INDUSTRY-BASED IT CERTIFICATIONS IN HIGHER EDUCATION INSTITUTIONS: A STAKEHOLDER PERSPECTIVE

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Abstract:

Industry-based certifications (IBC) are one way to provide credentials to learners in Higher Education Institutions (HEI) with product-specific skills (e.g., Low-Code development) that can complement academic degrees (e.g., Business Informatics). To understand the ecosystem of industry-based certifications in the context of HEI, we first visualize stakeholders using the influence and affected features of a rainbow diagram. In this opinion paper, we draw on our personal experiences to understand the opportunities and challenges stakeholders face through the lens of Curriculum Theory to determine that IBC is a recognized way of learning IT skills in a Higher Education Institution. By applying a case study in an Australian university, we explore the challenges and potential of IBC to create value (social, functional, and emotional) to stakeholders in the ecosystem. We will discuss how we integrated the Low-Code development content in an undergraduate and postgraduate course at a mid-sized university. We make several recommendations that could be adopted by stakeholders to drive strategic decision-making.

Keywords: , Higher Education, Stakeholders, Low-code Development, Value creation.

I. INTRODUCTION

In the twenty-first century, micro-credentials are major disruptors of higher education [Varadarajan et al., 2023]. Academics have debated the benefits and challenges of embedding alternative credentials into the traditional higher education degrees [Ahsan et al., 2023, Thi Ngoc Ha et al., 2023, Bull, 2015]. Introducing competency assessments into the curriculum has addressed this concern to a certain extent [Dragoo and Barrows, 2016]. But, for rapid upskilling and gaining employment opportunities quickly, micro-credentials is one of the promising pathways [Varadarajan et al., 2023]. Industry-based certifications (IBC) are a type of micro-credential that could be embedded into the Information Technology curriculum in higher education [Hitchcock, 2007]. The certifications are generally administered by external organizations (e.g., Pearson VUE) and

validated by industry partners (e.g., Microsoft). The IBCs are designed to meet the standards of the Information Technology industry and hence the requirements of recruiters and potential employers [Goldring, 2017]. In the next section, we describe the major industry partners in the ecosystem of IBCs.

Google, Microsoft, Nutanix, Project Management Institute, Amazon, and International Information System Security Certification Consortium are some of the well-known industry partners providing certifications in Information Technology [PCMag, 2023]. Other popular ones are CompTIA, Oracle, IBM, and Cisco. In Australia, some commercial and government organizations using Low-Code development platforms are the Commonwealth Bank, Services Australia, and the Department of Home Affairs. The Commonwealth Bank is the second leading company listed on the Australian Securities Exchange by market capitalization [Statista.com, 2023]. Services Australia is an executive agency of the Australian Government that offers a range of services and makes the government services simple to operate for customers [Services Australia, 2023]. Some industries where Low-Code development platforms have been implemented are Financial Services, Insurance, Healthcare & Life Sciences, Communications Service Providers, Government, and Manufacturing & High-Tech organizations. Thus, based on the above discussion, Low-Code development (e.g., Business Architect Certification) is one way to provide credentials to learners in higher education institutions with product-specific skills that can complement academic degrees. In the next section, we will identify the stakeholders in the IBC ecosystem.

II. STAKEHOLDERS

The stakeholders in the IBC ecosystem are discussed based on the influence and affected factors of a rainbow diagram [Chevalier and Buckles, 2008]. In the rainbow diagram, we represent two aspects (i) how stakeholders are affected by IBCs and (ii) the extent to which stakeholders influence IBCs. To represent the degree of impact and influence, we use the least, moderate and most scale. The stakeholder rainbow diagram is illustrated in Figure 1.

