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Educating for Adaptability: Exploring Transferable Skills and Disciplinary Influence in Higher Education

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Abstract

With increasing attention on student employability and the idea of "return-on-investment" for a college degree, universities have begun to focus on how well their students are acquiring transferable skills as a means of promoting student success. The current study attempts to explore areas of strengths and weaknesses for various majors across three dimensions of transferable skills: Speaking & Complex Discussions, Creativity & Problem Solving, and Complex Writing. Using survey data from 5,823 seniors attending 33 institutions who participated in the 2022 administration of the National Survey of Student Engagement, results from Ordinary Least Squares regression models suggest several significant relationships between major field and transferable skills. Some majors are positive predictors of these three types of transferable skills, while others are negative predictors. These patterns are apparent even after controlling for a variety of other student identities and institutional characteristics. Potential reasons and educational implications for these findings are discussed.

Keywords: transferable skills, major, higher education, discussions, creativity, writing

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Educating for Adaptability: Exploring Transferable Skills and Disciplinary Influence in Higher Education

In response to an increasing emphasis on student employability outcomes measured in skill development, universities have begun to ensure that their curricula provide students with transferable skills. Transferable skills do not have an agreed upon definition (Matteson et al., 2016), despite the breadth of research involving their development and importance in higher education and career success. We define transferable skills as those which can be applied across different situations (Bridges, 1993), encompass knowledge outside of a specific educational domain (Chan et al., 2017), and usually fall within the realm of interpersonal and personal development (Karras, 2022; Schulz, 2008). According to research on the topic, communication, critical thinking, creativity, teamwork, and leadership are often cited as important transferable skills (Finley, 2021; Humphreys et al., 2001; Job Outlook 2023, 2022; Noah & Abdul Aziz, 2020; Robles, 2012).

The value of developing transferable skills lies in their potential for career attainment and to serve as a building block for further skill development. Critical thinking, for example, serves as a prerequisite for problem solving, creativity for innovation, and communication for conflict management (Schulz, 2008). Skills predict success not only while at the university (Cassady et al., 2022), but in later careers as well (Sinche et al., 2017). Transferable skills carry the advantage of generalizability, a crucial trait for successful employment in the fast-evolving modern world, but employers are increasingly noting that college graduates are missing key skills. The purpose of this study is to explore the association between college seniors' skill development and their chosen major field of study.

The Skill Gap

Transferable skill research has often focused on employer perceptions of undergraduate student skill development. When there are differences in perception that indicate employers feel students are insufficiently prepared for the workplace, it is sometimes referred to as the "skill gap" (Stewart et al., 2016; Williams, 1999). However, this is not the universally accepted definition; for example, Whittaker (2016) defines the skill gap as the macro-level efficiency of the economy—the extent to which each sector is able to achieve full employment. A more general definition offered by Moore et al. (2024) presents the skill gap as an under-supply of demanded skills. Additionally, researchers view the skill gap in the context of technical skills (Jobs for the Future, 2015; Mikalef & Krogstie, 2019) and/or transferable skills (Ramanathan, 2017; Wynekoop & Nakatani, 2024). Studies looking at the skill gap in the context of technical skills more commonly define it in macro-level terms of the economy. Those looking at transferable skills more commonly define the skill gap in terms of employer expectations. In this

paper, we understand the skill gap as the employers' expectations of students' skill development upon graduation.

In surveys of employers and recruiters, communication is cited as the most important career competency (Job Outlook 2023, 2022; Williams, 1999), followed by critical thinking. Employers note both competencies as areas in which graduates are below the desired proficiency level. Other commonly noted transferable skills include teamwork, integrity, and problem solving. Students have also recognized the importance of soft skill development to their careers but placed little emphasis on these skills as an opportunity for personal development (Williams, 1999). Student perceptions further indicate that they did not receive formal instruction in developing transferable skills (Kemp & Seagraves, 1995). Unlike employers, students generally had high levels of confidence in their transferable skills (Stewart et al., 2016). This disconnect potentially contributes to the challenge of introducing curricula that foster transferable skill development at the university level.

Transferable Skill Development in Higher Education

Despite increased interest by students in pre-professional majors with a curriculum based on technical skill development (Van Sloun, 2022), employers still highly value transferable skills when making hiring considerations (Finley, 2021; Robles, 2012). This continued emphasis on transferable skills is due to the ongoing importance for employee development, as evolving technology can quickly lead to outdated hard skills (Deepa & Seth, 2013).

The role of universities in supporting employers' job training has shifted from the 1990s, when Bishop (1994) noted that job training costs were not fully recouped by the employer, necessitating shared costs with employees or with universities. The 2000s saw a decline in employer-sponsored training (Waddoups, 2016), which coincided with universities shifting to more industry-relevant degrees (Lyons & Hill, 2020). In particular, employers find it challenging to justify the cost of transferable skills training, given the difficulties in defining and measuring these skills (Georges, 1996; Redford, 2007). Thus, the shared costs of the 1990s approach seem to have become imbalanced, and now universities are more responsible for imparting domain knowledge and transferable skills (Cheng et al., 2021; Humphreys et al., 2001). Despite universities taking on this role, the skill gap persists, signaling that universities may struggle to help students develop transferable skills.

