

Entrepreneurship through Multidisciplinary Learning: A Cooperative Procedural Framework for Implementation

Lok Boon Thian, Wai Keng Choong, and Yen Heng Chang

Abstract—Governments and higher education institutions around the world have expressed a strong opinion that entrepreneurship among students must be enhanced to address the concern of graduate employability post-pandemic. Supporting this agenda, the Ministry of Higher Education Malaysia has launched a national Entrepreneurship Action Plan and a guide for Entrepreneurship Integrated Curriculum in 2021. While teaching entrepreneurship in higher education has gained great acceptance, transforming a traditional university to nurture student entrepreneurs is still challenging. A key challenge is to transform faculty-centric learning into multidisciplinary learning so that students from different disciplines can work cooperatively to enhance the success of an entrepreneurship venture. Hence, a design-based study has been conducted at a private university in Malaysia, with a cooperative procedural framework developed and improved through two cycles of implementation over one year period. The study was participated by academics and students from more than six disciplines including computing, design, business, bioscience, culinary art, and communication. The proposed framework highlights the importance of intentional alignment among the curriculum of collaborating courses, the mindset of collaborating academics and students, as well as the supporting ecosystem. The framework has expanded the practical knowledge of multidisciplinary learning implementation by detailing the practical steps to ensure its effective implementation. The proposed framework could be extremely helpful for institutions that are struggling to implement multidisciplinary learning across faculties, supporting the entrepreneurship agenda of the institutions.

Index Terms—Entrepreneurship, multidisciplinary learning, cooperative learning, procedural framework, higher education, Malaysia.

I. INTRODUCTION

Entrepreneurship education has diffused to different parts of the world, from the USA to Europe, China, Philippines, Ghana, and Malaysia [1]. The spread is mainly due to governments, universities, and international agencies' intention to reduce unemployment and to support economy development through entrepreneurship agenda [2], which is expected to be more important post-COVID-19 pandemic. Responding to this, the Ministry of Higher Education Malaysia (MOHE) has launched a national Entrepreneurship Action Plan [3] and a guide for Entrepreneurship Integrated Curriculum [4]. While the number of entrepreneurship

courses offered by higher education institutions is increasing [1], [5] transforming a traditional university to nurture student entrepreneurs is still challenging.

Literature argued for the need to have more experiential learning rather than theoretical understanding to nurture student entrepreneurs [6], [7]. However, most entrepreneurship courses are offered to students from a single discipline, without complementary competencies from students of different disciplines [8]. Hence, literature argued that there is a need to enable multidisciplinary team learning to develop a product or business, to encourage more practical-oriented learning, to increase the entrepreneurship intention, and to enhance the success of an entrepreneurship venture [8]-[13]. However, transforming faculty-centric learning into multidisciplinary learning so that students from different disciplines can work cooperatively is still a challenge [8]. Hence, having a practical framework to guide the implementation of multidisciplinary learning to strengthen the success of an entrepreneurship venture is critically needed.

A. Cooperative Learning Framework

This paper uses “cooperative learning” to refer to a learning design where individuals in a team, collaborate on the same or different aspects of a shared task to accomplish shared and individual learning goals, with a certain level of interdependence among the individuals, structured by an academic [14], [15]. Literature [15] highlighted two key principles in designing effective cooperative learning. They are a) commitment to individual accountability and positive interdependence, and b) the alignment of eight components of the collaborative learning design framework identified by de He, Srijbos *et al.* [16]. The eight components of the framework are 1) interaction, 2) learning objectives and outcomes, 3) assessment, 4) task characteristics, 5) structuring, 6) guidance, 7) group constellation, and 8) facilities.

When the cooperation involves students and academics from different disciplines, multidisciplinary cooperative learning takes place. While curricula in higher education have increasingly incorporated cooperative learning [15] to enhance students' academic and social learning, teachers experience difficulties implementing the method [14], especially when the team involves individuals from different disciplines. Hence, having a more practical procedural framework to guide the implementation of multidisciplinary learning leveraging on the generic cooperative learning framework is still needed.

