



Career Perspectives and Pathways: A Multi-Method Clustering Analysis of First-year Business Students

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ABSTRACT

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This study examines first-year business students' career perspectives and pathways through the lens of clustering analysis. Using Particle Swarm Optimization (PSO), K-means, and Hierarchical Clustering techniques, the data reveals three distinct student clusters: a goal-oriented group focused on traditional business careers, an exploratory cluster still discovering their passions, and a smaller segment of passion-driven individuals pursuing specialized or innovative career paths. Positioning these clusters along the dimensions of career perspectives and career paths provides insights into the diversity of first-year business students. The study concludes that business schools must implement tailored career exploration programs, structured mentorship opportunities, and entrepreneurship-specific initiatives targeting this diverse cohort's unique needs and aspirations. Fostering this holistic ecosystem to celebrate the diversity of career outlooks will better position first-year business students for long-term success and fulfillment in the evolving business landscape.

KEYWORDS:

Career Development, PSO, Hierarchical and K-means cluster analysis, business schools

1. INTRODUCTION

First-year business students face various challenges and problems regarding their career perspectives, significantly influencing their academic experience and future employment opportunities. This analysis draws on recent research findings and data to highlight key issues (Tate et al., 2015). Most first-year business students are worried about their career prospects. They feel very burdened by having to set a clear career path early in their program (Wright et al., 2013). A survey revealed that students often worry about their chances of getting a job immediately after graduation, fearing an unattractive labor market. Stress becomes a critical factor affecting students' academic performance and well-being (Hwang et al., 2014).

Despite growing attention in higher education to becoming better prepared for work through career readiness, many students currently graduate feeling ill-prepared for the workforce. Studies indicate that as great as internship opportunities and experiential learning are for hands-on experience, many students refrain from

participating in such activities during their first year of studies (Lindstrom et al., 2022). Only 9 out of 10 four-year colleges offer structured work experiences, leaving many students without opportunities to expand their resumés and networks when most beneficial (Gault, 2000).

A critical skills gap for first-year business students is the perceived inconsistency between academic education and the skills demanded by employers (Majid et al., 2019). Many companies complain that 'non-technical' entry-level job vacancies go unfilled because applicants lack indispensable 'soft skills,' including communication, teamwork, and problem-solving skills. Such skills gaps can hurt students' readiness and confidence upon entering internships or finding jobs (Ngo & Thuy, 2024).

Very often, students in their first year of business study face challenges in structuring their careers, which are affected by several factors, including their career opportunity perceptions (Donald et al., 2018), educational experiences (Tate et al., 2015), and drives (Luwei & Huimin, 2024). All these factors are going to determine their future careers and professional decisions. Recent studies show statistics such that a substantial proportion of first-year business students have characterized preferences concerning where they will work in the future. For example, a report showed that 65% of students preferred working in mid-to-large-sized companies after completing an introductory business course, while 35% considered self-employment or entrepreneurship (Whitlock,

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2024). Such interest in traditional employment sectors is consistent with students' general tendencies toward security and stability in the early stages of their academic careers (Kwok, 2018). On the other hand, students' interests change with seniority; for instance, the seniors indicated a 25% interest in entrepreneurship; thus, experience-based exposures may impact their career aspirations throughout their studies (Afridila & Alansa, 2020).

Student's Perspective regarding their careers is influenced dramatically by the nature of education. Programs offering experiential learning, mentoring (Soliman et al., 2021), and internships have improved students' preparedness for work. Research shows that students who participate in such programs experience high satisfaction and are more prepared for career advancement (Ng et al., 2017). In particular, compulsory interns show better career aspirations and accomplishments than those who do not (Metz et al., 2009). It indicates that early experience through real-world applications of their studies enhances their confidence and formulates the right career pathways.

The other influential factor among first-year business students is the perceived gap between academic training and the skills demanded in practice. A study discovered that most students were worried about their preparedness for the labor market due to insufficient soft skills development, such as communication and teamwork (Rosenbaum et al., 2017). Close to 47% of the studied students admitted they needed more confidence in these areas, which can impede their employability prospects. As the institution supports the students in their studies, such institutions must have something planned to address such a gap through training and development programs.

