EFFECT OF STUDENTS' ETHNIC AND CULTURAL BACKGROUNDS ON THE SUCCESS OF PRACTICAL PROJECTS WITHIN STATISTICS AND DATA SCIENCE COURSES

ANNA KHALEMSKY
Hadassah Academic college
anaha@edu.hac.ac.il

YELENA STUKALIN
The Academic college of Tel-Aviv-Yaffo
elena@mta.ac.il

ABSTRACT

The article describes the inclusive perspective of instruction of multi-stage practical projects in undergraduate non-STEM statistics and data mining courses at an academic college in Israel. The student population is highly diverse, comprising individuals from various cultural and ethnic groups. The study examines the impact of diversity on students' choices of project topics, database selection, methodological choice, research question formulation, and results interpretation. The research findings can contribute to educators and institutions striving to develop inclusive and effective teaching approaches in multicultural learning environments. Using a cluster analysis, we identified five groups of students, each exhibiting unique characteristics and varied perceptions of the learning process. These findings highlight the importance of tailored approaches.

Keywords: *Statistics education research; Statistics and data-science education; Multicultural learning environment; Project-based learning*

1. INTRODUCTION

The traditional higher education system is often lecturer-centered, where the lecturer plays a dominant role in imparting knowledge and making decisions at both macro (overall curriculum design) and micro (day-to-day classroom activities) levels. Over the last several years, the lecturer's role transformed from a "one-man show" to a "mentor and instructor" model (Dole et al., 2015). Student-centered learning approaches are now common, where the lecturer takes on the role of a facilitator of the learning environment rather than a sole knowledge provider (Dole et al., 2015). Lecturers are responsible for creating a safe, engaging, and productive atmosphere where students can learn and thrive. Lecturers in these approaches share with students the responsibility for generating ideas and content to study. Students are encouraged to take an active role in their learning process, engaging in problem-solving, critical thinking, and collaborative activities (Sormunen et al., 2020). As classrooms become more diverse, greater consideration of the alignment among students is also necessary (Dole et al., 2015). In recent years, there has been a growing emphasis on incorporating interactive and student-centered pedagogies in education to better meet the needs of diverse learners and prepare them for a rapidly changing world (Cetinkaya-Rundel et al., 2022). Various teaching methodologies, such as project-based learning, flipped classrooms, and personalized learning, have gained popularity as they align with the principles of interactive dynamic learning (Holmes & Hwang, 2016). These approaches aim to foster curiosity, creativity, and independent thinking while acknowledging the importance of individual differences among students.

Cultural and ethnic differences add multidimensionality to these student-centered approaches among higher education authorities, influencing teaching and learning approaches (Dogucu et al., 2023). Teaching approaches must adapt to accommodate varied learning styles, backgrounds, and experiences, fostering an inclusive environment. By embracing diversity, lecturers can create a dynamic space where every student's uniqueness is valued, enhancing the learning process and preparing students

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for their future studies and careers. Students' self-efficacy is another parameter in this multidimensional scheme (Luszczynska et al., 2005). This concept is highly valuable across various fields within the behavioral sciences, particularly in its application to math education. It mainly relates to the student's belief in his own personal abilities (Roick et al., 2018)

The ethnic and cultural characteristics of students go beyond language proficiency and can significantly influence various aspects of learning, studying, and group interactions (Freund, 2021). Different cultures may have distinct preferences for learning styles. Some students might thrive in collaborative group settings, while others may prefer individual study. Recognizing and accommodating these diverse learning styles can enhance student engagement and understanding. Alternatively, cultural backgrounds can influence how students communicate and participate in classroom discussions (Sormunen et al., 2020). Some cultures may value direct and assertive communication between students and lecturers, making students feel more comfortable asking questions or expressing personal opinions during the lecture and in front of other students. In contrast, other cultures may emphasize indirect approaches, such as e-mail correspondence, and sometimes only as a reply to a personalized message from the lecturer. Lecturers need to be aware of these variations to foster inclusive and respectful communication in the classroom (Sisto, 2009). Cultural norms can additionally impact how students approach decision-making in group settings. Some cultures may prioritize reaching a consensus, while others may emphasize hierarchical decision-making. Alternatively, some cultures emphasize individual accomplishment, while others may prioritize collective success (Foote & Gau Bartell, 2011). Cultural attitudes toward time and punctuality can impact students' behaviors in the classroom (Carstensen et al., 1999). For example, in cultures where punctuality and adherence to schedules are emphasized, students are likely to prioritize arriving on time and adhering strictly to deadlines. This could result in students feeling anxious or stressed if they are unexpectedly delayed or if classroom activities start late (White et al., 2011).