B. Challenges Faced in Multidisciplinary Learning Implementation

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Based on literature [8], the multidisciplinary learning experience is the most important and value-adding aspect of a challenge-based entrepreneurship programme, as feedback by students. However, implementing multidisciplinary learning across faculties is still challenging. The challenges can be viewed from the perspectives of the institutional level, the academics, the students, and the collaboration itself.

1) Lack of institutional-level support

Literature [8] commented that creating a multidisciplinary course within the curriculum can be challenging due to the university policy, and the need to include academics and students from different disciplines. This is especially the case when a university has not made a strategic decision to adopt multidisciplinary learning at the university level.

2) Lack of commitment from academics

Literature [8] also highlighted that lack of commitment from academics towards multidisciplinary learning is a difficult challenge to be overcome. Lots of effort need to be put in to explain and convince the academics of the need to change. Academics also find it challenging to teach or supervise students across disciplines due to the different disciplinary perspectives the students have been trained on.

3) Lack of interest among students

Literature [1] highlighted that higher education students display low interest in entrepreneurship education. Studies have also mentioned that some students have a negative attitude towards entrepreneurship education. This is possibly due to the perception of the difficulty in starting a business as compared with earning employment. The situation gets worse when the entrepreneurship programme is not credit-bearing.

4) Challenges faced during implementation

The primary challenge faced during implementation is to communicate and collaborate across disciplines [13], [17]. The challenge is due to multiple reasons, including difficulty in getting an equal commitment from all members which could be due to different levels of ambition, and workload among members. Due to different study schedules among students from different disciplines, it becomes more challenging to schedule meetings. As a result, some students did not fully experience the benefit of complementary disciplines.

5) Strategies to increase students' commitment

Studies have reported various specific strategies to increase students' commitment, which are consistent with two key principles in designing effective cooperative learning as mentioned earlier. First of all, it is important to select meaningful entrepreneurship project that requires the different expertise of the students from different disciplines [18], [19]. Such a project will help students to understand the interdependence among them, and the need to collaborate as well as to commit to individual accountability.

Secondly, studies showed that it is useful to focus on team formation [8], including organising an orientation meeting for the team members to negotiate how they will collaborate, and clarifying their roles and responsibilities [17]. Studies also showed that it is useful to help students to learn to confront disagreement constructively [19] and deepen the

appreciation of team and learning through reflection [17]. Lastly, to ensure there is sufficient time for discussion across disciplines, a structured timetable is needed [17].

In a nutshell, the success of multidisciplinary cooperative learning depends on the ability of academics to regulate students' behaviour [20]. While the collaborative learning design framework identified by de Hei, Strijbos et al. [16] has provided a generic framework to support multidisciplinary learning implementation, a framework with more detailed procedures is still needed to guide the academics and students [16]. Hence, this study was conducted supporting the entrepreneurship agenda of a university.

C. The Study Context

The study was carried out at a private university in Malaysia. In alignment with the national and the institution's strategic direction, the institution has commenced on a 2-year learning transformation project to institutionalise multidisciplinary learning at all of its bachelor's degree programmes. The objective of the project is to systematically institutionalise multidisciplinary learning to nurture graduates who are entrepreneurial, able to solve complex problems, and excellent in collaborating across disciplines.

Specifically, students are required to apply their disciplinary knowledge in a multidisciplinary setting, in the second or third year of their studies. After exploring different possibilities, the project has decided to form collaboration among existing courses from different disciplines to work on a common task or certain components of a common task. The task must contribute to the student's final grade to ensure reasonable commitment among students. The project leverages the concept of cooperative learning given the nature of multidisciplinary learning across disciplines. This paper aims to report the outcome of a study supporting the institution's learning transformation project.

D. Research Objectives

Informed by the study context, specifically the problem faced by the institution and its intention to transform its learning into multidisciplinary learning, this study consists of two phases. The first phase is the Design Phase and the second phase is Pilot Implementation Phase.