The perspective of a first-year business student regarding their career determines how they build their career. It includes goals, values, motivation, and interests, essential for their career decisions and actions (Komarraju et al., 2014). If students have a clear and defined career perspective, they are more likely to pursue specific career paths according to their aspirations. For example, a student who wants to become an investment banker must be interested in finance. This student will likely pursue relevant coursework, internships, and networking to help him or her build the necessary skills and experiences to achieve the desired career goals (Ciarocco, 2018).

Students with less defined perspectives about their desired careers would experience more uncertainty and exploration in their career paths. These students could test different roles or sectors to determine what is exciting and intense for them (Kwok, 2018). While this exploratory phase is advantageous for personal growth and self-awareness, it may initially lead to a less structured career path. However, the more focused these students become on their preferences, the more they focus their efforts and make more informed career decisions (Chen & Kizilcec, 2024). This adaptability

and exploratory spirit ultimately culminate in very fulfilling and successful careers, even if they are not typical linear ones.

The match between career conceptions and career processes may also critically affect students' fulfillment and success in their fields of study (Karp, 2013). By closely matching students' values or interests to the careers pursued, students are more likely to find their jobs more satisfying, motivating, and engaging. Alignment also leads to high performance and career growth because the student is more responsible and focused on the task. Students perform poorly in their careers and even change jobs often because the mismatches between the perspectives on careers and careers lead to dissatisfaction and burnout.

Clustering first-year students into classifications of levels of career perspective and career paths is that it improves educational institutions' provision to individual students. By identifying specific groups within the student population, advisers and career counselors can better understand the distinct needs of each cluster and tailor guidance to address those needs (Sung et al., 2013). Thus, career-oriented students may be subjected to advanced career planning workshops (Fenning & May, 2013) and networking facilities (Badoer et al., 2021) instead of providing foundational support such as career exploration activities and self-assessment tools to those more career-oriented. Such a focused approach ensures that all students need the right resources and support to build their career paths.

The multi-method clustering analysis of first-year business students' career perspectives and pathways aimed to promote UNSDG 4: Quality Education. Based on their career aspirations and pathways, the study furthers enhancements in educational strategies and career guidance programs for that particular cohort. It fits well with ensuring inclusive and equitable education and promoting lifelong learning opportunities for all. Understanding students' different needs and motivations, the paper contributes to creating a supportive and effective environment where learning and teaching occur and prepare future working professionals for business careers.

This study aims to group business students based on their career perspectives and paths, composed of peers who share the same views and interests regarding their probable careers. Moreover, clustering provides valuable insights to analyze the characteristics and needs of different student clusters (Lv, 2024), after which gaps in the current offered programs and courses can be identified. For example, if many students are interested in entrepreneurship but need more authentic experience, the college might introduce more practical entrepreneurial projects or partnerships with local businesses. The curriculum benefits because it follows a data-driven approach that maintains relevance toward accommodating the changing career aspirations of students (Liu et al., 2017).

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It is essential, therefore, to group first years by the level of career perspective and career paths to add a personal dimension to the support and enhancement of their learning experience and information in curriculum development. A better understanding of the diverse needs of students in educational institutions leads to their achievement of full career potential. The overall results are achieved by fostering a supportive and engaging learning environment for all to be well-prepared for future careers.

II. THEORETICAL FRAMEWORK

Different career paths and perspectives, such as goal-oriented achievers (Poondej et al., 2013), exploratory innovators (Tate et al., 2015), and passion-driven entrepreneurs, have different ways business students get clustered, which can be understood with various theories on career development. These theories reveal the reasons behind how each type operates in terms of motivation, behavior, and outcome, indicating the necessity of well-articulated goals, flexibility, and intrinsically motivated individuals to achieve successful career paths (Shin & Lee, 2017). By applying such theoretical frameworks, educators and career counselors can better support students when they face their career development journey, appropriately guiding each cluster to reach its potential (Ng et al., 2017).

Goal-oriented achievers are students with a well-defined and structural career path and perspective. Some of the theories that are relevant to such students. Super's life span (Kalchik & Oertle, 2010), Life-Space Theory (Super, 1980), and Locke's Goal-Setting Theory (Clements & Kamau, 2018) are rather specific. Super's theory of self-concept leans toward what constitutes the nature and structure of an individual's self-concept. Regarding career development, people with better knowledge about their capacity and area of interest are likelier to establish and reach concrete career goals (Montano & Valdez, n.d.) Locke's Goal-Setting Theory supports this idea by pointing out that specific, challenging goals enhance and motivate performance. These theories suggest that for goal-oriented achievers, their well-defined career objectives and structured plans are the sources of their success, guiding them in the right direction as they plan to pursue their preferred paths for career development (Shahi, 2024).

