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Framework to Maintain Specialisations in a General Degree Structure: An Economical High-Value degree Structure

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ABSTRACT

Structuring a degree is a common activity for course developers. Analyzing appropriate subjects and year levels, establishing pre- and co-requisite, and benchmarking against similar degrees are common academic activities. However, the degree structure itself has not had significant changes until now. A degree often lacks flexibility and cohesion and arguably may even lose the main concept of making students highly skilled in the selected labor market more employable. After examining different degree structures, approaches, and employability incentives, we identified a degree structure that can divide each subject into components. Subjects' learning activities, tutorials, and assessments are tailored to align more closely with employment skills. We then proposed breaking all subjects into components relative to year levels, such as majors, minors, streams, and more. *This sub-division of work can be performed to any degree. Particular advantages come with a general degree with standard core units and majors—creating learning activities closer to the major and offering students a more robust academic scaffold of their subjects. In addition, higher Education providers benefit by having a cost-efficient degree with minimum overhead to pass the benefits onto students. We discussed several examples from engineering, business, and information technology. Showing how learning opportunities can be divided per degree and subjects into degrees, majors, streams, and specializations. Students studying this framework will have developed skills firmly built on each other, enabling specialization in employment careers and academically. Closing the gap between employment and graduation.*

INTRODUCTION

Many universities offer general degrees, primarily caused by major cost-saving initiatives, including mass redundancies and campus closure, resulting in maintained core units and electives or less popular units discontinued. As a result, the general degree structure typically comprises a fundamental multi-discipline core with limited discipline-specific subjects. Rather than a dedicated professional degree with mostly discipline-specific subjects. Therefore, it is argued that students no longer gain sufficient discipline-specific knowledge that their predecessors enjoyed. It may cause

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students to become less competent in their chosen discipline and consequently find it harder to get a job and force them to do further studies such as a master's degree.

This proposed research examines the existing teaching framework of the standard lecturer-tutorial approach and makes recommendations for specialization-specific learning activities. The framework developed demonstrates how subdivision-specific learning opportunities can be introduced to a general degree structure to maintain specific skills and competencies.

Background and Rationale

There is significant research on the effectiveness of higher education. Cost benefits analysis often shows that those who complete a university degree and have a career are generally financially much better off decades later (Walcott, Corso, Rodenbusch, & Dolan, 2018); (Hauser, 2012); (Vuolo, Mortimer, & Staff, 2016). However, the research literature does not commonly discuss the difficulties in finding a job and how many graduates cannot find a job. Often reported in the press, such as (Scheiber, 2016); (Clark, 2013); (Chamorro-Premuzic & Frankiewicz, 2019); (Redden, 2020). Higher Education providers must do a better job of making graduates more employable and educating their students on realistic employability prospects.

Professionalism includes restricting the labor pool for credentials such as an academic degree, commonly done for lawyers, doctors, accountants, economists, engineers, scientists, etc. These expert or specialized knowledge requirements can be inaccurate or overstated when controlling the labor supply hence, rewarding labor within a market niche. Although niche markets, by definition, are difficult to get into.

Nowadays, there are three main types of degrees: Academic degrees that focus on research and traditional fields such as history, sciences, and mathematics; professional degrees that focus on practicality, such as the Bachelor of Accounting or Bachelor of Computer Science. Lastly, the general degree such as a Bachelor of Engineering with common core subjects with majors and related disciplines subjects (Venkatraman, Wahr, de Souza-Daw, & Kaspi, 2016); (Kelly, 2000); (Walker, 1990). Degrees must be economically affordable without lacking in integrity or rigor. General degrees with multiple common subjects are seen as economical by the educational provider but may fail to prepare students adequately for a professional career as they might be too general. We focus on improving the general degree structure such that both the economy of a general degree and the integrity of specializing in a professional degree are preserved. More economically structured degrees will enable savings to be passed on to students.

It has been established that there is a gap between higher education and higher employment. Bravenboer and Lester (Bravenboer & Lester, 2016) examined professional competence, particularly the debate between theory and practice/knowledge and competence. Their suggested findings that we support indicate that competence can be effectively integrated and aligned with academic learning outcomes.

It is far too familiar that graduates comment they use *"nothing"* or very little of their degree. Not surprising that some degrees have added subjects that include searching for extra-terrestrial life to attract students from other disciplines (Machado & Casillas-Marti´nez, 2009). The more common explanation why students use very little of their degree is the disconnect between subjects and the graduate's career. Several degrees might be less practical for a career (Childress & Gerber, 2015). However, it is most likely not the subject itself, except for a few cases, that is disconnected from a graduate career subjects, and their contents are highly debated in advisory boards and professional society (de Souza-Daw & Ross, Fraud in higher education: a system for detection and prevention, 2021). It is more likely that subjects' assessments and learning activities are rarely discussed with the same rigor. Assessments could be toy-based with little practical applications (limits good students' capacity to excel) to highly advanced real-world applications. Alternatively, at worse and breach of the subject guide, an assessment may not be relevant to the subject! It is an area that can be significantly improved. Making as many practical learning opportunities relevant to a career path should be of paramount concern.