Frameworks have been designed to assist universities in integrating transferable skill development into their curricula (Bennett et al., 1999; Olesen et al., 2021). The Quality Assurance Commons (2022) developed a framework termed the "eight Essential Employability Qualities" (EEQs) that includes effective communication, teamwork, critical analysis, problem solving, learning & adaptability, professionalism & responsibility, motivation & initiative, and digital literacy as guiding areas for cross-disciplinary

skill development. Another example of a structuring framework is the American Association of Colleges and Universities' VALUE rubrics (Association of American Colleges and Universities, 2009), which focus on 16 different areas, including civic engagement, quantitative literacy, creative thinking, critical thinking, problem-solving, teamwork, oral communication, and written communication. Despite these frameworks' existence for curriculum improvement, implementation remains challenging due to the lack of a cohesive definition, as well as student and faculty perceptions of transferable skill development (Chan et al., 2017) and faculty implementation capacity (Hora & Lee, 2024).

Transferable skill development in higher education may partially depend on teaching pedagogy. For example, detailed feedback in the context of constructivist skill-based learning activities can promote transferable skill development (Alt et al., 2023). Still, certain fields of study may be more successful in integrating certain types of transferable skills into their curriculum than others. Further complicating the implementation and assessment, cocurricular activities occurring outside the classroom have also been shown to be spaces where students can participate in transferable skill development (Collins-Nelsen et al., 2022). In the following section, we review research on creative skills, problem-solving skills, writing skills, and oral communication skills development in college students.

Creative Skills

While creative skills development is often assumed to be the purview of arts-based majors, research shows that the ability to develop creativity can reside in the curriculum, not specific to any field of study. Hulme et al. (2014) noted that universities tend to ascribe teaching creativity to fine arts or entrepreneurship programs which have a clear connection to creativity rather than infusing the curriculum across their degree programs and into the campus culture. Indeed, research suggests that art majors have high levels of confidence in their creative skills compared to other majors (Miller, 2018b; Miller & Smith, 2017; Silvia & Nusbaum, 2012). Other studies have shown that creativity development depends on the skill of the faculty in developing a teaching environment that fosters creativity (De Souza Fleith, 2000), as well as student interactions with faculty and the extent to which they feel freedom and encouragement to take risks (Chambers, 1973; Miller, 2018a; Miller & Dumford, n.d.; Wodtke & Wallen, 1965). These studies indicate an opportunity for higher education institutions to empower faculty to integrate creativity development into the curriculum across various disciplines.

Problem-Solving Skills

Much of the research on developing problem-solving skills focuses on engineering majors because there exists a presumed connection between the engineering curriculum and problem-solving skill development (Klegeris et al., 2017; Loji, 2012; Miller et al., 2016; Purington & Nieswandt, 2022). However, Miller et al. (2016) found that art

majors also had a high level of confidence in their problem-solving skills. While art and engineering students may see a direct connection between their coursework and problem-solving skills, Wismath et al. (2014) showed that students who completed a general education course focused on developing problem-solving skills had an increased awareness of how their majors also emphasized problem solving. Similar to creativity, Mahanal et al. (2022) and Fissore et al. (2021) used pedagogical tools to demonstrate how problem-solving skills can be taught across disciplines.

Writing Skills

Sigmar and Hynes (2012) found no significant differences in writing skills across majors but students who are strongest in writing tend to self-select into journalism, communication, and English majors (Daly & Shamo, 1978; Wiltse, 2006). This effect was also noted by Oppenheimer et al. (2017) whose multi-year study showed that students majoring in the humanities and social sciences (defined broadly) had higher writing skills than those in other majors at the beginning of the experiment. This preference indicates that students may believe those majors contain the most opportunities for continuing to develop writing skills. While the previous studies focused on evaluating students' writing, Routon et al. (2021) found that student perceptions of writing skills across majors varied widely, with Business majors least likely to report high writing skills at graduation.

Oral Communication Skills

Oral communication is perhaps one of the most commonly integrated skills into any subject through presentation-based assignments, which have been shown to increase students' oral communication skills (Nadeem & Rahman, 2013). Schmidt-Wilk (2021) provides several different exercises that can be integrated into the classroom to help train management students in a variety of oral communication competencies and notes how vital these are when students begin their careers. Overall, the literature indicates a clear need for integrating oral communication skill development into the undergraduate curriculum (Amalraj, 2010; Maclean, 1994; Murphy, 1991) but few studies show if certain majors are more successful than others. It should be noted that merely including oral communication skill development is not necessarily enough, as students may still be performing lower than hoped on scales that measure their oral communication skill development (Dunbar et al., 2006). A review of the literature by Morreale et al. (2011) indicated that studies concerning the assessment of students' oral communication skills had been declining since around 2005, indicating a potential shift in focus in the field despite its continued importance.