Exploratory innovators have only a moderately defined career perspective. They follow a flexible kind of career path. The Chaos Theory of Careers (Schlesinger & Daley, 2016) and Krumboltz's Social Learning Theory (Krumboltz et al., 1976) apply best to this group. The Chaos Theory of Careers (Garmon, 2004) suggests that career development is non-linear and influenced by complex and dynamic factors. This theory supports that exploratory innovators benefit from openness to new experiences and adaptability to change (Pryor & Bright, 2003). Krumboltz's Social Learning Theory emphasizes learning from

experiences and the environment in shaping career choices. For exploratory innovators, these theories show that the ability to explore different roles and industries and flexibility is essential for finding their interests and strengths, eventually resulting in good career choices (Vanek et al., 2019).

Passion-driven entrepreneurs have a very precisely defined type of career but a very emergent, non-traditional career pattern. Here comes the applied relevance of Entrepreneurial Intentions Theory (Cieřlik & Van Stel, 2017) and Self-Determination Theory (Chen, 2017). Entrepreneurial Intentions Theory stresses factors influencing a person's intentions to start a business, including personal attitudes, perceived behavioral control, and subjective norms. The theory relates to passion-driven entrepreneurs because this group develops business interests and values that become essential career drivers (Marshall & Gigliotti, 2020). Self-determination theory identifies basic psychological needs of autonomy, competence, and relatedness, which support an individual's intrinsic motivation in promoting behavior (Montaño & Sobrejuanite, 2024). For passion-driven entrepreneurs, these theories suggest that their internal motivational system, passion for innovation, and self-concept play crucial roles in their career development, leading to entrepreneurial ventures and emerging career paths (Weigold et al., 2021).

Several theoretical frameworks effectively describe the grouping of business students by their level of career path and career perspective. The clusters of goal-oriented achievers, exploratory innovators, and passion-driven entrepreneurs correspond to a different career development theory model.

III. METHOD

This research was conducted on 148 first-year business students who were interested and volunteered to participate in a career perspective enhancement program during the summer of 2024. The program is aimed at helping students explore and develop their career goals, interests, and pathways in the business field. The students have gained insight into their career perspectives and ambitions through these activities and assessments and engaged in career interest inventories, values clarification exercises, and informational and reflective writing assignments. The scores and outcomes from the program activities represent the data points used in the clustering analysis.

Three clustering techniques were used to understand the students' career prospects: Particle Swarm Optimization Clustering, K-means Clustering, and Hierarchical Clustering. These methodologies were used to capture the career visions of the students with their various dimensions and identify any underlying patterns or clusters within the data (Fan, 2024). The PSO Clustering method utilizes the concept of swarm intelligence in an iterative optimization of the identification of cluster centers and their memberships (Lin et al., 2020).

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The K-means Clustering uses an iterative algorithm based on the centroid to partition the data into distinct groups (Shaikh et al., 2024). Lastly, the Hierarchical Clustering technique uses a bottom-up linkage-based technique to systematically organize the students into a hierarchical tree-like structure (Massoni et al., n.d.).

Therefore, applying these three alternative clustering techniques allowed the researchers to triangulate the findings and better understand the career perspective typologies within the sample of first-year business students. Consistent performance metrics, such as the Silhouette Coefficient and the Davies-Bouldin Index (Geddani et al., 2024), across various clustering techniques further validated the structure and quality inherent in the identified groups. This multi-pronged methodological approach, coupled with the rich dataset from the career perspective enhancement program, enabled the researchers to conduct a nuanced and comprehensive analysis of the diverse career outlooks and pathways within the first-year business student population.

IV. RESULT AND DISCUSSIONS

This study explores and classifies first-year business students' diverse career aspirations and trajectories. Employing a multi-method clustering approach, the study

aims to identify distinct groups based on their career goals, motivations, and perceived barriers. The objectives include developing an understanding of the influencing factors for students' career choices, furnishing insights into how a business school can better facilitate their career development, and recommending tailored career guidance programs within the criteria set for the diverse aspirations of business students.

