A Comparative Quantitative Study of Hard and Soft Disciplines in Academia

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Abstract – Disciplinary differences between academic fields refer to those differences in teaching approaches, course design, and instructional tools but often considered "hard" sciences like physics and engineering, and "soft" sciences such as social sciences and humanities. This study seeks to explore these differences through a quantitative analysis of how course design and teaching tools differ across hard and soft academic disciplines. The research employs a survey-based approach to obtaining data from 240 academics from a few institutions and disciplines. Statistical tests such as t-tests and regression analysis were used to identify and test the difference between the disciplines. The results found that instructors of hard sciences favor the delivery of structured content, emphasize technical skills, standardized assessments, and the use of digital simulation tools. On the other hand, soft sciences integrate collaborative projects, discussion based learning, and experiential methods like case studies for the most part. The findings also showed a significant variation in how technology gets adopted; where hard fields prefer software and digital tools that help with precise measurements and quantitative data analysis, while soft fields tend to prefer platforms that allow for discussion and qualitative analysis.

Keywords – Business and Management Education, Hard/Soft Academic Fields, Cross Disciplinary Differences, E-Learning Projects, Course Modes, Teaching Tools, Teaching or Pedagogical Methods.

I. INTRODUCTION

Research in Business and Management Education (BME) has increased in both quantity and credibility; however, it has mostly remained confined to the distinct domains of major school subjects, including accounting, economics, and marketing. Recently, some studies have significantly diverged from the conventional silo method by investigating BME scholarship across other fields. Research by Hwang et al. [1] enhance the initiative to catalog BME scholarship across business schools by analyzing publications in the top 17 BME journals from 2010 to 2019 and identifying the most prolific BME writers along with their respective business disciplines.

In the present dynamic context, the BME field faces unexpected obstacles. Teaching and learning activities are often conducted in person to meet the growing demand for educational opportunities. Higher education institutions (HEIs) are perpetually augmenting their online offerings. Nonetheless, swift innovations, innovative teaching tools, software applications, and the limited attention spans of students have transformed pedagogical methods, particularly in higher education institutions. The efficacy of learning in higher education significantly relies on the selection of suitable delivery methods. The Face-to-Face (F2F) modality has historically been regarded as the most dependable, as the teacher delivers knowledge in person during regular sessions or laboratories, accompanied by immediate feedback [2]. This style primarily pertains to the instructor's pedagogical approach and the classroom activities.

Conversely, online/remote/web-based instruction is a kind of distance education whereby students do not attend the university campus but rather engage in learning and evaluations from a remote location. As online education becomes more prevalent, disparities within academic areas are usually neglected by scholars. Specific disciplinary distinctions in e-learning design have been observed by White and Liccardi [3]. Considering the variations in curriculum and pedagogical approaches between disciplines, disciplinary disparities may be seen as a significant concern in distant learning research. The necessary scope of investigation, utilizing courses as the unit of analysis and disciplinary clusters of courses as comparative groups, has hindered the demonstration of the significance of disciplinary clusters in e-learning.

The remote method has been operational for an extended period, and before the emergence of the internet, remote education was conducted by mail communication. Nonetheless, technological improvements have transformed distant education, enabling the provision of courses "virtually/online" for the first time in the early 1990s, which has now become indispensable in higher education. Buhalis, Leung, and Lin [4] emphasized the significance of innovative technologies such as the metaverse for management instructors. Educators undoubtedly encounter several obstacles in the current paradigm of online learning. A significant difficulty in online education is students' motivation for engaging in online instruction. Motivation is described as a student's inclination to acquire knowledge within an educational setting. The pupils' motivation stems from the relationship between instructors and their students.

Blended learning, or hybrid learning, integrates instructional methods used in both in-person and online educational settings. It is characterized as a learning modality in which elements of conventional educational practices have been supplanted by online methods of information dissemination. Blended learning provides different options for learners and establishes adaptable online educational settings. Global colleges and universities strive to provide scalable knowledge within a contemporary, lifelong educational framework via blended learning. Nonetheless, there exists controversy about the definition of mixed learning. It may be characterized as any amalgamation of in-person and online education. The quantity conceptualization asserts that a significant portion of the course must be conducted in both in-person and online formats, whereas quality conceptualization prioritizes the deliberate integration of the advantages of both modalities to enhance quality or attain other beneficial outcomes. Effective blended learning programs need a robust institutional strategic plan; exemplary practices serve as a reference for educators to design and execute a successful mixed learning initiative.

We focus on the differences in courses designs or modes and learning/teaching initiatives or tools between hard and soft academic disciplines. The objective is to identify how instructors in these fields differ in their structuring of courses, selecting instructional methods and use of technology in teaching in order to understand how these variations mirror the distinctive needs and characteristics of each field. Quantitative analysis is used to uncover these distinctions and their implications for educational practice optimization. The subsequent sections of our study are organized in the following manner: Section II reviews related works on course mode, instructional tools, and teaching/pedagogical methods. Section III describes the methodology employed when composing this research paper. This methodology encompasses survey design/data collection, statistical analysis/model formulation, MANOVA/ANOVA/hypotheses/correction analysis, and SEM. A detailed account of the results has been provided in Section IV and V, which integrates a discussion of the three hypotheses. Lastly, Section VI confirms the findings obtained in this research confirming the major differences between soft and hard academic disciplines in relation to course design and application of teaching tools.

