

BRIDGING THE GAP: AN NLP-BASED COMPARATIVE ANALYSIS OF COMMERCE STREAM DEGREE AND PROFESSIONAL QUALIFICATION CURRICULA IN SRI LANKA

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ABSTRACT

Selecting a suitable career path is a challenging task for students in Sri Lanka, particularly after the Advanced Level Examination. The student has multiple choices, like pursuing a degree at state universities, professional qualifications, or non-state universities. These decisions are influenced by their cultural backgrounds, peers' opinions, and a lack of knowledge about the skills needed for their desired jobs in the market. This can create a mismatch between the skills that the graduates have, and the skills required by the employers. This study systematically analyses 598 modules from eight state university accounting and finance degrees and compares them with 128 modules from six professional accounting programs. The aim is to identify the similarities, gaps, and opportunities for better alignment. Utilizing Natural Language Processing techniques, especially the Sentence-BERT tool, this study analyzed the module names, descriptions of programs for content similarity, thematic relevance, and alignment with the skills needed in the accounting job market with extracted from 20 job postings. Our analysis reveals that professional programs cover about 92% of the necessary technical and soft skills, while university curricula address only 8%, which derived from semantic skill tag matching, where each module was compared with industry skills using SBERT based similarity scoring. This study offers a roadmap to guide students in making informed choices about their educational paths, based on their career goals.

Keywords: Commerce Curriculum, Curriculum Comparison, Natural Language Processing, Professional Qualification, Skill Mapping

1. Introduction

Choosing a suitable higher educational path after completing the General Certificate of Education Level (G.C.E. A/L) examination is a challenging task for students in Sri Lanka. They typically select among their major students' available options including degrees in state universities, professional qualifications, and non-state university programs. However, their choices are often made based on cultural influences, peer and family pressure, cost issues, and perceived prestige rather than an all-out assessment of program suitability (Edirisinghe et al., 2022). This issue is further compounded by structural limitations within the higher education system in Sri Lanka. After successfully completing the A/L examinations, around 26% of eligible students gain admission to state universities and this leaves the majority forced to take other paths like enrolling in private universities or obtaining professional qualifications (Elango, 2025).

However, these alternatives differ in their curricula structures, delivery methods and intended learning outcomes. For example, professional programs frequently follow staged examination approaches in addition to practical training, while university degrees typically follow a semester-based format. Despite these structural differences, students frequently do not have access to clear, comparative curriculum information (Lakshmi et al., 2023). In addition, the fact that Sri Lankan students have limited and dispersed access to career guidance services. Although the current system is still underdeveloped, it is acknowledged that this type of assistance is important to resolve discrepancies between graduate skills and labor market demands (Elango, 2025). Lack availability of career guidance services further enhanced this information gap, causing many students to choose programs that are not relevant to their competencies or career goals.

Given these challenges, this study aims to systematically compare commerce related bachelor's degree curricula with professional qualifications to identify skill gaps and provide evidence-based roadmap guidance. This study is guided by three main objectives:

- (1) What similarities and differences exist between the curriculum content of state university degree programs and professional qualifications?
- (2) To what extent do these curricula align with skills required in the accounting job market?
- (3) How can data driven evidence be translated into a practical roadmap that guides students toward the most suitable educational pathway?

In order to achieve these objectives, this study employs recent advancements in Natural Language Processing (NLP), which is especially applicable for analyzing curriculum documents as they contain large volumes of unstructured, inconsistently formatted texts. NLP enables scalable, systematic comparison of module names, descriptions, learning outcomes and thematic structures which would be difficult to evaluate manually (Lan et al., 2015). Techniques such as TF-IDF, SBERT embeddings, Cosine similarity and keyword based classifications allow the detection of latent themes, semantic overlaps and skill set alignments with a greater precision and less human bias (Ahadi et al., 2022; Reimers & Gurevych, 2019). Studies that are conducted globally, have demonstrated that NLP techniques can enhance curriculum analysis by identifying gaps that are often missed in traditional evaluations (Ahadi et al., 2022; Gonzalez-Gomez et al., 2025).