These cultural differences can impact group dynamics and productivity. Personal backgrounds can influence the way students interact with their peers and instructors (Sisto, 2009). Creating a supportive and inclusive classroom environment can help students feel comfortable expressing themselves. The attitudes toward authority figures, such as lecturers, may impact students' willingness to engage in discussions, ask questions, or challenge ideas (Foote & Gau Bartell, 2011). Building trust and rapport with students can help bridge these gaps. Cultural values and expectations may shape students' definitions of success and their approaches to academic achievement (Erickson, 1987).

As educators and institutions strive for inclusivity and equitable education, it is essential to recognize and respect the cultural diversity within classrooms in statistics and data science courses (Dickens, 2021). Instructors can create a more culturally responsive learning environment by incorporating diverse perspectives in the curriculum, encouraging open dialogue about cultural differences, and adapting instructional strategies to meet the needs of all students effectively (Foote & Gau Bartell, 2011).

In statistics and basic data-science courses for non-STEM undergraduate students, these practices must be connected to professional tools and skills. The increasing availability of data and the growing importance of data analysis have led to a more data-driven approach to teaching these subjects (Lee et al., 2022). Lecturers are expected to incorporate real-world datasets and case studies to help students develop practical data analysis skills (Holmes & Hwang, 2016). With the rise of powerful software and tools for data analysis and visualization, lecturers are also incorporating advanced analytical tools into their courses (Burckhardt et al., 2021). Interpreting results is crucial in statistics and data science; students must effectively express their interpretations based on the obtained outcomes to derive meaningful insights and draw accurate conclusions (Donoghue et al., 2021). Project-based learning is therefore becoming more widespread, where students work on data-related projects from start to finish, gaining hands-on experience in collecting, cleaning, analyzing, and interpreting data (Donoghue et al., 2021). These project-based learning activities require students to engage in critical thinking, collaborate effectively, and apply theoretical concepts to solve real-world problems, preparing them for data-driven decision-making in their future careers.

2. LITERATURE REVIEW

2.1. THE IMPACT OF CULTURAL AND ETHNIC DIFFERENCES IN QUANTITATIVE COURSES

Language proficiency is essential in quantitative courses for contextual understanding, effective communication with peers and instructors, and the articulation of solutions in written exams and assignments (Byrne et al., 2009). Despite the abstract nature of quantitative courses, language mastery remains crucial for academic success. Students must interpret contexts and problem statements accurately, collaborate, and convey their methodologies effectively (Lai, 2021; Byrne et al., 2009). In addition, ethnic and cultural differences among students affect material perception, peer and lecturer interactions, and motivation levels (Sisto, 2009).

Those differences can have both positive and negative impacts on the learning experience in quantitative courses, such as statistics and data science. The benefits of cultural diversity can be seen in how it enriches learning with a variety of viewpoints, approaches, and strategies in quantitative courses. This enrichment promotes collaboration and discussions among students (Vance, 2021). In addition, varied cultural perspectives inspire creativity and innovation, prompting students to devise novel solutions to quantitative problems. However, diversity may cause several issues. Differences in communication styles and norms may lead to misunderstandings between students and instructors, affecting class participation and effective knowledge transfer (Lesser, 2007). Students from diverse cultural backgrounds might also have experienced different educational systems, resulting in varied levels of preparedness and understanding of quantitative concepts (Lesser, 2007). Finally, cultural factors can influence students' motivation and confidence in quantitative subjects, ultimately impacting their level of engagement and performance (Eagan et al., 2013).

2.2. LEARNING PATTERNS AND CHARACTERISTICS AMONG MUSLIMS AND JEWISH ULTRA-ORTHODOX STUDENTS (HAREDIM)

In recent years, religious and bounded communities have increasingly engaged with modern education while preserving their values and beliefs, reflecting a growing interest in contemporary educational systems and knowledge incorporation (Golan & Fehl, 2020). Bounded communities are ethnic groups that are united by common geographical, religious, and lifestyle characteristics. These groups typically show minimal assimilation into other cultures. Characterizing Muslim and Haredi Jewish education in this context is therefore vital to contextualize this study's findings and make meaningful comparisons.

Cole and Ahmadi (2010) explored the differences among Muslim, Jewish, and Christian students in the US, leading to noteworthy, though occasionally contentious, conclusions. Academic performance, as indicated by GPA, showed no significant differences between Muslim, Jewish, and Christian students. Diversity benefits primarily non-minority students, and inclusion of racial and ethnic minorities enhances educational gains for white students. The influence of religious behavior is often found to be inconsistent across studies, and the presence of religious diversity adds an additional layer of complexity to the campus environment. The complexity arises, in part, from the requirement to provide separate study environments for women and men in ultra-Orthodox Jewish communities. Both young and older individuals are accustomed to studying in a "Torah atmosphere" that emphasizes segregation. While these aspects can influence even the syllabi of certain courses, they are less significant in the context of statistics studies. Cohen (2006) compared the characteristics of Arab and Jewish populations living in Israel and indicated significant differences between them. He found that Arabic people often exhibit higher levels of masculinity, collectivism, and uncertainty avoidance when compared to Jewish people.