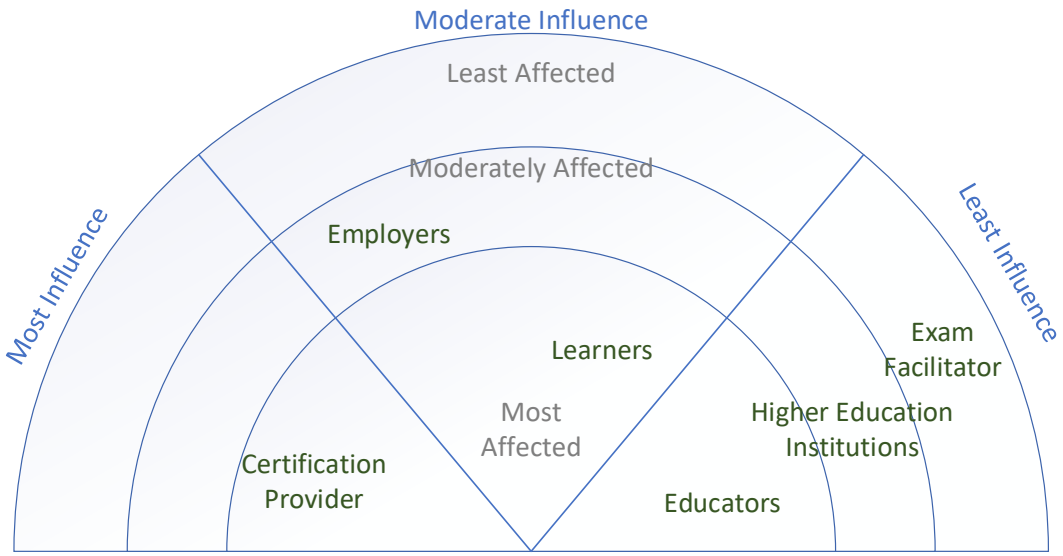

Figure 1: Stakeholder Rainbow Diagram

Learners: Learners are the students undertaking an information technology-based bachelor's or master's degree (course) at a tertiary institute (e.g., university) that incorporates an IBC component in one or more of the units in the course. This is an opportunity to develop knowledge and skills relevant to both their degree and future workplace. Learners are highly affected by IBCs, as these certifications affect not only their learning experience but also their future employment

opportunities. Although they can provide feedback on IBCs through their experiences, overall, they have minimal influence.

Educators: Educators are the tertiary institute's academic staff who deliver the unit in which the IBC is embedded. This includes the unit convenor, lecturers, and sessional staff who facilitate the implementation and lab component of the certification. Educators are highly affected by IBCs as these staff will need to be trained and certified to deliver these certifications, and then provide training and guidance to students when teaching the certification material. Educators can provide feedback on IBCs, and although may have slightly more influence than students, will still have minimal overall influence as these staff are not the primary consumers of IBCs.

Higher Education Institutions: This includes universities and colleges that provide the IBC as part of their course units but do not have the authority to award the certification upon completion of the unit. Certification is awarded by the industry partner offering the certification. These institutions are moderately affected by IBCs, with the demand for IBCs having some effect on student demand and whether an institution's course and unit offerings address industry and professional expectations. Like educators, at an institutional level, feedback can also be provided, particularly through partnership arrangements, but otherwise these institutions have minimal influence over the IBC.

Employers: Employers include commercial organizations, government agencies, and departments that require IT and ICT professionals with real-world skills and knowledge facilitated by the certification. As noted above, this includes (and not limited to) Financial Services, Insurance, Healthcare & Life Sciences, Communications Service Providers, Government, Manufacturing, High-Tech organizations, and others. Employers are moderately affected by IBCs, with these certifications providing a mechanism to verify employee knowledge and skills. The availability of associated training courses and educational offerings in this area provide opportunities for employers to upskill their employees or to obtain new employees with the necessary skills. Employer demand for industry-certified professionals drives uptake of IBCs, thereby providing employers with a moderate degree of influence.

Certification Provider: This is the organization that provides the materials and the credentials required by the certification. This generally includes theory-based content to support the IBC, training materials including practical labs and the technical platform to run practical labs, and certification exam material. The organization is also responsible for managing and authenticating the credentials awarded, either through their own platform or through a third-party credential service such as Credly. The certification provider naturally is highly affected by changes to the IBC as these will necessitate corresponding changes to the materials, platforms, and certification exams. Similarly, the certification provider has high influence on the IBC as this organization is the source of those materials and the credential itself.