However, the application of NLP in curriculum studies remains limited. As far as the authors are aware, this is the first study in Sri Lanka to apply NLP for comparative analysis of commerce curricula across academic and professional qualifications.

Within this broader setting of commerce curricula, this study focuses on the accounting domain due to its high demand and the significant number of students pursuing jobs in business and financial services. This offers a comprehensive roadmap to assist students, educators and policymakers in making well informed decisions regarding academic and professional pathways. It makes two main contributions; 1) illustrating how NLP techniques like TF-IDF, Jaccard similarity and SBERT embeddings can be used to compare curriculum contents, identify thematic areas, and map skill alignment and 2) proposing a data driven roadmap to make informed decisions about academic and

professional pathways. The results highlight the need to better align Sri Lanka's educational system with the demands of the labor market by indicating notable content overlap but distinct thematic focus and industry alignment discrepancies.

2. Literature Review

2.1. Higher Education and Professional Pathways in Sri Lanka

As noted earlier, Sri Lanka's higher education system provides alternative options with many students turning to private university degrees or professional qualifications due to limited access to state universities. Professional programs like AAT, CA, CIMA, and ACCA are especially attractive in commerce related fields due to their industry alignment, perceived employability and flexible entrance pathways. Nadishan (2020) shows that institutional image, program structure and the quality of instruction are critical factors impacting the student satisfaction in these programs. Despite the high perceived value, Perera et al. (2021) noted that, only 30% of undergraduates follow both academic and professional programs highlighting the practical barriers. This underscores an overall issue in misalignment between educational content and labor market needs. According to Muthaiyah et al. (2021), found that less than 5% of modern digital tools were included in the accounting curriculum and in relation to Peemanee et al. (2024) emphasized that the majority of employers feel dissatisfied with graduate's analytical and digital skills capabilities. However, these studies focus on symptomatic signs of the skill gaps like satisfaction or enrolment rates, but do not systematically compare the curriculum content of academic and professional pathways. Therefore, this suggests a significant gap in literature regarding how curriculum design can drive these discrepancies.

2.2. Existing Curriculum Comparison Studies

In the Sri Lankan context, empirical comparisons of academic and professional qualifications are limited. However, (Edirisinghe et al., 2019) revealed differences in structure, credit distribution and course coverage by conducting a comparative study of accounting programs in Sri Lanka and Australia, but did not include professional qualifications

and was cross country, which limited its direct applicability to local pathways Globally, West (2016) used text analytics to detect gaps and redundancies in curricular with recommending redesign. Similarly, Muthaiyah et al. (2021) and Ontong & Bruwer (2024) emphasized the need of combining digital and analytical skills into business education by noting the impact of curricula sequencing on skill acquisition, yet they did not directly compare different qualifications pathways or measures the overlaps of curriculum contents. Garbett (2016) compared a business degree curriculum in UK university with professional program syllabus and concluded that the latter was rigorous and in line with industry standards. Such comparative studies imply that professional programs can serve as reform models for boosting complementary. However, it is still unclear that these trends of curricula rigor and alignment are also reflected in the Sri Lankan context. Overall, despite these studies suggest that the value of professional programs as the reform model, they have not conducted a qualitative study of the compatibility between academic and professional tracks, which leaves this question open.

2.3. Role of NLP in Curriculum Analysis and Skill Mapping

Natural Language Processing (NLP) is a powerful methodological tool for analyzing curricula at a large scale. Lan et al. (2015) reviewed NLP applications in the education domain including semantic analysis and topic modelling methods, which enables thorough mapping of educational contents. The article by Ahadi et al. (2022) highlighted the skill analytics framework which used NLP techniques to map curricula content to industry skills and identify skill gaps. Alkhidir et al. (2024) applied BERT based models to identify topic overlaps in the UAE's curriculum. Conversely, Duarte et al. (2024) and John & Gasmi (2024) employed clustering techniques to compare course content by revealing overlaps and missing themes. Rashtian et al. (2020) demonstrated the possibility of NLP in aligning learning outcomes with graduates' competencies, whereas Botov & Klenin (2017) used composite similarity measures to automate syllabus comparison. Gonzalez-Gomez et al. (2025) highlighted employment of NLP in making skill predictions through the curriculum and job texts. Altogether, these studies establish NLP as a stable tool to reveal latent insights with the help of curricula analysis and skill matchings. However, most of this research focuses on

mapping and comparing curricula in one educational path or on the course level, rather than directly comparing different qualification pathways.