Ultra-Orthodox Jews, also known as Haredi Jews, are individuals who adhere to a strict interpretation of Jewish religious law and traditions. They often live in bounded communities and prioritize religious study and observance above secular pursuits. In Yeshivas, Jewish religious schools for boys, scriptural learning occurs in small groups, where students participate in recitation and engage in peer debates. This approach fosters active involvement and critical thinking, leading to a profound comprehension of religious texts and stimulating meaningful discussions among the students (Sered, 2010). Ultra-Orthodox women face different experiences than men entering higher education programs (Novis Deutsch & Rubin, 2019). A cluster analysis revealed five profiles of female Haredi students:

practical, driven, anxious, self-realized and conventional. When comparing secular and Ultra-Orthodox students, Freund found that Ultra-Orthodox students exhibited a significantly higher preference for individual learning, whereas secular students showed a preference for group learning, supervision, or management approaches (2021).

2.3. THE IMPORTANCE OF INCLUSION IN STATISTICS AND DATA SCIENCE COURSES CONDUCTED USING PROJECT-BASED METHODOLOGY

Implementing Project-Based Learning methodologies (PBL) in statistics and data science courses for undergraduate non-STEM multicultural students requires a combination of expertise, patience, sensitivity, and cultural awareness to foster an inclusive and equal learning environment (Sormunen et al., 2020). Incorporating examples, data sets, and case studies that are relevant to students' cultural groups can enhance engagement and help students relate to the subject matter (Han et al., 2016). Creating an inclusive classroom environment requires valuing and respecting all students, and acknowledging their diverse learning styles and abilities. Employing diverse teaching strategies and resources ensures equal opportunities for every student to excel (Holmes & Hwang, 2016). Practical projects can be powerful tools that can create balanced and inclusive learning environments while allowing students to showcase their individual strengths and characteristics (Han et al., 2016). By designing flexible practical projects, students can modify their approaches based on their interests and abilities. Group projects in particular promote collaboration and cross-cultural learning, breaking barriers and fostering camaraderie among diverse students (Vance, 2021). By successfully completing practical projects that can adapt to their interests and strengths, students can gain confidence in their abilities (Von Kotze & Cooper, 2000). In short, inclusion and exclusion are not always mutually exclusive. Bounded ethnic student groups, such as Muslims and Haredim, must adapt to institutional programs while retaining their cultural boundaries. The PBL methodology helps reduce the tension between familiar and unfamiliar study environments.

3. METHODS

3.1. PARTICIPANTS AND PROCEDURE

This study recruited 208 undergraduate students from a community college, with ages between 18 and 45 years (M = 24.5, SD = 5.3). This research encompassed nine classes spanning different disciplines, among which three were focused on data science and the remaining six on statistics. Ultimately, data collection yielded 156 fully completed questionnaires.

There were three study populations who participated: Jewish students who studied at a primary campus, Muslim students who studied at the same campus, and two Haredi campuses (separate for men and women). All of these populations were combined for analysis. No non-Haredi students can study at one of the separate Haredi campuses but Haredi students were allowed to study at the primary campus if they wished to.

Utilizing the online platform Qualtrics (Qualtrics XM: Experience Management Software), participants filled out the survey after being briefed about the research context and providing their consent. The survey included an initial demographic questionnaire, followed by an academic performance self-efficacy scale. Furthermore, a questionnaire comprising ten questions pertaining to practical projects was developed and administered. These questions encompassed aspects ranging from the students' personal involvement in the project to the project itself and its significance.

Demographic questionnaire. Demographic information was collected with questions designed for the current study. Participants were asked to report their age, gender, college year, department (social sciences, paramedical sciences or natural sciences), the number of mathematics units completed in a high school (3-minimal, 4-good, 5-advanced), employment status, course (data mining or statistics), and attention-deficit/hyperactivity disorder (ADHD) diagnosis.

Self-efficacy scale for academic performance. This tool was developed by Zimmerman and colleagues (1992) and is a self-report measure. The full questionnaire is presented in Appendix 2. We used the short Hebrew version, as demonstrated by Niflay (2003). We used two subscales from the original scale for the current study: (1) self-efficacy for learning and (2) self-efficacy for academic achievement. The first subscale had eleven items measuring participants' perceived ability to engage and use self-regulation strategies with tasks in learning. The second subscale had seven items measuring participants' perceived competence to accomplish objectives. Cronbach's alpha coefficient for the original scale was high (α = .84). In this study, Cronbach's alpha coefficient was also high (α = .940).

Practical project questionnaire. This questionnaire was designed in accordance with established PBL pedagogy trends and uniquely targets subgroup disparities. This approach bolsters the questionnaire's validity. The deliberate choice of questions enhances the potential for the questionnaire to provide nuanced insights into the efficacy of PBL in the context of undergraduate non-STEM statistics and data mining courses. We used the Likert scales for each question (with answers between 1 and 10). The distributions of the answers for each cluster are demonstrated in Appendix 1. The questions are provided below.

