

Implementation of Collaborative Teaching for the College of Computing, Informatics and Mathematics,
Universiti Teknologi MARA: A Case Study of Semester 20222 and Semester 20224

Implementation of Collaborative Teaching for the College of Computing, Informatics and Mathematics, Universiti Teknologi MARA: A Case Study of Semester 20222 and Semester 20224

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Abstract: Collaborative teaching allows lecturers to move away from the traditional model of one teacher stirring the entire class. This strategy encourages the integration of different perspectives and teaching styles. As a result, students receive a more thorough and well-rounded education. This method of teaching involves teachers complementing each other's skills, knowledge, and teaching methodologies. In this article, we describe the implementation of collaborative teaching for two academic terms: semester 20222 (March – August 2022) and semester 20224 (October

2022 – February 2023) for the College of Computing, Informatics, and Mathematics (CCIM), Universiti Teknologi MARA (UiTM) Shah Alam. Respondents from survey data were selected CCIM lecturers collected from three (3) schools of CCIM lecturers, namely which are the School of Computing Sciences, the School of Mathematical Sciences, and the School of Information Science. The survey data collected was mainly, on their experience as well as their evaluation of conducting collaborative teaching during their teaching sessions. The findings were analyzed in order to make informed decisions for future academic terms. Additionally, recommendations for improvements and best practices were suggested based on the feedback received from the respondents.

Keywords: Case Study, Collaborative Teaching, Computing, Mathematic, University,

1. INTRODUCTION

It is a vision of the Ministry of Higher Education (MOHE) to expect universities as Higher Education Institutions (HEIs) to produce well-equipped students with 21st century skills (Leong et al., 2018). These skills include creative problem solving, critical thinking, effective communication, effectively functioning in society, and being able to work collaboratively in a team (Ibrahim, 2017). Constantly upgrading their skills and enhancing their learning are vital for student survival in this challenging world (Saavedra & Opfer, 2012). The key education providers, HEIs, received a lot of pressure to redefine their instructional facilities and delivery systems in order to provide an environment that is conducive to student learning and will facilitate it with the current changes of the 21st century (Leong et al., 2018). Teaching strategies such as teacher-centred, student-centred, case-based learning, problem-based learning, and collaborative teaching are important parts of educational fields that are required to be investigated and analyzed for the benefit of students in HEIs (Leong et al., 2018).

The collaborative working environment seems to be the norm for every organization (Decuyper et al., 2010; Edmondson, 2013). The most significant context for students to obtain collaborative skills is the educational environment (Vangrieken et al., 2015). Within the education

environment, as an educator practicing collaborative learning for students by working together as a team, the collaboration portrayed by the educator plays a significant impact on enhancing students into future collaborators. This skill can be developed by students when they see educators “practice what they preach” (Coke, 2005). Because of that, collaborative teaching is an important aspect that needs to be implemented and actively practiced in the whole system of education. In a typical inclusive, both staff members are certified teachers; both hold a content-area certification; or one holds a content-area certification and the other a special education certification (industrial background expertise) (Keeley, 2015). The advantages for both students and lecturers are evident in many ways. For lecturers, these advantages include improved instruction, immediate lesson feedback, the prevention of student conflicts, and many others (Conderman, 2011; Fenty & McDuffie-Landrum, 2011; Keefe & Moore, 2004; Magiera & Zigmond, 2005; Murawski, 2008; Nichols et al., 2010; Rice et al., 2007; Walther-Thomas, 1997). Additionally, having two professional educators in a classroom allows for a more diverse range of teaching styles and perspectives. This can cater to different learning preferences and help engage students who may respond better to alternative approaches. Moreover, the presence of two educators’ fosters collaboration and brainstorming between them, leading to innovative teaching methods and enhanced problem-solving skills among students.

Collaborative teaching is also implemented at Universiti Teknologi MARA (UiTM), a prominent HEI in Malaysia, as one of its teaching strategies. UiTM recognizes the usefulness of collaborative teaching in enhancing learning outcomes, promoting student engagement, and dynamically fostering the educational environment. It is a 1-year (two academic terms) implementation of collaborative teaching in the UiTM education system, whereby the system has been in place since 2022. The first term of implementation is for the semester of 20222 (March – August 2022), and the semester of 20224 (October 2022 – February 2023) is the second term of implementation. The College of Computing, Informatics, and Mathematics (CCIM), as one of the UiTM’s faculties, has also been actively executing the concept of collaborative teaching in the education systems it first implemented. In this article, the implementation of collaborative teaching is described in two academic terms (semesters 20222 and 20224) for the College of Computing, Informatics, and Mathematics (CCIM), UiTM.

