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ENHANCING QUALITY TVET GRADUATES THROUGH THREE INTEGRATED CURRICULUM MODELS – THE DPCCE EXPERIENCE

Noreen Kamarudin
Curriculum Division,
Department of Polytechnic and Community College Education
Ministry of Higher Education, Malaysia
e-mail: noreen.kamarudin@mohe.gov.my

Abstract

This paper reports the initiative by the Curriculum Division (CD), Department of Polytechnic & Community College Education (DPCCE), Ministry of Higher Education Malaysia (MoHE) in introducing the integrated curriculum in Malaysian polytechnics and community colleges to enhance the quality of its graduates. The objective of this paper is to introduce 3 Integrated Curriculum Models, based on the Conceive-Design-Implement-Operate (CDIO) education framework that could be used by lecturers to integrate courses in polytechnics, community colleges and other higher educational institutions, to ensure students' efficient attainment of technical and generic learning outcomes. The 3 integrated curriculum models described in this paper are: i) the Intra-programme Integrated Curriculum Model (IntraIC), ii) the Inter-programme Integrated Curriculum Model (InterIC), and iii) the Inter-institution Integrated Curriculum Model (3IC). The IntraIC dan InterIC models described in this paper have been implemented in 17 degree and diploma programmes in polytechnics; while the 3IC model, is a new integrated curriculum model which is recommended for future collaborative use between polytechnics and community colleges. The engagement with industry and community when doing integrated curriculum projects have enhanced lecturers' and students' teamwork, communication, creative, and critical thinking skills. Likewise, the reduced Students Learning Time (SLT) and focused workload, improved students' learning outcomes and quality of work.
Keywords: quality TVET graduates, CDIO, integrated curriculum

1. Introduction

The world of work has been going through transformative change since the end of the last century. The 3rd era of globalization in the 1990s, the 4th Industrial Revolution (4IR) circa 2011, and the onset of the COVID-19 pandemic in 2020, has affected the nature and future of work, and as a result, disrupted education and training as well.

The International Labour Organization (ILO) and United Nations Education, Scientific and Cultural Organization (UNESCO) which headed the world's labour and education organizations, both promoted the (life-long) training and teaching of "core skills for life and work" (ILO, 2021) or "21st Century Skills" (UNESCO, 2014), to ensure that (prospective) workers trained and nurtured at training and educational institutions are not only responsive to the labour market needs but are also good global citizens.

The first framework for 21st century competencies which was formulated by Delors, Al Mufti, Amagi, Carneiro, Chiung, Geremek, Gorham, Kornhauser, Manley, Padrón Quero, Savané, Singh, Stavenhagen, Won Suhr, and Nanzhao (1996); proposed the 4 Pillars of Education: Learning to Know, Learning to Do, Learning to Be and Learning to Live Together. Since then, this framework has been redefined from 4Cs: Communication, Collaboration, Critical thinking, and Creativity; to 3Rs: Reasoning, Resilience and Responsibility (Partnership for 21st Century, 2007), among others. The repertoire of 21st century skills has also expanded over the years (Scott, 2015; Gray, 2016). The advent of 4IR, saw some skills such as analytical thinking and innovation, active learning and learning strategies, complex problem-solving, critical thinking and analysis, creativity, originality and initiative; take precedent over other skills (World Economic Forum, 2020). The recent COVID-19 crisis has rendered the following skills: basic digital skills, critical thinking, self-awareness, self-management, problem-solving, advanced interpersonal skills (negotiation, conflict resolution and persuasion), adaptability, emotional stability, creativity and innovative thinking and empathy; vital for workers (ILO, 2021). From the description above, it is clear that as job scopes changed due to 4IR, and workers displaced due to the COVID-19 pandemic; a person who is currently employed, as well as those seeking to be employed, need to have good self-reflective skills, agility, self-management skills, and emotional well-being to face the challenges of the world today.

1.1. Quality TVET Graduates - The Agenda

The National Education Philosophy aspires to develop Malaysian citizens who are holistic, balanced and harmonious. Therefore, the objective of education in Malaysia is to nurture not only students who are knowledgeable and skillful, but also possess good morals and ethics, in order to contribute to society and nation.

This aspiration is also reflected in the Malaysian Education Blueprint (MEB) 2015-2025 (Higher Education) which emphasizes the 6 primary attributes of Higher Educational Institution (HEI) graduates: ethical, spiritual, able to lead, possess a national identity, proficient in a few languages, possess thinking skills and knowledgeable. In addition, emphasis is also given to nurturing the entrepreneurial mindset in students, promoting Technical and Vocational Education and Training (TVET) and enabling greater personalization of learning experience. In the global context, TVET has been defined as "comprising education, training and skills development relating to a wide range of occupational fields, production, services and livelihoods" (UNESCO, 2016). Out of 10 Shifts outline by the MEB, 4 were outcomes for key stakeholders of the higher education system (students, academia and life-long learners). Two shifts were outcomes for HEI graduates, namely Shift 1: holistic, entrepreneurial and balanced graduates; and Shift 4: Quality TVET graduates.

The emphasis on TVET (Shift 4: Quality TVET graduates) is spurred due to the undersupply of TVET workers in 10 out of 12 National Key Economic Areas (NKEA) sectors (Ministry of Education, 2015). As such the objective of the government is to ensure more school leavers enrol in TVET institutions such as polytechnics and community colleges, and to ensure that TVET programmes are matched to the industries' needs. The key initiatives outlined are: i) enabling industry to lead curriculum design and delivery, ii) enhancing coordination across the ministry's various TVET institutions to enable greater specialization in areas of expertise, and iii) coordinating with other ministries and agencies offering TVET programmes to ensure alignment with professional bodies and international accreditation (Ministry of Education, 2015).