1) Do you believe that the combination of the practical project that simulates real research enriches the course?
2) Do you feel more engaged when there is a practical project in the course?
3) Do you prefer a more structured data mining course?
4) Do you like the autonomy of choosing your own topic and data?
5) Do you like the autonomy in decision-making in this course?
6) How much do you like teamwork during practical projects?
7) Do you feel free to contact the lecturer for help?
8) Do you feel free to ask other students for help?
9) Are you using external information sources to accomplish learning goals?

3.2. STATISTICAL ANALYSIS

The statistical analysis was conducted using the Statistical Package for the Social Sciences (SPSS), Version 28 (IBM Corporation). All population groups (General campus Jews; General campus Muslims; Haredi campus Jews) were compared using analysis of variance (ANOVA) and multivariate analysis of variance (MANOVA). A principal component analysis (PCA) revealed the relations between variables in the Practical Project Questionnaire. The analysis provided four components explaining 68.49% of the total variance. Questions 3, 6, 8, and 9 were excluded from the subsequent cluster analysis. The criterion for exclusion was the correlation coefficient below .4. The cluster analysis was conducted using Weka software, Version 3.8.6 (Weka - Browse /Weka-3-8-6-Windows-X64 at SourceForge.Net). We used a *k*-means algorithm with standard parameters (Euclidian distance, random initialization method, and percentage split for 66.7% training set and 33.3% test set). The rule for the choice of final number of clusters was set according to the meaningful segmentation of participants.

4. RESULTS

Tables 1 and 2 demonstrate the descriptive statistics for all categorical and numerical variables, as well as hypothesis testing for mean differences among numerical variables. In Table 1 we provide a comparison of relative frequencies across three groups: Jewish students on the main campus, Muslim students on the main campus, and Jewish students on the Haredi campus. We compared variables include gender, the academic year when students enroll in the course, faculty, the level of mathematics studied in high school, employment status during studies, ADHD diagnosis, and the course type (either statistics or data mining).

Table 1. Distribution of categorical variables overall and by subgroup

	General campus Jews *n* = 88		General campus Muslims *n* = 21		Religious campus Jews *n* = 47		Total N = 156	
	n	%	*n*	%	*n*	%	*n*	%
Gender								
Male	19	21.6	3	14.3	5	10.6	27	17.3
Female	69	78.4	18	85.7	42	89.4	129	82.7
College year								
1st	39	44.3	6	28.6	14	29.8	59	37.8
2nd	48	54.5	14	66.7	31	66	93	59.6
3rd	1	1.1	1	4.8	2	4.3	4	2.6
Faculty								
Social sc.	25	28.4	4	19	15	31.9	44	28.2
Natural sc.	22	25	11	52.4	9	19.1	42	26.9
Paramedical	41	46.6	6	28.6	23	48.9	70	44.9
Math units in high school								
3	30	34.1	2	9.5	21	44.7	53	34
4	42	47.7	8	38.1	18	38.3	68	43.6
5	16	18.2	11	52.4	8	17	35	22.4
Employment status								
Yes	69	78.4	12	57.1	25	53.2	106	67.9
No	19	21.6	9	42.9	22	46.8	50	32.1
ADHD status								
Positive diagnosis	21	23.9	2	9.5	4	8.5	27	17.3
None	67	76.1	19	90.5	43	91.5	129	82.7
Course								
Statistics	62	70.5	17	81	32	68.1	111	71.2
Data mining	26	29.5	4	19	15	31.9	45	28.8

Table 2 presents the mean and standard deviation for responses to each of the ten questions related to student experiences in the practical projects. Additionally, the table includes the results of a repeated measures ANOVA conducted separately for each question to compare groups.

Table 2. Follow-up repeated measures within-subject ANOVAs, within-subject MANOVA

Question	General campus Jews *n* = 88		General campus Muslims *n* = 21		Religious campus Jews *n* = 47			
	M	*SD*	*M*	*SD*	*M*	*SD*	*F*	*p*
Do you think that the combination of the practical project that simulates real research enriches the course?	6.0	2.9	6.0	2.6	5.53	2.9	0.5	.617
Do you feel more engaged when there is a practical project in the course?	5.7	3.0	5.8	2.5	5.13	2.92	0.7	.481
Do you prefer a more structured course?	6.7	2.9	6.5	2.4	6.4	3.1	0.2	.782
Do you like the autonomy of choosing your own topic and data?	6.3	3.0	5.0	2.3	6.3	3.2	1.5	.224