Respondents from survey data were collected from three (3) schools of CCIM lecturers, which are the School of Computing Sciences, the School of Mathematical Sciences, and the School of Information Science, on their experience as well as their evaluation of conducting collaborative teaching during their teaching sessions. The survey data collected from the CCIM lecturers provided valuable insights into their experiences, evaluations, and perceptions when engaging in collaborative teaching. Additionally, recommendations for improvements and best practices were suggested based on the feedback received from the respondents.

2. METHOD

2.1 DATA COLLECTION

The quantitative research data collection was acquired using the ‘Google Form Survey’. The respondents are required to answer the self-administered survey regarding the implementation of collaborative teaching during teaching sessions. Respondents from survey data were collected from lecturers of three (3) schools of the CCIM, UiTM, which are the School of Computing Sciences, the School of Mathematical Sciences, and the School of Information Science. Only the lecturer who is implementing collaborative teaching during teaching sessions was required to answer the survey to ensure the validity of the data collected. The data is in the form of two academic terms, which are semesters 20222 and 20224. The survey aims to gather insights on the effectiveness of collaborative teaching methods within the CCIM schools. By focusing on lecturers who actively implement collaborative teaching, the data collected provided a comprehensive understanding of its impact on student learning outcomes. Additionally, capturing data from two academic terms will allow for a longitudinal analysis and the identification of any potential trends or changes in collaborative teaching practices over time.

2.2 COLLABORATIVE TEACHING INSTRUMENT AND MODELS

The development and implementation of collaborative teaching are monitored by the Centre for Innovative Delivery and Learning Development (CIDL), UiTM. There are a few steps that lecturers need to undergo when they want to register their group for collaborative teaching as in Fig. 1.

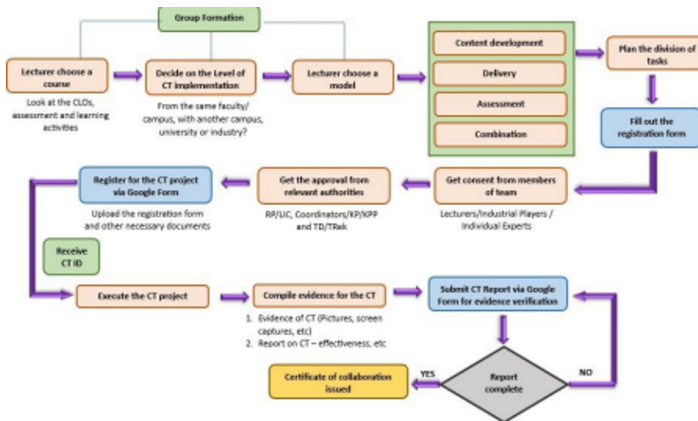


Fig. 5 Income Generated from NTB's Sponsored Student status

In Fig. 1, during group formation, the lecturers need to decide on the collaborative teaching implementation level. There are six (6) levels of collaborative teaching implementation to choose from, as depicted in Fig. 2. These levels vary in terms of the degree of collaboration required among students and the level of guidance provided by the lecturers. Each level offers a unique approach to collaborative teaching, allowing lecturers to tailor their instruction to meet the specific needs and goals of their students. It is important for lecturers to carefully consider these options and select the most appropriate implementation level for their teaching context.



Fig. 5 Income Generated from NTB's Sponsored Student status

In the collaborative teaching approach, there are numerous distinct teaching models inside it, each with a unique style of setting up the classroom and the duties that the lecturer will use, as shown in Fig. 2. These instructional approaches are not thought to be better than one another (Gokbulut et al., 2020). However, there are seven types of collaboration models that can be implemented in UiTM. The lecturer can choose any one of the models as tabulated in Table 1 below. Model 1, Model 2, and Model 3 are single-task models, while Model 4, Model 5, Model 6, and Model 7 are combinations of tasks between models. The single-task models (Model 1, Model 2, and Model 3) focus on specific collaborative activities that enhance student engagement and participation. On the other hand, the combination models (Model 4, Model 5, Model 6, and Model 7) offer a more comprehensive approach by integrating multiple collaborative tasks to foster a deeper understanding of the subject matter. The choice of model depends on the lecturer's teaching style and the learning objectives of the class session.

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Type of Model	Method	Description
Model 1	Content	Course content development collaboration
Model 2	Delivery	Delivery collaboration
Model 3	Assessment	Assessment evaluation collaboration
Model 4	Content and Delivery	Course content development and delivery collaboration
Model 5	Content and Assessment	Course content development and assessment evaluation collaboration
Model 6	Delivery and Assessment	Delivery and assessment evaluation collaboration
Model 7	Content, Delivery and Assessment	Course content development, delivery and assessment evaluation collaboration

Table 1. Collaborative Teaching Models

3. RESULTS AND DISCUSSION

The survey data collected from the CCIM lecturers provided valuable insights into their experiences, evaluations, and perceptions while conducting collaborative teaching.