Figure 1 depicts a scatterplot of the 148 first-year students in business who attended the career perspective enhancement program over the summer of 2024. Each data point shown on the plot represents a student's performance across all the activities and assessments conducted over the program. The horizontal axis corresponds to the "Career Paths" dimension, and the vertical axis captures the "Career Perspectives" dimension. The distribution of data points suggests various career outlooks and trajectories spread throughout the student cohort. Several students tend to concentrate more on both axes towards the higher end, indicating a high correlation between their career paths and perspectives. The scatterplot would offer a snapshot of the heterogeneity among first-year business students. It can inform the design of tailored support and development initiatives to address different needs and aspirations among first-year business students.

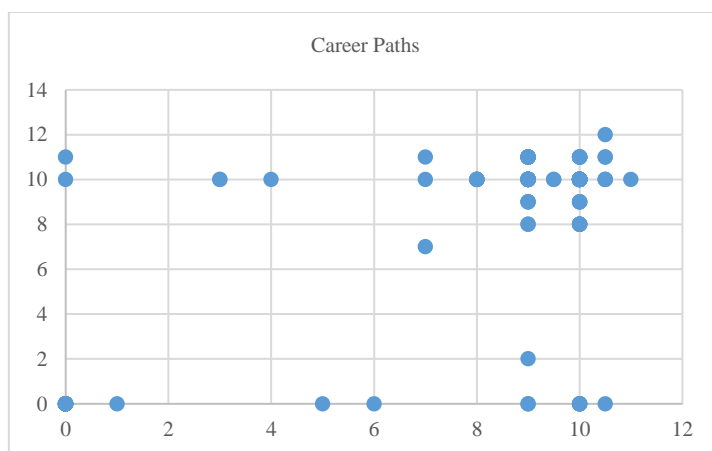


Figure 1. Career Paths and Career Perceptions of First-Year Business Students

Figure 2 shows the scores distribution of students in the career paths and career perspective activities within the enhancement program, conveying their developmental progress. They are most likely the pattern that shows varying clarity and directionality among the students, some having a clear career outcome and others being exploratory or newly emerging. This variation highlights the need for differentiated

support within the program, including those students who score high in the career perspective activities to access advanced career planning resources. In contrast, those scoring lower may require foundational guidance and exploration opportunities. Distribution, in general, elucidates the diverse needs of the students and the requirement for individualized interventions to support students' careers effectively.

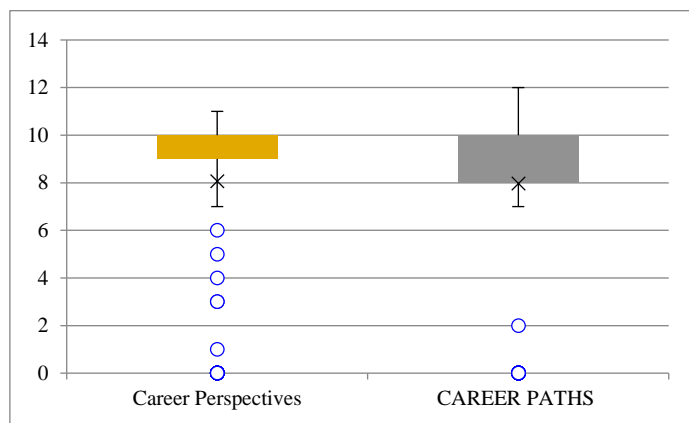


Figure 2. Box plot and Outliers Career perspective and paths score of students

The Particle Swarm Optimization (PSO) Clustering in Table 1 presents three separate cluster centers at (0.187, 1.219), (8.992, 0.416), and (9.308, 9.952). At this stage, the Silhouette Coefficient reached a high value of 0.831,

signifying excellent cluster separation and cohesion. The Davies-Bouldin Index value of 0.264 again validates the high quality of the clusters, with values closer to zero indicating more well-defined clusters.

