the interaction between personal resources and supportive environments.

The NRC framework for 21st-century skills reflects the same developmental and contextual logic emphasized in socio-ecological perspectives and in Margalit's holistic model. It defines cognitive, intrapersonal, and interpersonal skills as capacities that evolve through continuous engagement in learning environments and remain responsive to personal resources and contextual conditions (NRC, 2012). In higher education, the development of these skills is shaped by opportunity structures, including socioeconomic background, the need to balance study with employment, and the availability of institutional supports. For students with LD, these barriers are often more pronounced, highlighting the need for tailored accommodations and explicit instruction that strengthen the self-regulatory and academic strategies underpinning 21st-century skills (Horton, 2015; Patterson, 2022; Showers & Kinsman, 2017).

The first year of post-secondary education represents a pivotal stage in the development of 21st-century skills. It requires swift academic, social, and emotional adaptation and can determine the trajectory of later success. For students with LD, this transition often amplifies pre-existing challenges and reveals gaps in support, making the alignment between personal resources and contextual affordances particularly critical at this stage (Gresham & Karatekin, 2023; Patterson, 2022; Showers & Kinsman, 2017). The educational environment, including the availability of accommodations and inclusive teaching practices, plays a key role in shaping opportunities to acquire 21st-century skills. Evidence from Israeli and international contexts shows that many students with LD report that university interventions partially meet their academic and social needs, which can perpetuate disparities unless institutions respond with targeted, skill-focused supports (Eisenberg & Selivansky Eden, 2019; Vaknin-Nusbaum & Rachevski, 2023; Römhild & Holleder, 2024).

Overall, socio-ecological perspectives and Margalit's Multi-Component Holistic approach jointly offer a coherent foundation for the present study. They support the examination of 21st-century skills as context-dependent outcomes, identify personal and background characteristics as potential risk or protective factors, and emphasize the importance of institutional conditions that can either narrow or widen the gaps between students with LD and their typical peers.

1.3. The Present Study

Students with LD remain underrepresented in research on 21st-century skills, despite being a population at high risk of academic difficulties, reduced employability, and limited socioeconomic mobility. Their challenges are well-documented, including higher dropout rates and difficulties acquiring skills essential for employment and meaningful participation in society (Hadad Haj-Yahya & Assaf, 2017; Horton, 2015; Cortiella & Horowitz, 2014;

Johnson et al., 2007; Kim & Aquino, 2017). These difficulties become particularly acute during critical academic transitions, such as the first year of post-secondary education, when students must navigate new academic demands and independent learning responsibilities (Patterson, 2022; Showers & Kinsman, 2017).

In Israel, higher education is recognized as a central pathway for socioeconomic mobility (Ayalon, 2008; Davidovitch & Soen, 2005; Haimovich & Ben-Shahar, 2004), yet students with LD remain at risk of exclusion from these opportunities. Recent findings indicate that they frequently report insufficient institutional support in developing 21st-century skills, which deepens inequalities between them and their typical peers (Vaknin-Nusbaum & Rachevski, 2023). Understanding the extent of these disparities is therefore crucial not only for academic outcomes but also for social and economic integration.

Despite this importance, significant research gaps remain. Few studies have examined how students with LD differ in 21st-century skills across academic stages or how background factors such as maternal education, family income, and employment status relate to these differences. Moreover, it is not clear whether academic experience (first-year versus upper-year studies) mitigates or intensifies these barriers. Clarifying these gaps is essential for designing institutional supports that align with students' academic and contextual realities. Thus, this study aims to examine differences in 21st-century skills between students with LD and their typical peers at two academic stages (freshmen and upper-year students) and to evaluate the contribution of background variables to these differences. By identifying risks and protective aspects that shape skill development, the study provides a clearer picture of the factors correlated with 21st-century skills among students with LD in Israeli higher education.

1.4. Research Questions and Hypotheses

1. What are the differences in self-reported 21st-century skills between post-secondary students with LD and their typical peers, and how do these differences vary across academic stages, that is, between first-year students and upper-year students (second year and beyond)?
2. What personal, socioeconomic, and academic factors predict the level of readiness for each of the eight 21st-century skills among first-year and upper-year students? Specifically, to what extent do gender, age, learner type (LD vs. typical), mother's education, family income, and employment status contribute to these predictions?
3. How do the differences in 21st-century skills between students with LD and their typical peers change across academic stages? Specifically, do these gaps widen, narrow, or remain stable when comparing first-year and upper-year students?

Based on socio-ecological perspectives that highlight the relationships between contextual factors and students' academic achievement (Grigorenko et al., 2020; Klassen et al., 2013; Margalit, 2003), we hypothesized that students with LD would report lower levels of 21st-century skills compared to their typical peers across cognitive, intrapersonal, and interpersonal domains in both first-year and upper-year cohorts. We further hypothesized that personal characteristics (gender, age), socioeconomic background (maternal education, family income), and employment status would contribute to 21st-century skill levels in both groups. These factors may function as risk or protective mechanisms, though their relative influence may differ between students with and without LD.

2. Method

2.1. Participants

The participants were 739 Israeli undergraduate students, of whom 287 (39%) were first-year students and 452 (61%) were upper-year students ($M = 32.9$, $SD = 9.91$). Of the total participants, 487 (66%) identified as women, 246 (33%) as men, and 6 (1%) as "other." The

LD group included individuals who had been formally diagnosed with learning disabilities due to difficulties in one or more of the following academic domains: reading, writing, and mathematics. Participants with ADHD (attention-deficit/hyperactivity disorder) or with sensory disabilities were excluded. All participants were 18 years of age or older and were recruited voluntarily. Regarding the type of learner, 168 (23%) were students with LD, and 571 (77%) were typical students.

As for the mother's education, 8% of participants reported that their mother had an elementary school education, 37% reported high school education, 17% reported professional education, and 22% reported a bachelor's degree. The remaining 16% reported that their mother had a master's degree or higher. Regarding family income, 40% reported lower than the median family income, 23% around the median, and 34% above the median. As for employment status, 34% reported being unemployed, 40% part-time employed, and 26% full-time employed. Participants were students at 15 academic colleges and six universities, studying for a B.A. or vocational degree.

Young adult students are at a crucial stage in which they are developing the necessary skills for future integration into the labor market. Thus, examining both first-year students and upper-year groups allows for identifying strengths and weaknesses in their 21st-century skills and their relation to personal and social characteristics. By examining these characteristics, we aim to map sub-groups by study year and identify those at higher risk of failing to acquire essential 21st-century skills.

2.2. Research Tools

The questionnaires were translated into Hebrew using a forward-back translation procedure by independent bilingual experts, followed by cultural adaptation to ensure contextual relevance. Exploratory factor analysis confirmed the expected eight-factor structure with strong psychometric properties. The questionnaire was administered in Hebrew, the primary language of instruction in most higher education institutions in Israel, and included two parts: (a) a set of demographic questions and (b) a 34-item instrument assessing 21st-century skills. Each part is described in detail below.