Plans to enhance the quality of polytechnic and community college TVET graduates are also reflected in the DPCCE Strategic Plan 2018-2025. Out of the 6 thrusts outlined, 2 were on enhancing quality TVET graduates specifically; Thrust 1: Producing quality TVET graduates and Thrust 4: Leading education system through TVET 4.0 (Jabatan Pendidikan Politeknik & Kolej Komuniti, 2018). To ensure these objectives are achieved, key initiatives proposed are: i) offering seamless and articulated quality dynamic programmes, ii) focusing on the commonality and collegiality of polytechnics and community colleges to enhance talent synergy, mobility and collaboration; and iii) offering digital and technology driven TVET learning modules aligned to 4IR (Jabatan Pendidikan Politeknik & Kolej Komuniti, 2018).

Based on the above aspirations, a quality TVET graduate from the polytechnic and community college context is described as someone who not only has excellent knowledge and skills in his/her areas of expertise, but also good interpersonal skills as he/she needs to collaborate with industry players and community.

A major task for educators in educational institutions is how best to impart, facilitate, and nurture these qualities in their students (UNESCO-IBE, 2013; Scott, 2015). Some educators believed that these skills need to be explicitly taught (Crawley, Malmqvist, Ostlund, and Brodeur, 2007; Saavedra & Opfer, 2012), others believed these skills need to be integrated/embedded in the curriculum (ILO, 2021).

1.2 Polytechnics and Community Colleges in Malaysia – The TVET Context

There are currently 593 TVET education and training institutions in Malaysia under 11 Ministries, 22 TVET institutions under the state government and 633 private TVET institutions. The Department of Polytechnic and Community College Education (DPCCE) which is under the purview of the Ministry of Higher Education (MoHE), oversees the centralized strategic, operational and academic management of 36 polytechnics and 104 community colleges nationwide.

Politeknik Ungku Omar (PUO) was the first polytechnic to be established in Malaysia, hence, the introduction of polytechnic education in Malaysia under the United Nations Development Plan in 1969 (Jabatan Pendidikan Politeknik, 2015). More polytechnics where then built based on the resolutions by the Cabinet Committee on Education in 1979 and the First National Industrial Plan 1985-1995. There are now 36 polytechnics in Malaysia that admit secondary school-leavers and adult learners into Engineering, Architecture, Business Management, Accountancy, Information Communication Technology, Agrotechnology, Tourism, Hospitality, Graphics, Design and other programmes. Currently the polytechnic offers 2 pre-diplomas, 5 certificate, 79 diploma, and 7 degree programmes.

Community colleges were first introduced in Malaysia based on the *Mesyuarat Jemaah Menteri* decision on 5th July 2000 to establish community colleges in each parliament constituency. Starting with the establishment of 12 pilot institutions in 2001, community colleges offered an alternative TVET path to school leavers and community alike, to attend short courses (lifelong learning), as well as full-time programmes. 8 special skills certificates, 41 certificate and 17 diploma programmes in various niche areas such as technology, hospitality and services are offered in 104 community colleges, nationwide. In 2018, the Department of Community College Education (DPCE) officially merged with the Department of Polytechnic Education (DPE) to become The Department of Polytechnic and Community College Education (DPCCE).

2.0 Background of problem

2.1 Enhancing Graduates Interpersonal Skills – The Challenge

Polytechnic and community college graduates are much sought after by employers and industries due to their technical skills. This is reflected in the high percentage of polytechnic and community college graduate employability (GE) rate over the past 4 years. The GE of polytechnic and community college graduates were at their highest in 2019 at 96.7 percent and 97.8 percent respectively, but dropped to 91.4 percent and 94.3 percent in 2020, probably due to the COVID-19 pandemic (*Unit Kebolehpasaran Graduan*, 2021).

However, it is a known fact that the soft skills of graduates across all higher educational institutions including in polytechnics and community colleges, leaves much to be desired (Ministry of Education, 2015). Five undesirable attributes possessed by Malaysian graduates were: poor command of the English language, communication skills, character, attitude and personality (Jobstreet, 2017).

To solve this problem, some industry partners have proposed the review of the polytechnic and community college curriculum. The DPCCE Industry Advisory Council (IAC), while consistently acknowledging polytechnic graduates' excellent technical skills; have voiced out their concern on graduates' poor soft skills, calling for more effective measures of inculcating soft skills in the curriculum (*Bahagian Hubungan Industri*, 2017). Representatives from the Creative Industry have not only highlighted graduates' weaknesses in communication, collaboration, problem-solving and critical thinking skills, but also a probable misalignment between the creative content taught at the polytechnic and the creative content used in the creative industries (Beh, Saad, Amin, Isa, and Ramin, 2020).

Adding more soft skills courses to programmes, however, is not feasible due to 3 reasons. First, the total graduation credits for certificate and diploma programmes are quite small: 60 and 90 credits, respectively. Therefore, it is quite difficult to squeeze in additional courses to an already packed programme structure. This situation is similar in other higher education context, whereby students' class load/ credit per semester is already determined for every semester and most programme owners are reluctant to propose semester extension to their students/clients (Edstrom, Gunnarsson, and Gustafsson, 2007). Members of the Polytechnic and Community College Curriculum Board have consistently advised against burdening students with heavy graduating credit load. Secondly, it is impossible for curriculum developers to add more supporting courses to the programme as they must adhere to the professional bodies/ accreditation councils (such as Engineering Technician Accreditation Council (ETAC)) guidelines which stipulated that a high percentage of courses in these programmes be allocated to core discipline courses in engineering/technology. Edstrom et al. (2007) concurred with this view saying that in conventional engineering curriculum, it is difficult to add more content or time if the learning outcomes are beyond the discipline core content.