Exam Facilitator: This includes the organization(s) that provide the invigilated exam environments for conducting the exams outside of the Higher Education institution, for example Pearson VUE. These organizations are less affected by the IBC than others, as the exam facilitators are only involved at the certification exam stage to provide the appropriate environment, whether online or in-person, for the exam to be undertaken. They also have a low level of influence, being able to influence the style and nature of the certification exam through provision of platforms or environments, but otherwise not having influence into the overall content of the IBC.

The industry-based certification ecosystem is illustrated in Figure 2. The benefits and challenges are discussed in the next section.

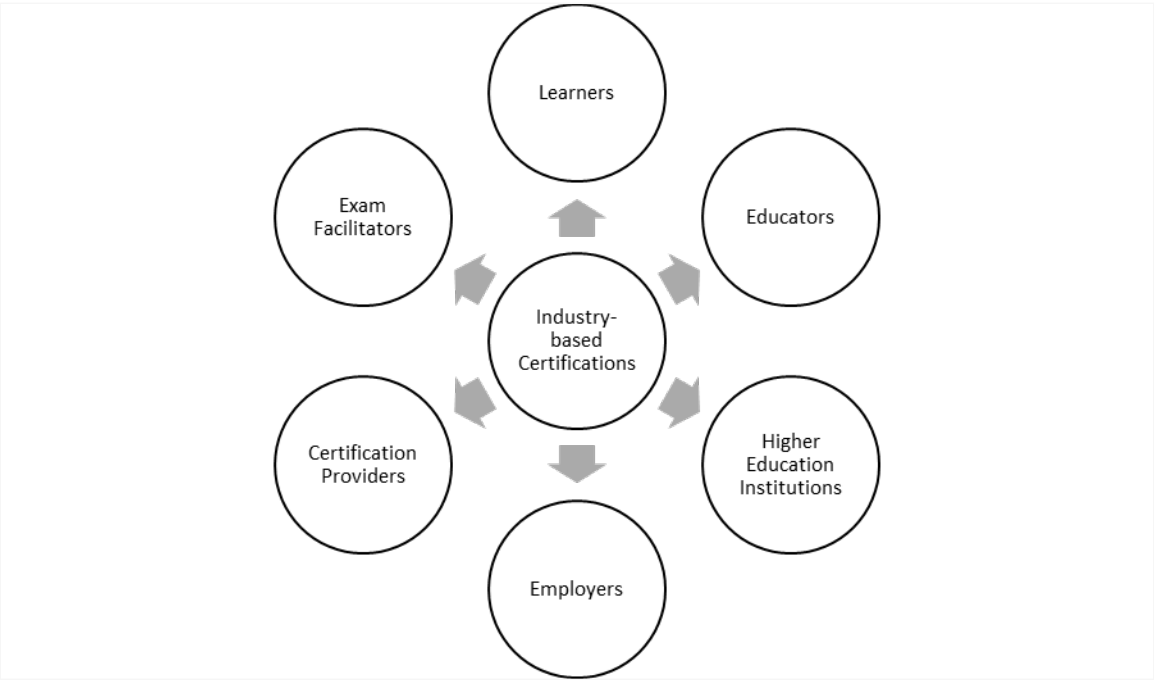

Figure 2: Industry-based Certification Ecosystem

III. BENEFITS AND CHALLENGES

In this section, we will discuss the general benefits and challenges of IBC for stakeholders.

Learners: For learners, there is no additional or reduced costs for the certification. The certification cost is waived for learners once they complete the unit that is embedded with the certification content. It's an opportunity for learners to gain a certification that is industry-recognized and complements university education. They are more marketable to future employers and have an increased chance of employability. Learners can acquire transferable skills and knowledge, across other organizations, and possibly countries where such skills are in demand. Learners are provided with an authentic learning experience using development tools and platforms that are used by industry which will jump-start their career. The challenges faced by learners are the prerequisite knowledge of modelling notations used in vendor-specific certifications. The relevance of a certification on a vendor-specific tool may vary subject to vendor change in learners' current/future employer organization. The knowledge and skills developed using a specific certification may not be transferable to other competing toolsets within the same domain. The certification content may not be placed in an ideal place within the structure of their academic program, e.g., they may not realize the benefit of doing the additional work relating to the certification at the time, and when they do want to sit the certification (in the future) their knowledge may no longer be current due to certification upgrades.