2.4. Research Gap

Overall, the literature implies general issues about outdated curricula and skill gaps in Sri Lanka (Muthaiyah et al., 2021; Peemanee et al., 2024), but does not directly and empirically compare academic and professional pathways. Especially, no previous literature has been able to use NLP to quantify the alignments of the state university and professional accounting programs with one another and with industry requirements. Therefore, to fill this gap, this study addresses this gap by using advanced NLP techniques to compute the Sri Lankan curriculum contents overlaps, gaps and complementarities between academic and professional paths. By doing that, it aims to offer evidence-based roadmap for students, educators, and policymakers to better align educational pathways with workforce skill needs.

3. Methodology

3.1. Data Collection and Preparation

This study examined eight state universities offering specialized bachelor's degrees in accounting and finance (University Grant Commissions, 2023) and six professional accounting bodies CA Sri Lanka, ACCA, CIMA, CPA Australia, AAT, and CMA to represent both local and international career pathways. Curricula were obtained from official websites, converted from PDF to structured Excel files using PDFPlumber in Python. To ensure reliability, all module titles and descriptions were checked manually against the original documents for completeness, accuracy, and institutional consistency. Three datasets were used: (a) state university curricula, (b) professional qualification curricula, and (c) skills extracted from LinkedIn job postings for entry-level accounting and finance roles. Module names and descriptions were pre-processed by converting text to lowercase, removing punctuation and excess whitespace, and merging them into a single "full text" field for analysis.

The skills dataset stored within an Excel sheet contained job titles, company names, and a predefined “Skills” field. The skills were cleaned and standardized using keyword lists of technical, soft and emerging skills, and matched with curriculum content later using SBERT semantic similarity. Python (3.10) using pandas and NumPy for data management; Matplotlib and Seaborn for data visualization; NLTK for removing stop words and token management; scikit-learn for TF-IDF, similarities (cosine) calculations; and the Sentence-Transformers library (model all-MiniLM-L6-v2) for SBERT embeddings.

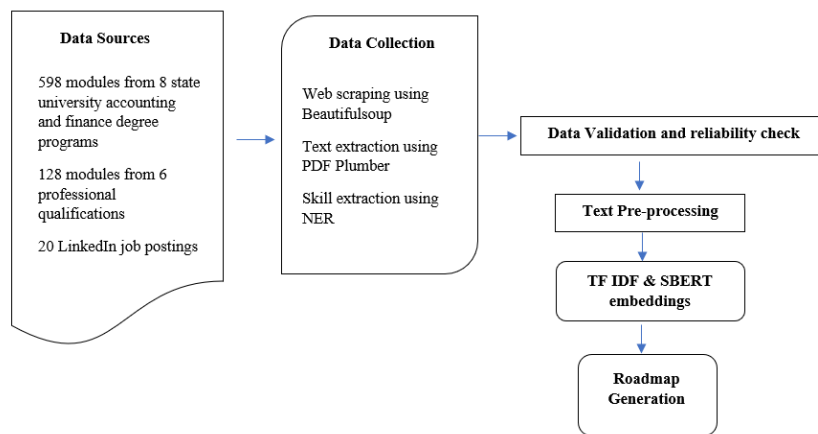


Figure 1: Methodology Pipeline Steps

3.2. Analytical Framework

In this study, several analytical methods were used to compare the curriculum. First, Term Frequency–Inverse Document Frequency (TF-IDF) was applied to highlight both commonly used and institution-specific terms, while cosine similarity on TF-IDF vectors helped measure how closely the wording of different modules matched (Manning & Raghavan, 2009). Jaccard similarity was then used to check the degree of overlap in language between module names (Sun et al., 2024). To go beyond surface-level wording, we used Sentence-BERT (SBERT) embeddings combined with cosine similarity to capture deeper semantic connections between modules (Reimers & Gurevych, 2019).