II. RELATED WORKS

Course Mode

The course modality in e-education was a significant variable of interest in this research. The success of e-learning programs relies on many elements, including well stated goals, content development, senior management support, usability, and project assessment. Most eLearning programs lack clearly defined goals and consistent methodologies. Organizations must establish a plan outlining the expected outcomes of each e-learning program. The training department must adopt a training technique that aligns with the organization's strategic goal, necessitating an awareness of that direction and the ability to guide personnel accordingly. Content in an e-learning program must be relevant to the audience and their requirements. Macpherson et al. [5] stipulate that material must facilitate attainable training objectives and be structured in a coherent way for learners. E-learners want material that enhances their efficiency, speed, and cost-effectiveness.

Content should be informed and primarily determined by the priorities of the e-learner. Content must be tailored to the specific requirements of individual e-learners. These problems are also prevalent in conventional classroom training; nevertheless, this user-centric approach poses a challenge for management to provide relevant and successful learning experiences in an electronic context. The existing research and stories suggest that the present e-learning packages, whether of being internet-based or not, fail to provide a satisfactory learning experience or serve as an adequate alternative for conventional methods of information delivery. Primarily, they fail to maintain student engagement in the educational process. This leads to elevated turnover and little benefit for firms that have invested significantly in this technique. Significant difficulties discovered include: (a) inadequate alignment of content structure with learners' cognitive processes; (b) individual view of technology as an impediment to the learning process; (c) disorganized material that is incompatible with hypermedia. Consequently, we suggest H1:

H1: The selection of course mode by academics, categorized by discipline or topic groupings, will exhibit little variation.

Instructional Tools

We were interested in the influence of discipline on tool selection. Frequently used methodologies include standardized examinations, evaluation of student portfolios, evaluative evaluations conducted by educators, routine teacher-created assessments, and appraisals of student assignments, projects, and homework. Assessments vary significantly in type and quality, and assessment policies and methods are often implemented differently across faculties and disciplines. This is a procedure designated for assessing qualification, an activity to evaluate progress or understanding. The validity and reliability of the assessment tools used to evaluate students' comprehension must be taken into account when determining their level of knowledge. Mayo [6] states that “the objective of a test is to ascertain what an individual can accomplish under specific conditions, such as responding to a series of questions either verbally or in writing, or executing a particular task or tasks within a designated timeframe.” Consequently, the examiner must adhere strictly to the goals behind the exams. Due to the scarcity of cross-disciplinary biomedical engineering comparative studies on tool use and the data suggesting disciplinary differences, we formulated H2:

H2: Faculty will exhibit a preference for using tools aligned with the specific field taught, categorized as soft and hard disciplines across five distinct categories.

Teaching or Pedagogical Methods

The new century brought substantial shifts in pedagogy and instructional techniques. The pedagogy of the 20th century contrasts with that of the 21st century. From the onset of the 21st century, several transformations have occurred in the evolution of both the local and global educational system. One of the most evident phenomena are the “Internetization” of society and the integration of digitalized technology into the system for the cohort of schoolboys who are typically referred to as “Gen Z, socially digital, and the digital. Knowledge encompasses the shift from obtaining information via reading and the instructor’s monologue to classroom discourse or visual perception. Digitalized technology transforms our lifestyle, communication modes, cognitive processes, emotions, avenues of impact on others, social competencies, and social conduct. According to Choudhury and McKinney [7], “high-tech environments (including video games, search engines, smartphones, and computers) reconfigures the human brain”.

Instructors must have sufficient digital literacy competencies to proficiently use technology tools, resources, and platforms to augment teaching, learning, and research. Complementary research by Lai, Shum, and Tian [8] has shown the presence of many methodologies for skill acquisition and the proficient use of tools, resources, and technological platforms to enhance educational practices. Higher education institutions have to provide consistent professional development opportunities and training sessions to assist teachers in enhancing their digital literacy. These chances may include seminars, webinars, and courses on diverse technologies, software, and online platforms pertinent to their specific areas of expertise. By augmenting their digital literacy abilities, lecturers may enable themselves to use interactive and engaging pedagogical techniques.

Cairncross and Mannion [9] propose the use of multimedia components, interactive simulations, and online debates to engage students' attention and promote active involvement. Furthermore, educators must actively stay informed about the current technological developments and advancements in educational technology. This proactive strategy motivates lecturers to explore diverse technological tools and platforms in a risk-free setting, enabling them to master their functionalities prior to classroom use. As a result, educators often consult pertinent blogs, seminars, and newsletters to get knowledge about innovative tools and methodologies for incorporating technology into their instruction. As a result, educators often consult pertinent blogs, seminars, and newsletters to get knowledge about innovative tools and methodologies for incorporating technology into their instruction.