In this review we discussed the shift, which has increasingly tasked universities with fostering transferable skills, such as critical thinking, communication, and leadership, viewed as essential for employability and adaptability in a rapidly evolving workforce (Sinche et al., 2017). Although universities have taken on this task, a persistent skills gap exists where employers' expectations exceed graduates' proficiency (Job Outlook,

2023), even though students may overestimate their own confidence and skills in these areas (Stewart et al., 2016). While frameworks like the eight EEQs (Quality Assurance Commons, 2022) exist to guide curricula, research suggests that effective skill acquisition relies less on a specific major and more on effective cross-disciplinary and faculty encouragement (Alt et al., 2023; Hulme et al., 2014; Miller et al., 2016). This article contributes to the literature by presenting a contemporary accounting of the relationship between three transferable skills—creativity, problem solving, and writing—and students' major, recognizing that while pedagogical practices can vary across majors, academic disciplines internal cultures may favor some pedagogical approaches over others which can lead to uneven skill development for students.

Theoretical Framework

In the above literature review, we explored the perceived skills gap between employer expectations and students' skill development, as well as evidence that pedagogical practices are key determinants of some transferable skill development in classroom settings. To frame this study, we draw on Becher and Trowler's (2001) Academic Tribes and Territories, which theorizes that academic disciplines function as cultural communities that shape both epistemological values and pedagogical choices. Their original framework argues that disciplines differ in their knowledge structures and cultural norms, which influence how knowledge is produced, taught, and valued.

Neumann (2001) extended this framework by linking disciplinary culture more directly to pedagogical differences, suggesting that these cultural patterns lead to the prioritization of different types of transferable skills. However, subsequent critiques noted that Becher and Trowler's (2001) depiction risked essentializing disciplinary identities—treating them as too fixed or universal. In response, Trowler (2014) reconceptualized disciplinary culture through the lens of moderate essentialism. This updated perspective recognizes that disciplines are shaped not only by internal academic traditions but also by external pressures such as market demands, policy changes, and institutional context. While disciplinary cultures are now viewed as more fluid and contested, they still maintain distinct identities and practices.

Applied to the present study, this theoretical framework helps explain how transferable skill development may differ across academic majors—not because disciplines cause these differences, but because they tend to organize and encourage different kinds of pedagogical practices and knowledge engagements. As Trowler (2014) notes, the framework offers a useful lens for "pick[ing] out the factors at play in one site and [. . .] offer[ing] conceptual clarity about the kinds of factors that are significant" (p. 1729). This study uses that lens to examine how disciplinary cultures—even amid overlapping pedagogical methods—may influence the development of students' transferable skills in distinct ways.

Research Questions

Given the importance of transferable skill development for postsecondary students, this study attempts to explore areas of strengths and weaknesses for various majors using a larger model including student identity-based background information and institutional characteristics, across three selected dimensions of transferable skills. This study is guided by the following research questions:

1. Is major field significantly related to engagement in speaking and complex discussions, creativity and problem solving, and complex writing for seniors, even after statistically controlling for student identities and institutional characteristics?
2. If so, which majors show the strongest relationships and what are the directions (positive or negative) of the results?

Methods

Data Source

This study uses data from the 2022 administration of the National Survey of Student Engagement (NSSE). NSSE is an annual survey administered to first-year and senior students at four-year colleges and universities across the country to assess exposure to and participation in effective educational practices (for the full survey instrument, see www.nsse.indiana.edu). NSSE data collection occurs annually during the spring semester, so depending on each institution's academic calendar, this may range from February to May. Students received an email contact with their invitation to participate in NSSE. All first-year and senior students at each of the participating institutions received this email invitation, which included a unique link to the survey instrument. All surveys were administered online, during untimed sessions, so students could take as much time as needed to respond to the items. Per Institutional Review Board regulations, students received a maximum of five email contacts.

Participating institutions can also add up to two Topical Modules (shorter sets of items on areas of specific interest) as part of their administration. A subsample of institutions appended the "Development of Transferable Skills" (TRN) Topical Module to the end of their core survey. We examined responses from 5,823 seniors attending 33 baccalaureate-granting institutions who received both the core survey and the TRN module. Approximately 70% of the students identified as women, 72% were enrolled full-time, and 58% were less than 25 years old. About 50% of respondents were White, 9% Asian/Pacific-Islander, 12% African American/Black, 14% Hispanic/Latino, 10% multiracial, and 5% identified with another racial/ethnic group (e.g., Native American, "Another race/ethnicity" category) or preferred not to respond. Respondents self-reported their academic major(s), which were then collapsed into fields: Arts & Humanities (7%); Biological Sciences, Agriculture, & Natural Resources (9%);

Physical Sciences, Mathematics, & Computer Science (5%); Social Sciences (10%); Business (14%); Communications, Media, & Public Relations (3%); Education (7%); Engineering (6%); Health Professions (29%); Social Service Professions (4%); All Other (5%); and Undecided/undeclared (< 1%). Although the distribution across fields is not necessarily equal, this recoding of majors paralleled the standard major field groupings used by NSSE staff for reporting.