Consider the common Chinese proverb, "I hear, and I forget; I see, and I remember; I do, and I understand." It highlights the need to be involved and practice the knowledge you are taught. It usually is done through assessments and other active participation activities. If we can make all assessments better aligned with one's chosen career, this will likely produce students with high practical experience and practical exposure to the profession. Structuring degree assessments and learning activities as a holistic approach to increasing students' skills in the profession is the focus of this paper. Our approach makes students better prepared for the industry with more exposure to professional aspirations without dropping standards, as other approaches have been heavily criticized (Schnee, 2008).

Literature review

Improvements to the course are usually add-ons. For example, adding a subject to an existing degree as done and publish countless times, such as (i) moving away from the conventional university practice of mathematics being delivered from the mathematics department to engineering mathematics taught by an engineer with dedicated engineering-related tutorial problems (Ferguson, 2012) (ii) adding a Secure Design subject to complement a Cybersecurity degrees (Sharevski, Trowbridge, & Westbrook, 2018) (iii) updating subject content with innovative software (de Souza-Daw, Nguyen, Hoang, & Le Hoang, 2021) and many more examples including (Daly, 2011); (Moskal, Lurie, & Cooper, 2004); (Cooper, Dann, & Pausch, 2003) and (Winberg, et al., 2020). Some address difficulties in learning specific topics by having dedicated software like Cengage's Alice to help teach the basics of programming. Others try to improve non-technical/soft skills (Jackson & Chapman, 2012). Most attempts have made students prepare to meet subject learning outcomes or better prepare them for the industry with real-world relevant examples and experience. Many focus on improving assessments.

Assessments are critical to demonstrate an assurance of learning attained through various knowledge and skills, and hence such a student is ready for employment or further study (Coates, 2015). However, the quality of assessments is a significant problem and has lacked a thorough analysis for a very long time. Coates argues that traditional approaches to higher education do not scale well in terms of quality and productivity. Coates says that building academics' assessment skills and capacity are arguably the most significant intervention. There is no doubt that assessment must come under increased scrutiny. However, the standardization of assessments, including those that test graduate learning outcomes, has little impact on learning or teaching practices (Coates, 2015). Riebe and Jackson have tried to analyze rubrics and change them to assess employability skills (Riebe & Jackson, 2014). This approach has merit. However, it needs to ensure that the assessment meets learning outcomes before improving them to meet employment skills. Another initiative has been taken to assess and measure students' learning based on the rubric to reflect the development of key employability skills during a course. These rubrics assess interpersonal skills like teamwork, personal qualities, communication, and critical thinking, which are considered vital skills to be career-ready (De la Harpe & David, Employability skills: Measuring and reflecting student learning, 2020); (Riebe & Jackson, 2014). The solution is not to focus on better assessments as these should improve over time as the same lecturer is teaching it, and it has been tried before, often resulting in peak performance metrics but not a long-term solution. Assessment accumulates together to form a degree and is highly dependent on a degree structure.

Joint, double, concurrent degrees (JDCD) (Joyner, 2016); (Lam & Tsui, 2013) have a strong focus on adding more and more knowledge. These degrees make graduates more employable, enabling them to use either majors or degrees in a job or job application. Moreover, as employment in one degree declines, there may be significantly more opportunities in the other degree. Majors usually consist of 5-8 subjects. Minors have a narrower focus and are typically 3-4 subjects related to a field of study. It may be beneficial but does not strengthen a graduate's skills; rather adds more variety of skills instead. Overloaded degrees were once another option. However, this allowed students to study more subjects than a standard degree. Increasing the student debt and creating a studying week greater than 40 hours per week for no real employment advantage. It triggers another problem by adding assessments and subjects to a course; it may over-assessed students as learning outcomes may overlap between subjects not normally taken together. We need to be careful not to add more assessments students need to do, such as group projects, oral presentations, laboratory work, and examinations, to avoid excessive workload that may have a negative learning effect instead of limiting the number of assessments and having them as close to real-work as possible. With a well-structured degree with adequate student support, non-traditional students can experience high levels of success reported in various engineering pathway programs (Belkina, 2016).

Undergraduate certificates are being offered as a solution for micro-credentialism at the Higher Education level. These are typically comprised of four subjects in a semester-long qualification. Although for skills-specific, it would be better if students did the first year than the more advanced units, such as a career in programming. The appropriate subject includes sequential programming, object-oriented programming, and rapid application development. The combination of all programming subjects would make a candidate a more skilled programmer after another. Certificates are a collection of subjects to specialize in a certain skill area in a semester. It, as well as diploma and advanced diploma, provide multiple exit points in a degree. However, the group of subjects could still have very little relevance or build upon each other sufficiently enough to meet employer and job competency. Table 1 shows how an undergraduate degree can be broken into qualifications. Table 2 shows how a graduate degree is broken into qualifications. All of these initiatives add costs.