Theoretical modifications in pedagogy and didactics underpin the most apparent inclination. Domestic science pedagogy was changed from the “science learning, teaching, and upbringing” to the science of education and upbringing.” The focus on the 20th century teaching was “upbringing”. Lozano et al. [10] state: “Upbringing”, in a comprehensive pedagogical context, refers to the intentional influence of society aimed at preparing the digital generation for lifestyles. “Upbringing”, in a strict educational context, refers to the intentional impact on the growth of certain personal attributes. Faculty members from various disciplines have challenges in determining content and pedagogical approaches within multidisciplinary educational settings. Faculty members face significant challenges, including achieving consensus on pertinent terminology for planning learning objectives, acquiring requisite skills in problem- or project-based pedagogical methods, and possessing prior experience with collaborative teaching. Furthermore, faculty members may have uneasiness when they lack familiarity with specific disciplines and may feel doubtful about the potential for students to acquire knowledge from other fields. Conceptual ambiguities in multi-, inter-, and transdisciplinary education are likely to exacerbate the discomfort experienced by numerous faculty members, potentially impacting the quality of teaching and learning.

According to Habibi et al. [11], students in STRAT subject courses found that employing digital group tools such as online simulations, digital group case projects, file-sharing, and wikis, along with dialectic dialogic methods like asynchronous discussion boards, were more engaging and resulted in more learning than in-person, synchronous discussions or team assignments. Given that the findings were from a literature categorization, we enhanced our results by gathering data based on discipline group and type as independent variable quantities, so formulating H3:

H3: The discipline of the course influences faculty members' selection of preferred teaching techniques.

III. METHODOLOGY

This research methodology is quantitative, using a survey to collect data and statistical analysis testing the hypotheses regarding the relationship between types of academic discipline and types of course design, as well as use of teaching tools and methods. The research aims to determine how disciplinary differences influence the selection of teaching strategies and tools, with a particular focus on differentiating between hard and soft disciplines and among five specific discipline groupings: AFE: Accounting, Finance, Economics; OPI: Operations, Production, Innovation; MBM: Marketing, Business Management; STRAT: Strategy; OBHR: Organizational Behavior, Human Resources. The survey responses collected are thoroughly examined using a robust analysis, including chi square tests, regression models and multivariate analysis of variance (MANOVA).

Survey Design and Data Collection

A total of 240 academics responded to the survey, with a large majority in North America (85%). The aim was to facilitate course design exploration of different disciplines (hard or soft) and academic levels (undergraduate or graduate) and tools used in teaching. Survey questions were specific to frequency and preference of particular teaching tools and methodologies, mode of course delivery (online, hybrid, or face to face), and background of respondents. Previous literature on disciplinary characteristics is used to categorize respondents into hard and soft disciplines by field of study. This process of data collection produced a balanced sample within the five discipline groups, from 13% to 34% of the total. There was also a positive association between the level of study and the disciplinary groupings. In particular, χ^2 (4) = 18.19, p = 0.001, which confirms that a greater Strategy proportion and OPI participants trained at the graduate level than did respondents from AFE, who mostly taught at the undergraduate level.

Statistical Analysis and Model Formulation

A series of chi-square tests were used to examine relationships between course design choices and disciplinary differences, and regression analyses were used to explore any predictive relationships. We used chi square tests to determine whether categorical variables (like course mode: fully online, hybrid, web-facilitated; and discipline type) are associated. For instance, Eq. (1) was tested for the relationship of course mode with discipline type.

$$\chi^2 = \sum \frac{(O_i - E_i)^2}{E_i} \tag{1}$$

where O_i stands for observed frequency, E_i is expected under null hypothesis. The choice of course mode for hard and soft disciplines did not vary significantly ((χ^2= 3.437; df = 2; p = 0.180). Then, a logistic regression model was used to predict the likelihood of choosing particular teaching tools, depending on the disciplinary type. Eq. (2) shows the logistic regression in its general form.

$$\log\left(\frac{p}{1-p}\right) = \beta_0 + \beta_1 X_1 + \beta_1 X_2 + \cdots \beta_n X_n \tag{2}$$

where p is the probability of using a particular tool (e.g. discussion boards) and $X_1, X_2,\ldots, X_n$ are independent variables such as discipline type, course level and region and $\beta_0, \beta_1,\ldots, \beta_n$ are the coefficients.s. This model permitted to find out the major predictors, for instance, the probability of soft disciplines to utilize the collaborative tools - group projects and discussion boards, more than hard disciplines.

MANOVA and ANCOVA

A MANOVA was performed to understand the effect of the use of disciplinary groupings on the choice of teaching methods using the 5 discipline teams as independent variable quantities and the use of teaching methods as the dependent variables. In Eq. (3), the general formula for MANOVA is given.

$$Y = XB + E \tag{3}$$

where Y refers to dependent variable quantity, X refers to the independent variable quantity, and B is a matrix of coefficients Y and E – matrix from error. Results showed a statistically significant multivariate effect (Wilk's Λ = 0.87, p = 0.006, F (16, 71) = 2.149) indicating that the application of various teaching approaches varied amongst the different discipline groups. Analysis of covariance (ANOVA) was used to control for potential confounding variables, such as geographical level and region of research, in a further analysis. Eq (4) is the ANCOVA model.

$$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \cdots \beta_n X_n + \gamma Z + \epsilon \tag{4}$$

Such as if Y is the dependent variable (such as use of collaborative tools), α\alphaα is the intercept, $\beta_1, \beta_2,\ldots, \beta_n$ are the coefficients for the independent variables, and γ is the coefficient for the covariate Z such as region, and ϵ is the error term. The results of the ANCOVA confirmed the effect of region and study level on the use of specific teaching methods and found significant difference between North American and European instructors.