Table 1. Comparative Cluster Methods

| Clustering Method | Cluster Centers | Silhouette Coefficient | Davies-Bouldin Index |
|-------------------------|---|------------------------|----------------------|
| PSO Clustering | [0.18699558, 1.21921837], [8.9920467, 0.41603396], [9.30841386, 9.95230437] | 0.8308 | 0.2644 |
| K-means Clustering | [9.18644068, 9.97457627], [0.05555556, 8.88178420e-16], [9.04166667, 0.16666667] | 0.834 | 0.2322 |
| Hierarchical Clustering | N/A (not applicable for hierarchical clustering) | 0.834 | 0.2322 |

The K-means yielded the center of clusters to be at (9.186, 9.975), (0.056, 0.000), and (9.042, 0.167). Interestingly, performance metrics are almost identical to PSO, having a Silhouette Coefficient of 0.834 and a Davies-Bouldin Index of 0.232. This implies that the clustering results of PSO and K-means are almost similar regarding cluster quality and separation. Interestingly, the same performance metrics for the two methods were shown in the hierarchical clustering technique with a Silhouette Coefficient of 0.834 and a Davies-Bouldin Index of 0.232. This indicates that the robust structure lies beneath the variability present in the dataset. High Silhouette Coefficients are obtained for all three methods at around 0.83 to 0.84, indicating well-defined, distinct clusters with clear boundaries. Low Davies-Bouldin Indices further confirm the clustering quality, indicating minimal overlap between clusters and compact cluster formations.

Even though the cluster centers are slightly different between PSO and K-means, their overall clustering performance remains consistent. This may indicate a robust inherent clustering structure within the dataset that could be captured effectively using different algorithmic approaches. The cluster centers might have slight variations due to the differences in optimization strategy between PSO (particle

movement and swarm intelligence), which is more distinct, versus K-means, using centroid-based iterative optimization. However, both could spot and separate clusters hidden in the data accurately.

The Silhouette Coefficient is used to interpret the similarity of a single object to its cluster versus other clusters. Higher values indicate more defined clusters. By the results of the Silhouette Coefficient, K-means and Hierarchical clustering methods have almost achieved more value (0.8340) as compared to PSO (0.8308), meaning that K-means and Hierarchical clustering presented slightly better-defined clusters than the other. Davies-Bouldin Index calculates the average similarity ratio between each cluster and the best cluster to which it could belong. Lower values are better. The Davies-Bouldin Index of K-means and Hierarchical is 0.2322, while that of PSO is 0.2644, thus demonstrating that both K-means and Hierarchical are much more compact and separated than PSO.

Figure 3 illustrates data clustering using three different techniques: PSO Clustering, K-means Clustering, and Hierarchical Clustering. From the above plot, the PSO Clustering algorithm has identified three different clusters of data points. The points are well distinguished from each other, and the center of the clusters are located at

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approximately (0.187, 1.219), (8.992, 0.416), and (9.308, 9.952). The K-means Clustering plot has also revealed three identified clusters, and the cluster centers are at (9.186, 9.975), (0.056, 0.000), and (9.042, 0.167). The overall clustering pattern resembles the PSO Clustering results, so both methods capture the underlying data structure well. Thirdly, the hierarchical clustering plot also indicates three significant clusters; the data points are grouped similarly, as suggested by K-means Clustering. Cluster centers are not

directly indicated; however, the visual displays of the clusters are similar to those identified by the other two clustering methods. Summarizing, all three algorithms have picked up the three clusters in the data, even if there are slight differences in the positions of the center cluster. The same should not be expected of algorithms, and thus, the data has a visibly defined structure for which different algorithms catch different good versions reliably.