Table 1 Qualification Structure of an Undergraduate Degree

Year	Semester	Qualifications
1	1	Undergraduate Certification
	2	Diploma
2	3	Advanced Diploma/Associate Degree
	4	
3	5	
	6	Degrees
4	7	
	8	Honors

Table 2 Qualification Structure of a Graduate Degree

Year	Semester	Qualifications
5	9	Graduate Certificates
	10	
6	11	
	12	Masters
7-10	13	PhD

Adding to the expense of the degree should be avoided. Costs of the degree, particularly in recent times, have become an ever-mounting concern for people taking up a degree (Gonz´alez Canch´e); (Canch´e, 2019); (Andruska, Hogarth, Fletcher, Forbes, & Wohlgemuth, 2014). Moreover, it questions whether a degree is worthwhile. Notably, low-income students cannot afford to fail; otherwise, their opportunities will be limited.

There is always a debate on whether higher education providers are doing enough to prepare students for the workforce. Studies often find that graduates overestimate themselves while employers argue they lack necessary skills (Matsouka & Mihail, 2016); (Fajaryati, Budiyono, Akhyar, & Wiranto, 2020); (Osmani, et al., 2015); (Lowden, Hall, Elliot, & Lewin, 2011). To make matters more complex, studies show that employment gaps and degrees have a shelf life - much harder to get a professional job the longer the gap after graduation and before professional employment (Redden, 2020) significantly more uncertainty for Masters degrees and especially for Ph.D. students (Woolston, 2019); (Economist, 2016). CNBC reported (Connley, 2018) that the job-search site Glassdoor (Team, 2020) compiled a list of top employers who no longer require a degree, including Google, Apple, and IBM (Eadicicco, 2020). Perhaps, in defense of higher education institutes, they can not focus their education on one job selection criteria but a common more general position.

Fundamentally, all examples to improve a degree are an add-on to an existing course or changes to an existing subject. Even when a new degree forms, it follows a process similar to (Pitt & Tepper, 2012), but the only solid connection between subjects is the prerequisite. Mapping is performed to subject learning outcomes to degrees learning outcomes and institutes learning outcomes (Pitt & Tepper, 2012); (Knight, 2011).

The University of Colorado took another approach by creating the Bachelor of Innovation (Boult, Dandapani, Polok, Reddy, & Stock, 2010), combining the Business and Engineering majors to have students graduating with a so-called innovative degree. Students can major in Computer Science, Business Administration, Computer Security, Electrical Engineering, and Game Design within the Bachelor of Innovation. It challenges the whole approach and changes the subjects - acknowledging that education must change. Although, it is degrees like this that reduce the student exposure to traditional major knowledge areas and conventional field-work by replacing core engineering or business units with creative communication and globalization units. It is questionable whether they meet the professional standards of an engineering or computer profession under the international accords, particularly when compared to traditional degrees; hence the degree may not be recognized internationally. Boult et al. (Boult, Dandapani, Polok, Reddy, & Stock, 2010) have emphasized entrepreneurship as a core skill. Acknowledging innovation as a graduate skill is important (Meissner & Shmatko, 2019); we, however, want to strengthen the skills within the current degree rather than create a family of degrees.

Four methods of a holistic approach to creating a tailored plan of studies are presented in (Venkatraman, de Souza-Daw, & Kaspi, Improving employment outcomes of career and technical education students, 2018) inclusive of (1) Degree-Apprenticeship, (2) Start-Up Focus Degrees, (3) Tailored Studies, (4) Multiple Majors. It allows a student to concentrate on subjects with a targeted goal. Degrees-Apprenticeship allows students to study in an apprenticeship arrangement to achieve a degree (Hathaway, 2017). A Start-up Focus degree allows students with an entrepreneurial idea to enable studies to create a business. The tailored studies approach allows students to follow a prerequisites structure such as Web Development and Web Application programming. To allow a student to follow a Web Developer career aspirations without finishing the full degree. Degrees-Apprenticeship is envisioned to be particularly good at bridging the technical (hands-on) gap in higher education.