The research objective of the first phase, the Design Phase, are:

- 1) To identify the key challenges in implementing or institutionalising multidisciplinary learning where students are required to apply their disciplinary knowledge in a multidisciplinary setting
- 2) To identify strategies to address the key challenges
- 3) To propose a multidisciplinary learning cooperative procedural framework to systematically implement multidisciplinary learning leveraging on the concept of cooperative learning, to enhance the success of an entrepreneurship venture.

The research objective of the second phase, the Pilot Implementation Phase, is to identify refinement needed to the proposed multidisciplinary learning cooperative procedural framework.

II. METHODOLOGY

A. Research Approach

Literature shows that design-based research is increasingly being used to improve learning through interventions [21], [22]. Based on the research objectives of the two phases, design-based research is the most suitable research approach. Guided by the generic model for conducting design-based research in education [23], the first phase, the Design Phase, covers both the analysis and exploration stage, as well as the design and construction stage of design-based research. The second phase, the Pilot Implementation Phase, covers the evaluation and reflection stage of a design-based research. Guided by the principle of design-based research, the researchers of this study are directly involved in the design and pilot implementation of the cooperative framework for multidisciplinary learning.

B. Design Phase Research Procedure

Based on the objectives of the Design Phase, the most suitable approach is to trial run the multidisciplinary learning at a small scale in a normal semester, followed by the development of an implementation framework. This phase lasted for five months. During the trial run, student groups of multidisciplinary learning from the following disciplines and courses from the second and third years were formed.

The disciplines and courses chosen are those with high commercialisation potential, supporting the entrepreneurship agenda of the university.

- 1) Business (business startup course) and Engineering (product development course)
- 2) Business (business startup course), Computing (product development course), and Design (user interface design course)
- 3) Biotechnology (food product development course) and Design (packaging design course)

This trial run phase consists of the following activities. First of all, the researchers obtained consent from the heads of school or programme directors, and the six course leaders to participate in this trial run, with their experience being recorded and analysed under this study. Then, collaborating projects were agreed on. During the trial run, fortnightly monitoring and problem-solving group discussion with the six course leaders was carried out to identify the key challenges and strategies to address those challenges.

Specifically, the researchers collect data through group interviews with the six participating course leaders. While data were also collected through reviewing the curriculum or course information documents of the collaborating courses and observation of student work or presentation, those data are considered complementary data to provide a better understanding of the findings through interviews. The research objectives guide the questions asked during data collection and data analysis.

The researchers analysed and triangulated the data collected from different course leaders from the fortnightly group discussion sessions, to identify the key themes through continual reflection. Towards the end of the semester, a final overall reflection discussion was conducted with the six course leaders to conclude on the key challenges and strategies to inform the development of the procedural framework for implementation. Based on the data collected,

the researchers drafted the scope and key sections of the procedural framework, followed by the necessary details to guide the implementation of the multidisciplinary learning. Finally, the proposed procedural framework was shared with the six course leaders for feedback and confirmation.

C. Pilot Implementation Phase Research Procedure

Based on the objectives of the second phase, a small-scale pilot implementation of the proposed cooperative framework developed from the first phase was conducted for one semester, last for five months. This phase allows the university to learn and refine the proposed framework before a full implementation at all faculties. Most of the disciplines and courses from the first phase continue to participate in the second phase, with additional disciplines and courses with commercialisation potential joining this phase.

Courses from different disciplines are chosen to maximise the potential variations, to validate the proposed cooperative framework as suitable for all faculties before full implementation.

- 1) Business (business startup course), Computing (product development course), and Design (user interface design course)
- 2) Biotechnology (food product development course), Culinology (food product development course), Media and Communication (brand management course), and Design (packaging design course)

Similar to Phase one, Phase two started with obtaining consent from the respective heads of school or programme directors and the seven course leaders to participate in the pilot implementation. This was followed by the researchers explaining the proposal from Phase one with respective course leaders. Before the semester commencement, the collaborating courses agreed on the multidisciplinary projects to be worked on by students. The projects are specially selected based on their commercialisation potential, validated by the Director for Commercialisation of the university.