Do you like the autonomy in decision-making?	6.3	3.1	5.6	2.2	5.8	3.0	0.8	.460
How much do you like teamwork during practical projects?	7.1	2.9	5.2	2.7	6.9	3.0	3.5	.034*
Do you feel free to contact the lecturer for help?	7.85	2.7	6.4	2.3	7.3	2.9	2.5	.084
Do you feel free to ask other students for help?	7.9_a	2.4	5.6_b	2.8	8.3_a	2.3	9.5**	< .001*
Are you using external information sources for learning goals?	6.0	3.4	6.1	3.1	5.4	3.3	0.5	.596
Do you think that learning materials will be useful for you in the future?	5.3_a	2.9	7.0_b	2.1	4.1_a	2.5	7.7**	< .001*

Note: Groups a, b, and c with similar indices do not differ at 0.05 significance level according to Tukey's test for multiple comparisons. * $p < .05$, ** $p < .01$. Results of the multivariate test indicate an overall statistically significant change in three subgroups for the combination of dependent variables, $\lambda = 0.72$, $F(10, 144) = 2.59$, $p < .001$. Follow-up between subject ANOVA indicated statistically significant effect on two dependent variables. The Bonferroni adjustment was applied to the alpha level of the follow-up ANOVAs to control for family-wise error rate, generating an adjusted significance level of .005 (.05 / 10 = .005)

Table 3 displays the outcomes of a cluster analysis using the k-means algorithm, presenting the centroids of five clusters. Each centroid represents a vector of the average values for the observations within that cluster.

Table 3. Revealing student patterns through cluster analysis: Insights from diversity

	Cluster 1	Cluster 2	Cluster 3	Cluster 4	Cluster 5
No. of cases	44	27	35	35	15
Gender					
Male	12	0	0	3	11
Female	32	27	35	32	4
Age	25.26	21.31	23.37	26.04	26.7
Subgroup					
General campus Jews	26	2	24	24	12
General campus Muslims	4	1	8	6	2
Religious campus Jews	14	24	3	5	1
School year					
1st	0	17	22	19	1
2nd	44	8	12	15	14
3rd	0	2	1	1	0
Faculty					
Social sc.	42	0	0	1	1
Natural sc.	2	4	6	18	12
Paramedical	0	23	29	16	2
Math units in high school					
3	32	13	1	3	4
4	11	6	24	21	6

5	1	8	10	11	5
Employment status					
Yes	40	8	11	35	12
No	4	19	24	0	3
ADHD status					
Positive diagnosis	7	2	5	4	9
None	37	25	30	31	6
Course					
Statistics	0	27	35	35	14
Data mining	44	0	0	0	1
Duration					
Learning hours	2.55	2.99	3.17	3.13	2.87
Practical Project (1-10)					
Q1	7.48	4.11	5.09	6.17	5.33
Q2	7.5	3.67	4.4	5.83	5.33
Q4	6.77	7.04	3.66	6.86	6.47
Q5	6.57	6.41	4.09	6.66	6.93
Q7	7.57	7.44	6	8.867	7.53
Q10	5.34	3.78	4.69	5.97	6.47
Self-efficacy learning (1–7)	4.96	4.94	5.07	5.18	4.77
Self-efficacy achievement (1–7)	5.14	5.45	5.19	5.47	5.32

4.1. CLUSTER ANALYSIS INTERPRETATION

Cluster 1. The first cluster comprised of 44 students; all but 4 participants were Jewish. Of the students in this cluster, 12 were male (46% of all male students participants). All were in their second year, enrolled in the data mining course, and 90.9% worked alongside their studies. They spent the least time on practical projects (average 2.55), but valued them highly (average 7.48) and felt most involved (average 7.5). This suggests they approached education in a mature manner, prioritizing practical learning and remaining actively engaged despite external responsibilities. Their motivation and seriousness about studies made them proactive and hands-on learners.

Cluster 2. The second cluster comprised entirely of 27 female students with an average age of 21.31 years, the youngest among all clusters. Most (88.9%) study at a women's religious campus, and 85.1% pursue paramedical professions, and were currently taking a statistics course. Unlike the first cluster, they valued practical projects less (average 4.11) and were less engaged (average 3.67). However, they showed enthusiasm in topic choice and data analysis (average 7.04). Yet, their awareness of the future potential of acquired knowledge was relatively low (average 3.78). Overall, this cluster appeared youthful and many participants in this cluster seemed keen on the creative aspects of data processing but lacked motivation for practical projects and active involvement. They were yet to fully grasp the value of their learning, suggesting they have more maturing and learning to do.

Cluster 3. The third cluster comprised entirely of 35 female students, with 68.6% of Jewish women studying on the main campus, 22.9% of Muslim women on the main campus, and the rest on a separate religious campus. Most (68.6%) were in their second year and studying statistics. This cluster exhibited lower scores in certain aspects of their educational experience. They had the lowest scores for interest in autonomy of topic choice and analysis (average 3.66) and decision-making autonomy (average 4.09). Additionally, their ability to contact instructors faced challenges, scoring an average of 6. They also seemed uncertain about future knowledge applications, scoring an average of 4.69. Although not as severe as the second cluster, their uncertainty might necessitate additional support to understand the significance of their studies and future career prospects.