There exists a gap between graduates' skills and knowledge and the employers' ideal candidates. There have been many studies analyzing this difference (Abdullah, et al., 2007); (Wickramasinghe & Perera, 2010); (Love, Haynes, & Irani, 2001); (Bui & Porter, 2010); (Weligamage S. , 2009); (Jusoh, Simun, & Chong, 2011); (Nicholson & Arnold, 1991); (Islam, Ahmed, Khalifah, Sadiq, & Faheem, 2015) using several measurable qualities such as field of study knowledge (Raybould & Wilkins, 2005); (Low, Botes, De La Rue, & Allen, 2016), communication skills (Azami Zaharim, Muhamad, & Isa, 2008), motivation (McMurray, Dutton, McQuaid, & Richard, 2016), trustworthiness, reliability, and willingness to learn, teamwork (Azmi, Kamin, Noordin, & Nasir, 2018), problem-solving (Radermacher, Walia, & Knudson, 2014), entrepreneur and computer skills (Ghani & Muhammad, 2019), confidence (Almi, Rahman, Purusothaman, & Sulaiman, 2011), creativity and innovation (Hill, Overton, Thompson, Kitson, & Coppo, 2019). The engineering program needs to improve in all areas (Trout, 1997) as the workforce needs skilled graduates (Weligamage & Siengthai, 2003); (Johari, Zaini, Zaharim, Basri, & Omar, 2011). As reported, this is a problem across the world in every discipline. Making sure graduates are the best skilled and knowledgeable as possible is not an easy task.

Academic standards are constantly debated. However, t seems to be a consensus that academic standards are falling (Lomas & Tomlinson, 2000); (Levy, 2013), often refers to as dumbing down or lowering standards. Some say it is due to the privatization of the industry (Jałowiecki, 2001), and others say it is massification (Trow, 1987). Others say the decline in the quality of the degree is due to multiple factors such as a reduced average study time, lower academic requirements (Trout, 1997) and average wages, and inflated grade (Beblav´y, Teteryatnikova, & Thum-Thysen, 2015). Delayed regulation and stricter enforcement may occur, but still, it is not a fundamental solution to degrees paired with careers.

Assessments have been mapped to Subject Intended Learning Outcomes and the Degree Learning Outcome. Studies indicate this approach is essential and analyze some critical influences in beliefs, reporting, and policy (De la Harpe & David, Major influences on the teaching and assessment of graduate attribute, 2012). There is no mapping of assessments to other assessments in the same subjects or other subjects. For example, assessments build upon another learning activity that supports another activity in another subject. Learning Outcomes can be mapped to Skills Framework for the Information Age (SFIA), typically done during an Australian Computer Society accreditation. No assessment is mapped to a job outcome. There is no solid connection between what students do (e.g., assessments/learning activities) within a degree or their career aspirations and identifying a gap that needs analysis for opportunity and development.

One such attempt has taken a professional engineering subject common to six majors and comprises global lectures with major-specific workshops (Cuskelly & McBride, 2017). The assessment was a project related to students primarily in the first year. The authors negatively reported the workload distribution as course coordinators leading projects they did not have a background in lack of ownership and responsibilities (Cuskelly & McBride, 2017). The initiatives of making common assessments and workshop contributing to their major is commendable. However, a holistic structure approach is needed. As we believe this can be done for all subjects without minimizing the disadvantages.

METHODS

This study adopts a descriptive and pragmatic research approach. It allowed us to analyze the current literature and make observations while applying a range of research techniques as performed in similar studies (Salkind, 2010); (Ihuah & Eaton, 2013); (Venkatraman, de Souza-Daw, & Kaspi, Improving employment outcomes of career and technical education students, 2018); (Creswell, 2003), allows us to make policy suggestions and develop a more robust framework. The insights of "what works" (Patton, 1990) from literature and observations. A similar observation is performed using Kolb's learning cycle (Kolb & Fry, 1975).

The practical framework of specialization-specific assessment is first to identify the problem and understand it within its broadest context. An extensive initial literature review was conducted to identify the possible problem and understand the existing teaching framework of the standard lecturer-tutorial approach. It has been identified that there has been limited research and published literature on such a structure, where students can learn the most critical skills through their assessments, which makes the pragmatic approach the best fit to conduct this study. It leads to research inquiry, which seeks to understand how to maintain discipline-specific skills-set and competence. After consulting the existing literature, the framework based on multiple steps is developed to introduce the specialized assessments into a general structure to retain discipline-specific competencies. The first step is to understand the degree structure by identifying each subject's prerequisites, co-requisites, and major. It leads to the development of subject assessments and relates them to one of the majors. The subject assessments are further broken down into components. Finally, after formulating the framework, it was uniquely trialed within the computer and engineering discipline. During this, key subjects were identified and investigated for mapping multiple specific assessments.

Proposal

In order to combat the growing shortcomings of the traditional higher education approach, a new initiative is needed. Students learn the most critical skills while working on their assignments/assessments and tutorials (e.g., learning activities). We use this observation to build our proposal. These works propose a revolutionary concept with a strong focus on giving students as much practical experience as possible through assessment and classroom activities in their chosen career aspirations. Over the years, there has been significant research into tailoring assessments to project-based assessments to various assessment types, pedagogy, and industry-based experience. However, this is the first paper to present a structured subject-based assessment to allow specialization division at the subject level for all subjects at any year level. We define the subject-division approach to focus on the discipline areas from first-year common core units by initially exposing them to the different discipline opportunities and expectations and following through with second-year core units. Students have been assessed on skills attainment before choosing their specialty. Third-year core standard units would differ by having different assessments that target learning outcomes of the units and learning outcomes of the specialty.