Guided by the proposed cooperative framework, the collaborating courses establish their multidisciplinary learning collaboration agreement to ensure clear alignment and commitment. The Pilot Implementation was kicked started by explaining the nature of the projects and collaboration to ensure the collaborating students are aligned. Similar to Phase one, fortnightly monitoring and problem-solving discussion for at least an hour were conducted among the researchers and the seven course leaders to identify the problems faced and improvements needed to the proposed framework.

Specifically, the researchers collect data through interviews with the seven participating course leaders. While data were also collected through surveys with participating students, review of course information and collaboration agreement of the collaborating courses, and observation of student work or presentation, those data are considered complementary data to provide a better understanding of the findings through interviews. The research objectives guide the questions asked during data collection and data analysis.

The researchers analysed and triangulated the data collected from different course leaders from the fortnightly

group discussion sessions, to identify the key refinements needed through continual reflection. Towards the end of the semester, a survey was conducted to collect feedback from the participating students, followed by a final reflection discussion to conclude on the improvements needed to the procedural framework for implementation. With the information collected, the researchers refined and finalised the procedural framework. Finally, the proposed procedural framework was shared with the seven course leaders for final feedback and confirmation.

III. RESULTS

A. Design Phase: Key Challenges, Strategies and Proposed Framework

Through reflection among the researchers and course leaders of the trial implementation, the following are the key challenges faced, proposed strategies, and proposed multidisciplinary learning cooperative procedural framework.

1) Key challenges

a) Lack of interest among academics

While the project was mandated by the senior management, getting support from academics to trial run multidisciplinary learning is still a challenge. The initial proposal is to get students to work cooperatively on their final year project, for the reason that students are more matured in their learning and collaboration through an application or project-based course allows more flexibility compared with a theory-based course. However, the idea was rejected due to a concern of diluting the rigor of the projects and potential concern from the accreditation body. Another concern of academics is the impact to collaborating students if certain students fail to deliver on time.

“The inherent culture of most of my colleagues’ mindsets does not favour interdisciplinary collaborations as it is considered lacking in focus and dilutes the standards of specialized outcomes.”
Comment by a course leader

In addition, the academics are also concerned about the anticipated extra workload to supervise students across disciplines and lack of experience to do so, as highlighted by the following reflective note.

“Due to the negative perception of interdisciplinary collaboration, fear of unnecessary extra workload and efforts having to teach and guide interdisciplinary students with unfamiliar processes, protocols, and expectations; causes concerns amongst my colleagues.” Comment by a course leader

Through some persuasion and negotiation, a few programmes with greater entrepreneurialism intention joined the trial run, choosing project-based courses from the second year and final year of studies. The agreement was that students from different disciplines will continue to work and be assessed based on their respective assessment tasks, while working cooperatively on a common project, and starting with a very limited number of students.

A broader reason causing the lack of interest among most

academics is that nurturing student entrepreneurs is not a priority of the academic programmes. This is evidenced by the reflective note of a course leader, “However, commercializing or attaining industry validation of final student works is not a priority in most programmes, schools or faculties; resulting in the lack of entrepreneurialism drive and conviction amongst faculty members and the students.”

b) Lack of know-how

While a few academics have agreed to participate, the next challenge is how to design the learning experience to ensure students across disciplines can cooperate meaningfully. Due to lack of experience, lots of discussions was conducted to uncover the areas for consideration. The areas ranging from simple matters like which semester the courses are offered, number of students for collaboration, to more serious matters such as the nature of collaboration, learning outcomes, assessment tasks and deadline. Another challenge is to agree on projects to be offered to students.

“However, the constructive alignment was a challenge as we were all maintaining our courses for the collaboration which independently differs in learning outcomes, pedagogy, and assessment. ... There were also logistical concerns about class sessions for collaborative meetings, discussions, and reviews as none of the collaborating cohorts shared the same timetable.” Comment by a course leader

This challenge partly comes about due to the hope that minimum changes to the course design are needed. Due to incompatibility between the collaborating project and course learning outcome, the Engineering lecturer withdrew from the collaboration at the early part of the semester, leaving behind two collaborations to continue.

c) Conflict among students

While it was expected that collaborating students will face challenges in collaboration, the magnitude of the challenge was underestimated. At the later part of the semester, students from computing and business had major conflicts in their expectations from each other, causing the collaboration to almost being terminated by students before the end of the semester. The causes of the conflict are a) unclear expectations to start with causing students to perceive their counterpart as lack of commitment and competencies, b) conflict in personality and communication style partly due to insufficient team-building effort to start with, and c) supervisors lack of experience in managing the conflict.