Cluster 4. The fourth cluster comprised 35 students, with 91.4% being female with average age of 26.04 years. Most (68.6%) studied on the main campus and 17.1% were Muslims. They were predominantly in the natural sciences or paramedical fields and were currently taking a statistics course. All students worked, but still dedicated an average of 3.13 hours to projects during the week. They felt free to seek help from instructors (average score 8.86) and displayed a proactive approach to learning. Additionally, they exhibited high self-efficacy in learning and achievement, with average scores of 5.18 and 5.47, respectively. This confidence in their abilities and motivation contributed to their self-sufficient study habits.

Cluster 5. The fifth cluster consisted of 15 students, mostly male, with the highest average age of 26.7 among all clusters. The majority of this cluster studied on the main campus, were in their second year, and worked while studying. Remarkably, 60% had ADHD. They highly valued decision-making autonomy (average score 6.93) and recognized the potential of what they learned (average score 6.47). This result indicated independence and clarity in applying their studies to future careers. However, their learning self-efficacy level was the lowest (average score 4.77) among all clusters, suggesting potential concerns in their confidence and belief in their abilities.

5. DISCUSSION AND CONCLUSION

Practical projects are essential in quantitative subjects like statistics and data mining, offering hands-on experience that reinforces comprehension and showcases real-world applications. These projects bridge theory and practice, fostering critical thinking and decision-making. Teamwork enhances collaboration, and feedback drives improvement, fueling motivation and deepening knowledge. Integrating knowledge from different courses allows students to apply learning to real challenges. Byrne (Byrne et al., 2009) and Lai (Lai, 2021) discuss the impact of language proficiency in quantitative courses. Cultural and ethnic differences significantly influence students' approach to statistical and data literacy, in turn impacting interest and motivation. As several researchers have stated, addressing these differences is crucial for promoting equitable access to statistical and data literacy education, creating an inclusive learning environment that empowers all students to excel in quantitative subjects (Sisto, 2009; Vance, 2021; Lesser, 2007). As lecturers and course coordinators, our commitment to promoting diversity, equity, and inclusion in education can have a profound impact on students' learning experiences and overall success. By recognizing and valuing the unique perspectives and needs of students from diverse cultural backgrounds, we can foster a supportive learning atmosphere where all students feel welcome, respected, and understood (Eagan et al., 2013). Students are more likely to be engaged and motivated to learn when they feel that their cultural identities and experiences are acknowledged. This can lead to a more meaningful and relevant learning experiences. Inclusive teaching can help identify and address potential barriers to learning that students from different cultural backgrounds may face, ensuring that they receive the necessary support to succeed.

In the current study, the focus was on investigating the differences between three groups of students studying non-STEM courses. The three groups were as follows: (1) Jewish students on the main campus, (2) Muslim students on the main campus, and (3) students on an Haredi campus. This study aimed to analyze and compare the differences between these three groups in the context of inclusive practices in project-based learning approach. We analyzed how cultural and religious factors may influence the students' academic experiences, study habits, and overall satisfaction with their college environment. It is worth noting that this study may be valuable in understanding the educational experiences and needs of different cultural and religious groups within the academic context, potentially leading to more targeted and inclusive support systems for students from diverse backgrounds. Additionally, the findings of this research could contribute to a broader understanding of diversity and inclusion within higher education institutions.

Cluster analysis revealed five subgroups of students with different characteristics. This segmentation can allow us to tailor our teaching approach to each subgroup, thereby enhancing the effectiveness of our teaching methods and accommodating the diverse learning needs of students. By consistently trying different ways of teaching for each subgroup, we can create a more personalized and targeted learning experience for our students. This might involve adjusting the teaching style, using different teaching materials, incorporating various active learning activities, or even offering additional support for certain clusters.

The first cluster, consisting of 44 students studying the data mining course, exhibited high motivation and engagement in their learning. Their enthusiasm for practical projects and specialization may be a valuable asset for both students and instructors. Guiding and mentoring these motivated learners may help them explore their interests and develop expertise. Tailoring the learning experience to their strengths and interests can lead to a more enriching and fulfilling educational process, benefiting both students and instructors alike. Several possible suggestions regarding this group of students comes to mind. These students can deal with advanced projects that challenge their cognitive and motivational abilities (Bryan et al., 2011). The instructor can encourage these students to peer mentor where they can share their knowledge with other groups and even be involved in interdisciplinary projects (Pilot et al., 2023). These students can also choose flexible learning paths and handle real-world data projects.