Thirdly, adding more courses would also increase students' and lecturers' workload (Beh et al., 2020; Kamarudin & Teh, 2017). On average, polytechnic diploma students undertake about 5 courses per semester, which can total up to 18 credits. Each course consists of 5 assessments which may consist of lab work, case study, mini project, test and final exam. This means that students might have up to 25 assessments in their 14-week of learning. There has been reports of students in polytechnics and other HIEs getting stressed due to the excessive assessment and this was not healthy for their well-being (Astro Awani, 2014; Rahman, 2021).

Due to these constraints, Edstrom et al. (2007) and Crawley, Malmqvist, Ostlund, and Brodeur (2007) proposed to lecturers the following options:

i) retask the time and resources that they have
ii) make dual use of time and resources within the same core discipline
iii) synergize the simultaneous learning of skills and disciplinary outcomes
iv) find innovative ways to make double duty of teaching time
v) teach the skills explicitly rather than leaving them to chance.

Based on these suggestions, DPCCE decided to explore other approaches to TVET education such as the Conceive-Design-Implement-Operate (CDIO) approach.

3.0 Literature Review

3.1 Conceive-Design-Implement-Operate (CDIO) – The Education Framework

CDIO, is an international education framework that is based on the engineering fundamentals of conceiving, designing, implementing and operating real-world product, process and systems. It was conceived, circa 1990s, in the Massachusetts Institute of Technology (MIT). Subsequently, MIT together with three Swedish Universities: Chalmers University of Technology, Linkoping University and the Royal institute of Technology; formally founded the CDIO Initiative, which has now expanded its network to hundreds of HEI around the world. The goals of the CDIO Initiative are as the following:

> *To educate students who are able to master a deeper working knowledge of technical fundamentals; lead in the creation and operation of new products, processes and systems; and understand the importance and strategic impact of research and technological development on society. (Crawley et al., 2007, 2)*

The CDIO approach was proposed to address the tension between the two needs of the engineering academia and industry fraternity: the need to educate students as "specialists" to master the engineering skills; and the need to train students as "generalists", in a range of personal and interpersonal skills, as well as in product, process and system building (Crawley et al., 2007).

Therefore, to cater to these needs, the CDIO Standard and syllabus were developed as guidelines for engineering education. The CDIO Standard (refer to Table 1) lists down the requirements that need to be met if an institution aspires to be an engineering institution.

Table 1: 12 CDIO Standards and Its Focus Areas (Source: Crawley et al. (2007).

CDIO STANDARDS	FOCUS AREAS
1. The Context	**Program Philosophy**
2. Learning Outcomes	**Curriculum Development**
3. Integrated Curriculum	
4. Introduction to Engineering	
5. Design-Implement Experiences	**Design-Implement Experiences & Workspaces**
6. Engineering Workspace	
7. Integrated Learning Experiences	**Methods of Teaching & Learning**
8. Active Learning	
9. Enhancement of Faculty Competence	**Faculty Development**
10. Enhancement of Faculty Teaching Competence	
11. Learning Assessment	**Assessment & Evaluation**
12. Programme Evaluation	

The CDIO syllabus on the other hand, addresses the skills and competencies of engineering graduates (refer to Table 2). The syllabus specifications state that engineering graduates need to have both technical skills (1. technical knowledge and 4. CDIO skills) and soft skills (2. personal and 3. interpersonal skills). Due to its holistic and balanced curriculum specifications, the syllabus has been used by both engineering and non-engineering educators worldwide for outcome-based curriculum planning and assessment, although the CDIO Standard and syllabus were originally conceived for engineering education.

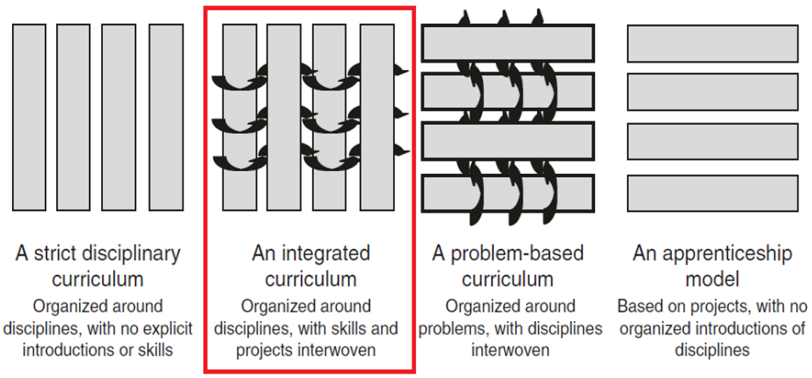
Table 2: CDIO Syllabus at First Level of Detail (Source: Crawley et al. (2007)).

1. **Technical Knowledge and Reasoning**
2. **Personal and Professional Skills and Attributes**
3. **Interpersonal Skills: Teamwork and Communication**
4. **Conceiving, Designing, Implementing and Operating Systems in the Enterprise and Societal Context**

3.2 CDIO Integrated Curriculum – The Approach

CDIO integrated curriculum is Standard 3 of CDIO. It is described as a curriculum which is organized around mutually supporting technical disciplines with the CDIO skills (personal, interpersonal, and product, process and system building skills) highly interwoven (Edstrom, et al., 2007). A simple illustration of an integrated curriculum is shown in Figure 1:

Figure 1: Four Approaches to Curriculum Organization (Source: Edstrom et al. (2007).



A simple analogy to understand the dual impact/outcome of the integrated curriculum is killing two birds with one stone. It means, at the end of the course/programme, students will not only have achieved 1 particular outcome such as fundamental knowledge/skills; but they should have also acquired another skill such as collaborative skills.