The tension among students was amplified by the fear of their grades will be negatively affected. In addition, students struggle to find a common time slot for face-to-face discussion, especially when students put higher priority to work on their assessment task compared with supporting their collaborating partners.

“But the main and most pressing challenge was the students themselves. Clashes of personalities, schools of thought, prejudice, and pride were all noticeable from the first mass gathering and briefing with the cohorts. Some students from certain disciplines were more outspoken and seem to dominate their groups, while some challenged each other for their voices to be heard.” Comment by a course leader

d) Lack of support from the ecosystem

The last important challenge came about when the collaborating course leaders are trying to identify projects for the Phase two collaboration. While the various programmes have projects from the industries, those projects are single disciplinary and not suitable for multidisciplinary learning. The challenge was temporarily addressed by the Commercialisation Department, which offers few multidisciplinary projects with commercialization potential.

Another challenge faced was how to support students to commercialise their product or start up a business towards the end of the collaboration. Again, this challenge was addressed by the Commercialisation Department and Business Incubator of the university. Through the experience, the team learned the importance of the supporting functions within the university to support this agenda. After that, a conscious effort was put in to engage the Commercialisation Department, the Business Incubator and the Makerspace of the university throughout the journey from the initial project conception to commercialisation or start-up.

2) Key strategies

a) Leadership commitment and strategic vision

Reflecting on the journey, the project would not have continued for one year without the strong support from the senior leaders. The senior leaders provided a strong commitment and strategic direction for the project team as well as the resources needed to enable the success of the project. This support is especially critical for institutional-level strategic and full implementation across all disciplines.

“Leadership commitment and conviction from top-down is critical to achieve the institutionalized effect as the removal of faculty siloes require consistent, overarching and inclusive policies to merge disciplines and develop shared visions and beliefs amongst all academicians regardless of their fields of expertise.” Comment by a course leader

b) An institutional level coordinated effort

As academics are used to single discipline governance as well as learning and teaching, a systematic and well-coordinated institutional effort is needed to bring the different disciplines together. Identifying a passionate academic to champion the project from each discipline is key. Constant alignment and encouragement to motivate the academics to work together are required to shape a new culture.

“The vision needs to resonate with each school champion in realizing the benefits and values in breaking the mould of mono-discipline academic methodologies and schools of thought.” Comment by a course leader

The effort also needs to be guided by a working framework or “recipe” to ensure the effective implementation. This is discussed further under the proposed multidisciplinary learning cooperative framework.

“An important learning from the trial run is the need to identify the nature and expectation of the multidisciplinary collaboration, as either a “ground-up” (“end-to-end equal partnership”)

collaboration, or a “client-servicing” collaboration. ... This learning was a result of the unmet expectations amongst the collaborating students which almost ended the project abruptly.” Comment by a course leader

c) Aligned ecosystem

Last but not least, since the intention is to support the entrepreneurship agenda of the university, the multidisciplinary learning effort must be supported by an ecosystem that enables it. As mentioned earlier, the support from the Commercialisation Department, Business Incubator and other functions such as Makerspace is key.

3) Proposed Multidisciplinary Learning Cooperative Procedural Framework

Through reflecting on the Design Phase experience especially the challenges faced, a multidisciplinary learning cooperative procedural framework was proposed. The procedural framework consists of a) a guideline to implement multidisciplinary collaboration as well as b) a template for a multidisciplinary collaboration agreement.