The second cluster comprised 27 young female students from a religious campus in a first-year statistics course. They lacked understanding of the learning process and the material's significance. They were also unfamiliar with personalized learning. They expected detailed instructions but also sought autonomy in topic choice. Recognizing their potential to absorb ideas with guidance, we must provide frequent instructions and support for these students due to their lack of self-confidence. Balancing clear explanations with autonomy can create an engaging and empowering learning environment for these students. Academic maturity is also a concern with this cluster. Such students are closer to high school than to the job market. Instructors can incorporate reflections and self-assessments into their schedule and then gradually release responsibility to the students as they gain confidence and familiarity with personalized learning approaches (Patall et al., 2013).

The 35 female students in the third cluster exhibited characteristics distinct from the second cluster, with one-third being Muslim, potentially influencing the cluster's approach to learning such as the balance between individual and structured learning. This finding is consistent with conclusions from Golan & Fehl's study (2020). Muslims can display a cautious and distrustful attitude towards autonomy, particularly in selecting topics, conducting analyses, and making decisions, which may stem from feeling intimidated or lacking interest. Teaching this group requires a different approach, emphasizing creativity and patience in demonstrating practical examples, and using visual aids to cater to diverse learning styles. Providing slightly more structured guidelines for assignments can help them feel more secure and guided, while interacting with other teams can create a supportive atmosphere and foster mutual feedback, increasing their confidence and participation. The characteristics revealed in this cluster can encourage the utilization of their stronger characteristics as well as patience towards the weaker characteristics. Clear and structured guidelines, more visual aids, and practical examples may be effective. The instructor can also gradually introduce autonomy in choice and decision-making.

The 35 students in the fourth cluster, comprised of Jews and Muslims from the main campus, have unique qualities that can enhance their learning. As they were older students accustomed to lecturer guidance, this cluster may value mentorship from instructors who can offer support and consultation. Acknowledging their multiple responsibilities as older students, instructors can help them integrate personal experiences effectively. Flexible learning options and understanding their commitments can also create a positive environment. Encouraging discussions and group activities can leverage their self-confidence and unique perspectives. Appreciating diverse viewpoints and collaborative problem-solving can be fostered in these students. Their life experiences can be tapped into to make real-world connections to the subject matter (Cybinsky & Selvanathan, 2005)

The final group, comprised of 15 students, presents distinct challenges due to its higher incidence of ADHD diagnoses. Despite struggling with attention and organization, they are genuinely interested in learning, though low self-esteem impacts their academic confidence. Personalized attention is paramount to this cluster. Instructors can tailor teaching by recognizing individual needs and learning styles. Simplifying complex ideas, interactive activities, and hands-on learning can sustain engagement. Consistent support for these students is also vital. Offering one-on-one consultations can foster approachability. Time management and organizational strategies are additionally beneficial. Regular, constructive feedback is crucial, bolstering confidence and motivation. Acknowledging small achievements can also encourage progress. Patience and empathy are vital due to their unique hurdles. Through personalized support, ongoing feedback, and an inclusive environment, the instructor can enhance confidence, academic performance, and foster positive learning attitudes among these students.

To conclude, implementing practical projects exemplifies dynamic interactive learning, offering a framework that adjusts to the individual needs of each student. Each student possesses unique characteristics, including cognitive abilities, mathematical background, motivation, level of attention, and concentration. Holmes & Hwang and Han (Holmes & Hwang, 2016; Han et al., 2016) suggest that incorporating diverse datasets, case studies, and examples that resonate with students from various cultural backgrounds in project-based learning ensure an inclusive learning environment.

We recommend that lecturers teaching undergraduate statistics and data science courses assess their students at the start of the course and classify them into one of the groups outlined in this study. Utilizing a methodology like latent class clustering, which involves unsupervised cluster analysis with a logical interpretation of the resulting groups, can assist in supervised classification. When implementing project-based learning in statistics and data science courses, the aim is to enhance efficiency in achieving both academic and personal objectives. These courses often serve as foundational elements in academic degrees, fostering students' quantitative thinking and independence in handling data.

The unique combination of a multicultural student population, the learning environment, and our analytical approach yielded interesting results that can significantly inform and enhance statistics education. Drawing on twenty-five years of experience and insights from current research, we have outlined several future research directions, some of which are currently underway. Our next focus is on analyzing students' attitudes toward project-based learning using text analysis tools. We aim to develop an instructional model that works on a human-computer integration platform (e.g., Moodle). Additionally, we intend to assess the predictive validity of the initial classification of students for advanced studies and their professional careers.