3.3 Best Practices of CDIO

The CDIO integrated curriculum has been adopted by engineering educators (Antokina Olenev, and Syenin, 2016; Hermon, McCartan, and Cunningham, 2020; Kuptasthien, 2014; Xiong and Lu, 2007) and non-engineering educators (Malmqvist, Leong, Kontio, and Doan, 2016; Nguyen, 2018), worldwide. These educators have conducted the integrated curriculum based on the suitability of their programmes and context. Among the best practices that were highlighted:

i) Involve stakeholders (Hermon et al., 2010) such as programme experts, (Nguyen, 2018) industries, employers, academia, professional bodies, and accreditation councils in the process of determining CDIO skills most needed for the integrated curriculum (Nguyen, 2018, Kuptasthien, 2014).
ii) Arrange the flow of learning outcomes and content of the integrated curriculum (Kuptasthien, 2014). Remove courses which are not suitable (Nguyen, 2018). Infuse generic skills in subject specialty courses where possible (Malmqvist et al., 2021).
iii) Enhance faculty professional and teaching skills (Kuptasthien, 2014; Malmqvist et al., 2016) by conducting training to introduce lecturers to Active Learning (CDIO Std 8) to complement the integrated curriculum (Nguyen, 2018).
iv) Use the Design-Build-Test context in the teaching of core skills and the development of professional skills and attributes (Hermon et al., 2010).
v) Evaluate student attainment of learning outcomes to ensure the curriculum is relevant (Hermon et al., 2010).
vi) Use design projects as the vehicle to integrate curriculum (Xiong & Lu, 2007).
vii) Train the lecturers to teach generic skills such as design and communication skills besides their subject specialty courses (Malmqvist et al., 2016).

All of the above educators reported positive views of the integrated curriculum method despite facing some challenges in revamping the programme structure, getting approval from education authorities (Antokina et al., 2016), resource and staffing issues (Hermon et al., 2010). As such, based on literature, supported by training from Singapore Polytechnic (the Asia region CDIO manager); the then Department of Polytechnic Education (DPE) in 2014 decided to adopt this framework to enhance the quality of polytechnic graduates.

4.0 Methodology

4.1 The DPCCE CDIO Integrated Curriculum - The Initiative

CDIO and subsequently, integrated curriculum, was first introduced to the Malaysian polytechnic system by Singapore Polytechnic which is the CDIO Asia regional manager. A Note of Understanding (NoU) signed in 2014 between DPE with Singapore Polytechnic (SP) and Temasek Foundation (TF), enabled Malaysian polytechnic lecturers to be inducted and trained by SP trainers on CDIO.

With the support from the top management of DPE and the 11th Malaysia Plan Curriculum Development fundings from the Economic Planning Unit (EPU), the Curriculum Division (CD) set out to plan and implement the integrated curriculum which is Std 3 of CDIO (see Figure 2).

Figure 2: Timeline of DPCCE CDIO Initiative from 2013 to 2021

Since 2016, 17 integrated curriculum in 10 polytechnics had been developed and implemented. As the CDIO approach is not prescriptive (Crawley et al., 2007), the following 3 models have been conceived to describe the 3 methods of integrating the curriculum in the polytechnic and community college context:

i) The Intra-programme Integrated Curriculum Model (IntraIC)
ii) The Inter-programme Integrated Curriculum Model (InterIC)
iii) The Inter-institution Integrated Curriculum Model (3IC)

The IntraIC and InterIC models were first proposed by Kamarudin & Teh (2017) based on the piloted integrated learning experience in 3 polytechnics: Politeknik Ungku Omar (PUO), Politeknik Ibrahim Sultan (PIS) and Politeknik Tun Syed Nasir (PTSN). The 3IC is a new model that will be described in this paper.

4.2 Intra-Programme Integrated Curriculum Model (IntraIC)

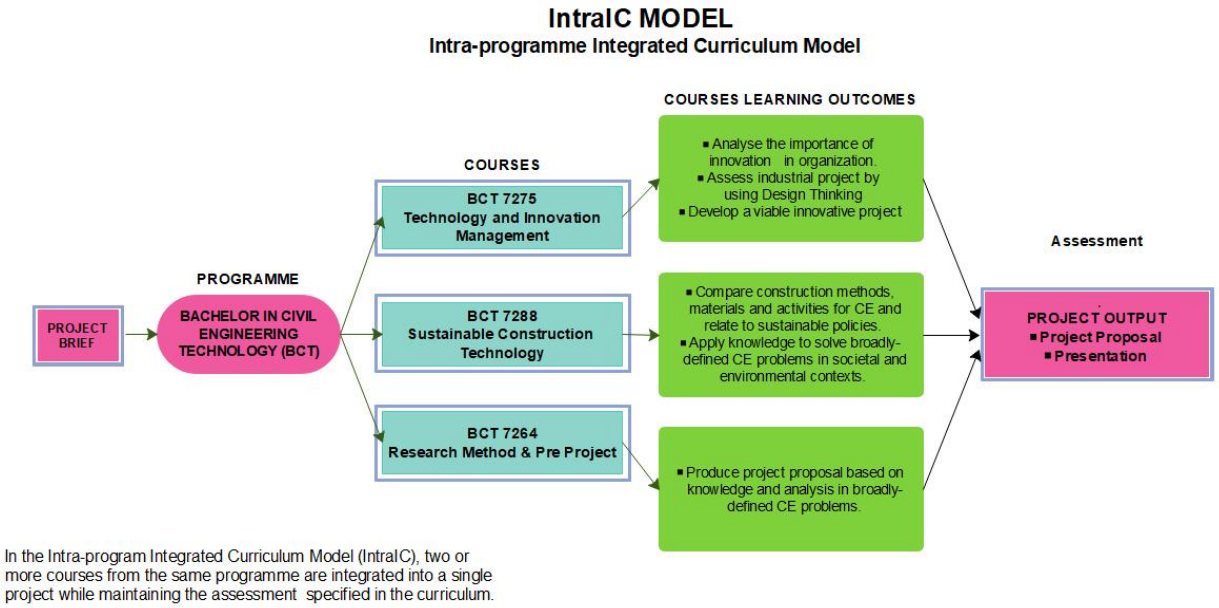
In the Intra-Programme Integrated Curriculum Model (IntraIC), 2 or more courses in the same programme or in the same department are integrated in a single project whilst maintaining the assessment specified in the curriculum, as illustrated in Figure 3.