Respondents also represented a variety of institutional types with 30% of institutions as public and 70% as private. For enrollment size, 55% of institutions had under 2,500 students, 30% were in the 2,500–4,999 range, and 15% had more than 5,000 students. For Carnegie classification, 24% were Doctoral universities, 36% were Master's colleges and universities, and 33% were Baccalaureate colleges. These characteristics are fairly consistent with the overall patterns for NSSE respondents (NSSE, 2022), although smaller private institutions, women, and health professions majors were somewhat overrepresented. The average institutional response rate was 28%.

Measures

The TRN module is a 19-item set asking about the frequency of participation in a variety of activities that indicate use of selected transferable skills. It is not meant to be a comprehensive assessment of all possible transferable skills, but a short set of items to complement the core NSSE engagement constructs. All items in the TRN module use the stem "During the current school year, whether course-related or not, about how often have you done the following?" with response options on a 4-point Likert-type scale ranging from *Never* to *Very often*.

Exploratory and confirmatory factor analysis was used to derive three subscales from the TRN module items. The data was randomly divided into two halves, and exploratory factor analysis (using Maximum Likelihood Estimation with orthogonal rotation) suggested that 12 of the 19 items loaded on three factors. Using the other half of the sample, follow-up confirmatory factor analysis showed good model fit for this three-factor solution. Model fit indices and item loadings are detailed in Tables 1 and 2. The subscales consisted of four items each and were named (a) Speaking & Complex Discussions, (b) Creativity & Problem Solving, and (c) Complex Writing.

Once the evidence for construct validity was sufficient, scores for the three subscales were calculated. To maintain consistency with other established NSSE measures, the subscales were calculated to mirror the NSSE engagement indicators. Each indicator is on a 60-point scale, calculated by scoring responses from each component question from 0 to 60, then taking the average (see https://nsse.indiana.edu/nsse/survey-instruments/engagement-indicators.html for details). The scales show good internal consistency, i.e., Speaking & Complex Discussions Cronbach α = .768; Creativity & Problem Solving Cronbach α = .896; Complex Writing Cronbach α = .896.

The main survey instrument also collects student identity and other background information from respondents, which is then combined with institution-provided data as

Table 1. Model-Fit Results for Confirmatory Factor Analyses

	N	GFI	CFI	TLI	RMSEA (C.I.)	PCLOSE	χ^2 (df)
Transferable Skills	5,693	.979	.983	.976	.051 (.048, .054)	.301	742.557 (47)

Note. GFI = Goodness-of-Fit Index; CFI = Comparative Fit Index; TLI = Tucker-Lewis Index; RMSEA = root mean square error of approximation; C.I. = confidence interval; PCLOSE = *p* of close fit. Strong model fit is reflected by GFI and CFI greater than .90, TLI greater than .95, RMSEA less than .06, and PCLOSE greater than .05.

Table 2. Item Loadings for Transferable Skills Scales

During the current school year, whether course-related or not, about how often have you done the following?	**Std. Regression Weight**
Speaking & Complex Discussions (Cronbach's α = .768)	
Discussed or debated an issue of social, political, or philosophical importance	.577
Made a speech to a group	.573
Worked in a group with people who differed from you in terms of background, political orientation, points of view, etc.	.705
Discussed the ethical consequences of a course of action	.773
Creativity & Problem Solving (Cronbach's α = .896)	
Discussed complex problems with others to develop a better solution	.869
Generated multiple solutions to a problem or task	.885
Combined dissimilar concepts to create a novel idea	.738
Adapted a previously used solution to a new situation	.770
Complex Writing (Cronbach's α = .896)	
Written something (paper, report, article, etc.) that used information from a variety of sources (books, journals, Internet, databases, etc.)	.726
Written something (paper, report, article, etc.) that assessed the conclusions of a published work	.802
Written something (paper, report, article, etc.) that included ideas from more than one academic discipline	.874
Written something (paper, report, article, etc.) that presented multiple viewpoints or perspectives	.872

Note. Subscales were allowed to correlate in the model. Modification indices were applied only to error terms.

well as publicly available institution-level data, such as institution control (public vs. private), Carnegie classification, and institutional enrollment size. Students are asked to self-report their major(s) from a drop-down autofill list, and are then coded into 138 categories, which are then further collapsed into 10 major field categories (listed in Table 3), along with "Other" and "Undecided" (see https://nsse.indiana.edu/nsse/reports-data/sample-report/major_field_categories.html for details). Because several other student identities and institutional characteristics have been shown to impact college student development (Mayhew & Simonoff, 2015; McCormick et al., 2013), they were included in the analyses as control variables (see Table 3).

Table 3. Description of Variables

Variable	Description/Response options
Sexual orientation [a]	Straight (heterosexual); Bisexual; Gay; Lesbian; Queer; Questioning or unsure; Another sexual orientation; I prefer not to respond
Major field [a]	Arts & Humanities; Biological Sciences, Agriculture, & Natural Resources; Physical Sciences, Mathematics, & Computer Science; Social Sciences; Business; Communications, Media, & Public Relations; Education; Engineering; Health Professions; Social Service Professions; Other Majors; Undecided/Undeclared
Educational aspiration [a]	Some college/university but less than a bachelor's degree; Bachelor's degree (B.A., B.S., etc.); Master's degree (M.A., M.S., etc.); Doctoral or professional degree (Ph.D., J.D., M.D., etc.)
Race or ethnicity [a]	American Indian or Alaska Native; Asian, Black or African American; Hispanic or Latina/o; Middle Eastern or North African; Native Hawaiian or Other Pacific Islander; White; Another race or ethnicity; Two or more race/ethnicities; I prefer not to respond
Gender identity [a]	Man; Woman; Another gender identity; I prefer not to respond
Disability status [a]	No; Yes; I prefer not to respond
Course format [a]	Mostly in-person courses; Mostly remote courses (online, web-based, Zoom, etc.); Mostly hybrid or blended courses that combine in-person and remote instruction; A balanced mix of the above course types