Demographic Questionnaire

In the demographic section, participants were asked to provide information regarding their age, gender, learning disability status, mother's education, family income, and employment status. Mother's education was reported across five categories: elementary school, high school, vocational, BA, and MA or higher. Family income was measured relative to the national median (approximately 15,000 NIS per month, according to the Israeli Central Bureau of Statistics) and reported across three categories: above the median, around the median, and below the median. Maternal education was selected as a focal predictor because Israeli evidence shows a robust, widening correlation with early language milestones (Akiva et al., 2024) and identifies it as a strong predictor of youths' later educational success (Ayalon et al., 2019). Mother's education and family income were therefore included as socioeconomic indicators, given their documented correlation with educational achievement in Israel (Blass, 2020). Overall, personal-social characteristics such as a low SES background may serve as additional risk factors for acquiring 21st-century skills in the LD group. Employment status was reported in three categories: unemployed, part-time employed, and full-time employed.

2.3. 21st-Century Skills

To comprehensively assess all eight skills identified in the literature review, we constructed a composite instrument by combining items from previously validated questionnaires that have been used in prior studies with similar student populations (Author &

Author, under review). This approach allowed us to assess all eight skills simultaneously within a single group of participants preparing to enter the labor market, addressing the scarcity of research examining these skills together. The final questionnaire consisted of three parts and 34 items covering cognitive skills (Kelley et al., 2019); intrapersonal skills (intellectual openness, Kashdan et al., 2009; professional integrity, Miller et al., 2002; positive self-image, Rosenberg, 1965); and interpersonal skills (teamwork and collaboration, Kelley et al., 2019; leadership, Ball et al., 2016). Participants rated each item using the response scale from its source instrument (1–5 or 1–7), with anchors ranging from strongly disagree to strongly agree.

Factor analysis and psychometric validation in the Israeli context. Because the study integrated validated scales from several existing questionnaires into one comprehensive instrument adapted for Israeli students, we conducted exploratory factor analysis to examine whether items clustered as expected, reduce redundancy, and verify psychometric properties. After seven iterations and applying a minimum factor loading of 0.40 (Field, 2013; Raubenheimer, 2004), an eight-factor solution was obtained, corresponding to the eight 21st-century skills. The final version of the questionnaire included 34 items, with an overall Cronbach's alpha of 0.899. Subscale reliability ranged from acceptable to excellent (Taber, 2018) (see Table A1 for factor loadings and Cronbach's alpha values). This procedure is particularly important when combining several established skill domains into one instrument, as it empirically tests whether items align with their intended domains. In the context of 21st-century skills, researchers have emphasized the need for such validation when integrating diverse constructs (Cevik & Senturk, 2019; Kereluik et al., 2013; Voogt & Roblin, 2012). A full description of item content and reliability for each skill appears in Appendix A.

Cognitive Skills (14 items). Items from Kelley et al. (2019) indexed three aspects: cognitive processes and thinking strategies (7 items; $\alpha = 0.842$; e.g., "I can identify in detail what needs to be known to answer a science inquiry question"), knowledge/information literacy and information technology (4 items; $\alpha = 0.811$; e.g., "I am confident in my ability to present all information clearly, concisely, and logically"), and creativity (3 items; $\alpha = 0.734$; e.g., "I am confident in my ability to elaborate and improve on ideas"). The three aspects were significantly intercorrelated: cognitive processes with knowledge, $r = 0.37$, $p < 0.001$; cognitive processes with creativity, $r = 0.55$, $p < 0.001$; and knowledge with creativity, $r = 0.46$, $p < 0.001$.

Intrapersonal Skills (13 items). This set covered intellectual openness (4 items; $\alpha = 0.862$; Kashdan et al., 2009; e.g., "I view challenging situations as an opportunity to grow and learn"), professional integrity and diligence (2 items; $\alpha = 0.567$; Miller et al., 2002; e.g., "Stealing is all right as long as you don't get caught," reverse-coded), and positive self-image (7 items; $\alpha = 0.868$; Rosenberg, 1965; e.g., "On the whole, I am satisfied with myself"). Intercorrelations were significant: intellectual openness with professional integrity/diligence, $r = 0.10$, $p < 0.05$; intellectual openness with positive self-image, $r = 0.19$, $p < 0.001$; and professional integrity/diligence with positive self-image, $r = 0.30$, $p < 0.001$.

Interpersonal Skills (7 items). Teamwork and collaboration (4 items; $\alpha = 0.709$; Kelley et al., 2019; e.g., "I follow rules for team decision-making") and leadership (3 items; $\alpha = 0.755$; Ball et al., 2016; e.g., "I put all my energy into accomplishing my goals") were moderately correlated, $r = 0.45$, $p < 0.001$. A full description of item content and reliability for each skill appears in Appendix A.

2.4. Procedure

Data were collected over the course of one year via an online questionnaire, following approval from the authors' college's Institutional Review Board. College and university administrators distributed the survey link to students' mobile phones, inviting anonymous,

voluntary participation. The questionnaire was untimed; participants gave informed consent before beginning, were told there were no right or wrong answers, and could withdraw at any time. Completion typically required about 20 minutes. Because of institutional privacy and confidentiality policies, the number of students who received the link was not available, so a response rate could not be estimated.

2.5. Statistical Analysis

Analyses were conducted with SPSS ver. 28. Prior to examining the differences between LD and non-LD students.

The first hypothesis was examined by multivariate analysis of variance (MANOVA) to test whether there are differences in self-reported 21st-century skills between the means of identified groups of first-year students and upper-year students on a combination of dependent variables simultaneously (Field, 2013, 2024). This method helped determine if the mean scores of cognitive, intrapersonal, and interpersonal skills significantly differed between the two groups, thereby addressing the first research objective effectively.

To test the second hypothesis, regarding the prediction of each of the 21st-century skills, a hierarchical linear regression with four forced steps was conducted. The dependent variables for each analysis were the eight 21st-century skills. The first step included personal characteristics as a control variable, and the second step included the type of LD vs. typical. The third step included socioeconomic characteristics, and the fourth step included education and employment status. The aim was to examine the amount of explained variance that the addition of these predictors contributed to the model.

3. Results

Table 1 reports results for the three clusters of 21st-century skills. The first column lists the skills, their clusters, and subfactors. Columns 2–5 present descriptive statistics (means, M, and standard deviations, SD) for the four groups: first-year LD, first-year typical, upper-year LD, and upper-year typical. Columns 6 and 7 present the within-year mean differences (Typical minus LD) for first-year and upper-year students, respectively.

Because the design is cross-sectional, these comparisons reflect differences between independent groups at each academic stage.

Table 1 shows that students with LD generally reported lower mean scores across most 21st-century skills compared to their typical peers, in both first-year students and upper-year groups. The significance of these differences was assessed using a MANOVA test, which revealed that among first-year students (LD vs. typical), significant differences emerged in the skills of knowledge, total cognitive skills, and positive self-image. Among upper-year students, significant gaps were found in cognitive processes, knowledge, total cognitive skills, positive self-image, total intrapersonal skills, and teamwork and collaboration. Overall, the results indicate that students with LD consistently report lower levels of 21st-century skills than their typical peers, with differences emerging across a broader range of skill domains among upper-year students.

To examine the second hypothesis regarding the contribution of personal and background variables to 21st-century skills, Pearson correlations were calculated between all study variables. The results, presented in Table 2, show generally weak correlations among the variables.