Analysis of Hypotheses and Correlation Analysis

Three primary hypotheses were tested regarding the influence of discipline type on course mode, tool selection, and teaching methods. The relationships between the frequency of tool use and discipline type were assessed using correlation analysis. Using Eq. (5), Pearson correlation coefficient was calculated.

$$r = \frac{\sum (X_i - \bar{X})(Y_i - \bar{Y})}{\sqrt{\sum (X_i - \bar{X})^2 \sum (Y_i - \bar{Y})^2}} \tag{5}$$

The correlation coefficient is denoted by r, and X_i and Y_i are the value of the two variable quantities, and $\bar{Y}$ and $\bar{X}$ refers to the respective mean. The relationship between the use of case studies and being in soft discipline was positive and statistically significant (p < 0.010, (r = 0.421), which is what one would expect soft disciplines to do more often using case studies as a teaching tool. Further chi square and regression analyses were also conducted to test hypothesis 2, which predicted that faculty in hard disciplines would prefer tools such as test creation and specialized software, while faculty in soft disciplines would like group projects and discussion boards. Most of the tools were significantly different between the two types of disciplines in the chi-square tests (e.g., case studies, χ^2 = 7.96, η^2 = 0.033, p = 0.005).

Structural Equation Modeling

Structural Equation Modeling (SEM) was employed to further determine the links between latent variable quantities such as discipline type, course mode and tool use. The SEM analysis was done in accordance with the general form in Eq. (6).

$$\eta = \beta\eta + \Gamma\xi + \zeta \tag{6}$$

We denote η as endogenous latent variables (e.g., types of teaching methods), ξ as exogenous latent variables (e.g., types of discipline), β and Γ are matrices of path coefficients, and ζ is error terms. By using SEM, we can gain a more comprehensive understanding of how discipline type affects teaching method preferences, and find that discipline type has a direct effect on tool selection but an indirect effect on teaching method preferences through course mode. This analysis of the SEM results confirmed the mediation of the course mode in the relationship between discipline type and tool selection. For example, the path from discipline type to course mode (β = 0.35, p < 0.01) and from course mode to tool selection (β = 0.42, p < 0.01) was significant, indicating discipline type affects tool selection via course mode.

IV. RESULTS

Table 1 presents the characteristics of the 240 usable survey respondents: The participant distribution is mostly North American (85 percent); sufficiently represented throughout 5 discipline categories (i.e. 13-34 percent); and somewhat highly represented soft discipline (i.e. 62 percent). A majority of responders (74 percent) were educated at undergraduate levels. A positive correlation existed between the study levels (i.e., undergraduate vs. graduate) and classifications of disciplines (p = .001, χ^2 = 18.191), with a greater Strategy proportion and OPI participants instructing at postgraduate levels, in contrast to AFE disciplines that were predominantly offered at the undergraduate level.

Table 1. Sample Attributes

Characteristic	Count (%)	Characteristic	Frequency (%)
Level of Course			
Undergraduate	177 (74%)	Graduate	63 (26%)
Type of Discipline			
Hard	92 (38%)	Soft	148 (62%)
Discipline Group			
Accounting, Finance, Economics (AFE)	50 (21%)	Operations, Production, Innovation (OPI)	43 (18%)
Marketing, Business Management (MBM)	81 (34%)	Strategy (STRAT)	35 (15%)
Organizational Behavior, Human Resources (OBHR)	31 (14%)		
Class Size			
20 students or fewer	34 (13%)	21–35 students	72 (30%)
36–50 students	67 (28%)	51–75 students	32 (13%)
More than 75 students	35 (14%)	Massive Open Online Course (MOOC)	13 (6%)
Teaching Experience (Years)			
1–4 years	47 (20%)	5–10 years	65 (27%)
Over 10 years	128 (53%)		
Geographical Region			
Europe	33 (16%)	Canada	98 (44%)
USA	96 (41%)		

Table 2. Course Modalities Based on Disciplines (Including Groupings and Types) (Percentage and Count)

Course Mode/Disciplines (Count)	Completely Online (%)	Blended/Hybrid (%)	Web-based (%)	Chi-Square Statistics
HARD (89)	44.9 (40)	36 (32)	19.1 (17)	χ^2 = 3.42, df = 2.1, p = .179
SOFT (144)	54.2 (78)	34.7 (50)	11.1 (16)	
AFE (47)	40.4 (19)	36.2 (17)	23.4 (11)	χ^2 = 14.18, df = 8, p = .077
OPI (42)	50 (21)	35.7 (15)	14.3 (6)	
MBM (80)	58.8 (47)	33.8 (27)	7.5 (6)	
STRAT (34)	35.3 (12)	50 (17)	14.7 (5)	
OBHR (30)	63.3 (19)	20 (6)	16.7 (5)	

NOTE: Highest percentages for every mode are emphasized in bold within the categories and classifications of disciplines (first column).

Regional disparities were evident in 5 categories (p = .019, χ^2 = 18.469). The participants in Europe mostly occupied OPI and AFE groups (e.g. 35.2 percent vs 55 percent of participants in North America). European teachers were more inclined to offer undergraduate courses than their counterparts in North American (p = .003, χ^2 = 11.179). In subsequent evaluations, research area and degree served as factors for examining variations across five disciplinary categories. The disparities in several demographic parameters (e.g., class size, MOOC, teaching experience) across different fields and disciplinary groups we statistically insignificant.