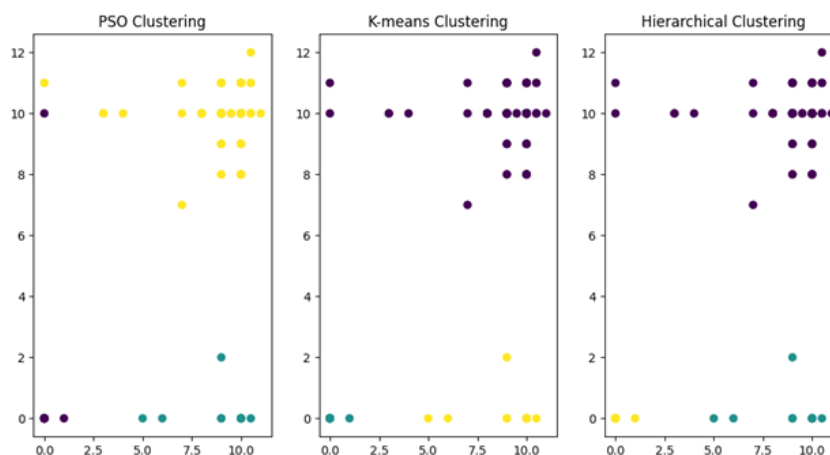


Figure 3. Three Clustering Techniques Plots

The PSO Clustering plot shows the densest clustering of data points in the third cluster centered at (9.308, 9.952), suggesting this may be the most significant cluster regarding the number of students who use it. The first cluster, centered at (0.187, 1.219), has the next-highest density of data points, so it also has the second-biggest student base. The second cluster at (8.992, 0.416) appeared to have the fewest data points, and the distribution of data points was more scattered than the others. The third cluster contains the largest student count, the first cluster has the second largest, and the second cluster is the smallest among the three regarding student numbers in each category.

Upon closer examination of the cluster positions in the context of career perspectives and paths, some additional insights are gleaned. The first cluster, centered at (0.187, 1.219), represents students with a more focused and structured career perspective. These individuals likely have a clear vision for their future careers and actively pursue a defined path to achieve their goals. This cluster comprises students interested in traditional business career tracks, such as finance, consulting, or management, who are positioning themselves to succeed in these high-competition fields. Most likely, this cluster makes up a large portion of the first-year class because goal-oriented, career-focused individuals tend to be a large proportion of this population.

However, the second cluster (8.992, 0.416) hints at students with more exploratory attitudes towards careers. They are open to different career prospects and are still discovering their passion and interests based on their real

passion within the business domain. They are attracted to niche or non-traditional areas, such as social impact investing, entrepreneurship, and sustainability-related positions. While this group is smaller by number than the first, it is still an essential part of the cohort for whom the stage of self-discovery and personal satisfaction figures more than a strictly linear career.

The third cluster is centered at (9.308, 9.952) and consists of students with a very passion-driven career perspective. These individuals have already identified areas of deep interest and enthusiasm and are actively pursuing opportunities that align with their passions. They are interested in unique or novel business fields like technology, digital marketing, or social entrepreneurship. Since the population of passion-based career paths is smaller, this cluster has fewer students since passion-based jobs are sometimes more niche and less widely represented among first-year business students.

These three clusters draw a somewhat nuanced picture of the diversity of career perspectives and paths among the first-year business student population. In this way, while the most traditional goal-oriented approach is reflected in the first cluster, the second and third clusters reflect the increasing importance of exploration and passion-driven career development among today's future business leaders.

This enables university administrators, faculty, and career services professionals to tailor their offerings and support to better cater to the different needs and preferences of these various groups of students. The more an institution

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fosters a rich atmosphere for celebrating and nurturing such diversity in career perspectives, the better it ensures its first-year business students' long-term success and fulfillment.

V. CONCLUSION AND RECOMMENDATIONS

From this result analysis, the first-year business student population carries a great diversity of career perspectives and paths. The largest cluster comprises more goal-oriented students with apparent visions for their futures and are focused on more traditional business career tracks. The other two clusters refer to even smaller groups of exploratory students still discovering what interests them within business, either looking for nontraditional or niche opportunities. The smallest cluster is composed of passion-driven students who are deepening their know-how in areas of genuine enthusiasm and are undertaking specialized or innovative business paths in those areas. This career outlook heterogeneity makes it critical that universities tailor their support, resources, and development opportunities to the needs and preferences of these different segments of students to help them ultimately achieve their goals and fulfill their ambitions in the business world.

Based on these insights from the clustering analysis, several key recommendations emerge that could better support first-year business students' diverse career perspectives and paths. In particular, business schools should implement substantive, comprehensive career exploration and advising programs beyond traditional paths to empower students in the exploratory cluster to discover their unique strengths and interests. For the goal-oriented group, access to a mentorship framework and high-profile internships and career placements will lead the group toward achieving the ambitious objectives. Meanwhile, the passion-driven cluster would gain through specialized workshops, networking events, and startup incubator programs that nurture their innovative spirit and entrepreneurial aspirations. Tailoring resources and interventions to meet the specific needs of every cluster will enable universities to create a holistic ecosystem in which all first-year business students can truly thrive and reach their full potential regardless of individual career orientations.

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VII. DISCLOSURE

The author reports no conflicts of interest in this work.

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