3.1. ENROLMENT OF LECTURER CONDUCTING COLLABORATIVE TEACHING

The results of collaborative teaching in CCIM are divided into three schools: the School of Computing Sciences (CS), the School of Information Science (IM), and the School of Mathematical Sciences (MS). Based on Table 2 and Table 3 below, it shows the registration status (“Completed” or “Unfinished”) for semester 20222 and semester 20224, respectively. Status “Completed” means the registered group of lecturers is submitting the collaborative teaching report, while “Unfinished” status stand for the registered group of lecturers not submitting the report.

REGISTRATION STATUS	SCHOOL			TOTAL
	CS	IM	MS	
Registered with report (Completed)	8	9	12	29
Registered without report (Unfinished)	0	4	0	4
TOTAL	8	13	12	33

Table 2. Registration Status for Semester 20222

REGISTRATION STATUS	SCHOOL			TOTAL
	CS	IM	MS	
Registered with report (Completed)	17	9	24	50
Registered without report (Unfinished)	0	0	4	0
TOTAL	17	9	28	54

Table 3. Registration Status for Semester 20224

In semester 20222, as shown in Table 2, there are 33 groups of lecturers registering for collaborative teaching in CCIM, UiTM, while there is an increment of 63.6% on the number of registrations to 54 groups for semester 20224, as shown in Table 3. However, in the semester 20222, out of 33 groups registered, only 29 projects succeeded in completing their report (87.9%), while 4 registered groups, or 12.1%, failed to complete their report. The unfinished registered groups are from the IM. In the semester 20224, out of 54 groups registered, only 50 projects succeeded in completing their report (92.6%), while 4 registered groups, or 7.4%, failed to complete their report. The unfinished registered groups are from the MS. Nevertheless, the increase in the number of groups participating in collaborative teaching in CCIM, UiTM from semester 20222 to 20224 indicates a rising awareness for this teaching strategy.

From Table 2 (semester 20222), the smallest number of groups completing collaborative teaching is 8 groups, or 27.6%, from the CS, followed by the IM, with 9 groups completed, or 31.0%. The highest number of lecturers completing registration, with 41.4%, or 12 registrations, are from the MS. However, based on Table 3, this scenario is changing in semester 20224.

From 50 complete registered groups, it can be seen that the smallest number of groups registered, with 9 registrations, or 18%, are from the IM, followed by 17 groups registered, or 34%, from the CS. It can be seen that the majority of the complete registered groups, with 24 registrations, or 48%, are also from the MS. This indicates that the MS plays a significant role in promoting collaborative teaching within CCIM, UiTM. Therefore, this data suggests that there may be a need for increased efforts to encourage other schools to engage in collaborative teaching practices during the lecture session.

3.2. MOST-AND LEAST-LIKED LEVELS OF IMPLEMENTATION

The implementation of collaborative teaching is divided into six (6) levels, as shown in Fig. 3. The results of the registration based on level have been recorded for each school in the semesters 20222 and 20224, respectively. For semester 20222, there are 29 groups that have completed registration, while there are 50 groups that have completed registration for semester 20224.