We examined the combined contribution of personal, academic, and socioeconomic variables to the variance in each 21st-century skill domain. Hierarchical regression analyses were conducted separately for first-year students and upper-year students. Each model included four steps: the first step included personal characteristics (gender and age); the second step added type of learner (LD vs. typical); the third step introduced socioeco-

nomic variables (mother's education and family income); and the fourth step included employment status. Table 3 shows how each set of predictors contributed to the explained variance and the strength of associations for each 21st-century skill within each academic stage. This analysis design allowed us to assess which factors were most predictive of skill development among students in their first year versus upper years, while accounting for learner type and background characteristics. The first column of Table 3 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.

Table 1. Statistical Indices and Results by Each Skill and Comparison via Study Year (Freshmen Students or Upper-Year Students) (N = 739).

Skill	Freshmen Mean (SD) (n = 287)		Upper-Year Mean (SD) (n = 452)		Freshmen Diff. (Typical-LD)		Upper-Year Diff. (Typical-LD)	
	LD (n = 62)	Typical (n = 225)	LD (n = 106)	Typical (n = 346)	Mean Diff. (SE)	p-Value	Mean Diff. (SE)	p-Value
Cognitive skills								
Cognitive processes	4.03 (0.63)	4.10 (0.66)	3.80 (0.76)	4.07 (0.60)	0.07 (0.09)	0.457	0.27 *** (0.10)	0.000
Knowledge	3.65 (0.91)	4.20 (0.71)	3.74 (0.83)	4.19 (0.63)	0.55 *** (0.12)	0.000	0.45 *** (0.11)	0.000
Creativity	4.18 (0.71)	4.21 (0.74)	4.03 (0.77)	4.15 (0.63)	0.03 (0.10)	0.749	0.12 (0.11)	0.163
Total cognitive skills	3.95 (0.54)	4.15 (0.58)	3.83 (0.61)	4.12 (0.49)	0.20 ** (0.08)	0.009	0.29 *** (0.08)	0.000
Intrapersonal skills								
Intellectual openness	3.49 (0.81)	3.38 (0.85)	3.20 (0.90)	3.34 (0.79)	−0.11 (0.12)	0.374	0.14 (0.13)	0.153
Professional integrity	4.44 (0.98)	4.58 (0.80)	4.62 (0.68)	4.59 (0.74)	0.14 (0.14)	0.333	−0.03 (0.10)	0.654
Positive self-image	3.48 (1.05)	3.77 (0.97)	3.46 (0.92)	3.84 (0.85)	0.29 * (0.15)	0.049	0.38 *** (0.13)	0.000
Total intrapersonal skills	3.59 (0.60)	3.67 (0.65)	3.46 (0.60)	3.67 (0.56)	0.08 (0.09)	0.381	0.21 *** (0.08)	0.000
Interpersonal skills								
Teamwork and collaboration	4.41 (0.51)	4.41 (0.60)	4.28 (0.67)	4.40 (0.55)	0.00 (0.08)	1.000	0.12 * (0.09)	0.014
Leadership	4.48 (0.65)	4.49 (0.65)	4.48 (0.56)	4.48 (0.59)	0.01 (0.09)	0.884	0.00 (0.08)	1.000
Total interpersonal skills	4.44 (0.47)	4.44 (0.55)	4.36 (0.48)	4.43 (0.47)	0.00 (0.07)	1.000	0.07 (0.07)	0.308

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

Table 2. Correlation matrix between all study variables.

Variable	1	2	3	4	5
1. Gender	—				
2. Age	0.042	—			
3. Type of Learner	0.057	−0.162 ***	—		
4. Mother Education	0.021	−0.116 **	0.117 **	—	
5. Income	−0.075 *	0.142 ***	−0.100 **	−0.024	—
6. Employment Status	−0.020	0.319 ***	−0.130 ***	−0.084 *	0.117 **

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

Table 3. Hierarchical Regression Analysis of Explained Variance of 21st-Century Skills in Each Group.

Cluster (i) Cognitive skills																
Predictor	Cognitive processes and thinking strategies				Knowledge				Creativity				Total cognitive skills			
	Freshmen		Upper-year		Freshmen		Upper-year		Freshmen		Upper-year		Freshmen		Upper-year	
	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	0.006		0.033 ***		0.003		0.006		0.010		0.013		0.006		0.026 **	
Gender		0.004		0.007		−0.001		−0.004		−0.004		0.002		0.001		0.003
Age		0.000		0.000 ***		0.000		0.000		0.000		0.000 ***		0.000		0.000 **
Step 2	0.003		0.031 **		0.090 ***		0.079 ***		0.001		0.005		0.025 *		0.052 ***	
Type of Learner		−0.091		−0.275 **		−0.569 ***		−0.482 ***		−0.057		−0.114		−0.215 **		−0.296 ***
Step 3	0.010		0.002 ***		0.023 ***		0.017 ***		0.017		0.010 *		0.017 *		0.005 ***	
Mother Education		0.143		0.022		0.109		−0.040		−0.103		0.019		0.090		0.004
Income		0.026		0.006		0.110 *		0.081 **		0.088 *		0.069 *		0.063		0.040
Step 4	0.011		0.009 ***		0.007 ***		0.019 ***		0.004		0.023 **		0.011 *		0.027 ***	
Employment Status		0.071		0.065 *		0.070		0.107 **		0.050		0.113 ***		0.194 **		0.095 ***
Total R ²	0.031		0.074 ***		0.124 ***		0.122 ***		0.032		0.051 **		0.059 *		0.111 ***	
Cluster (ii) Intrapersonal skills																
Predictor	Intellectual openness				Professional integrity and diligence				Positive_S_I				Total intrapersonal skills			
	Freshmen		Upper-year		Freshmen		Upper-year		Freshmen		Upper-year		Freshmen		Upper-year	
	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	0.021		0.000		0.014		0.002		0.033 *		0.004		0.045 **		0.001	
Gender		−0.005		0.002		−0.009		0.001		−0.002		−0.005		−0.005		−0.001
Age		0.000 ***		0.000		0.000		0.000		0.000 **		0.000		0.000 **		0.000
Step 2	0.003		0.006		0.003		0.000		0.011 **		0.027 **		0.001 **		0.022 *	
Type of Learner		0.115		−0.151		−0.107		0.033		−0.254		−0.343 **		−0.053		−0.205 **
Step 3	0.039 **		0.001		0.014		0.010		0.026 **		0.024 ***		0.048 ***		0.014 **	
Mother Education		−0.373 **		−0.023		0.210		0.014		−0.352 *		−0.031		−0.300 **		−0.022
Income		0.073		0.012		0.042		0.072 *		0.085		0.131		0.074		0.065
Step 4	0.007 **		0.004		0.004		0.004		0.024 ***		0.062 ***		0.019 ***		0.040 ***	
Employment Status		0.071		0.056		0.194 **		0.194 **		0.162 **		0.194 **		0.194 **		0.124 **
Total R ²	0.069		0.012		0.035		0.017		0.095 ***		0.116 ***		0.113 ***		0.07 ***	

Table 3. Cont.