The IntraIC model is the simplest method of integrating the curriculum/courses and it has been implemented successfully in most of the polytechnics involved in the integrated curriculum initiative including in the work-based learning (WBL) Bachelor in Civil Engineering Technology (BCT) programme. In Figure 3, 3 BCT discipline core courses in semester 7: BCT 7275 (Technology and Innovation Management), BCT 7288 (Sustainable Construction Technology) and BCT 7264 (Research); were integrated to produce a final output: a written project proposal and a presentation. Factors that bound or made the integration possible were:

i) the courses' learning outcomes (CLO) were interrelated

ii) the interrelated CLOs had the same type of assessments (report and presentation)
iii) the three courses were in the same semester (semester 7) and run simultaneously
iv) the students were from the same programme and class.

Figure 3: Intra-Programme Integrated Curriculum Model (IntraIC)



Before the curriculum integration, students had to submit 3 reports and delivered 3 presentations for the 3 courses. After the curriculum was integrated, students submitted only 1 report and presented 1 project proposal, for the interrelated CLOs, at the end of the semester. However, they were still assessed by 3 different lecturers teaching the 3 courses as the different CLOS required different rubrics. Students' work were also assessed by the students' superiors during WBL.

The integration of the courses enabled students to:

i) understand the connection of the courses
ii) have more time to do fewer tasks
iii) focus on a particular project rather than to muster their energy on many tasks. The integrated curriculum reduced the workload of both the students and the teachers without compromising on the learning outcomes.

The 21st Century Skills Set (collaboration, creativity, communication and creative thinking) which were often not explicitly stated in the outcomes, can be explicitly stated in the Project Learning Outcomes as shown in Table 3. This summary of syllabus helped lecturers and students see what were the project outcomes and the learning outcomes that they should address in the project.

The BCT programme in PUO has been integrating selected courses via IntraIC and implementing it to students since 2016. While the IntraIC was implemented to students in semester 3 (as illustrated in Table 3) and 5 in the campus, the one in semester 7 (as illustrated in Figure 3) was implemented to students who were undergoing WBL at industries. BCT students normally undergo WBL in approximately 7 to 10 industries each year and they include construction giants such as Masters' Builders Association Malaysia, Trans Resources Corporation (TRC) Sdn. Bhd., Sunway Construction, Sdn. Bhd., Yeoh Tiong Lay (YTL) Sdn Bhd, IJM Corporation Bhd, Bina Puri Sdn. Bhd., and Pembinaan Mitrajaya Sdn Bhd. About 30 percent of the students were absorbed by these main contractors after students completed their WBL, while the rest were offered posts in sub-contractor companies. Thus, BCT graduate employability has been 100 percent which directly attests to their excellent skills and indirectly indicating effectiveness of the integrated curriculum model.

4.3 Inter-Programme Integrated Curriculum Model (InterIC)

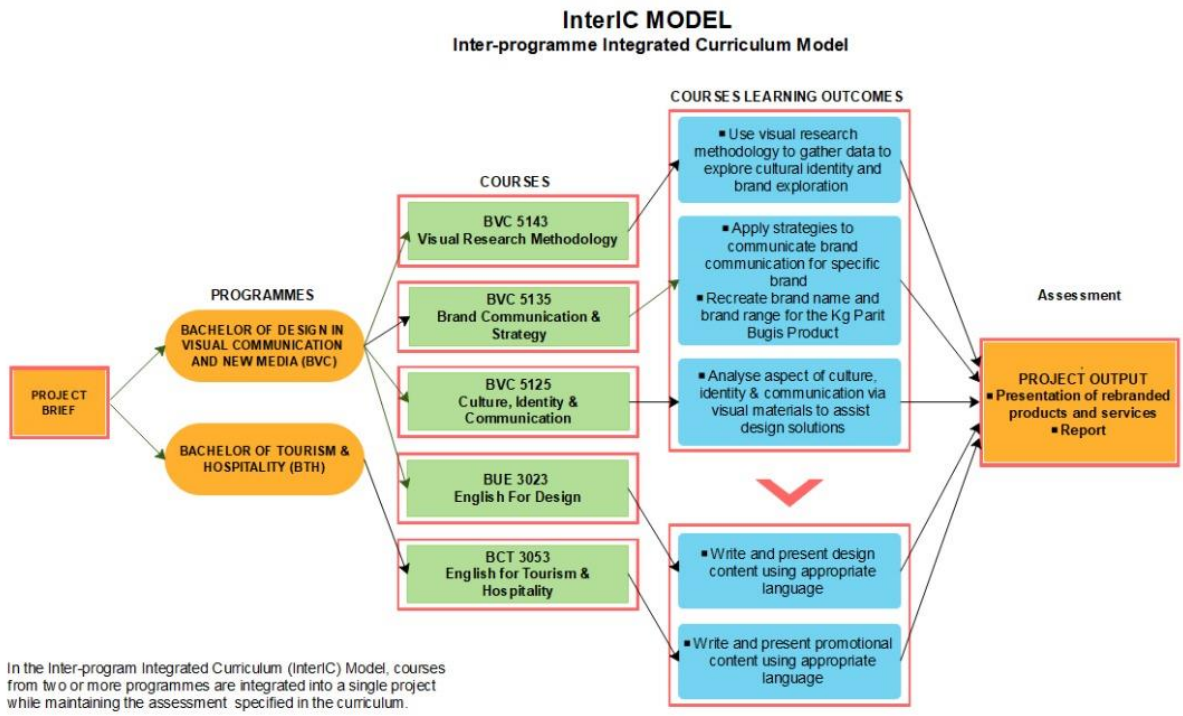
In the Inter-Programme Integrated Curriculum Model (InterIC), 2 or more courses from 2 or more programmes or departments, are integrated in a single project, whilst maintaining the assessment specified in the curriculum. The InterIC model is more complicated compared to the IntraIC model. Figure 4 shows the flow of