Educators: For educators, IBC provides an opportunity for professional development and certification in the flow of work and within their workload. The employer covers the cost of the training and certification, and educators get an opportunity to upgrade skills. By embedding the certification content in the unit, educators can ascribe quality to the teaching resources and continuance of the demanding program. The challenges faced by the educators are a lack of experience with the vendor-specific tool, additional workload including material training, training for managing and running the lab environment, managing issues with students' access, troubleshooting issues with little or no on-site technical support. Other challenges include retraining and upskilling required on a regular basis to remain current with the IBC and platform updates, additional teaching requirements based on the lack of standard terms used within a particular

certification and across the domain and non-alignment of the certification content with the theoretical underpinnings of the course and the unit learning objectives.

Employers: For employers, they can source graduates who are trained to work with systems implemented in their IT environment. This reduces the costs of employee training and seamless integration into the workforce with less lead time. Thus, employers can build an agile workforce that can integrate well into digital workplaces. The challenge for employers is the need to 'untrain' certain language concepts from students if the organization is using a different toolset other than what the learners have mastered in their academic program.

Higher Education Institutions: For institutions, IBC provides a better reputation as they support more employment-ready graduates, offer units that are aligned with industry requirements and standards and show better responsiveness to industry demands, particularly government organizations. The certifications also provide an avenue to establish academia-industry collaboration, that may provide opportunities for Work-Integrated Learning (WIL) for students, for example, internships with employers using the IBC. The challenges faced by higher education institutions are promoting the uptake of the certification exam as often students lack incentive to pursue the certification after the completion of unit in which the IBC is embedded, additional costs in paying for the training/certification of lecturers/tutors and risk of staff with IBC using these certifications to find other employment opportunities.

Certification Providers: With more individuals trained in the toolset, they are more likely to have that toolset recommended for deployment in industry by those individuals. The increase in the number of trained individuals in their toolset improves the availability of trained consultants, who could be provided to potential clients. The challenges faced by certification providers are the need to balance 'fully paid' certification students with university-based certifications and the need to work with the universities to ensure that the 'correct' version of the certification is being taught. This is because, certification learnings tend to evolve fast in-line with toolsets, while university courses can stay relatively static for several years.

Exam facilitators: IBC generates additional revenue by students completing certifications. On the other hand, exam facilitators may not be set up to support large numbers of students in their test centres for large units.

IV. CASE STUDY

Curriculum is a learning program within a formal setting [Scott, 2001]. Curriculum theory has four dimensions, Objective, Content, Method, and Evaluation. Objective is about the selection of content. The certification content was selected since the unit in which the content was taught included workflow modelling, and automation of business processes. Content is the subject matter to be taught. The subject matter included the tools to design, and develop processes management systems, and reengineer and automate processes. Method is the how, the pedagogy, the mode of delivery of the content. The content delivery was scheduled in two stages: first by introducing theory on business process management and second through self-paced learning followed by a practical implementation of theoretical concepts taught in lectures. Evaluation is the act of judging the individuals' learning. This was done by implementing an already documented business process, which helped to test students' knowledge. The students were able to develop communication, analysis, inquiry, and problem-solving skills while working independently and in a team with professionalism and social responsibility.

To understand the implications (benefits and challenges) of IBCs, we follow the taxonomy of values where the concept of value has been defined into three types: social, functional, and emotional [Sweeney and Soutar, 2001]. Social value refers to the influence generated by others at the workplace. For example, learners who completed the industry-based certification were given an opportunity by the certification provider to publish their credentials on a profile page. This professional acknowledgement by the certification provider will motivate learners to participate and contribute in Low-Code development forums. Contributing to the Low-Code development forums could generate social value (e.g., building professional networks and relationships) for learners. On

the other hand, participation and contribution to the Low-Code development forums could lead to professional acknowledgment from other members in the community. This could generate emotional value (i.e., feelings experienced by learners) for learners. The functional value refers to the utility experienced by stakeholders because of completing a task. For example, educators can use the Low-Code development tools that they have taught in the unit for their research. Thus, completing a task efficiently and accurately at the workplace results in functional value for the stakeholders. Thus, based on the above discussion, we adopt the dimensions of Curriculum Theory and Value framework in this study.