Cluster (iii) Interpersonal skills												
Predictor	Teamwork and collaboration				Leadership				Total interpersonal skills			
	Freshmen		Upper-year		Freshmen		Upper-year		Freshmen		Upper-year	
	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β	ΔR^2	β
Step 1	0.001		0.004		0.001		0.001		0.001		0.003	
Gender		0.002		−0.004		0.002		−0.001		0.002		−0.003
Age		0.000		0.000		0.000		0.000		0.000		0.000
Step 2	0.000		0.007		0.000		0.000		0.000		0.005	
Type of Learner		−0.010		−0.120		−0.016		−0.022		−0.010		−0.079
Step 3	0.001		0.000		0.001		0.002		0.001		0.001	
Mother Education		−0.025		0.010		−0.035		0.003		−0.024		−0.006
Income		0.012		−0.004		0.007		0.029		0.010		0.010
Step 4	0.004		0.001		0.018		0.004		0.012		0.004	
Employment Status		0.035		0.022		0.089 *		0.040		0.057		0.031
Total R ²	0.006		0.013		0.020		0.007		0.014		0.012	

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

The table is structured according to three main clusters: cognitive, intrapersonal, and interpersonal skills, each representing a distinct set of skills. The predictive model results provide information about the relationships between demographic variables, learner type, SES, employment status, and 21st-century skills across groups of students (first-year and upper-year students). The following section summarizes the amount of variance explained by these predictors across each 21st-century skill domain, based on Table 3.

3.1. Explained Variance by Skill Domains

Cognitive skills. Cognitive processes: The explained variance was observed only in the upper-year student group. Demographic factors accounted for 3.3% of the variance. The inclusion of learner type added 3.1%, SES variables contributed 0.2%, and employment status explained an additional 0.9%, yielding a total explained variance of 7.4%.

Knowledge. Demographic factors had no significant contribution to the explained variance in either group. The inclusion of learner type added 0.9% to the explained variance in first-year students and 7.9% in upper-year students. Additionally, SES, such as mother's education and family income, contributed an additional 2.3% in first-year students and 1.7% in upper-year students. Employment status explained a further 0.7% of the variance in first-year students and 1.9% in upper-year students, leading to a total explained variance of 12.4% in first-year students and 12.2% in upper-year students.

Creativity. Explained variance was found only in the upper-year students' group. Socioeconomic status (SES) alone explained 1.0% of the variance, and the inclusion of employment status increased the total explained variance to 5.1%.

Total cognitive skills. Demographic factors were significant only in the upper-year students, explaining 2.6% of the variance. The inclusion of learner type added 2.5% to the explained variance for first-year students and 5.2% for upper-year students. Additionally, SES factors contributed an additional 1.1% in first-year students and 2.7% in upper-year students. Employment status further explained 1.1% of the variance in first-year students and 2.7% in upper-year students, leading to a total explained variance of 5.9% for first-year students and 11.1% for upper-year students.

Intrapersonal skills. Intellectual openness: Explained variance was observed only in the first-year students' group. SES factors accounted for 3.9% of the variance, and the inclusion of employment status increased the total explained variance to 6.9%.

Professional integrity and diligence. No significant predictors were found in either group.

Positive self-image. Demographic factors were significant only in first-year students, explaining 3.3% of the variance. The inclusion of learner type added 1.1% to the explained variance in first-year students and 2.7% in upper-year students. SES factors contributed 2.6% in first-year students and 2.4% in upper-year students, while employment status explained an additional 2.4% and 6.2%, respectively. The total explained variance was 9.5% for first-year students and 11.6% for upper-year students.

Total intrapersonal skills. Among first-year students, demographic factors accounted for 4.5% of the variance, with the full model explaining 11.3%. In contrast, the full model explained only 7.7% of the variance in upper-year students.

Interpersonal skills (teamwork, leadership, and total): None of the predictors significantly explained variance in either first-year or upper-year groups.

3.2. Wald Test Comparison of Learner Type Effects

Finally, we compared the β coefficients of the variable type of learner (LD vs. typical) across the 21st-century skills that were examined in this study, using the Wald test. Table 4 presents the results of this comparison. The first column lists the 21st-century skills,

including their clusters and subfactors. The second column presents the differences in β coefficients for the learner type variable across academic stages (first-year and upper-year students), and the third column reports the p -values from the Wald test.

Table 4. Results of Wald test for comparing β coefficients of type of learner (LD vs. typical) in all 21st-century skills, split by study year (freshmen students and upper-year students).

Skill	β Diff. of Type of Learner	p -Value (χ^2 Test)
Cognitive skills		
Cognitive processes	−0.18	0.012 *
Knowledge	0.09	0.275
Creativity	−0.06	0.474
Total cognitive skills	−0.08	0.177
Intrapersonal skills		
Intellectual openness	−0.27	0.005 **
Professional integrity	0.14	0.094
Positive self-image	−0.09	0.376
Total intrapersonal skills	−0.15	0.024 *
Interpersonal skills		
Teamwork and collaboration	−0.11	0.100
Leadership	−0.01	0.922
Total interpersonal skills	−0.07	0.210

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

Significant differences in β coefficients between students with LD and typical peers were found in the following skills: knowledge and total cognitive skills. These results suggest that for some domains, the gap differs by academic stage.

4. Discussion

The present study aimed to examine differences in 21st-century skills between students with LD and their typical peers across first-year and upper-year stages of post-secondary education. In addition, it examined how personal, socioeconomic (e.g., mother's education and family income), and employment status variables are related to 21st-century skills within each group. Finally, it assessed whether the gaps in 21st-century skills between students with LD and their typical peers differ between first-year and upper-year students, thereby indicating whether these gaps widen, narrow, or remain stable across the academic learning period. The findings show that students with LD reported significantly lower levels of most 21st-century skills compared to their typical peers. These differences were evident in both first-year and upper-year groups and appeared stable across academic stages, with some gaps more pronounced among upper-year students. Socioeconomic background (mother's education and family income) was found to be correlated with the level of 21st-century skills in both groups, although somewhat more strongly among typical peers. Employment status was also related to specific skills, particularly among upper-year students, although the correlations were not consistent across skill domains. Overall, typical peers displayed higher levels of 21st-century skills at both stages, whereas students with LD did not show comparable levels, highlighting persistent gaps.

4.1. Differences in 21st-Century Skills Between Students with LD and Their Typical Peers in First and Upper Years and Across Academic Years

The present study results show significant differences in the levels of 21st-century skills between students with LD and their typical peers in both the first year and upper years of post-secondary education. Students with LD reported lower levels of most 21st-

century skills compared to typical peers in both academic stages. These gaps remained stable across many domains and, in some cases, even widened (e.g., cognitive processes, intellectual openness, and total intrapersonal skills), indicating that differences not only persist but may become more pronounced across years of study.

The gaps identified already in the first year may reflect the academic and social adjustment challenges associated with transitioning to higher education, which are particularly critical for students with LD. The first year involves substantial adaptation to independent learning, higher academic demands, and new social environments (Gresham & Karatekin, 2023; Patterson, 2022; Showers & Kinsman, 2017). While such challenges are common to many students, they are often intensified for students with LD, who experience additional difficulties related to executive functioning, literacy, and self-regulation (Hamblet, 2014; Johnson et al., 2007).