H1

We hypothesized that there will be no substantial variation in design of education program modes based on specific disciplines, as delineated by subject groups or types, according to contradictory literature on the matter. **Table 2** indicates that no substantial cross-disciplinary variations in course mode selection were observed (web-based = 14 percent; blended/hybrid = 35.2 percent; completely online = 50.6 percent of the sample) between soft and hard disciplines (p = .188, χ^2 = 3.436) and across five discipline categories (p = .076, χ^2 = 14.181). Assessments of 3-way crosstabulations (utilizing course levels and area) revealed no associations between kinds and groupings of course mode and discipline. Consequently, H1 is validated, which means that no statistically significant correlation exists between the selection of course method in a faculty (% of digital delivery) and BME discipline (topic or type groupings). This study elucidates that the style or mode of course, as curriculum component, is not significantly affected by specialty in academics.

H2

We posited that the selection of specific tools by members of a faculty will be affected by their field (hard/soft categories; five disciplinary groupings). This means that rigorous courses will choose test development, specialist application interfaces, and digital assignment platforms, while less rigorous courses will opt for discussion forums and collaborative tools. OPI and AFE are associated with specialist application interfaces, simulations, and games; STRAT with case studies, simulations, and presentations; OBHR and MBM with discussion boards, reflective journals, and collaborative work. Our χ^2 test indicated statistically significant variations between the two discipline groups (i.e. soft and hard). The software group had a higher propensity for using case scenarios (i.e. 87 percent), presentations (i.e. 68 percent), group projects (i.e. 78 percent), journals (i.e. 66 percent), group tools (i.e. 55 percent) and, research papers (i.e. 68 percent), so validating the majority of the anticipations outlined in H2 (refer to **Table 3**).

Additionally employed regularly, albeit with differences in application that were statistically insignificant across soft and hard groups or the disciplinary groups, which include text, audio, or video (62 percent), video/Camstasia lectures (62 percent), asynchronous discussion (71 percent), direct communications with learners (78 percent), PowerPoint (78 percent), online gradebook (82 percent), assignment grading (85 percent). We anticipated that the use of discussion boards would be much greater in soft disciplines than in hard disciplines; however, this was not seen, hence refuting H2. The technical proliferation of discussion forums is more general and not contingent upon the kind of course. Our χ^2 test revealed that grouping tools were substantially more prevalent in OBHR (61 percent) and STRAT (60 percent) than AFE (26 percent), exhibiting a medium effect degree (where η^2 is .06), hence corroborating H2. Professors (for Strategy) employed group projects (89 percent) and case studies (91 percent) more often than educators in OPI (58%, 74%) and AFE (43%, 70%). The OBHR group had the greatest application of journals at 81%, partly corroborating H2, while fields like OPI and AFE demonstrated markedly lower usage at 50% and 47%, respectively.

OPI teachers (49%) used specialist software more often than OBHR instructors (16%), aligning with the expectations of H2; however, AFE instructors (26 percent) did not fulfill the anticipated usage of the customized software that is statistically significant, hence not confirming H2. The most substantial size impact, indicated by η^2, was observed in grouping projects (i.e. 0.103), whereas medium-small from medium size impacts were identified in the comparison of disciplinary usage of research papers (i.e. 0.061), journal articles (i.e. 0.046), case studies (i.e. 0.039), and customized software (i.e. 0.049) (refer to **Table 3**). Further assessments using 3-way cross-tabulation, with either area or degree of research as factors, indicated that the disparities in 5 discipline groupings remained statistically relevant. The sort of instruments employed, nonetheless, varied according to area and academic level. For instance, group projects, case studies, research articles, and collaborative tools were associated with geographic area and academic level—North American educators instructing graduate and less rigorous subjects were more inclined to utilized these resources to enhance their teachings than their counterparts in Europe. The χ^2 and η^2 evaluation mainly supported H2, indicating that faculty chose technology and tools is highly influenced by their field, as assessed by both kinds and groups.

Table 3. Comparative Analysis of Tools by Discipline in Descending Order (%).

Disciplines/Tools (Mean % Use)	Group Projects (66%)	Research Papers (59%)	Journals (58%)	Grouping Tools (47%)	Customized Software (28%)	Case Study (80%)	Pres'n (63%)	Statistics
HARD	49.5***	44.6***	47.8*	35.9**	23.9	71.7**	55.4*	$\chi^2 = 7.96$, $\eta^2 = 0.033$
SOFT	77.7***	68.2***	65.5**	55.4*	34.3	86.5**	68.2*	$\chi^2 = 20.33$, $\eta^2 = 0.085$
AFE	42.5**	42.5**	46.8	45.7**	30*	70*	61.7	$\chi^2 = 13.17$, $\eta^2 = 0.055$
OPI	58.1***	53.5**	58.1*	58.1**	26*	74.4*	65.1	$\chi^2 = 7.35$, $\eta^2 = 0.031$
MBM	64.4**	67.9**	62.5**	48.8**	24.7	72.9**	59.7*	$\chi^2 = 24.56$, $\eta^2 = 0.103$
STRAT	88.6***	68.6**	68.6*	60**	28.6*	91.4*	74.3	$\chi^2 = 14.63$, $\eta^2 = 0.061$
OBHR	88.8**	67.7**	60**	61.3*	26.7*	90.3**	71	$\chi^2 = 11.08$, $\eta^2 = 0.046$
STATS (df = 1)	$\chi^2 = 4.01$, $\eta^2 = 0.017$							
STATS (df = 4)	$\chi^2 = 24.56$, $\eta^2 = 0.103$	$\chi^2 = 14.63$, $\eta^2 = 0.061$		$\chi^2 = 8.68$, $\eta^2 = 0.036$	$\chi^2 = 11.72$, $\eta^2 = 0.049$	$\chi^2 = 9.45$, $\eta^2 = 0.039$		