After calculating similarity scores for every SBERT embedding pair, we examined their distribution (Figure 1) to choose a threshold that would reliably identify high similarity. The roadmap and subsequent decisions presented in this study are derived from the results generated by the SBERT-based comparison.

The distribution of SBERT similarities showed a median of 0.41, and only about 1% of module pairs had similarity scores above 0.72. Accordingly, similar thresholds were established empirically rather than in an arbitrary manner. Pairs with scores of ≥ 0.75 corresponded to the top $\sim 1\%$ of pairs in the similarity distribution table (99th percentile) and

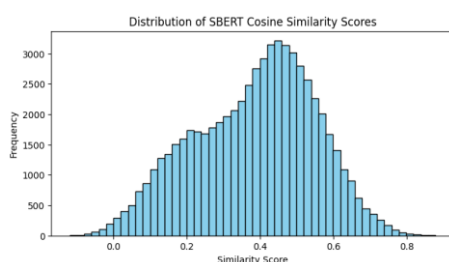


Figure 2: Distribution of SBERT Cosine Similarity Scores

were categorized as high-similar semantic matches. Pairs with scores < 0.65 ($< 95\text{th}-99\text{th}$ percentile band) were labelled unique modules. Unique modules were also noted for those appearing only once or twice in both datasets. Thus, these threshold determinations are statistically grounded and

robust, and alignment is consistent with previous literature, which has treated cosine similarity values of > 0.70 as evidence for strong semantic matching. Classified the major curriculum themes such as Financial Technology (FinTech), Enterprise Resource Planning (ERP), Data Analytics, and Ethics using keywords selected by experts. These themes were tagged using a combined approach of rule-based keyword matching with SBERT and cosine similarity.

Skills were classified into three categories: technical skills (such as Python, SQL, and ERP), soft skills (including communication and leadership), and emerging skills (like artificial intelligence and blockchain), using the same hybrid method (Khushi Jaiswal, 2024). The analysis also identified emerging tools, including SAP, Power BI, and Tableau. The findings were visualized using Matplotlib and Seaborn, including heatmaps for module similarity, word clouds for common and unique modules, bar and pie charts for theme and skill coverage, and tree maps for module frequency and uniqueness.

4. Results/Analysis and Discussion

This section synthesizes the findings derived from three comprehensive analyses. The initial analysis employed SBERT-based semantic similarity to compare the curricula of Sri Lankan state universities with those of professional accounting programs, thereby identifying both shared and distinct academic content. The second analysis assessed the alignment of university and professional curricula with the skills extracted from a range of accounting job postings. The third analysis culminated in the development of a student-centered roadmap designed to address identified discrepancies, effectively guiding Advanced Level (A/L) students in selecting optimal educational pathways. Collectively, these analyses illuminate both structural similarities and notable divergences among academic, professional, and hybrid pathways.

4.1. Curriculum Content Comparison

The analysis of cosine similarities between academic modules using SBERT revealed important topic overlaps, which were illustrated by a word cloud. The key subjects included management accounting, financial accounting, advanced management accounting, strategic management, cost management accounting, and corporate reporting. These findings show that, despite different names, both state university degree programs and professional qualifications emphasize advanced financial management, cost control, and strategic analysis.

A heat map of high similarity module counts (cosine score ≥ 0.75) was used to examine cross-institutional alignment. There was considerable variance among the universities in the analysis. Sri Jayewardenepura and Jaffna displayed higher alignment to programs like ACCA and CMA, while Sabaragamuwa and Wayamba had limited alignment. This implies that some universities may have incorporated more industry-aligned content than their colleagues. Darker cells indicate more shared modules.