To further investigate the benefits and challenges of IBC, we present a case study at a mid-sized university in Australia, where students from the School of Information Technology and Systems had the opportunity to engage in IBC. Particularly, this was for a Business Architect (BA) certification administered by one of the global software development companies to implement a tool that automates the implementation of code through the modelling of business processes. Over 200 plus roles are available on the LinkedIn job market on a single search day in July 2023 for the BA role so it is high in demand.

The Global software company has offices in Australia, Singapore, Thailand, Hong Kong, India, Japan, New Zealand, South America, Europe, and North America. It is used and trusted as everyday technology by some of the world's leading companies such as HP, ING, PayPal, FedEx, Cisco, NAB, ANZ, Optus, HSBC, Vodafone, and in federal government departments such as Services Australia, Department of Defense, Department of Home Affairs, and some Queensland Government departments. The technology used by the company delivers workflow automation and AI powered decisions making using a 'Low-Code' platform. The company has a university program which works with tertiary institutions to offer their curriculum at a university level. They supply the materials, the exercise system and provide training.

The certification training was incorporated into the requirements of one of the school's units, offered both to undergraduate as well as postgraduate students. This unit is required in the Bachelor of Business Informatics, Master of Business Informatics in Project Management, and Master of Information Technology and Systems in Project Management. The unit is also available as an elective unit for other courses and specializations, such as the Bachelor of Information Technology and Bachelor of Software Engineering. The certification material was embedded with the unit and was delivered as part of the content and requirements of completing the unit. Academic staff involved in the unit had to undergo 1 week Business Architect training prior to the commencement of the unit. There was no requirement for the students to undertake the certification exam. Students were required to cover the topics of the certification in the form of self-study and had to cover the theoretical component in their own time as the 2-hours lecture was dedicated to covering the material from the University required unit in parallel with their self-paced learning. The unit convenor and lecturer created short videos to assist students with the allocated readings for Low-Code development. The practical labs commenced in the second half of the semester, with the assumption that all students had completed the required reading in the first half of the semester, again, in the form of self-paced learning. The labs were 1-hour in duration and were administered by trained and/or certified tutors. An assessment item was designed to test the students' knowledge of the implementation environment, based on an already documented business process. This was an individual assessment and had a 30% weighting, to be submitted in the final teaching week of the semester. In the next section, we present the following reflections on the benefits and challenges of Business Architect Certification experience in Semester 1 (Feb-May), 2023.

Stakeholder benefits within the case study: The university and the learners are based within a region where there is a significant presence of Government agencies. The global software company is actively marketing their products into the Government agencies, creating opportunities for learners to use the certification as a recognized skillset that is actively being used and sought after within the Government agencies. As the certification is delivered as part of a required unit, and the university and the global software company are supporting the process, no additional costs are imposed upon the learner for an industry certification that is in demand.

In 2020, one of the Workplace Learning Trends placed the taught certification and tools within the top 10 for their skills of the future [Udemy Business, 2020]. In 2021, the Business Architect certification provided by this case study was ranked 30th in relation to salaries provided by industry for this skillset [Certification Magazine, 2021]. In 2022, Gartner [2022] predicted Low-Code application platforms would grow 25% within the Low-Code development market, growing the need for learners with these skillsets. The global software company provides a website that allows learners to share their learnings and certification status via career portals, allowing for them to be recognized and seek out work for the skillsets they have developed.

Stakeholders gained social and functional value through the network that was established during the unit organization and delivery, the certification provider, HEI and educators, were able to build relationships that allowed the improvement of each of their programs, and learners benefited through the additional curriculum, and availability of the certification and introduction to employers through the HEI and industry events. Emotional value was realized through the successful delivery of the unit for educators, and for those learners that were able to complete the certification and successfully gain employment in their chosen industry.