*NOTE: *, **, and *** represent $p \leq .05$, $p \leq .01$, and $p < .001$, respectively. The highest % mean usage of every instrument is BOLDED across disciplinary categories and groups.*

H3

We hypothesized the disciplines of course would affect selection by faculty members concerning favorite teaching approaches. Hard discipline groups favor instruments from didactic methodology of teaching, while soft disciplines use tools associated with dialectic methodology (collaborative and dialogic). OPI and AFE instruments shall be categorized under didactic methodology. MBM, OBHR, and STRAT will favor instruments derived from dialectic communication technique. STRAT would increasingly use dialectical collaborative teaching techniques. MBM, OBHR, OPI, and AFE will favor instruments derived from heuristic approach. Our study identified disciplinary variations in teaching methodologies or pedagogy. According to the classifications of Haruna [12], the 29 examined instructional resources, together with their percentage use and totals, were categorized into 4 methodologies of teaching.

The t-test methodology regarding the application of various instructional methodologies across soft and hard disciplines indicated that soft groupings preferred more dynamic strategies, yielding high ratings for dialectic interactive methods (where Cohen's d is 0=.34, i.e. small effect size) and heuristic approaches (where Cohen's d is 0.38, i.e. small-medium impact size), thereby supporting H3. This means that educators in 'soft' subjects were inclined to include reflective and interactive activities into their instruction. Various MANCOVA and MANOVA tests ensued, using a 5-group disciplines as independent variable quantity, with area and degree of research considered as covariates and instruction methods as dependent variable quantity, with area and degree of studies as a covariate, and instructional techniques as dependent variable quantity. Disciplines, as indicated by participation in the five groupings, had a substantial multi-variate influence on the employment of instructional techniques ($p = .006$, $F(16, 710) = 2.160$; partial $\eta^2 = 0.040$, Wilk's $\Lambda = 0.871$).

There was no correlation between the study location and the employment of instructional techniques; nevertheless, significant variations in teaching methods were seen between study levels (partial $\eta^2 = 0.088$, Wilk's $\Lambda = 0.910$, $p < .006$, $F(4, 219) = 5.330$). Utilizing area and study area as factors in MANCOVA approach revealed statistically significant variations in the entire 5-grouped disciplines (partial $\eta^2 = 0.041$, Wilk's $\Lambda = 0.085$, $p = .005$, $F(16, 665) = 2.181$). Subsequent evaluations based on ANCOVA indicated that the employment of dialectic interactive technique varied significantly in the entire 5-grouped disciplines (partial $\eta^2 = 0.061$, $p = .0111$, $F(4,220) = 3.231$), so partly corroborating H3. Paired post-hoc comparison employment the Scheffe's process revealed significant disparities in the utilization of dialectic interactive instruments (including group instruments, case studies, group projects, and simulations) between STRAT and AFE ($p = .0089$), corroborating H3 – Strategy teachers utilized these instruments more extensively than their counterparts in Accounting, Finance, and Economics.

V. DISCUSSION

The results have not only validated the significance of distinctions between disciplines identified in 21st century study, but also clarified their characteristics by indicating that disciplinary categories (soft vs. hard and their associated subject groupings (e.g. AFE) continue to impact the selection of tools and pedagogical approaches in online and blended environments. Numerous colleges and academic institutions have embraced a hybrid or blended mode of education. This instructional method encompasses both on-campus sessions and flexible online learning. Hybrid and blended education enable students to engage in both in-person and online learning, along with structured and self-directed coursework. This instructional method may become the standard, since it enables educators to innovate and modify material, particularly in fields where they have had challenges in delivering an engaging online learning experience.

From the standpoint of cognitive psychology, the disparities in online instruction across diverse fields mostly appear in the cognitive perspectives and learning patterns of students from different academic backgrounds. From the perspective of educational technology theory, there is a need for the ongoing advancement of multidimensional and multilayer teaching systems to align with the knowledge frameworks, pedagogical principles, and curricular attributes of many disciplines. From a practical standpoint, it is essential to closely examine the substantial differences among various disciplines regarding subject content and learning objectives, pedagogical approaches and learning activities, assessment and feedback mechanisms, as well as the roles of educators and technological assistance. It is essential to actively cultivate pedagogical approaches that are customized for various fields, particularly for experimental courses. In contrast to conventional classroom education, a significant advancement of online learning is the enhanced convenience and immediacy of instructional feedback.