Further analysis identified modules that were unique to each educational pathway. Modules exclusive to state universities indicated by a similarity score of less than 0.65 included research methodology, business statistics, socio-political environment, and introduction to real

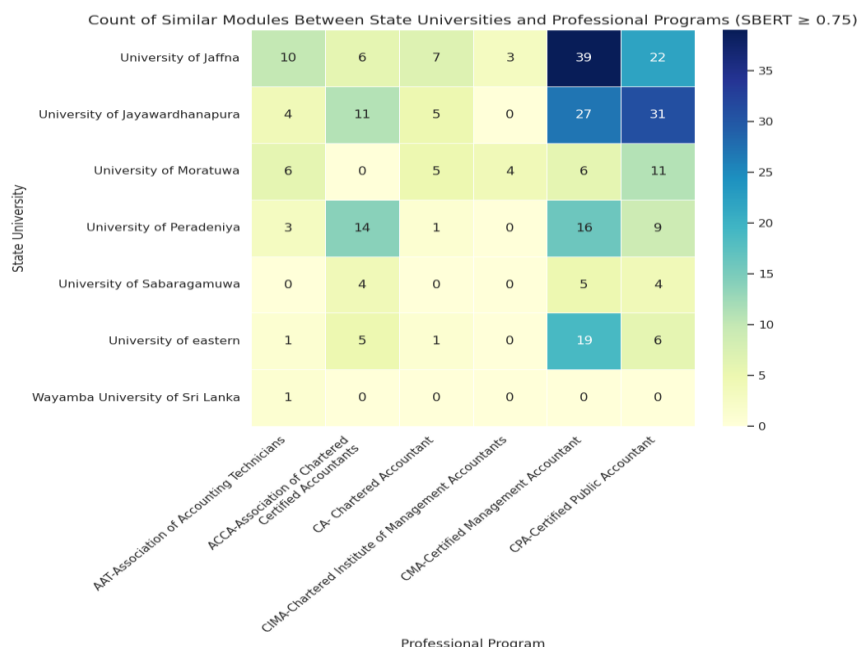


Figure 3: Heat Map of High-Similarity Module Counts (SBERT ≥ 0.75) between State Universities and Professional Qualifications



Figure 4: Unique Module Name in State in Professional Curriculum (SBERT < 0.65)

estate. This highlights a broader academic focus that goes beyond accounting, including research skills, quantitative analysis, and contextual studies. On the other hand, modules unique to professional programs reflected by similar scores of less than 0.65 focused on essential leadership, professional ethics, and public interest, demonstrating a commitment to leadership, ethical practices, and decision-making in professional contexts. reflecting their role in

competency-based training and preparing learners for immediate industry engagement.

Key themes include leadership, ethics, and public interest, reflecting practical orientation. The high concentration of similarity scores in the lower range with more than 73% of module pairs below 0.50 and only 0.5% above 0.75 shows that there is significant structural limitation on meaningful semantic alignment between academic and professional modules. This score distribution provides compelling evidence that the two pathways are anchored in fundamentally different pedagogical logics: universities tend to focus on broader disciplinary exposure and research-oriented knowledge, whereas professional bodies emphasize technical skills, leadership, and ethical practice. These findings are consistent with studies by (Garbett, 2016), which found that professional qualifications consist greater focus on competency-based, workplace-oriented learning and require higher levels of analytic and evaluative abilities than a university degree program. Additionally, these findings were also similar to the results of (Muthaiyah et al., 2021), who identified significant gaps in digital and analytical skills of accounting graduates in the context of university curricula, as well as the evolving use of technologies.

4.2. Industry Skill Alignment with the Curriculum

In evaluating the alignment of curricula with labor market demands, skills were extracted from accounting job postings and categorized into technical (e.g., ERP systems, data analytics), soft (e.g., communication, teamwork), and emerging (e.g., fintech, blockchain, AI) skills. A skill was determined to be in a curriculum if one of the modules met the cosine similarity threshold of 0.70, which was chosen based on distributional analysis where scores above the 75th percentile (~ 0.72) reflected strong semantic alignment. Coverage values were calculated as the proportion of skills exceeding the threshold in each pathway. The result revealed that the comparison of courses from state universities and professional programs showed a marked disparity in skill coverage. Professional programs addressed approximately 92% of the technical and soft skills identified in job postings, while state university curricula covered only about 8%. This indicates that professional bodies are significantly more

attuned to market needs, effectively integrating industry-relevant competencies within their syllabi.