(*continued*)

Table 3. Description of Variables (*continued*)

Variable	Description/Response options
Transfer status	0 = Started at current institution; 1 = Transfer student
First-generation status	0 = At least one parent earned a bachelors degree; 1 = Neither parent earned a bachelors degree
Traditional age	0 = Not traditional age; 1 = Traditional age (> 15; <21 for FY, <25 for SR)
International student	0 = No; 1 = Yes
Greek status	0 = No; 1 = Yes
Athlete status	0 = No; 1 = Yes
Living on campus	0 = No; 1 = Yes
Enrollment status	0 = Part-time; 1 = Full-time
Self-reported GPA (estimated) [b]	Continuous variable ranging from 1.67 to 4.00
Enrollment size [b]	Continuous variable for the total number of enrolled undergraduate students at institution
Control	0 = Public; 1 = Private
Carnegie classification [a]	Doctoral; Masters; Baccalaureate; Other Carnegie classification
Speaking & Complex Discussions [b]	Continuous variable ranging from 0 to 60
Creativity & Problem Solving [b]	Continuous variable ranging from 0 to 60
Complex Writing [b]	Continuous variable ranging from 0 to 60

[a] Coded as multiple dichotomous variables (0 = not in group; 1 = in group); [b] z-score used in regression analysis

Analyses

Ordinary Least Squares (OLS) regression analyses were used to explore the relationship between student identities and institutional characteristics, major field, and transferable skills. OLS regression analyses were chosen based on the student-level and univariate focus of the research questions, the ordinal nature of the dependent variables, the number and type of control variables, the utility of the coefficient interpretation, and the appropriateness of this method for testing theory with real-world data collected outside of manipulated laboratory settings (Aldrich, 2019; Field, 2009; Huang, 2020; Rocconi, 2013; Tabachnick & Fidell, 2001). The variables were entered into the model in two blocks to estimate the unique effect of each block. The student identity and institutional variables were first introduced as independent variables (sexual orientation, educational aspiration, race/ethnicity, gender identity, disability status, course format, transfer status, first-generation, age, international, Greek affiliation, athlete status, on campus living, enrollment status, GPA, institutional size, control, and Carnegie classification). In the second step, the 12 major field categories were added. Three

models were conducted with (a) Speaking & Complex Discussions, (b) Creativity & Problem Solving, and (c) Complex Writing as the outcome variables. Listwise deletion was used for missing data. No imputations for missing data were used, as only 2.1% of data from the three TRN subscales was missing (Little & Rubin, 2019). For categorical independent variables, effect coding was used, meaning each group was compared to the average responses rather than an arbitrary reference group (Mayhew & Simonoff, 2015). The ICC values for each of the three subscales (.02–.04) suggest most variation in skill development occurs within institutions, justifying data aggregation (LeBreton & Senter, 2008). This is also consistent with previous NSSE findings demonstrating there is generally more variance within any given institution than between institutions (NSSE, 2008).

Results

In general, the second block of the OLS models, which included major field, made a statistically significant contribution to explaining model variance (1.2% for Speaking & Complex Discussions, .5% for Creativity & Problem Solving, and 1.9% for Complex Writing; see Table 4). However, this is a relatively small amount of explained variance compared to the first block that includes the student identity and institutional characteristics (9.2%, 3.0%, and 6.1%, respectively).

Although the explained variance from the second block including major field is smaller in magnitude, the statistical significance suggests that further examination of the standardized regression coefficients is warranted (see Table 5). For Speaking & Complex Discussions, the fields of Arts & Humanities (β = .031), Social Sciences (β = .050), Business (β = .034), Communications (β = .038), and Social Service Professions (β = .053) are positive predictors, while Biological Sciences (β = –.038) and Physical Sciences, Mathematics, & Computer Science (β = –.050) are negative predictors. For Creativity & Problem Solving, the field of Engineering (β = .057) is a positive predictor, while Biological Sciences (β = –.040) is a negative predictor. For

Table 4. Model Summary Statistics for OLS Regression Predicting Transferable Skills

	F	df	Sig.	Adjusted R^2	ΔR^2 (Major Field)
Speaking & Complex Discussions	13.439	52, 5569	<.001	.104	.012
Creativity & Problem Solving	4.901	52, 5537	<.001	.035	.005
Complex Writing	10.270	52, 5515	<.001	.080	.019

Table 5. OLS Regression Models Predicting Transferable Skills: Detailed Statistics