We should highlight the prospects for educational technology innovation and the integration of industry and education resulting from the varied advancement of online teaching across different disciplines within the larger external educational landscape and technological development trends. The topic of disciplinary distinctions poses obstacles for teaching structure and operation, while also fostering potential for individualized learning, collaborative teaching, and diverse evaluation. China is a significant participant in online education; however, it has not yet emerged as a dominant force in this sector. To maximize the educational potential of online learning and enhance its revolutionary importance, online education, exemplified by flipped classrooms and MOOCs, offers novel teaching methodologies and educational avenues, while also introducing groundbreaking educational concepts and paradigms. Consequently, online education must prioritize the reassessment of external contexts, transcend the rigid mindset of "100% replication of classroom education," and investigate innovative pedagogical approaches and operational models, thereby offering educators and learners more unique educational experiences and fostering the holistic enhancement of their knowledge, skills, and attributes.

Nonetheless, not every research has shown disciplinary variations in pedagogy. Khummanee et al. [13] posited that the establishment and oversight of teaching standards at the institutional level are pertinent to the assertion that specific disciplines may have less influence than the institution on the duration and kind of instruction selected by faculty. The first significant observation, as noted by Andrews and Higson [14], was that distinctions between soft and hard groupings were evident, albeit sometimes at odds with previous studies. These inconsistencies may stem from the evolution of academic standards or may reflect the multifaceted character of the BME area, which encompasses other groupings. The business groupings are progressively required to create curriculum, which enhances learners' communication skills, teamwork, leadership, and interpersonal skills, typically referred to as 'soft' skills, alongside numerical analyses or technical expertise, or 'hard' competencies, typically gained in more numerical fields.

Currently, the cultivation of soft competencies at college is essential, as learners must be prepared as proactive individuals to enter the job market and meet its expectations upon graduation. Therefore, it is important to use pedagogical techniques in the classroom that facilitate students in acquiring or enhancing these abilities. Consequently, tasks that need both technical expertise and skill development must be considered. In light of these concepts, the faculty responsible for Numerical Analysis courses at the FRSN (Facultad Regional San Nicolás), UTN (Universidad Tecnológica Nacional) in Argentina, included didactic arrangements into their instruction to facilitate the acquisition and reinforcement of these abilities. Active communication is among the most esteemed soft talents. This capability pertains to the formulation of claims that are both grammatically accurate and socially acceptable. Numerous writers equate soft skills with interactive skills; nevertheless, the former represents just one aspect of soft talents. Cimatti [15] asserts that soft skills are crucial, with companies acknowledging them as a fundamental criterion for job seekers across all industries and professions. Soft competencies are non-technical, intangible, personality-based abilities that define an individual's capabilities as a facilitator, leader, negotiator, and mediator.

In a study by Beutell, Abarca, and Majluf [16], the majority of CEOs identified soft competencies (written or oral communication, collaboration, and critical thinking) as the most deficient among business graduate students. The transformative prospectus in the business discipline will prioritize both hard and soft competencies, including problem-solving, critical thinking, communication, computer and technological skills, collaboration, analytical reasoning, and business analysis. Rao [17] advocated for colleges to enhance students' soft skills, such as interpersonal, teamwork, communication, and management abilities, while also maintaining the development of fundamental entry-level hard skills to satisfy industry requirements. In the study conducted by Azevedo, Apfelthaler, and Hurst [18], employers in four European nations anticipated that business graduates would have elevated levels of discipline-specific abilities combined with broader communication and interpersonal competences.

The field of BME will persist in prioritizing the acquisition of advanced analytical skills due to the growing significance of novel technologies, data mining, and artificial intelligence [19]. However, BME is required to implement a balanced strategy that also enhances human competencies, particularly those focused in soft groupings, which are not easily automatable in the near future. Teaching methodologies may be classified into two primary categories: teacher-centered methodologies and student-centered methodologies. Prior research indicated a preference for teacher-centered pedagogical methods in challenging subjects. In a teacher-centered approach, knowledge is mostly generated by the educator, who perceives students as passive consumers of information, disregarding their pre-existing knowledge. This method articulates learning outcomes in quantitative terms, neglecting to adequately acknowledge students' grasp of information.

VI. CONCLUSION

We discover that there are large differences between hard and soft academic disciplines regarding the course design, as well as the use of teaching tools, which are consistent with the specific characteristics of each field. The findings from quantitative analysis indicated that instructors of hard disciplines such as sciences and engineering teach structured, content rich courses focused on problem solving and technical skill development through simulations, lab work and quantitative assessments. Unlike hard disciplines, however, social science and humanities soft discipline instructors prefer a less rigid course design which encourages discussion, critical thinking, reflective learning using tools such as case studies, open ended assignments, and qualitative assessment. These new findings have implications that pedagogical choices are strongly influenced by disciplinary context in which they are embedded. Pedagogical methods are employed in each field that are appropriate to its students' cognitive demands and learning styles. Results show that the importance of an approach to educational design that acknowledges these disciplinary differences as well as the divergent objectives and learning outcomes among each discipline in course structure and teaching tools. Such an approach can be tailor made for any academic discipline and can enhance the student engagement and the effectiveness of student learning.

CRediT Author Statement

The author reviewed the results and approved the final version of the manuscript.

Data Availability

No data was used to support this study.