Stakeholder challenges within the case study: The addition of certification requirements on top of the requirements for a university unit is an overhead that many students find challenging to complete, leading to negative sentiment towards the certification, or disconnecting from the certification component of the unit entirely. Much of the certification requirements for the unit structure were provided as additional self-paced learning for the tool, that had been aligned to the theoretical components of the unit, e.g., Topic A is taught in class, self-paced tool learning is provided by the certification unit material, and then tutorial exercises that apply the topic within the tool are conducted. This additional self-paced material was often seen as overwhelming by the students due to the amount required to be completed in each topic, the difference in language between the certification material and the theory, and the difference in modelling practice compared to the standard taught within the unit.

The placement of the unit within the program, during the case study, the unit with the implementation of the certification, was delivered as a 2nd year unit within a 3-year degree. Anecdotally, many learners questioned the certifications value to them, as they did not have a sense of what their career intentions were, and just wanted to complete their university program. However, when offered in 3rd year/final year, then many students have already made decisions about what sorts of jobs they want to do and will already have applied for jobs, so the exposure to and completion of the certification may be ‘too late’ to influence their decision.

Educators received up-to-date training in the new Low-Code application development platform and was able to work with other educators to find best-practice methods to facilitate the learning of these topics and toolsets, improving their professional and education skills and received the certification at no personal cost. Educators delivered the unit in one semester each year, while the Low-Code development platform and certification process continually evolved, requiring the educators to refresh and relearn content each time the unit was to be run. Educators were expected to learn and support administration tools to support the certification education environment run externally by the company. This overhead was challenging as the support for these tools was offered in different time zones used by Australian universities.

The Higher Education Institution (HEI) and the training/certification record systems had no integration, this has meant that the HEI cannot determine how many students actively pursued and completed the certification. This has made it difficult to determine the value of the certification to the learners from a HEI perspective, and if the investment and engagement with the Company is valuable to the program. Industry and Industry Employers that are engaged with HEIs, actively working with them to influence the type of outcomes expected from specific higher education programs for their current and future staff, can ask for programs to deliver specific knowledge, skills, and tools. For a HEI to be able to provide specific in-demand certification programs that support industry requirements, can strengthen industry/university ties leading to benefits for both groups. This can lead to employers seeking out graduates from specific HEIs and to support their current staff to attend the HEI to receive those skills on top of higher education degrees.

Educator emotional and functional value was impacted by the complexity of integrating some of the materials into the unit. Learners emotional value was impacted by the volume of additional work that was required to complete the certification over and above what was required for the unit. Social value of the certification provider was impacted by some of the learners being discouraged by the unit implementation and complaining that it was the certification providers fault that their degree program was complex beyond their expectations for a unit.

V. RECOMMENDATIONS

Based on the case study discussed in the previous section, we make the following recommendations that could be adopted by stakeholders to drive strategic decision-making. First, The Industry-based certification discussed in the case study can address the human resource challenges faced especially in the Government to Citizens (G2C) services. Second, it can address the needs of future workplaces, especially in Low-Code development platforms which is a disruptive technology in the design and development of systems. Third, higher education institutions will benefit in terms of graduate employability by providing industry-based capstone projects in Low-Code development to final year students in the graduate and undergraduate programs. Four, educators researching in digital transformation can use the Low-Code development tools that they teach in their research, industry-based consultancy projects or collaboration across universities. Five, educators must work closely with certification providers to constructively align tutorials with the theory taught in lectures by inviting industry speakers who have successfully implemented Low-Code applications. Six, educators must design curriculum by considering the objective, content, method, and evaluation dimensions of the Curriculum Theory to address the unit learning objectives. Seven, the unit objective must be application-agnostic to meet the current and future needs of Low-Code development. Eight, the implementation of an analytics program in the unit will provide insights on the skills developed by students in problem solving, critical thinking, and teamwork that plays a critical role in graduate employability. Nine, the language used within the theory aspects of the unit, and the language used by the certification providers need to be aligned within the unit, to allow understanding of the theory within the practical.