The proposed guideline consists of the following sections:

- 1) Objectives of multidisciplinary learning, to explain the purpose and benefits to students, in order to address the challenge regarding lack of interest among academics
- 2) Establishment of multidisciplinary learning collaboration, resulting in a multidisciplinary collaboration agreement among the collaboration courses. This section is critical to address the lack of know-how among the academics and minimise the conflict among students. The template for the agreement will be discussed in the following section.
- 3) Communication and collaboration engagement, to ensure key parties involved in the collaboration are aligned to ensure effective implementation. This section is also meant to address the challenges regarding lack of know-how among the academics and conflict among students.
- 4) Multidisciplinary project design guiding principles, to explain the key considerations in designing a multidisciplinary project supporting this initiative. This section partly addresses the challenge pertaining to lack of support from the ecosystem in terms of identifying suitable project for multidisciplinary collaboration and commercialisation.
- 5) Discontinuation of collaboration relationship, to end the relationship on a positive note to mitigate potential negative impacts on students’ intention to collaborate in the future and to conclude the collaboration meaningfully. This section aims to complement the challenge in terms of conflict among students.
- 6) Intellectual property, to ensure clarity of intellectual property ownership within the context of this collaboration. This section partly addresses the challenge regarding lack of support from the ecosystem in terms of support for commercialisation.

Supporting the proposed multidisciplinary collaboration guidelines, the proposed agreement template consists of the following key questions and considerations as mentioned at Table I.

TABLE I: COLLABORATION AGREEMENT: KEY QUESTIONS AND CONSIDERATIONS

Questions	Considerations
1 What are the collaborating courses, the courses' learning outcomes, assessment tasks, and their year-level?	a. Ascertain the courses are at a similar year-level to ensure a similar level of maturity among students. b. Suggest the courses to be from the final year or the year before, so that the professional identity of students is developed resembling the real-world working environment. c. Collaboration among three courses is challenging but still manageable.
2 What are the purposes or benefits of the collaboration to the collaborating students?	a. Ensure the collaboration will benefit all collaborating parties, such as for complementary competencies to develop a potential product for commercialisation or start-up. b. May allow certain students to participate to experience a real context for application of knowledge, supporting their peers with the intention to start up a business.
3 What is the relationship among the collaborating courses?	Clarify whether the relationship is "end-to-end equal partnership" (similar to the business partners) or "client servicing" (a client-supplier relationship). Confirm whether the assessment is within a context of a discipline (with lower inter-dependence among students) or jointly assessed across disciplines (with high inter-dependence among students).
4 How the student assessment will be conducted?	
5 How the learning and assessment activities, especially the formal joint session (if any), are scheduled across the learning weeks?	Ensure alignment of priorities and commitment from both academics and students.
6 How will the group be formed? What is the number of students from each discipline per collaboration?	a. Ensure proper matching of competencies needed, matching of collaborating students can be done by course leaders instead of students. b. The complexity of collaboration significantly increased when students from each discipline exceeded five.
7 What is the common time slot per week for students to discuss and work together?	Ensure there is at least one hour of a common slot allocated to students' timetable per week to ease discussion among students and academics from different disciplines.
8 How will students communicate with each other?	Ensure there is a communication platform to ease communication, especially during a fully online learning environment.
9 What is the multidisciplinary project about? Who owns the project idea and intellectual property?	The project must be needing the competencies from the different disciplines with clear ownership of intellectual property for commercialisation purposes.
10 What are the expected deliverables from each party and by when?	Must be clearly and explicitly written and agreed on to ensure effective collaboration.
11 What are the roles and responsibilities of the parties involved, especially the students, supervisors or course leaders?	Explicitly list down the roles and responsibilities to ensure clear authority and accountability among all parties, including how conflict among collaborating parties will be resolved.

B. Pilot Implementation Phase: Refined Framework

Through the reflection among the researchers and course leaders of the Pilot Implementation, the proposed multidisciplinary learning cooperative procedural framework is refined to ensure commitment to individual accountability and positive interdependence. The first refinement is to highlight the importance of providing details of the deliverers from each collaborating party, such as "prototype with thirty percent functionality completed by week 12", to ensure a clear understanding of expectations among collaborating parties.

The second refinement is to emphasise the importance of early involvement (before semester commencement) of all project supervisors in addition to the course leaders. The early involvement is to ensure buy-in and a clear understanding of their roles and responsibilities. The third refinement is the inclusion of a project brief template for project idea originators to document their ideas and to facilitate a clear understanding of the project among the collaborating parties. In practice, the supporting functions, such as Commercialisation Department, Business Incubator and the Makerspace, are consulted during the project idea conceptualisation and they are involved again during the final presentation of the project to support the commercialisation and start-up intention.