From a socio-ecological perspective, these findings suggest that the persistence and, in some cases, widening of gaps reflect not only individual learning challenges but also the ways in which multiple environmental systems either fail to buffer risks or provide adequate protection (Grigorenko et al., 2020; Klassen et al., 2013). Recent work in higher education similarly shows that while services, accommodations, and opportunities for social and academic integration can act as protective factors, their uneven availability limits their effectiveness in narrowing gaps (Römhild & Holleder, 2024). The current results highlight that higher education environments may not yet provide the conditions necessary for students with LD to develop 21st-century skills at a pace comparable to their typical peers. Margalit's (2003; Idan & Margalit, 2014) Multi-Component Holistic model further explains these outcomes by emphasizing the dynamic interaction of personal resources (e.g., literacy and self-regulation skills, hopeful thinking) with contextual supports (e.g., family climate, peer relations, institutional services). The widening gaps observed in our study reflect an imbalance in risk and protective factors. While typical students appear to benefit from cumulative protective experiences, students with LD encounter more risks that exacerbate difficulties over time. Both socio-ecological and holistic perspectives suggest that unless protective factors are deliberately strengthened, gaps in skill development may remain entrenched or expand.

When examining specific skills, the gaps in cognitive processes and knowledge are particularly troubling. These skills, which encompass critical thinking, problem-solving, and academic literacy (NRC, 2012), are foundational for success in higher education and later employment. The present results show that while typical students' skills tend to be higher in upper years, students with LD do not demonstrate parallel progress. Although post-secondary education aims to promote both academic knowledge and essential 21st-century skills necessary for workforce readiness (Ball et al., 2016; NRC, 2012; Binkley et al., 2010), the current findings highlight an important weakness in achieving this goal for students with LD. Prior studies have raised similar concerns, noting that institutional practices often fail to provide adequate support for LD students' 21st-century skill development (Eisenberg & Selivansky Eden, 2019; Kim & Aquino, 2017; Horton, 2015; Vaknin-Nusbaum & Rachevski, 2023).

The fact that no differences were found between the groups in professional integrity and diligence, as well as leadership and interpersonal skills, may point to areas where students with LD are able to maintain parity with their typical peers. It is possible that these skills are less dependent on academic and cognitive demands and may be shaped more by personal or social experiences (Ben-Naim et al., 2017). Nevertheless, the persistent gaps in cognitive and intrapersonal domains suggest that without explicit interventions, students with LD are unlikely to close these differences independently. Since these skills are critical to students' future employment and long-term participation in society (Ball

et al., 2016; Binkley et al., 2010; NRC, 2012), these results raise serious concerns about the prospects of students with LD. If these students are unable to develop the necessary skills during higher education, their chances of succeeding in an increasingly demanding and dynamic labor market are significantly reduced (Gebhardt et al., 2011; Johnson et al., 2007; Wagner et al., 2005).

4.2. Predictors of 21st-Century Skills in First-Year and Upper-Year Students

The present study also examined how personal, SES, and academic factors are related to 21st-century skills among both students with LD and their typical peers during first-year and upper-year academic stages. The predictive models shed light on how these factors contribute differently to skill development in each group.

Consistent with multi-component models of LD (Margalit, 2003; Grigorenko et al., 2020), both personal characteristics and family background emerged as important factors in explaining 21st-century skills, although their influence varied between the groups of participants. Gender and age, as personal variables, were found to be significant predictors of 21st-century skills in both first-year and upper-year students, with older students and female students reporting higher levels of various skills. These findings are in line with previous research emphasizing the role of gender and age in shaping academic self-perceptions and adaptive skills (Alesi et al., 2012; Ben-Naim et al., 2017).

Socioeconomic background also played a central role. Mother's education and family income were consistently related to higher levels of 21st-century skills in both groups and at both academic stages. However, these SES advantages appeared somewhat more influential among typical peers, suggesting that although helpful, SES may not fully compensate for the specific challenges posed by LD (D'Intino, 2017; Graham et al., 2017; Zeng et al., 2018). These patterns suggest that access to resources alone cannot ensure positive outcomes if institutional supports are not adequately tailored to the needs of students with LD.

Employment status also emerged as a significant predictor of some 21st-century skills, especially among upper-year students. While among typical peers, employment was associated with higher readiness in skills such as knowledge, creativity, and self-image; this pattern was not found among students with LD. Thus, although work experience may serve as an opportunity to further develop essential skills, students with LD seem less able to benefit from these opportunities. This pattern may reflect a Matthew effect, a cumulative developmental phenomenon originally described in the context of literacy (Stanovich et al., 1986) and more recently extended to 21st-century skills among students with LD (Vaknin-Nusbaum & Rachevski, 2023). According to this framework, students who already possess stronger cognitive and adaptive resources, such as typical students, are more likely to benefit from enriching experiences like employment, while students with LD, who lack these foundational resources, are left behind. In this way, employment may widen rather than reduce the gaps in 21st-century skills between these groups. Thus, without targeted interventions during their studies, students with LD may not only start at a disadvantage but also accumulate fewer tools over time. Finally, the type of learner (LD vs. typical) remained a robust predictor of 21st-century skills even after controlling for all other variables, highlighting the unique and persistent challenges associated with LD.

It is also important to consider why cognitive processes, knowledge, and total intrapersonal skills were more affected by the combined influence of learner type, socioeconomic background, and employment status. Cognitive processes and knowledge are heavily reliant on literacy and learning strategies that students with LD typically find challenging without specific interventions (M. Wolf, 2008; Snow, 2010; Showers & Kinsman, 2017). Intrapersonal skills such as self-image and intellectual openness may be hindered by repeated academic failure and lack of support, resulting in weaker self-perception of competence

(Ben-Naim et al., 2017; Patterson, 2022). These findings align with Zeng et al.'s (2018) emphasis on the persistent barriers to academic and social engagement experienced by students with LD.

Importantly, LD should be viewed as a dynamic characteristic whose impact unfolds across development. In the present study, learner type (LD vs. typical) remained a robust predictor of 21st-century skills in several models, which may reflect not only the presence of the disability itself but also the absence of adequate preparation in earlier educational stages. When students with LD enter higher education without having acquired self-learning strategies and tools for independent study, they are at a particular disadvantage in environments that demand autonomy and self-regulation. This developmental lens is consistent with the finding that socioeconomic background also predicts variation in skills, indicating that both personal characteristics and contextual resources shape outcomes. This interpretation is consistent with socio-ecological and holistic frameworks, which emphasize that long-term outcomes emerge from the cumulative balance of risks and protections across developmental stages. Overall, these patterns underscore that attention should be directed not only to post-secondary adaptations but also to the preparation provided by elementary and secondary schools, where cultivating self-learning strategies could help students with LD cope more effectively with the challenges of higher education.

4.3. Practical Implications for Higher Education Institutions

The present findings indicate that gaps in 21st-century skills are most pronounced in the cognitive and intrapersonal domains and that these gaps persist or even become wider over the course of academic studies. This suggests that these skill areas may require greater instructional and institutional attention if students with LD are to achieve parity with their typical peers.

Moreover, the results highlight the importance of raising awareness among higher education institutions and earlier stages of schooling about preparing students with LD for the demands of independent learning. Since much of post-secondary study depends on self-directed learning, students who enter higher education without effective strategies are likely to struggle in further developing 21st-century skills. Within higher education, these results point to the need for support systems that not only provide accommodations but also explicitly cultivate cognitive and intrapersonal skills. Approaches such as structured mentoring, targeted tutoring, learning-strategy workshops, and learning communities may help transform protective factors into more consistent gains. Ensuring that opportunities for collaboration, problem-solving, and self-regulation are embedded in coursework can further strengthen the conditions for inclusion.