the PKS-Help Project which was successfully implemented by PIS through their Creative Design Centre (CDeC) in 2015. The project was a real rebranding project to promote Small Medium Entrepreneurs' (SME) products and services (the clients) in Kg Parit Bugis, Johor.

Table 3: Intra-Programme Integrated Curriculum Design for BCT Semester 3

Project LOs	Courses	Related CLOs	Assessments
At the end of the project, students will be able to: 1. **Collaborate in a team** and develop sustainable building design using 3D modelling as well as energy, environmental system and design building structure for selected building using EUROCODE standard. 2. **Present** the building design effectively and confidently using **appropriate presentation** as well as language and non-verbal communication skills. 3. **Explain** the technical aspects of the model clearly in a **Q&A** session. **Collaboration** **Creativity** **Communication** **Critical Thinking**	BCT 5143: Building Information Modelling 2	Access the interaction processes involve in designing, constructing and managing a building through use of BIM 3D models and data sets. (C6, PLO3) Extract 3D virtual building models data set for a variety of situations including Construction Management for quantity takeoff and cost estimating (C5, PLO2)	Mini Project – 50%
	BCT 6243: Sustainable Building Design	To develop sustainable building design using 3D modelling. (C5, PLO2)	Project – 30%
	BCT 6203: Design of Reinforced Concrete Structures	Produce complete design calculation for concrete building structure according to EUROCODE (A5, PLO6)	Project – 50%
	BUE 3033: English for Engineering and Technology	Recommend and justify the selection of an engineering/technical equipment/product/material for identified purpose (C6,A3, PLO7)	Presentation – 20%

Figure 4: Inter-Programme Integrated Curriculum Model (InterIC)



For this InterIC project, 3 discipline core courses from the Bachelor of Design in Visual Communication and New Media (BVC): BVC 5143 (Visual Research Methodology), BVC 5135 (Brand Communication & Strategy), and BVC 5125 (Culture, Identity and Communication) were integrated with 2 compulsory English language courses: BUE 3023 (English for Design) and BTH 3053 (English for Tourism & Hospitality).

Unlike the IntraIC project in PUO which involved students from the same programme (BCT) and same semester (semester 7), this project involved 3 groups of students from 2 different semesters in 2 different programmes: semester 5 BVC, semester 3 BVC and semester 3 BTH students. This project was carried out for one semester from September 2015 till January 2016. A total of 52 students took part in this project.

For this problem-based learning (PBL) project, the BVC students were divided into 9 groups to rebrand 9 different products and services found in Kg Parit Bugis. Among the products and services of the village rebranded were various tapioca crackers (*kerepek ubi*), homestay services and traditional dance show (*Barongan*). Beside Integrated Curriculum (CDIO Std 3), the other CDIO standards incorporated in the activities were Active Learning (CDIO Std 8), and Integrated Learning Experience (CDIO Std 7). Design Thinking was used by the students as a method to solve problems and find solutions for the clients in their projects. When the BVC semester 5 students had completed rebranding the product and services, the BVC semester 3 students were tasked to prepare the English version of the brochures. These brochures were next used by the BTH semester 3 students to seek the opinion of tourists in the city (prospective tourists/clients) regarding the rebranded products and services offered at Kg. Parit Bugis. The final output was a written project proposal and a presentation of the rebranded Kg Parit Bugis products and services from the BVC and BTH students to the villagers. Expert panels from the Creative Industries were invited to assess the rebranded products/services in terms of design and innovation. By doing this, the quality of the products and services rebranded by the students were benchmarked to industry standards.

Factors that bound or made the integration possible were:

i) the nature of the project which was based on a problem in the village (PBL)
ii) the interrelatedness of the various courses learning outcomes (CLO) even though the programmes (Design and Tourism) were not from the same field
iii) the courses had the same type of assessments
iv) the five courses which were in different semesters (semester 3 and 5) ran simultaneously.

If the courses had not been integrated, the BVC sem. 5 students would have to submit 4 case studies, 4 collaborative review and 4 reflective journals which was quite a heavy load. By integrating the courses, the BVC semester 5 students only submitted 1 case study report, 1 collaborative review, 1 reflective journal, and did a presentation on the rebranded product and services. The semester 3 BVC and BTH students on the other hand, had different assessments (report and presentation), based on their tasks described earlier. However, they were still assessed by the 5 different lecturers teaching the 5 courses and industry panels.

The integration of the courses enabled students from both BVC and BTH to:

i) understand the connection of the courses
ii) have more time to do fewer tasks
iii) focus on a particular project rather than to muster their energy on many tasks
iv) reduce the workload of both the students and the teachers without compromising the learning outcomes.

The application of these 3 CDIO standards and Design Thinking, have resulted in students having better teamwork and communication in solving their problems (Kesavan, 2016). Incorporating five different courses to rebrand products and services (BVC's learning outcomes) and then promote the items (BTH's learning outcome) was not easy but in the end, students and lecturers enjoyed this rich experience.