The fourth refinement is to require a collaboration kick-off meeting among collaborating academics and students, to ensure a clear understanding of the collaboration and to break the ice among students. To ease the discussion across disciplines, the university has allocated a dedicated common slot for this purpose at the institutional level for all courses involved in this collaboration. In addition, to facilitate collaboration among students, the use of "students' behavioural contract" is encouraged where more detailed expectations such as "focus on the issue and not the person, always attend meeting well prepared" are agreed. In addition, based on academics' and students' feedback, a focused guideline on managing conflict has been included in the proposed guideline. Last but not least, the proposed guideline is refined to encourage students to reflect on their experiences to deepen their learning.

With the multiple refinements made, the proposed multidisciplinary learning cooperative procedural framework appears to be comprehensive and practical to support multidisciplinary learning in alignment with the entrepreneurship agenda of an institution.

IV. DISCUSSION AND CONCLUSION

A. Discussion

1) Key challenges

Most of the challenges reported in this study are consistent with the literature. Lack of interest among academics is consistent with the literature [8] partly due to the university being at the early stage of its entrepreneurship journey. Lack of know-how is a common challenge faced by universities or academics [14] while various attempts have been reported. The challenge of conflict among students is consistent and

being the most commonly reported challenge in literature [13], [17]. The lack of support from the ecosystem especially in terms of policy and resources is consistent with the literature [8].

However, the concern of lack of interest among students on entrepreneurship education [1] is not apparent in this study because the learning is credit-bearing, being part of the formal curriculum. However, the actual number of students taking up the challenge to become student entrepreneurs at the end of the learning is still limited. The situation could be partly due to the university being at the early stage of its entrepreneurship journey.

2) Key strategies

The proposed strategies in this study have not been widely mentioned by the existing studies. This difference could be because the strategies highlighted in this study focus on institutional level strategic and full implementation across all disciplines, while the existing literature reported mostly “isolated” effort from certain faculty, centre, or programmes. In addition, the need to manage change strategically may not be widely discussed in the related studies, because the effort is being treated as an academic exercise rather than a strategic effort. However, in the field of strategic change management, the proposed strategies are commonly discussed [24].

3) Multidisciplinary learning cooperative procedural framework

The proposed framework has more comprehensive and practical procedures to guide the implementation of multidisciplinary learning supporting the entrepreneurship agenda of a university. The proposed framework is supportive of the key principles of cooperative learning, namely commitment to individual accountability and positive interdependence [20]. In addition, the proposed framework provides detailed operational considerations to implement the eight components of the collaborative learning design framework identified by de Hei, Strijbos *et al.* [14].

B. Limitations and Recommendations

The findings of this study are based on the two phases of design and pilot implementation of multidisciplinary learning, covering programmes from seven disciplines in a private university in Malaysia. Data analysis is primarily based on reflection and discussion among the three researchers and the course leaders. It is arguably that more systematic and detailed data analysis could have strengthened the validity of the findings. In addition, the robustness of the findings can be increased through replications with more diverse programmes. A follow-up study can be conducted to confirm the effectiveness the framework during the full implementation at the institutional level. It is also recommended to conduct further studies at different types of public and private institutions to enable the development of a comprehensive framework taking into consideration the different natures of the institutions.

In conclusion, this study and the proposed procedural framework highlight the importance of intentional alignment among the curriculum of collaborating courses, the mindset of collaborating academics and students, as well as the supporting ecosystem including the leadership commitment

and strategic direction. The framework has expanded the practical knowledge of multidisciplinary learning implementation by detailing practical steps to ensure its effective implementation. The proposed procedural framework could be extremely helpful for institutions that are struggling to implement multidisciplinary learning across faculties, supporting the entrepreneurship agenda of the institutions.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTIONS

Lok Boon Thian wrote the paper, and others analyzed the data. All authors had approved the final version.

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