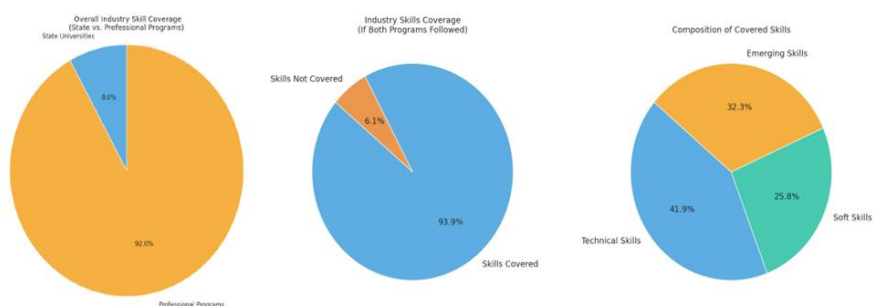


Figure 5: Industry Skill Coverage Across University, Professional, and Combined Pathways

The chart on the left side shows average technical and soft skill coverage across modules, indicating that professional programs cover over 90% of the required skills, while state universities cover roughly 8%.

When both university and professional programs were considered together, skill coverage increased significantly which is shown in the middle and right side of the pie charts in Figure 6. This combined approach addressed 93.9% of the identified skills, leaving just 6.1% uncovered. The skills encompassed approximately 42% technical skills, 26% soft skills, and 32% emerging skills. These findings highlight that integrating both pathways lead to near-complete skill coverage and a balanced distribution of skill types, whereas each pathway alone has considerable gaps, particularly within technical and emerging skill areas.

Middle proportion of industry skills covered if both university and professional programs are followed. Right composition of covered skills by category (technical, soft, emerging). Combining the two pathways covers nearly all required skills, with emerging skills representing about one-third of the covered portfolio.

Emerging tools and technologies, such as blockchain, data analytics platforms, and AI, are increasingly featured in job postings. A summary of these tools across curricula indicated that professional programs represented 74.6% of all mentions, while state universities accounted

for only 25.4%. This disparity emphasizes the limited exposure to cutting-edge tools in university curricula and identifies a pressing need for curriculum enhancement.

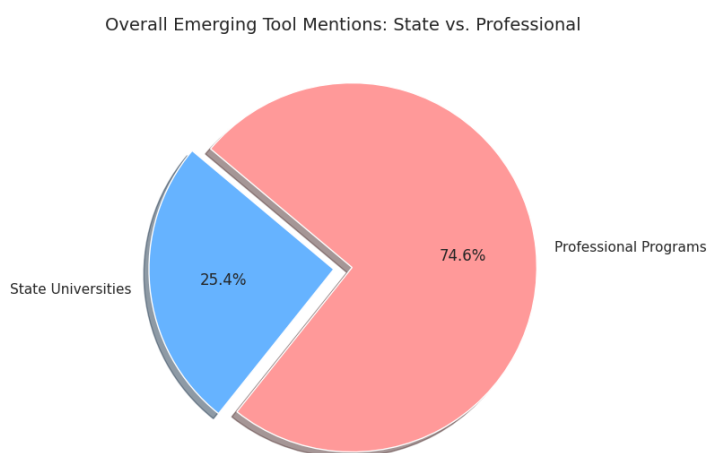


Figure 6: Overall Coverage of the Emerging Tools

Overall mentions of emerging tools in state-university curricula versus professional programs. Professional qualifications incorporate three-quarters of all mentions, whereas universities cover only about one-quarter, suggesting a significant lag in technology adoption. The alignment gap remains stable across threshold bands and module groupings, suggesting that the differences observed are systematic, not due to isolated modules or specific skill bundles. These results highlight the necessity of structured curriculum updates that should integrate digital, analytical, and practice competencies in demand in the accounting profession today.