However, achieving such parity also requires addressing structural barriers. Evidence from higher education indicates that assessment systems disproportionately emphasize traditional examinations relative to the broader competencies that institutions claim to cultivate (Hadiyanto, 2024). For students with LD, this emphasis can create a disadvantage. Institutions should therefore consider diversifying assessment modalities (e.g., performance-based tasks, portfolios, and team projects) to better reflect the multidimensional nature of 21st-century competencies and to reduce avoidable barriers for students with LD. Finally, the findings show that protective and risk factors differ across students, with socioeconomic background and employment status playing distinct roles in shaping skill levels. This underscores the need to consider the diversity within the LD population, rather than treating them as a homogeneous group, and to recognize that some students may have more protective factors than others, which may, in turn, shape the types of support they require. Accordingly, institutional policies and supports should be flexible enough to accommodate this heterogeneity.

5. Limitations and Directions for Future Research

This study has several limitations that should be considered when interpreting the findings. First, the reliance on self-reported data may not fully capture actual performance, as students might either under- or overestimate their skills. Future research should therefore combine self-reports with direct performance-based assessments to provide a more accurate picture. Second, the study focused on post-secondary students, yet disparities in 21st-century skills may begin much earlier. Longitudinal designs following students from secondary school into higher education are needed to determine when these gaps first appear and how they develop over time. Third, the study did not differentiate between types of LD, even though distinct profiles may be associated with different patterns of strengths and challenges. Subsequent studies should examine specific LD subtypes and their unique associations with 21st-century skills in order to inform more targeted interventions. Fourth, this study is cross-sectional. Thus, observed differences between academic stages could result from differential attrition, cohort effects, or selection factors. Longitudinal research tracking the same students over time is required to clarify these patterns. Finally, cross-national comparative studies are needed to determine whether these patterns hold in diverse educational contexts. Such research would enhance the generalizability of the findings and shed light on how different educational systems facilitate or hinder the development of 21st-century skills among students with LD.

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Appendix A

Table A1. Factor Loadings and Reliability Scores for 21st-Century Skills Assessment Items.

Factor Name	Item	Loading	Cronbach's Alpha (Eigenvalue)
Cluster (i) Cognitive Skills			
Cognitive processes and thinking strategies	Revise drafts and justify revisions with evidence	0.559	0.842 (8.174)
	Develop follow-up questions that focus or broaden inquiry	0.605	
	Identify in detail what needs to be known to answer a science inquiry question	0.785	
	Evaluate reasoning and evidence that support an argument	0.880	
	Understand questions that lead to critical thinking	0.586	
	Justify choices of evaluation criteria	0.515	
	Gather relevant and sufficient information from different sources	0.559	

Table A1. Cont.

Factor Name	Item	Loading	Cronbach's Alpha (Eigenvalue)
Knowledge	Use time and run meetings efficiently	0.718	0.811 (3.385)
	Organize information well	0.880	
	Track our team's progress toward goals and deadlines	0.586	
Creativity	Present all information clearly, concisely, and logically	0.639	0.734 (2.191)
	Help the team solve problems and manage conflicts	0.607	
	Adapt a communication style appropriate for the purpose, task, or audience	0.854	
Elaborate and improve on ideas		0.581	
Cluster (ii) Intrapersonal Skills			
Intellectual openness	I am at my best when doing something that is complex or challenging	0.711	0.862 (1.974)
	I view challenging situations as an opportunity to grow and learn	0.730	
	I am always looking for experiences that challenge how I think about myself and the world	0.857	
Work Ethic, Organizing, and Integrity	I frequently seek out opportunities to challenge myself and grow as a person	0.828	0.567 (1.422)
	I would take items from work if I felt I was not getting paid enough (R).	0.521	
	Stealing is all right as long as you don't get caught (R).	0.778	
Positive self-image	On the whole, I am satisfied with myself	0.625	0.868 (1.707)
	At times I think I am no good at all (R)	0.754	
	I feel I do not have much to be proud of (R)	0.647	
	I certainly feel useless at times (R)	0.769	0.645 (1.333)
	I wish I could have more respect for myself (R)	0.645	
	All in all, I am inclined to feel that I am a failure (R)	0.813	
I take a positive attitude toward myself		0.685	
Cluster (iii) Interpersonal Skills			
Teamwork and collaboration	Follow rules for team meetings	0.638	0.709 (1.412)
	Make sure all team members' ideas are equally valued	0.678	
	Offer assistance to others in their work when needed	0.477	
Leadership	Follow rules for team decision-making	0.696	0.755 (1.333)
	Team members can count on me	0.693	
	Others can count on me to accomplish a goal	0.918	
I put all my energy into accomplishing my goals		0.575	

References

- Ahmad, S. A., Yoke, S. K., Yunos, R. M., & Amin, J. M. (2020). Exploring lecturers' readiness for 21st century education in Malaysian higher learning institutions. *European Journal of Teaching and Education*, 1(1), 15–29. [\[CrossRef\]](#)
- Akiva, P., Amit, G., Girshovitz, I., Navon, Y., Sadaka, Y., Shavit, Y., & Silverman, S. (2024). *Widening socioeconomic inequalities in early childhood language milestone attainment in Israel, 2016–2022*. Taub Center for Social Policy Studies in Israel. [\[CrossRef\]](#)
- Alesi, M., Rappo, G., & Pepi, A. (2012). Self-esteem at school and self-handicapping in childhood: Comparison of groups with learning disabilities. *Psychological Reports*, 111(3), 952–962. [\[CrossRef\]](#) [\[PubMed\]](#)
- American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). American Psychiatric Publishing. [\[CrossRef\]](#)
- Aro, T., Rossi, M. L., Paakkari, L., & Torppa, M. (2025). Experienced protective factors while growing up with reading disability. *Learning Disability Quarterly*, 48(3), 173–187. [\[CrossRef\]](#) [\[PubMed\]](#)
- Ayalon, H. (2008). Who studies what? Where? Why? Social implications of the expansion and diversification of higher education in Israel. *Israeli Sociology*, 10, 33–60. Available online: <https://people.socsci.tau.ac.il/mu/hyalon/files/2010/11/whostudieswhat.pdf> (accessed on 16 September 2025). (In Hebrew).
- Ayalon, H., Blass, N., Feniger, Y., & Shavit, Y. (2019). *Educational inequality in Israel: From research to policy*. Taub Center for Social Policy Studies in Israel. Available online: <https://www.taubcenter.org.il/wp-content/uploads/2020/05/educationinequalityinisraeleng.pdf> (accessed on 16 September 2025).
- Ball, A., Joyce, H. D., & Anderson-Butcher, D. (2016). Exploring 21st century skills and learning environments for middle school youth. *International Journal of School Social Work*, 1(1), 1–15. [\[CrossRef\]](#)