It should be noted that although it is intended for students to be given different assessment, the assessment themselves is equivalent to one another, hence satisfying the higher education regulators. Furthermore, different assessments are typically done as a plagiarism avoidance strategy to give each student a different case study to work on projects with students completing a different project, but all assess the same criteria. Hence, subject-division assessment uses existing techniques more extensively throughout more subjects such that students gain more experience in their related specialty.

The proposed research could demonstrate competency attainment and mastery of discipline areas progressively and overall. It is intended that this will help students gain highly specialized skills as per the degree documentation because they have more practice and exposure in the field. Moreover, the connection between units and how each unit will become more evident to all stakeholders (students, staff, accreditation bodies, and government). An example of a discipline-based assessment would be for a computer scientist (specialty 1) to program his computer security (unit) software tool to flood to a network or for information technologies (specialty 2) to investigate and evaluate standard computer security tools and for computer security (specialty 3) to investigate a hardware image for a particular crime. These assessments would be too large (e.g., 15%) to do all of them in one unit, but if the student had the flexibility, they could do an assignment based on their chosen specialty. Assessments tailored to their discipline-specific degrees will help students be more employable in the discipline.

Proposed Method

Step 1: Break-into-Degrees: Consider a degree, typically a general degree such as engineering. It will have some common subjects and major base subjects. For example, typical engineering majors include Civil, Mechanical, and Electrical. Understand the degree structure and the prerequisite.

Step 2: Break-into-learning opportunities (e.g., Tutorials and Assessments): Every subject must be directly related to one of the majors. Hence, assessments within a subject should be easily tailored to one of the majors. Consider a simple case, such as the subject Professional and Ethical Engineering. The lecturers will discuss multiple codes of conduct, charters, ethical principles, and financial and anti-corruption guidelines within engineering-related examples. The assessments, where students learn to apply the knowledge gained in the lectures, can be major specifics. For example, consider a professional engineering practice degree: the assignments would analyze a professional or ethical case study related to the student's major in a typical two major assignment. i.e., An Electrical engineering student would complete an assignment directly related to electrical engineering, such as re-using electrical cable for another job, including considerations of rusty wiring, how long it will last, and other professional and ethical issues. A civil engineering student might have a case study on constructing a building to meet a 100-year wind. However, it was not tested for a 500-year wind. Similar ethical analysis is expected regardless of the major such as whom to tell, costs versus life, the life of the building/equipment, and more.

It is relatively simple to understand how assignments and subjects can be broken down. However, let us consider breaking it further. For example, civil engineering is typically broken into sub-disciplines, such as Water/Sewage, Transportation, and Structural. Consider a typical Civil Engineering subject of Structural Analysis, where students learn about internal forces, moments, and stress in structures such as beams, pillars, and rafters. Students who want to specialize in Construction engineering should have an assignment based on design, analyzing, and evaluating structural constructions such as buildings. Students choosing to study transportation sub-discipline should focus on designing and evaluating structures such as bridges. Students studying water/sewage should have an assessment focus on water towers or dams.

Assessments or more inclusive learning opportunities can be broken down per discipline, major, or stream in all subjects. For example, a first-year subject is broken down per discipline, a second-year subject is broken into majors, and a third/fourth-year subject is broken into streams. All with a heavy focus on actual work a student will perform in his or her career.

Step 3: Break-Administration: As each assessment can be broken down into components, so can the delivery of a subject. For example, the lecturer gives lectures covering the Learning Outcomes. The lecture covers all subject areas with examples for disciplines, majors, and streams. The tutorial covers the relevant discipline, major, or stream. A subject can be broken into tutorial groups, one for each sub-component. For example, the aforementioned Structural Analysis subject assessments are divided into transportation, water/sewage, and construction. There would be a tutorial and laboratory every week in a typical arrangement. This tutorial and laboratory every week should also be focused on their majors. Tutorial activities and laboratory experiments related to their majors include formulas/equations, examples, and experimentation for stress analysis of Construction, Water/sewage, and Transportation.

For example, building storm-water dykes would have the same first principal equations but different initial conditions and deduce a different result than building a bridge, all covered under the same learning outcomes. All tutorials can run parallel or asynchronous with no restrictions.