	Speaking & Complex Discussions		Creativity & Problem Solving		Complex Writing	
	Std. β Coeff.	Sig.	Std. β Coeff.	Sig.	Std. β Coeff.	Sig.
Step 1: Student Identities & Experiences						
Sexual Orientation:						
Straight	–.037	.084	–.005	.816	–.023	.299
Bisexual	**.084**	<.001	**.048**	.019	.006	.776
Gay	–.013	.632	.022	.430	.035	.197
Lesbian	–.022	.415	–.007	.803	–.010	.703
Queer	.032	.261	.006	.844	.044	.123
Unsure/Questioning	–.051	.095	–.001	.979	–.016	.610
Another	.022	.431	–.019	.518	–.011	.708
Prefer not respond	–.025	.456	**–.067**	.050	**–.070**	.036
Educational Aspirations:						
Less than Bachelors	**–.063**	.001	–.022	.258	–.027	.142
Bachelors	**–.079**	<.001	**–.086**	<.001	**–.100**	<.001
Masters	.023	.150	.005	.750	.007	.650
Doctoral	**.104**	<.001	**.079**	<.001	**.094**	<.001
Race:						
Native American	**.093**	.014	–.009	.828	–.008	.832
Asian	**–.053**	.015	**–.072**	.002	–.042	.064
Black/African American	–.025	.267	**–.054**	.023	–.032	.173
Hispanic/Latino	–.031	.187	–.048	.057	.003	.896
Middle Eastern/North African	.000	.992	.025	.396	–.040	.159
Hawaiian/Pacific Islander	.003	.963	**.138**	.027	.092	.131
White	–.008	.794	–.048	.130	–.018	.563
Other race/ethnicity	–.032	.312	–.031	.339	–.011	.736
Multiracial	–.009	.692	–.034	.151	–.011	.615
Prefer not respond	–.004	.773	–.010	.544	.009	.582

(*continued*)

Table 5. OLS Regression Models Predicting Transferable Skills: Detailed Statistics (*continued*)

	Speaking & Complex Discussions		Creativity & Problem Solving		Complex Writing	
	Std. β Coeff.	Sig.	Std. β Coeff.	Sig.	Std. β Coeff.	Sig.
Step 1: Student Identities & Experiences						
Gender:						
Man	**.053**	.016	**.054**	.020	.035	.125
Woman	.024	.281	.027	.236	**.093**	<.001
Another identity	.002	.901	–.004	.833	–.022	.193
Prefer not respond	**–.082**	.037	–.070	.089	–.063	.116
Disability:						
No	–.001	.930	.007	.603	.007	.636
Yes	**.029**	.027	.005	.695	.002	.854
Prefer not respond	–.034	.130	–.014	.554	–.010	.678
Course type:						
Mostly in-person	**.037**	.027	.006	.744	**–.038**	.025
Mostly remote	**–.062**	.001	**–.044**	.022	**.067**	<.001
Mostly hybrid	.005	.760	.022	.192	–.022	.177
Balanced mix	.023	.262	.010	.629	–.002	.910
Transfer student	.007	.681	.006	.707	–.001	.951
First-generation student	.003	.813	.019	.187	.021	.138
Age (under 25)	.021	.260	.030	.125	–.025	.201
International student	.017	.197	.002	.905	.020	.150
Greek	.016	.212	.005	.723	–.006	.633
Athlete	–.015	.264	–.013	.375	–.012	.366
Living on campus	-.003	.845	–.020	.180	–.013	.380
Full-time enrollment	**.078**	<.001	**.058**	<.001	**.058**	<.001
GPA estimate	**.080**	<.001	**.065**	<.001	**.075**	<.001
Institutional Characteristics						
Institution size	**–.056**	.031	–.005	.855	–.033	.203
Institution control	**.082**	<.001	**.058**	.009	**.092**	<.001

(*continued*)

Table 5. OLS Regression Models Predicting Transferable Skills: Detailed Statistics (*continued*)

	Speaking & Complex Discussions		Creativity & Problem Solving		Complex Writing	
	Std. β Coeff.	Sig.	Std. β Coeff.	Sig.	Std. β Coeff.	Sig.
Step 1: Student Identities & Experiences						
Carnegie Classification:						
Doctoral	.020	.283	.000	.995	.019	.327
Masters	–.008	.604	–.026	.112	.003	.854
Baccalaureate	–.014	.337	–.004	.780	**.031**	.032
Other Carnegie	.010	.795	.035	.358	–.069	.062
Step 2						
Major Field						
Arts & Humanities	**.031**	.041	.017	.285	.011	.477
Biological Sciences	**–.038**	.020	**–.040**	.021	.009	.605
Physical Sciences	**–.050**	.001	–.009	.567	**–.075**	<.001
Social Science	**.050**	.002	.017	.308	**.070**	<.001
Business	**.034**	.048	.027	.134	–.022	.214
Communications	**.038**	.004	.016	.256	.014	.320
Education	–.002	.883	.003	.825	–.020	.203
Engineering	–.008	.579	**.057**	<.001	**–.071**	<.001
Health Professions	–.001	.970	.030	.182	**.052**	.019
Social Service Professions	**.053**	<.001	.015	.288	.027	.055
Other	–.004	.784	.000	.998	–.012	.407
Undecided	–.116	.251	–.131	.210	.050	.626

Note. Effect coding was used for categorical variables. Significant coefficients are bolded.