- Ben-Naim, S., Laslo-Roth, R., Einav, M., Biran, H., & Margalit, M. (2017). Academic self-efficacy, sense of coherence, hope and tiredness among college students with learning disabilities. *European Journal of Special Needs Education*, 32(1), 18–34. Available online: <https://psycnet.apa.org/doi/10.1080/08856257.2016.1254973> (accessed on 16 September 2025). [CrossRef]
- Bewick, B., Koutsopoulou, G., Miles, J., Slaa, E., & Barkham, M. (2010). Changes in undergraduate students' psychological well-being as they progress through university. *Studies in Higher Education*, 35(6), 633–645. Available online: <https://www.tandfonline.com/doi/abs/10.1080/03075070903216643> (accessed on 16 September 2025). [CrossRef]
- Binkley, M., Erstad, O., Herman, J., Raizen, S., Ripley, M., & Rumble, M. (2010). *Draft white paper 1: Defining 21st century skills*. The University of Melbourne. Available online: https://www.academia.edu/download/75638799/Draft_White_Paper_1_Defining_21st_centur20211203-25870-1e02nv.pdf (accessed on 16 September 2025).
- Blass, N. (2020). *Achievements and gaps: The status of the Israeli education system*. Taub Center for Social Policy Studies in Israel.
- Cepeda, R., Buelow, M. T., Jaggars, S. S., & Rivera, M. D. (2021). "Like a freshman who didn't get a freshman orientation": How transfer student capital, social support, and self-efficacy intertwine in the transfer student experience. *Frontiers in Psychology*, 12, 767395. [CrossRef]
- Cevik, M., & Senturk, C. (2019). Multidimensional 21st century skills scale: Validity and reliability study. *Cypriot Journal of Educational Sciences*, 14(1), 11–28. [CrossRef]
- Connor, D. J. (2012). Actively navigating the transition into college: Narratives of students with learning disabilities. *International Journal of Qualitative Studies in Education*, 25(8), 1005–1036. [CrossRef]
- Cortiella, C., & Horowitz, S. H. (2014). The state of learning disabilities: Facts, trends and emerging issues. *New York: National Center for Learning Disabilities*, 25(3), 2–45. Available online: <https://www.myschoolpsychology.com/wp-content/uploads/2014/02/2014-State-of-LD.pdf> (accessed on 16 September 2025).
- Davidovitch, N., & Soen, D. (2005). A window of opportunity: Changes in the systems of higher education in Israel and the College of Judea and Samaria. *Judea and Samaria Research Studies*, 14, 321–344. (In Hebrew).
- D'Intino, J. S. (2017). Learning disabilities in Canada: Definitions and accommodations. *Canadian Psychology/Psychologie Canadienne*, 58(3), 228–237. Available online: <https://psycnet.apa.org/doi/10.1037/cap0000116> (accessed on 16 September 2025). [CrossRef]
- Dong, J., Chen, J., Li, Y., Huang, X., Rong, X., & Chen, L. (2023). Relationship between Freshmen's psychological health and family economic status in Chinese universities: A latent profile analysis. *Psychology Research and Behavior Management*, 16, 3489–3502. [CrossRef]
- Eisenberg, E., & Selivansky Eden, O. (2019). *Adapting the education system to the 21st century*. The Israel Democracy Institute. Available online: <https://www.idi.org.il/media/13079/adapting-israel-s-education-system-for-the-challenges-of-the-21st-centur.pdf> (accessed on 16 September 2025). (In Hebrew)
- Field, A. (2013). *Discovering statistics using IBM SPSS statistics*. Sage.
- Field, A. (2024). *Discovering statistics using IBM SPSS statistics*. Sage Publications Limited.
- Fleming, A. R., Edwin, M., Hayes, J. A., Locke, B. D., & Lockard, A. J. (2018). Treatment-seeking college students with disabilities: Presenting concerns, protective factors, and academic distress. *Rehabilitation Psychology*, 63(1), 55–67. Available online: <https://psycnet.apa.org/doi/10.1037/rep0000193> (accessed on 16 September 2025). [CrossRef]
- Garratt-Reed, D., Roberts, L. D., & Heritage, B. (2016). Grades, student satisfaction and retention in online and face-to-face introductory psychology units: A test of equivalency theory. *Frontiers in Psychology*, 7, 673. [CrossRef]
- Gebhardt, M., Tretter, T., Schwab, S., & Gasteiger-Klicpera, B. (2011). The transition from school to the workplace for students with learning disabilities: Status quo and the efficiency of pre-vocational and vocational training schemes. *European Journal of Special Needs Education*, 26(4), 443–459. [CrossRef]
- Goegan, L. D., & Daniels, L. M. (2021). Academic success for students in postsecondary education: The role of student characteristics and integration. *Journal of College Student Retention: Research, Theory & Practice*, 23(3), 659–685. [CrossRef]
- Graesser, A. C., Sabatini, J. P., & Li, H. (2022). Educational psychology is evolving to accommodate technology, multiple disciplines, and Twenty-First-Century skills. *Annual Review of Psychology*, 73, 547–574. [CrossRef]
- Graham, S., Collins, A. A., & Rigby-Wills, H. (2017). Writing characteristics of students with learning disabilities and typically achieving peers: A meta-analysis. *Exceptional Children*, 83(2), 199–218. [CrossRef]
- Gresham, B., & Karatekin, C. (2023). The role of adverse childhood experiences (ACEs) in predicting academic problems among college students. *Child Abuse & Neglect*, 142, 105595. [CrossRef]
- Grigorenko, E. L., Compton, D. L., Fuchs, L. S., Wagner, R. K., Willcutt, E. G., & Fletcher, J. M. (2020). Understanding, educating, and supporting children with specific learning disabilities: 50 years of science and practice. *American Psychologist*, 75(1), 37. Available online: <https://psycnet.apa.org/doi/10.1037/amp0000452> (accessed on 16 September 2025). [CrossRef]
- Hadad Haj-Yahya, N., & Assaf, R. (2017). *Arab society in Israel: A socioeconomic situation and future outlook*. The Israel Democracy Institute. Available online: <https://www.idi.org.il/books/19008> (accessed on 16 September 2025). (In Hebrew)
- Hadiyanto, H. (2024). Application of student-centered learning in improving teaching English as a foreign language students' 21st-century skills performance. *Education Sciences*, 14(9), 938. [CrossRef]