In Australia, the modern awards are the minimum terms and conditions of employment. The higher education sector award is known as the post-secondary educational award. In the award, tutors are paid for every one hour of delivery and additional 3 hours of preparation time. Preparation includes markings, consultation, laboratory setup, and other related duties (note that many enterprises' agreement allows for only 2 hours of preparation as 1 hour is paid separately for consultation). It supports our proposal of sub-divided subject content as the lecturer gives the overview, introduction, and general applications of the knowledge. Individual tutors are in charge of creating/organizing/ managing a tutorial related to the lectures and the major. There can be several tutors, one for each sub-division of the subject (the number of tutors equals the number of subdivisions, typically the number of majors). Supportive staff, also known as academic others, can help run the tutorial or laboratory. Therefore, tutors take ownership of the subject material and agree that more academics (including tutors) should have a more stable role in a higher education institute.

Similarly, the Student Satisfactory Survey completed towards the end of the semester is often broken into a lecture, tutorial, and laboratory. These surveys will quickly identify which sub-component has satisfied students or needs improvements. Moreover, it is typical (often regulated) that a disciplined leader in charge of majors and even streams must be disciplined. Our proposal supports these requirements and gives them more opportunity to improve the prerequisite subjects and introduce fundamental relevant material at the earliest possible stage, first-year core subjects with the relevant major division. Consider the case where a private higher education provider has three degrees; A Bachelor of Networking, a Bachelor of Business, and a Bachelor of Programming. Each degree is unique. Typical first-year programming subjects can have lectures that teach the algorithm of swapping two variables (need a temporary variable). It can be done in any computer language or application and will satisfy the learning outcomes. However, only a few will be relevant to a student's career aspiration. Table 3 explores some topics to break down subjects into their degree or majors.

Table 3 Subject Divided into Degrees Related Topics

Subject/Majors	Network	Business	Programming
First-Year Programming	Python	File Maker Pro	Java Scripts
Databases	Administration	Access	SQL
Foundations of IT	Network Project	Programming Project	Business Software Project
Mathematics	Spanning Tree, Subnet Masks, Modular Arithmetic (for encryption)	Decisions Making	Binary Arithmetic for CPU Architecture
System Analysis and design	Network Diagram	SOPIC Diagram	Class Diagram

Python is a widespread language used to configure servers and virtual machines and hence is needed for network professionals. File Maker Pro manages and maintains files and has a back-end script to help modify files or search for content. Particularly useful in a business setting. Web programmers heavily use Java scripts, and are valuable for various computer science applications. Hence, programming applies to different majors and dedicated tools to teach it.

Databases have applications in a wide range of contexts. For example, network engineers need to provide the virtual database machine; configure identity management, storage, backup, etc. Typical business applications include Microsoft Access to create a small to medium database to track business records. Moreover, the programmers would create tables, rows, and columns in the computer language SQL. Hence, database technologies apply to all degrees in this case.

Standard core units such as a foundation subject of IT could vary by doing projects in one's degree and exploring technology in the field. For example, the mathematics field of binary could be taught to network professionals, mainly to work out subnets and binary decision trees (yes/no) for business applications and register architecture operations for programmers. Lastly, System Analysis and Design could be sub-divided into particular applications by looking at a range of diagrams that better fit one major.

Figure 1shows how a range of subjects can be sub-divided into learning opportunities as Step 2. Four examples of a subject being divided into appropriate assessments are a first-year programming subject, a first-year networking subject, an ethical subject, and a testing subject. In this example, all these subjects are common core subjects in three degrees; programming, business, and networking. As aforementioned identified, any subject can be sub-divided.

Figure 2 breaks typical second and third-year subjects into components. These components we are calling streams, as is commonly done in the literature. Object-Oriented Programming can be broken into Java, C++, and Ruby, and each has different applications. For example, Java is for desktop applications, C++ is for drivers and operating systems, and ruby is for client-server applications. Network Forensics could be split depending on location and devices. For example, mobile, cloud, and network. Network Architecture varies widely depending on the application, including the Internet of Things (IoT), Data Centres, and Enterprises. Each subject in a stream can then be broken into Honours subjects, and they can be broken into graduates subjects and, in turn, Masters subjects.