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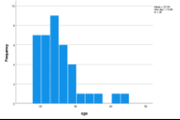
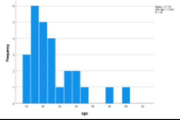
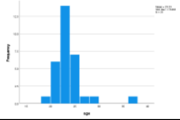
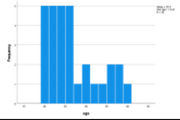
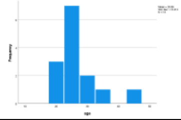
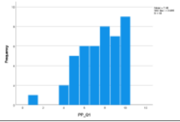
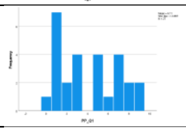
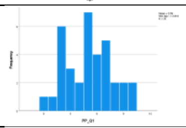
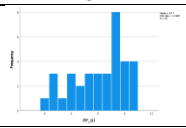
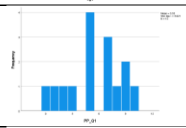
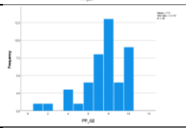
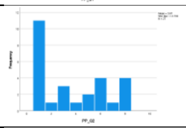
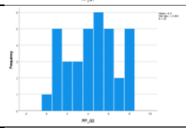
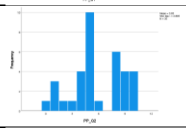
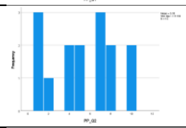
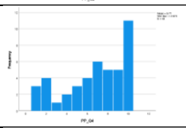
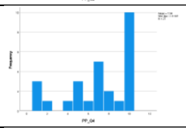
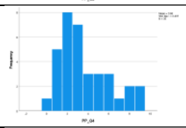
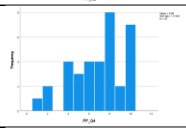
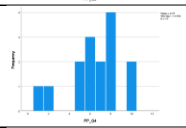
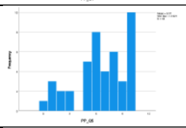
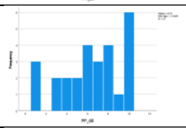
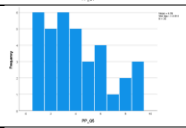
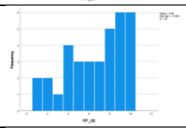
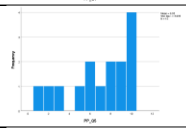
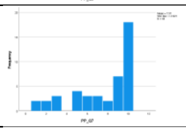
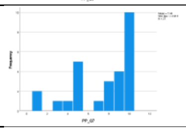
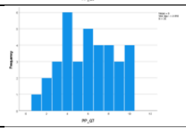
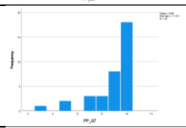
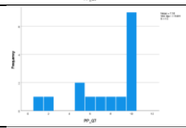
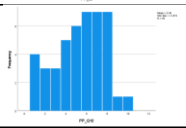
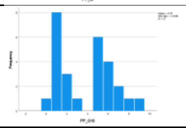
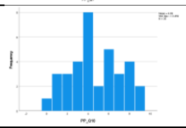
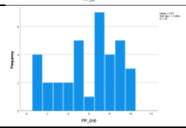
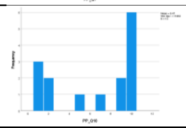
ANNA KHALEMSKY
Head of Data Science specialization
Management Department
Hadassah Academic college
anaha@edu.hac.ac.il
Israel

APPENDIX 1

	CLUSTER 1	CLUSTER 2	CLUSTER 3	CLUSTER 4	CLUSTER 5
AGE					
PP Q1					
PP Q2					
PP Q4					
PP Q5					
PP Q7					
PP Q10					

APPENDIX 2

ZIMMERMAN, BANDURA, AND MARTINEZ-PONZ (1992)
SELF-EFFICACY QUESTIONNAIRE

HOW WELL CAN YOU:

SELF-EFFICACY FOR SELF-REGULATED LEARNING

1. FINISH HOMEWORK ASSIGNMENTS BY DEADLINES?
2. STUDY WHEN THERE ARE OTHER INTERESTING THINGS TO DO?
3. CONCENTRATE ON SCHOOL SUBJECTS?
4. TAKE CLASS NOTES OF CLASS INSTRUCTION?
5. USE THE LIBRARY TO GET INFORMATION FOR CLASS ASSIGNMENTS?
6. PLAN YOUR SCHOOLWORK?
7. ORGANIZE YOUR SCHOOLWORK?
8. REMEMBER INFORMATION PRESENTED IN CLASS AND TEXTBOOKS?
9. ARRANGE A PLACE TO STUDY WITHOUT DISTRACTIONS?
10. MOTIVATE YOURSELF TO DO SCHOOLWORK?
11. PARTICIPATE IN CLASS DISCUSSIONS?

SELF-EFFICACY FOR ACADEMIC ACHIEVEMENT

1. LEARN GENERAL MATHEMATICS?
2. LEARN ALGEBRA?
3. LEARN SCIENCE?
4. LEARN BIOLOGY?
5. LEARN READING AND WRITING LANGUAGE SKILLS?
6. LEARN TO USE COMPUTERS?
7. LEARN FOREIGN LANGUAGES?
8. LEARN SOCIAL SRUDIES?
9. LEARN ENGLISH GRAMMAR?