- Haimovich, T., & Ben-Shahar, G. (2004). Matriculation exam and psychometric entrance test for universities (PET) as predictors of graduation and dropout. *Megamot*, 43, 446–470. (In Hebrew).
- Hamblet, E. C. (2014). Nine strategies to improve college transition planning for students with disabilities. *Teaching Exceptional Children*, 46(3), 53–59. [CrossRef]
- Horton, J. (2015). Identifying at-risk factors that affect college student success. *International Journal of Process Education*, 7(1), 83–101. Available online: <https://www.ijpe.online/2015/risk.pdf> (accessed on 16 September 2025).
- Hursen, C., Paşa, D., & Keser, H. (2023). High school students' use of information, media, and technology skills and multidimensional 21st-century skills: An investigation within the context of students, teachers, and curricula. *Sustainability*, 15(16), 12214. [CrossRef]
- Idan, O., & Margalit, M. (2014). Socioemotional self-perceptions, family climate, and hopeful thinking among students with learning disabilities and typically achieving students from the same classes. *Journal of Learning Disabilities*, 47(2), 136–152. [CrossRef]
- Johnson, D. R., Mellard, D. F., & Lancaster, P. (2007). Road to success: Helping young adults with learning disabilities plan and prepare for employment. *Teaching Exceptional Children*, 39(6), 26–32. [CrossRef]
- Karaca-Atik, A., Gorgievski, M. J., Meeuwisse, M., & Smeets, G. (2024). Possessing 21st-century skills and building sustainable careers: Early-career social sciences graduates' perspectives. *Sustainability*, 16(8), 3409. [CrossRef]
- Kashdan, T. B., Gallagher, M. W., Silvia, P. J., Winterstein, B. P., Breen, W. E., Terhar, D., & Steger, M. F. (2009). The curiosity and exploration inventory-II: Development, factor structure, and psychometrics. *Journal of Research in Personality*, 43(6), 987–998. [CrossRef]
- Kelley, T. R., Knowles, J. G., Han, J., & Sung, E. (2019). Creating a 21st century skills survey instrument for high school students. *American Journal of Educational Research*, 7(8), 583–590. [CrossRef]
- Kereluik, K., Mishra, P., Fahnoe, C., & Terry, L. (2013). What knowledge is of most worth: Teacher knowledge for 21st century learning. *Journal of Digital Learning in Teacher Education*, 29(4), 127–140. [CrossRef]
- Kim, E., & Aquino, K. C. (2017). *Disability as diversity in higher education: Policies and practices to enhance student success*. Routledge Taylor and Francis Group. [CrossRef]
- Klassen, R. M., & Lynch, S. L. (2007). Self-efficacy from the perspective of adolescents with LD and their specialist teachers. *Journal of Learning Disabilities*, 40(6), 494–507. [CrossRef]
- Klassen, R. M., Tze, V. M., & Hannok, W. (2013). Internalizing problems of adults with learning disabilities: A meta-analysis. *Journal of Learning Disabilities*, 46(4), 317–327. [CrossRef]
- Kochhar-Bryant, C., Bassett, D. S., & Webb, K. W. (2009). *Transition to postsecondary education for students with disabilities*. Corwin Press. ISBN 978-1412952798.
- Lang, V., & Šorgo, A. (2024). Views of students, parents, and teachers on smartphones and tablets in the development of 21st-century skills as a prerequisite for a sustainable future. *Sustainability*, 16(7), 3004. [CrossRef]
- LD Resources Foundation, Inc. (2020). *Transition planning for students with learning disabilities or dyslexia*. Available online: <https://www.ldrfa.org/transition-planning-for> (accessed on 16 September 2025).
- Margalit, M. (2003). Resilience model among individuals with learning disabilities: Proximal and distal influences. *Learning Disabilities Research & Practice*, 18(2), 82–86. [CrossRef]
- Martin, J. P. (2018). Skills for the 21st century: Findings and policy lessons from the OECD survey of adult skills. *OECD Education Working Paper*, 166(2), 1–33. [CrossRef]
- Miller, M. J., Woehr, D. J., & Hudspeth, N. (2002). The meaning and measurement of work ethic: Construction and initial validation of a multidimensional inventory. *Journal of Vocational Behavior*, 60(3), 451–489. [CrossRef]
- Murugiah, T. K. (2020). Challenges in transforming assessments for 21st century skills development: Lecturers' perspective. *Asian Journal of Education and Training*, 6(1), 41–46. [CrossRef]
- Nancarrow, S. (2007). The impact of intermediate care services on job satisfaction, skills and career development opportunities. *Journal of Clinical Nursing*, 16(7), 1222–1229. [CrossRef] [PubMed]
- National Research Council. (2012). *Education for life and work: Developing transferable knowledge and skills in the 21st century*. National Academies Press. [CrossRef]
- Patterson, M. B. (2022, January). *Assessed skills and skill use of adults with learning disabilities in PIAAC*. Available online: <http://piaacgateway.com/researchpapers> (accessed on 16 September 2025).
- Pingry O'Neill, L. N., Markward, M. J., & French, J. P. (2012). Predictors of graduation among college students with disabilities. *Journal of Postsecondary Education and Disability*, 25(1), 21–36. Available online: <http://files.eric.ed.gov/fulltext/EJ970017.pdf> (accessed on 16 September 2025).
- Polk, D. (2021). *College faculty preparation and comfort in teaching students with disabilities* [Ph.D. thesis, Seton Hall University]. Available online: <https://scholarship.shu.edu/dissertations/2894> (accessed on 16 September 2025).
- Raubenheimer, J. (2004). An item selection procedure to maximize scale reliability and validity. *SA Journal of Industrial Psychology*, 30(4), 59–64. Available online: <https://hdl.handle.net/10520/EJC89023> (accessed on 16 September 2025). [CrossRef]

- Römhild, A., & Hollederer, A. (2024). Effects of disability-related services, accommodations, and integration on academic success of students with disabilities in higher education. A scoping review. *European Journal of Special Needs Education*, 39(1), 143–166. [CrossRef]
- Rosenberg, M. (1965). *Rosenberg self-esteem scale (RSE)* [Acceptance and commitment therapy. Measures package, p. 61]. Available online: <https://psycnet.apa.org/doi/10.1037/t01038-000> (accessed on 16 September 2025).
- Showers, A. H., & Kinsman, J. W. (2017). Factors that contribute to college success for students with learning disabilities. *Learning Disability Quarterly*, 40(2), 81–90. [CrossRef]
- Snow, C. E. (2010). Academic language and the challenge of reading for learning about science. *Science*, 328(5977), 450–452. [CrossRef]
- Stanovich, K. E., Nathan, R. G., & Vala-Rossi, M. (1986). Developmental changes in the cognitive correlates of reading ability and the developmental lag hypothesis. *Reading Research Quarterly*, 21(3), 267–283. [CrossRef]
- Stephan, M., & Dieker, L. (2022). Equitable Co-teaching Practices in Mathematics. In *Enabling mathematics learning of struggling students* (pp. 199–219). Springer International Publishing. [CrossRef]
- Taber, K. S. (2018). The use of Cronbach's alpha when developing and reporting research instruments in science education. *Research in Science Education*, 48, 1273–1296. [CrossRef]
- Theobald, R. J., Goldhaber, D. D., Gratz, T. M., & Holden, K. L. (2019). Career and technical education, inclusion, and postsecondary outcomes for students with learning disabilities. *Journal of Learning Disabilities*, 52(2), 109–119. [CrossRef]
- Vaknin-Nusbaum, V., & Rachevski, I. (2023). Perpetuating the gaps: 21st-Century skills in students with learning disabilities and their typically developing peers. *Journal of Learning Disabilities*, 57(6), 371–383. [CrossRef]
- Voogt, J., & Roblin, N. P. (2012). A comparative analysis of international frameworks for 21st century competences: Implications for national curriculum policies. *Journal of Curriculum Studies*, 44(3), 299–321. [CrossRef]
- Wagner, M., Newman, L., Cameto, R., & Levine, P. (2005). *Changes over time in the early postschool outcomes of youth with disabilities. A report of findings from the National Longitudinal Transition Study (NLTS) and the National Longitudinal Transition Study-2 (NLTS2)*. Office of Special Education Programs, U.S. Department of Education.
- Wolf, L. E. (2001). College students with ADHD and other hidden disabilities: Outcomes and interventions. *Annals of the New York Academy of Sciences*, 931(1), 385–395. [CrossRef] [PubMed]
- Wolf, M. (2008). *Proust and the squid: The story and science of the reading brain*. Harper Perennial.
- Zeng, W., Ju, S., & Hord, C. (2018). A literature review of academic interventions for college students with learning disabilities. *Learning Disability Quarterly*, 41(3), 159–169. [CrossRef]

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