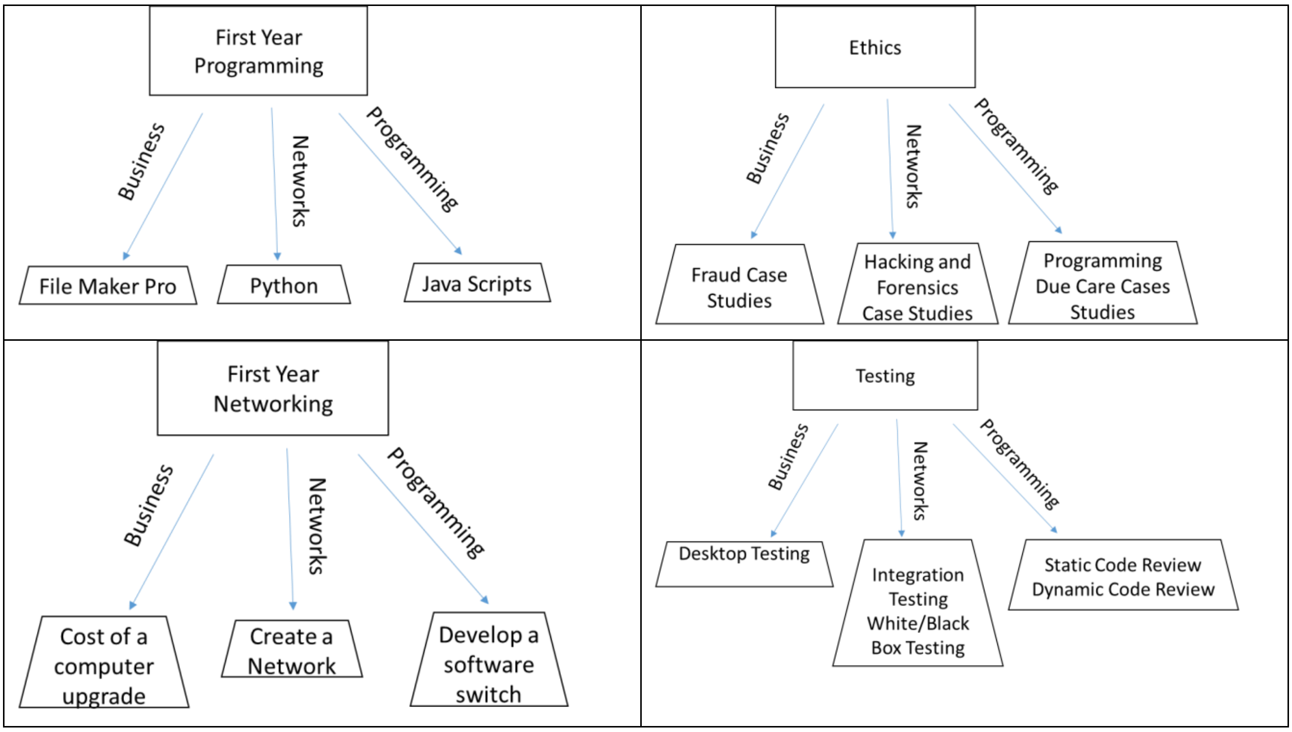
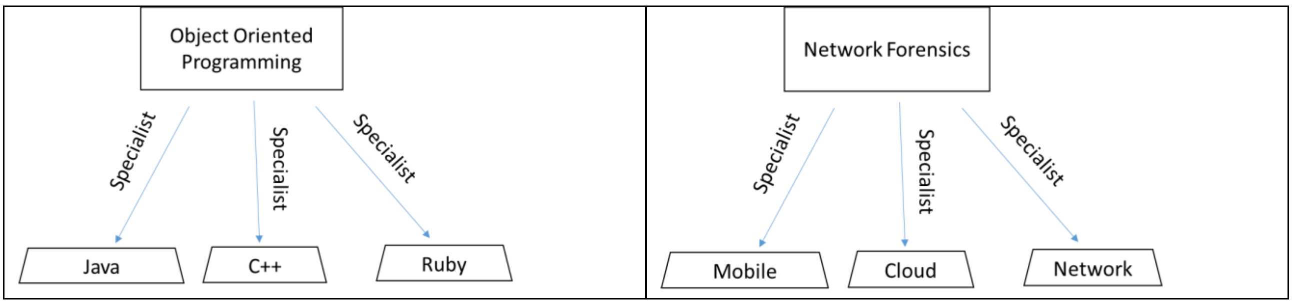


Figure 1 Tree Structure for components of elementary subjects a) First Year Programming, b) First Year Networking, c) Ethics, d) Testing



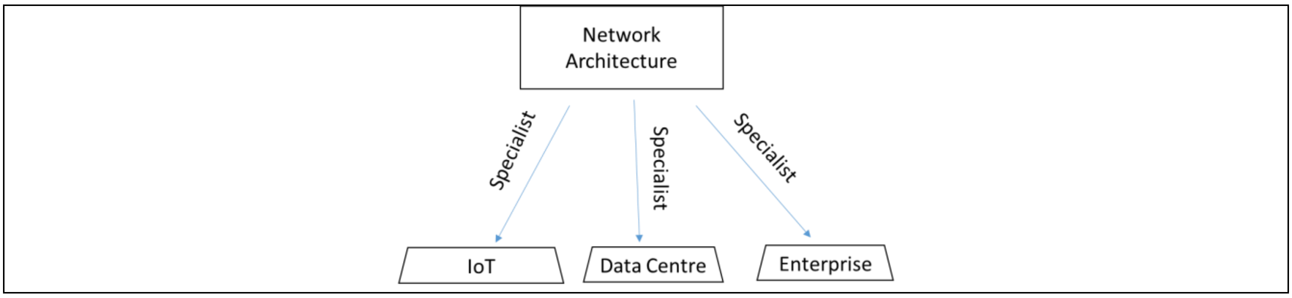


Figure 2 Tree Structure for advanced subjects. a) Object-Oriented Programming b) Network Forensics c) Network Architecture

The method procedure follows: Step 1 Breaking into Degrees, Step 2 Breaking Learning Opportunities, and Step 3 Breaking the Administration.