VI. CONCLUSION

The objective of this opinion paper was to understand the opportunities and challenges stakeholders face through the lens of Curriculum Theory to determine that Industry-based certification is a recognized way of learning IT skills in a Higher Education institution. For this, stakeholders were analyzed using a rainbow diagram and the implications to all stakeholders were analyzed using the Value Framework. From a theoretical perspective, this study contributes by examining the dimensions of Curriculum Theory and Value Framework in the Industry-based certification ecosystem. The case study discussed in this opinion paper provides practitioners with nine recommendations to improve the adoption of Low-Code development in Business Informatics curriculum.

VII. REFERENCES

Ahsan, K., S. Akbar., B. Kam. and M. D. A. Abdulrahman (2023) "Implementation of micro-credentials in higher education: A systematic literature review", *Education and Information Technologies*, 28(1), pp. 13505–13540.

Bull, B (2015) “Why colleges should support alternative credentials”, *The Chronicle of Higher Education, 62*(3), pp. 12.

Certification Magazine (2021) “The Salary Survey 75”, https://www.certmag.com/salary-survey/2021 (Current Aug. 24, 2023).

Chevalier, J. and D. Buckles (2008) *SAS: A Guide to Collaborative Inquiry and Social Engagement,* SAGE Publications India Pvt Ltd, New Delhi, India.

Dragoo, A. and R. Barrows (2016) “Implementing competency-based business curricula in higher education”, *Journal of Education for Business, 91*(7), pp. 374-379.

Gartner (2022) “Gartner Forecasts Worldwide Low-Code Development Technologies Market to Grow 20% in 2023”, https://www.gartner.com/en/newsroom/press-releases/2022-12-13-gartner-forecasts-worldwide-low-code-development-technologies-market-to-grow-20-percent-in-2023 (Current Aug. 24, 2023).

Goldring, D (2017) “Pathways for 21st century learners: Integrating industry-based certifications into the marketing curriculum”, *Journal of Higher Education Theory and Practice*, *17*(1), pp. 33-38.

Hitchcock, L (April 2007) “Industry certification and academic degrees: complementary, or poles apart?”, In *Proceedings of the 2007 ACM SIGMIS CPR conference on Computer personnel research: The global information technology workforce,* pp. 95-100.

PcMag. (2023) “The 10 Highest-Paying IT Certifications for 2023”, https://au.pcmag.com/news/66390/the-10-highest-paying-it-certifications (Current Aug. 24, 2023)

Scott, D (eds.) (2001) *Curriculum and assessment*, Greenwood Publishing Group.

Services Australia. (2023) “About us”, https://www.servicesaustralia.gov.au/about-us?context=1 (Current Aug. 24, 2023).

Statista.com. (2023) “Leading companies listed on the Australian Securities Exchange (ASX) as of July 31 2023, by market capitalization”, https://www.statista.com/statistics/1275814/australia-top-companies-asx-market-cap/#:~:text=Largest%20companies%20listed%20on%20ASX%20Australia%202023&text=As%20of%20June%207%2C%202023,over%20220%20billion%20Australian%20dollars. (Current Aug. 24, 2023).

Sweeney, J. C. and G.N. Soutar (2001) “Consumer perceived value: The development of a multiple item scale”, *Journal of retailing*, 77(2), pp. 203-220.

Thi Ngoc Ha, N., M. Spittle., A. Watt. and N. Van Dyke (2023) "A systematic literature review of micro-credentials in higher education: a non-zero-sum game", *Higher Education Research & Development*, 42(6), pp. 1527-1548.

Udemy Business Report. (2020) “2020 Workplace Learning Trends Report: The Skills of the Future”, https://business.udemy.com/resources/5-workplace-learning-trends-2020/ (Current Aug. 24, 2023).

Varadarajan, S. J., H.L. Koh. and B.K. Daniel (2023) “A systematic review of the opportunities and challenges of micro-credentials for multiple stakeholders: learners, employers, higher education institutions and government”, *International Journal of Educational Technology in Higher Education*, *20*(1), pp. 1-24.