Complex Writing, the fields of Social Sciences (β = .070) and Health Professions (β = .052) are positive predictors, while Physical Sciences, Mathematics, & Computer Science (β = –.075) and Engineering (β = –.071) are negative predictors. In terms of relative magnitude, these coefficients for major field are either similar or slightly smaller than the significant coefficients for the demographic and institutional characteristics from the first block of predictor variables. However, in general all of the coefficients (even the statistically significant ones) were small, which is commonly seen in this type of social science and educational research (Rocconi & Gonyea, 2018).

Although it is beyond the scope of this study to interpret every control variable in the models, there are a few worth noting here, as they seem to be playing a substantial role in the overall model. For instance, those with doctoral educational aspirations report higher transferable skills in all three areas with relatively strong magnitude (β ranging from .079 to .104), whereas full-time enrollment status (β ranging from .058 to .078), estimated grade-point average (β ranging from .065 to .080), and private institutional control (β ranging from .058 to .092) are also moderately strong positive predictors across all three transferable skills. In terms of other institutional characteristics, Speaking & Complex Discussions decrease as institutional size increases (β = –.056) and Complex Writing is higher at Baccalaureate institutions (β = .031). There are some contrasting patterns for gender identity, where men are higher for Speaking & Complex Discussions (β = .053) and Creativity & Problem Solving (β = .054), while women are higher for Complex Writing (β = .093). There are also diverging patterns for course format, with students taking most of their courses in person reporting higher levels of Speaking & Complex Discussions (β = .037) and lower levels of Complex Writing (β = –.038), whereas students taking most of their courses remotely reported lower levels of Speaking & Complex Discussions (β = –.062) and Creativity & Problem Solving (β = –.044) but higher levels for Complex Writing (β = .067).

Discussion

Taken together, the findings from this study suggest that there are several statistically significant differences in transferable skill development for seniors across major fields, albeit small to moderate in magnitude. These differences were apparent even after controlling for other relevant identity-based and institutional characteristics. Many of these findings make sense given the current practices and needs of many of the disciplines. Certain majors are likely to be more successful in integrating activities and assignments that promote these skills within their curricula. For instance, writing may be less of a focus in STEM fields in order to concentrate on lab work; those majoring in communications may have heightened expectations for verbal discourse (or the field may attract students who enjoy this more in the first place). However, one interesting pattern to note is that an Engineering major is a positive predictor when it comes to Creativity & Problem Solving, yet negative when it comes to Complex Writing. In the literature, problem solving is generally ascribed to engineering majors (Klegeris et al., 2017; Loji, 2012; Purington & Nieswandt, 2022), whereas creativity is more commonly ascribed to students studying the arts (Hulme et al., 2014; Miller, 2018b).

These results potentially align with the research showing that pedagogical practices can influence skill development across different fields of study, and that transdisciplinary learning initiatives can increase complex thinking skills (Amelink et al., 2024). These results also align with Trowler's (2014) update to their Academic Tribes and Territories framework that indicates potential crossover across academic disciplines. However, the potential siloing of skill development across majors may have a negative

impact on students' employment outlook. The 2025 Job Outlook Survey by the National Association of Colleges and Employers (NACE; Gatta, 2025) indicated that employers particularly prioritize problem-solving and writing skills (88.3% and 77.1% of employers respectively seek representation of these skills on resumes) and just 23% of employers hire solely from industry-aligned majors. The NACE findings indicate that all graduates would benefit from developing a variety of transferable skills and this study suggests all disciplines may have more work to do in providing more balanced skill development in students. More research is needed to further understand the unique strengths and weaknesses of the curriculum and pedagogy for transferable skill development in this discipline.

While not part of the primary research question, a few other noteworthy findings emerged from a closer look at the coefficients for the control variables. Many of these findings make sense given the realities of the higher education experience. Students with higher educational aspirations for the future, and higher GPAs in the present, were higher for skill development across all three areas. This indicates that students who do well in school and value education overall may have an easier time developing transferable skills in general, and vice versa, although continued research is needed to fully appreciate this relationship. The findings related to institutional characteristics like control, size, and Carnegie classification are also somewhat intuitive. The smaller classes and student-faculty ratios at institutions with lower enrollment sizes and Baccalaureate classifications mean that students have more opportunities to speak in class discussions and give course presentations, and furthermore faculty can assign more writing because their volume of grading (per student) is lower.

The differences for course format also make sense given the constraints of the online course format, which necessitates more communication in writing (discussion boards, chats, etc.) but can prevent spoken conversational interactions. Institutions should continue in their efforts to adapt technology use for online classrooms. It will be interesting to explore whether these patterns change as higher education continues its post-pandemic evolution, keeping some aspects of online courses even as students return to in-person settings. A final area of note is related to gender identity and how these findings somewhat aligned with gender stereotypes, with women reporting higher levels of writing and men higher levels of speaking and creativity. How might institutions and faculty encourage women to increase their speaking skills and men to increase their writing skills, rather than perpetuate existing social norms that are not particularly beneficial for students of any gender? Previous research indicates some base-level differences in transferable skill development for gender (Abraham, 2016; Álvarez-Huerta et al., 2023) but this pattern of results needs more detailed examination in future studies to determine potential reasons, implications, and interventions.