After The PKS-Help Project in 2015, PIS embarked on another InterIC which saw the integration of 2 programmes: Diploma in Graphics Design (DRG) and Diploma in Industrial Design (DRI) involving semester 4 students. Due to the complexities of implementing InterIC, however, another 4 programmes in PIS chose to implement IntraIC (refer to Beh et al. 2020).

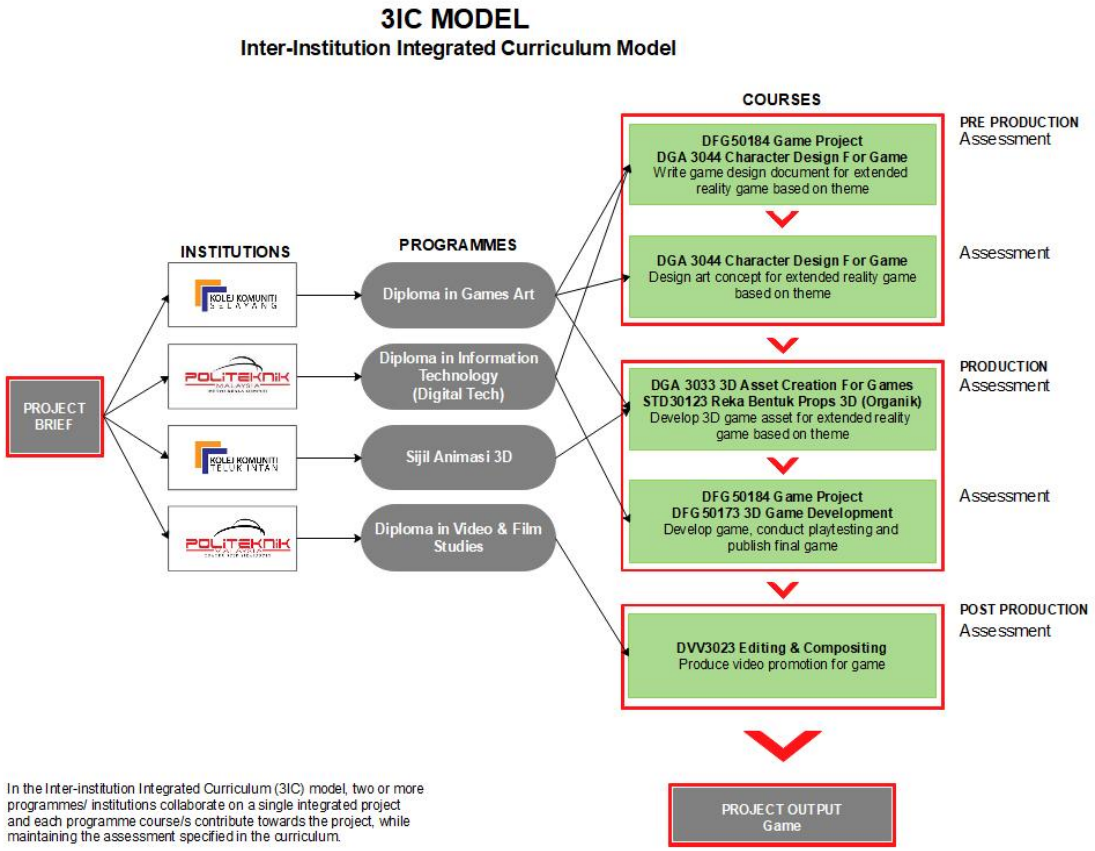
4.4 Inter-institution Integrated Curriculum Model (3IC)

The DPCCE Director General in his 2020 New Year Speech announced a milestone project for DPCCE: the development of 10 DPCCE 4IR Flagships - a 12th Malaysian Plan Development Project. Two Flagships: the Autonomous Vehicle Flagship, helmed by Politeknik Sultan Azlan Shah (PSAS) and the i-Entertainment Flagship, headed by Kolej Komuniti Selayang (KKSy) became the pilot projects for 2021. These Flagships have paved the way for the conception of a new integrated curriculum model: the Inter-institution Integrated Curriculum Model (3IC) as in Figure 5.

In this model, 2 or more programmes/ institutions collaborate on a single integrated project and each programme/course contributes towards the project, while maintaining the assessment specified in the curriculum. This is the most complicated integrated curriculum model as it involves 4 programmes in 4

institutions in different locations: Diploma in Games Art (Kolej Komuniti Selayang), Diploma in Information Technology (Politeknik Metro Kuala Lumpur), Certificate in 3D Animation (Kolej Komuniti Teluk Intan) and Diploma in Video & Film Studies (Politeknik Tuanku Syed Sirajuddin). This project is still in the planning stage and the projection for it to be completed is within a span of a few semesters as it involves students from different semesters and locations. Lecturers from these four institutions have conducted online discussions to discuss the sequence of each phase.

Figure 5: Inter-institution Integrated Curriculum Model (InterIC)



The rationale for adopting and implementing 3IC are as the following:

i) It enables students from different programmes to contribute their expertise to the project. To develop a digital game, students in Games Technology, Games Art, 3D Animation and other interrelated programmes, need to work together on the game development. Contrary to popular belief, students who are expert in Games Art, might not necessary be well-versed in Games Technology, vice versa. Therefore, rather than spending time learning a new skill (which is time-consuming), it is more practical and economical for the Games Technology students to work with the Games Art students in coming up with the game plan.

ii) Students from the designated programmes can channel their energies on the intended outcome/task. For example, in coming up with a game, Games Technology students should not be burdened with the task of developing the animation of the game which they might not have the expertise. This is unnecessary workload. It is feared students would spend too much time on preparing animation rather than on the game technology itself.

iii) By doing a collaborative project, each subject-matter expert can focus on their tasks and the project can be completed in a shorter period as many experts are involved in developing it.