Conflicts of Interests

The author declares that they have no conflicts of interest.

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References

[1]. A. Hwang, C. J. Fornaciari, C. J. Asarta, J. B. Arbaugh, and Z. Ferrara, "An analysis of highly cited scholarship in business and management education: Findings and future agendas," The International Journal of Management Education, vol. 19, no. 1, p. 100447, Nov. 2020, doi: 10.1016/j.ijme.2020.100447.

[2]. B. M. Jena, S. L. Gupta, and N. Mishra, "Effectiveness of online learning and Face-to-Face teaching pedagogy," in CRC Press eBooks, 2021, pp. 21–43. doi: 10.1201/9781003132097-2.

[3]. S. White and I. Liccardi, "Harnessing Insight into Disciplinary Differences to Refine e-learning Design," Proceedings. Frontiers in Education. 36th Annual Conference, Jan. 2006, doi: 10.1109/fie.2006.322553.

[4]. D. Buhalis, D. Leung, and M. Lin, "Metaverse as a disruptive technology revolutionising tourism management and marketing," Tourism Management, vol. 97, p. 104724, Jan. 2023, doi: 10.1016/j.tourman.2023.104724.

[5]. A. Macpherson, M. Elliot, I. Harris, and G. Homan, "E-learning: reflections and evaluation of corporate programmes," Human Resource Development International, vol. 7, no. 3, pp. 295–313, Sep. 2004, doi: 10.1080/13678860310001630638.

[6]. D. G. Mayo, "An objective theory of statistical testing," Synthese, vol. 57, no. 3, pp. 297–340, Dec. 1983, doi: 10.1007/bf01064701.

[7]. S. Choudhury and K. A. McKinney, “Digital media, the developing brain and the interpretive plasticity of neuroplasticity,” Transcultural Psychiatry, vol. 50, no. 2, pp. 192–215, Apr. 2013, doi: 10.1177/1363461512474623.
[8]. C. Lai, M. Shum, and Y. Tian, “Enhancing learners’ self-directed use of technology for language learning: the effectiveness of an online training platform,” Computer Assisted Language Learning, vol. 29, no. 1, pp. 40–60, Mar. 2014, doi: 10.1080/09588221.2014.889714.
[9]. S. Cairncross and M. Mannion, “Interactive Multimedia and Learning: Realizing the benefits,” Innovations in Education and Teaching International, vol. 38, no. 2, pp. 156–164, Jan. 2001, doi: 10.1080/14703290110035428.
[10]. R. Lozano, M. Merrill, K. Sammalisto, K. Ceulemans, and F. Lozano, “Connecting Competences and Pedagogical Approaches for Sustainable Development in Higher Education: A Literature Review and Framework proposal,” Sustainability, vol. 9, no. 10, p. 1889, Oct. 2017, doi: 10.3390/su9101889.
[11]. A. Habibi et al., “Building an Online community: student teachers’ perceptions on the advantages of using social networking services in a teacher education program,” Turkish Online Journal of Distance Education, vol. 19, no. 1, pp. 46–61, Jan. 2018, doi: 10.17718/tojde.382663.
[12]. P. Haruna, “Design, Extent of use and usefulness of instructional materials by student teachers on teaching practice – the Mentors’ assessment,” International Journal of Research and Innovation in Social Science, vol. 06, no. 06, pp. 394–398, Jan. 2022, doi: 10.47772/ijriss.2022.6608.
[13]. O. Khummanee, “The Supervision Model Promoting the Implementation of Education Quality Assurance System Development Based on Ministerial Regulations for Education Quality Assurance 2018 for Educational Institutions under Hua Hin Municipality, Thailand,” SSRN Electronic Journal, Jan. 2021, doi: 10.2139/ssrn.3921646.
[14]. J. Andrews and H. Higson, “Graduate Employability, ‘Soft Skills’ versus ‘Hard’ Business knowledge: A European study,” Higher Education in Europe, vol. 33, no. 4, pp. 411–422, Dec. 2008, doi: 10.1080/03797720802522627.
[15]. B. Cimatti, “definition, development, assessment of soft skills and their role for the quality of organizations and enterprises,” Mar. 2016, doi: 10.18421/ijqr10.01-05.
[16]. N. J. Beutell, N. Abarca, and N. Majluf, Soft skills for human centered management and global sustainability. 2021. doi: 10.4324/9781003094463.
[17]. Rao, “Step by step to soft-skills training,” Human Resource Management International Digest, vol. 23, no. 6, pp. 34–36, Aug. 2015, doi: 10.1108/hrmid-06-2015-0099.
[18]. A. Azevedo, G. Apfelthaler, and D. Hurst, “Competency development in business graduates: An industry-driven approach for examining the alignment of undergraduate business education with industry requirements,” The International Journal of Management Education, vol. 10, no. 1, pp. 12–28, Apr. 2012, doi: 10.1016/j.ijme.2012.02.002.
[19]. Z. B. Akhtar, “Exploring Biomedical Engineering (BME): Advances within Accelerated Computing and Regenerative Medicine for a Computational and Medical Science Perspective Exploration Analysis,” Journal of Emergency Medicine Open Access, vol. 2, no. 1, pp. 01–23, Jun. 2024, doi: 10.33140/jemoa.02.01.06.