Despite the more pessimistic interpretation that certain majors or other subgroups are at a disadvantage, another implication of researching transferable skills might extend to experiences beyond the classroom. Institutions may still be able to support the development of these highly desired skills through other means. They might explore ways

to incorporate these skills into other departmental or university-wide programming and activities, such as major-associated and pre-professional clubs, affinity groups and organizations, residence life, or work-study responsibilities. For instance, the pre-med club or an affinity group organization (such as Hillel or the Black Student Association) might offer a "Creativity Night" where students learn different problem-solving techniques or engage in fun creative exercises. Residence halls could host events that feature discussions of current news or pop culture events with student panelists sharing their views. Incorporating transferable skills into other student experiences through a more general lens can move beyond the classroom. Acquiring these valuable skills will not only please prospective employers but also provide students a better return-on-investment for their degree. This approach would align with research suggesting that students have a multi-faceted view of success that extends beyond blunt measures of academic (i.e., GPA) and career (i.e., income) achievements (Lipstein et al., 2023; Sundararaman et al., 2025).

Limitations

Although there are many informative aspects of this study, there are some limitations to note. Even though the sample includes a wide range of students attending multiple institutions, it may not be representative of all students at all universities. Although they generally mirror the national picture of U.S. higher education (NSSE, 2022), given the data source, there is some inherent self-selection since institutions choose to participate in NSSE, and the students at those institutions choose to respond to the survey invitation. Furthermore, students also choose their majors, with many elements contributing to that choice (Gillis & Ryberg, 2021) that were not measured in this study. The lower response rate could also be a potential source of bias in the sample, although previous research suggests that studies with lower response rates can still maintain adequate response representativeness (Fosnacht et al., 2017).

Because this study used existing data that was originally collected for other purposes, not all measures are in exact alignment with the constructs of interest. Not all transferable skills that have been cited in the literature were addressed in the item set, so only three subscales emerged from the factor analysis. Furthermore, frequency of use is not necessarily the same as demonstrated competency of the skill, so this is a proxy based on the assumption that there is overlap. Also, this study relied on self-reported information, which may not be completely objective. However, most studies looking at student self-reports in higher education suggest that student engagement, self-reported learning, and actual abilities and characteristics are positively related (Anaya, 1999; Hayek et al., 2002; Pike, 1995; Zilvinskis et al., 2017). The major field categorization is also rather broad, and certainly there are some differences in curriculum across institutions and faculty, the nuance of which is lost in this study's choice to group majors for more simplicity of interpretation.

Given the research design, this study was unable to test for causal relationships between major field and transferable skills. Despite the use of regression terms such

as "predictor" and "outcome," the results can only confirm whether they are associated. Additionally, there were relatively low standardized coefficients and percentages of explained variance for the models, which suggest that there are many other factors not included in the analyses influencing the variables of interest. In large samples, statistical significance should always be interpreted in conjunction with effect sizes (Courville & Thompson, 2001), and in this study many of these beta coefficients were small to moderate. This is often the case with social science and educational research (Rocconi & Gonyea, 2018). While the results should be interpreted with caution, the strengths and contributions of this study outweigh the limitations.

Conclusions & Future Research

This study adds to the research addressing the development of transferable skills in undergraduates. Our findings suggest that some majors are positive predictors, while others are negative predictors, even when accounting for other student identities and institutional characteristics. However, this depends on the type of transferable skill under investigation. Some majors may be at an advantage when it comes to one type of skill, but at a disadvantage for another type. These findings can help guide faculty, staff, and administrators in encouraging transferable skills both inside and outside the classroom, knowing that certain curricula may lend themselves to certain types of skills but also that other campus programs and activities can be designed to supplement skill development across majors.

Future research should continue to explore several of these findings in more detail. It may be of interest to look at trends over time, as institutions may have revised their curricular and course format offerings during the pandemic and continue to adapt to more flexible models of course content delivery. It may also be auspicious to investigate student experiences in other areas such as student organization meetings or work-study programs, and how these relate to transferable skill development. As there may be other influencing factors not measured in this study, such as personality traits, affect, or motivation, continuing to gather data on additional relevant constructs would also inform our understanding of transferable skills. Furthermore, it may be beneficial to dig deeper into the findings on differences for transferable skills across subgroups (such as gender identity), explore case studies of high-performing institutions, or use alternative data sources (such as performance rubrics or employer evaluations).

Declarations

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Data availability: The NSSE data set is proprietary and not currently available for free public use. Syntax for all analyses included in this paper are available from the authors upon request.

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Ethics approval and consent to participate: The data collection and analysis adhere to all human subject guidelines, as specified by the Indiana University Institutional Review Board (Protocol # 709000079), as well as with the Institutional Review Boards of all institutions participating in the study. Participation in the survey was voluntary, and Informed Consent was obtained from all participants in this study.

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