5.0 Summary of Findings and Discussion

The experience of polytechnic lecturers and students involved in the integrated curriculum has been reported by Beh et al., (2016, 2020), Hassan & Mainuri (2020), Kesavan (2016), Kamarudin & Teh (2017), and

Tuselim, Muhammad, and Riam (2020). Based on the feedback given by lecturers and students, the benefits of implementing an integrated curriculum are listed as the following:

5.1 Benefits of integrated curriculum to students

i) Students improved their communication, interpersonal and negotiation skills as they interacted extensively with the stakeholders/community/employers while doing their projects, to solve problems in the community/industry.
ii) Students were able to see the relation between the courses that were integrated in a single project.
iii) Students' workload were reduced. For example, in the integrated projects, students did 1 presentation involving 2 courses. In conventional courses, they would have different presentations for different courses.
iv) Students had more time to do their assignment as it had been integrated/merged and this results in more quality work.
v) Students enjoyed doing active experiential projects.
vi) Students produced more quality and innovative Final Year Projects and this was proven by their success/awards in innovation competitions locally and abroad.

5.2 Benefits of integrated curriculum to lecturers

i) Lecturers were no longer working in silo and have started to discuss with colleagues teaching other courses to plan on the timeline, division of work, project learning outcomes, integrated assessments, among others.
ii) Lecturers were able to assess students' task/presentation at the same time but using different rubrics. For example, lecturers teaching core discipline courses assessed more on the content of the presentation, while English language lecturers assessed more on the delivery aspect of the presentation.
iii) Lecturers were able to achieve the course/teaching objectives as well as the key-performance index (KPI) of the institution by conducting an integrated curriculum. For example, the PIS lecturers involved in the Kg Parit Bugis Project were able to achieve the outcomes of the courses as well as meet the KPI for their Corporate Social Responsibility (CSR).
iv) Lecturers enjoyed conducting active experiential projects.

Besides the benefits to students and lecturers involved in the projects, stakeholders such as the community and industry were also involved in assessing students' learning outcome and project output. For example, in PIS' Kg Parit Bugis Project, students' proposals for the homestay service and local crackers (*kerepek*) packaging were assessed by the Small Medium Enterprise (SME) entrepreneurs concerned.

Based on the writer's experience of coordinating integrated curriculum projects at DPCCE, the following requirements/enablers to implement integrated curriculum were also identified:

i) For the integrated curriculum to be a successful, there needs to be a leader or manager at course, programme and institution level, depending on the model's level (IntraIC, InterIC or 3IC).
ii) Stakeholders involved in the integrated curriculum initiative such as Directors of institutions, Heads of Programme and Course Coordinators need to be willing partners. IntraIC, InterIC and 3IC do not work if partners are unwilling to contribute to the project. This supports Edstrom et al. (2007) findings that faculty who believed that courses do not need to support the programme and should be taught separately, may be unwilling to opt for an integrated learning experience.
iii) A timeline or plan must be conceived and followed religiously to ensure the integrated curriculum proceed as plan and the output and outcomes are achieved. This is most important for the InterIC and 3IC Models as the project involved lecturers and students from different programmes and institutions.
iv) Find an organizing principle (such as disciplines, skills, outcomes, assessments, etc) that can bind the curriculum/project. Team projects, open-ended problem solving, experiential learning (Phuong, 2012), engagement in research (Vest, 2007), PBL (Edstrom and Kolmos, 2014), project proposal, Capstone Projects (Alarcón, Bou, Camps, Bragós, Oliveras, Pegueroles, Sayrol, and Marqués, 2013; Van Torre and Verhaevert, 2017), are some suitable assessments that can bind the integrated curriculum projects.
v) Explicitly state the CDIO skills to be interwoven in the integrated projects document so that the teaching or inculcating of those skills are done directly and not left to chance.

6.0 Achievements

Due to the diligence in adhering to CDIO Standards, PUO and PIS were accepted as CDIO Member Institutions by the Asia Region CDIO Council in 2017 and 2018 respectively. PUO, PIS, Universiti Teknologi MARA (UiTM) and Taylors' University are the only Malaysian HIEs to have been accepted as CDIO Member

Institutions. There are currently about 100 HIEs which are members of the global CDIO network including the prestigious Massachusetts Institute of Technology (MIT) and Stanford University. Gaining CDIO Member Institution status expands the polytechnic academics' and students' networking and learning opportunities with their CDIO counterparts in various countries. This is also in line with Shift 4: Quality TVET graduates of MEB 2015-2025 (HE) key initiative which was to ensure programmes are aligned to international bodies.

Two of the integrated curriculum programmes, BCT and BVC were also finalists in the *Anugerah Kurikulum Inovatif Menteri Pendidikan* (AKRI) 2018, with BVC clinching 3rd place for the category: *Pembelajaran Transformatif (Tanpa Syarahan).*

7.0 Conclusion and Future Endeavours

The DPCCE 4IR Flagship Initiative is a 10-year plan to help alleviate the PolyCC (abridged term for polytechnic and community college) brand among stakeholders, and the Malaysian public. DPCCE is excited and looking forward to the implementation of the 3IC Model through the i-Entertainment Flagship. Although the real reasons for the 3IC curriculum integration/ institution collaboration is for practical purposes, it also embodies the Open-source Philosophy which basically allows anyone or everyone the limitless benefit to participate in the development of a project. As Linux has shown: the strongest products will be developed when the largest number of people are working on product development (Torvalds and Diamond, 2001). DPCCE is optimistic that the latest integrated curriculum model might just spur a PolyCC i-Entertainment Hub in 3 years' time.

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