4.3. Roadmap for Bridging Curricular Gaps

The final analysis translated the findings into a comprehensive decision-making roadmap for Advanced Level (A/L) students pursuing accounting and finance. This guide first advises students to review the eligibility requirements for university admission and professional qualifications. Subsequently, students are encouraged to reflect on whether they seek academic depth, rapid professional recognition, or a blend of both. Three distinct pathways are outlined; (a) pursuing a

university degree independently, which fosters in-depth knowledge, academic rigor, and research skills; (b) obtaining a professional qualification exclusively, offering swift entry into the workforce and global recognition; and (c) a combined approach, whereby students first earn a university degree and subsequently pursue professional certification, thereby acquiring both a broad conceptual foundation and specialized technical expertise.

The guide further emphasizes the significance of strategic planning and lifelong learning. It recommends that students select electives, internships, and extracurricular activities aligned with contemporary, in-demand skills such as data analytics, financial technology (fintech), and sustainability. Moreover, it encourages students to utilize exemptions available from professional organizations and to consider postgraduate studies for advanced knowledge acquisition. This decision-making guide serves as a practical resource, translating analytical insights into personalized recommendations tailored to individual career aspirations. The complete decision-making roadmap, including a flow chart to assist students in navigating eligibility criteria, pathway selection, and skills planning, is provided in Appendix A.

5. Conclusion and Implication

The result of this study highlights notable findings. First, while both state university and professional accounting programs have a common foundation in financial and management accounting, their primary focus is very different. Academic programs value a thorough understanding of the area, contextual studies and research skills whereas professional qualifications focus practical skills, ethical practices, and industry relevancy. This noted dissimilarity highlights the interdependent quality of the two pathways. Second, a combination of both paths provides the most through covering of skills, effectively bridging significant gaps in technical, and emerging skills that may not be addressed through either path pursued separately. As a result, this reinforces the notion of combining curricula to provide the best preparation for future accounting professionals.

Theoretically, this study represents the potential of Natural Language Processing (NLP) to operationalize skill mapping in higher education

with semantic similarity, based on SBERT as a scalable and replicable technique to align academic curricula with real world industry needs. However, certain limits must be noticed. The analysis is limited to publicly available course materials, which may not include the most recent informal changes or practical experiences like internships. Furthermore, while NLP based semantic matching can provide reliable detection of similar content, it may not capture the depth or quality of each course instruction.

Future research should expand this approach by including private universities' curricula as well as long term employability data in order to analyze the real-world impact of various educational pathways. Even though this study first introduced the preliminary phrase of comparison of state and private degree programs, due to the limitation of availability of private university curriculum data this study did not include it. Furthermore, incorporating insights from key stakeholders, such as employers, graduates and academic designers would also strengthen the findings and allow for more specific further improvements. Finally, strong collaboration among universities, professional organizations and policymakers is critical in order to ensure that graduates have both academic knowledge and practical skills for long term success in the ever-evolving accounting profession.

In terms of actionable steps academic institutions should include modules that are related to FinTech, ERP and Data Analytics, which are heavily focused on professional courses but are often missing in degree curricula. Also tool specific training in platforms such as Tableau and Power BI which are increasingly demanded across industries, should also be embedded.

The practical implications of this study are significant. It is recommended that policymakers and educators should come up with ways to better align and recognize both academic and professional curricula like incorporating professional courses into degree programs or allowing credit transfers. Professional institutions should also consider recognizing academic coursework for exemptions, thus minimizing duplications and speeding up professional advancements. Theoretically, this study contributes to the new body of research on NLP

based curriculum analysis by demonstrating its usefulness in identifying gaps in curriculum structure and skill alignment in higher education.

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Appendix A

<https://drive.google.com/file/d/1-a1oIdnbwkPxlfkCDyOqnWbNDpi0Ut9D/view?usp=sharing>