RESULTS, DISCUSSIONS, AND OBSERVATIONS

Reviewing jobs on popular employment advertisement websites such as LinkedIn and Seek to identify several supporting concepts. Jobs titles and descriptions are highly focused that better fit our sub-division. For example, security cloud specialists or enterprise specialists are not general security network specialists. Another general role is the Cyber Security Analyst in comparison to more highly focusing jobs such as Threat Hunter, Penetration Tester, or Forensic Examiner (Falah, Pan, & Abdelrazek, Visual representation of penetration testing actions and skills in a technical tree model, 2017) and (Falah, Pan, & Chen, A quantitative approach to design special purpose systems to measure hacking skills., 2018). These roles have commonality but often require experience that is only obtainable in a highly specialized subject that would struggle getting enough students to run or a sub-division subject as we are proposing.

Previously, the only way to determine whether a third-year subject is a third-year is if that subject has a second-year prerequisite. Likewise, a second-year subject has the first-year prerequisite. This research demonstrates when a subject is sub-divided into components. The type of components indicates whether it is a first-year, second-year, or third/fourth-year subject. For example, a first-year subject can be broken into degrees related material. A second-year subject can be broken into majors, and a third-year subject can be broken into streams. It must be a first-year subject when a subject is broken into degrees related material.

Moreover, when a subject is divided into majors, it must be a second-year subject. This method is arguable better in determining whether a subject is at the correct year level as some second-year subjects may not have a prerequisite as it relies on knowledge gained in several first-year subjects that anyone or even two prerequisites could not easily be justified. Moreover, the sub-division gives more information to help understand a subject's intention and complexity to identify the year level.

There is an argument that the proposed framework trains students to be too specialized. The argument fundamentally comprises that a degree covers all areas of a successful career. The counter-argument is that we still are meeting the learning outcomes in all subjects and hence still complying with the notion that a degree covers a range of related areas. Moreover, we argue that the proposed framework will strengthen students' skills by focusing on more strongly related skills related to their degree and career. Similarly, employers would have more confidence in graduates as they have more closely aligned experiences in their chosen discipline.

Another confronting argument is that students must choose their majors as they progress through the degree. It is nothing new as students will typically choose their subject comprising of core and elective studies. However, the proposed framework adds another layer of complexity. As students propagate, they should understand what subjects will lead them to which types of jobs and either work backward or forwards to choose their major or specialization. Although triggering another problem as students swap between degrees, majors, and specializations in a subject with sub-components, will this put students at a more significant disadvantage? We argue there is no more disadvantage than students who swap degrees or majors in a more traditional degree structure. Perhaps, only conceding that students can change their sub-division more often than in a traditional degree. On the other hand, students have exposure to sub-components, so choosing a primary/specialization should be more identifiable, and students should have more confidence in their choice, reducing the probability of them changing.

Skills Centric

This proposal enables students to gain specialized skills that scaffold together to meet specific career responsibilities. The more specialized you are, the higher paid and fewer opportunities in general. Typically, you may need to relocate when the job ends. However, a degree with sub-division still meets the degree and intuitions' graduate learning outcomes and meets professional standards. It still gives students the ability to move around job prospects (vertical or parallel). However, once a student obtained a degree, the student could always return and complete the same subject twice but focus on a different sub-component. For example, learn Java, then return and learn the C++ programming language as a single unit. It creates a life-long approach to learning. Repeating particular or multiple subjects to upgrade or refine one's skills as the industry evolves—moreover, simple focus on critical subjects that obtain the appropriate skills needed to ascertain a career aspiration. Similarly, a student repeating the degree could find a different sub-division more motivating than another. It gives students opportunities to learn something new while repeating the fundamental concepts.

Quality Frameworks

The proposed framework strengthens the links between qualification frameworks such as the European Qualifications Framework, the United Kingdom Subject Benchmark Statements, the Australian Qualifications Framework, and the United States Degree Qualification Profile. Enabling students to have stronger foundations within the same level as they propagate through the levels; associate degree to degree to honors/graduate certificate and master. Masters competency includes applying first principles to the amalgamation of subject knowledge and developing new knowledge. The scaffold of sub-components of knowledge should naturally lead to knowledge gaps and exploration areas with our approach. The sub-division of units provides the most relevant knowledge and skills for a career and strengthens students' qualifications.

CONCLUSION

A discipline-specific assessment has been discussed within a practical framework that higher education providers can adopt to maintain a strong discipline skills-set and competence. The proposed degree framework enables a standard general degree structure while maintaining unique learning opportunities to foster employment.

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