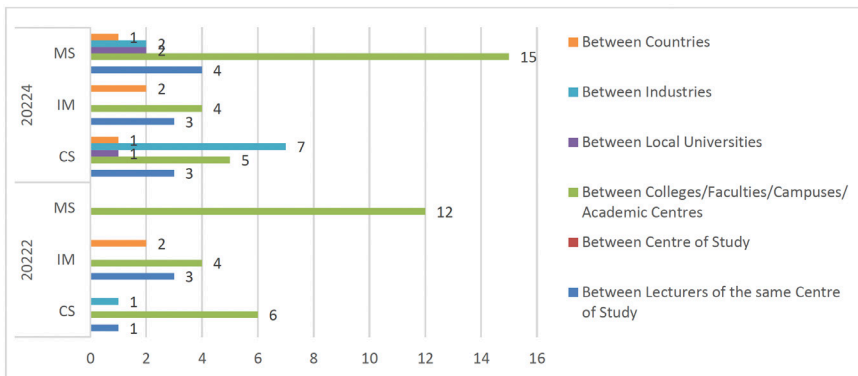


Fig. 3 The Number Registration Based on Level

Based on Fig. 3, the majority of the registered groups, 89.6% from semester 20222 and 68% from semester 20224, choose collaborative teaching within the UiTM domain, whether between lecturers of the same centre of study or between colleges, faculties, campuses, or academics. This indicates that the majority of CCIM, UiTM lecturers value and prioritize collaborative teaching within the university's ecosystem. The level of collaboration between centre of study is considered unpopular since none of the groups chose this level of collaboration for both semesters. The result also showed that only 3 groups registered, or 10.4%, chose collaboration outside the UiTM domain, which is level between industries and countries for semester 20222. The number of collaborations with external institutions, industry partners, or other countries has increased to 16 groups registered, or 32% for semester 20224. In semester 20222, none of the lecturers chose the collaboration level between local universities. However, for semester 20224, there are 3 collaborations between local universities, 4 collaborations between countries, and 9 collaborations between industries. This indicates that there is a shift in terms of collaboration from internal to external UiTM collaboration. This shift could be attributed to the increasing recognition of the benefits of collaborating with external partners, such as industry professionals or experts from other institutions. By engaging in collaborative teaching outside of UiTM, students can gain exposure to different perspectives and enhance their learning experience. Additionally, external collaborations can also provide opportunities for networking and future career prospects for students.

3.3. MOST-AND LEAST-LIKED MODELS OF COLLABORATION.

The registration is based on the model that has been chosen, as illustrated in Fig. 4 below. The results of the registration based on the model have been recorded for each school in the semesters 20222 and 20224, respectively. For semester 20222, there are 29 groups that have completed registration, while there are 50 groups that have completed registration for semester 20224.

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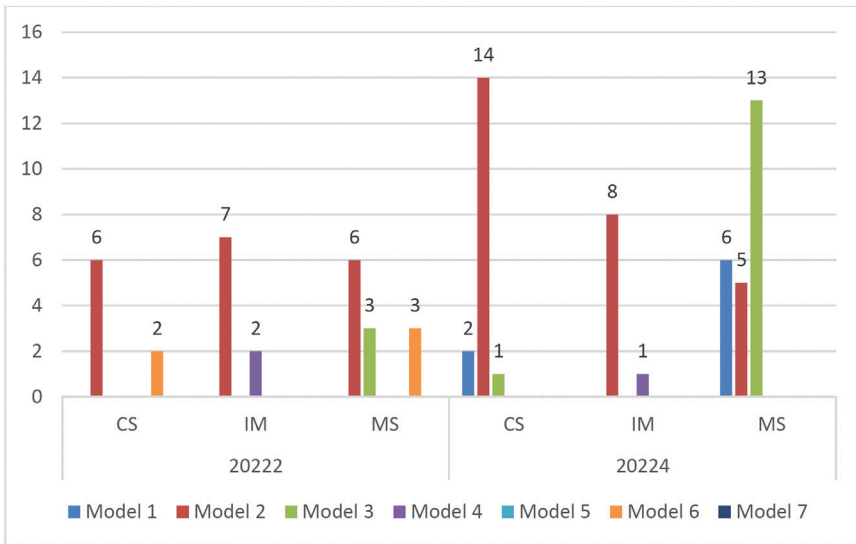


Fig. 4 Number of Registration Based on Model

Based on Fig. 4, it can be seen that for the semester 20222, 22 out of 29 groups of lecturers, or 75.9%, chose single-task models, while only 7 groups of lecturers, or 24.1%, selected combinations of tasks between models. The trend of selecting single-task models also reflects this for semester 20224, as the number is increasing to 49 out of 50 groups of lecturers, or 98%, who choose this kind of model. This shows that the number of lecturers who prefer to use combinations of tasks between models is decreasing to only 1 group, or 2%. These findings suggest that single-task models are more popular compared to the other models in both semesters for the CCIM, UiTM lecturers. The overwhelming majority of lecturers that are opting for this model indicate that lecturers are shifting away from using the technique of combinations of tasks between models since this model requires extra tasks to complete compared to a single-task model. The shift towards single-task models may be attributed to their simplicity, as the need for coordinating multiple tasks within a group is eliminated. Additionally, the preference for using single-task models allows lecturers to focus more on individual student progress and accordingly tailor their teaching methods.

3.4. LECTURERS PERCEPTIONS TOWARDS COLLABORATIVE TEACHING

These are the responses collected from the survey data given to the CCIM, UiTM lectures regarding their perception and evaluation of implementing collaborative teaching for semester 20224. There are 54 groups of lecturers registering, but only 44 groups, or 81.5%, answered this survey. The survey data revealed a mixed response from the CCIM lecture attendees regarding the implementation of collaborative teaching. While some participants expressed enthusiasm and believed it could enhance student engagement and learning outcomes, others had different points of view.

Q1: Does the implementation of collaborative teaching have an impact on your TEACHING?

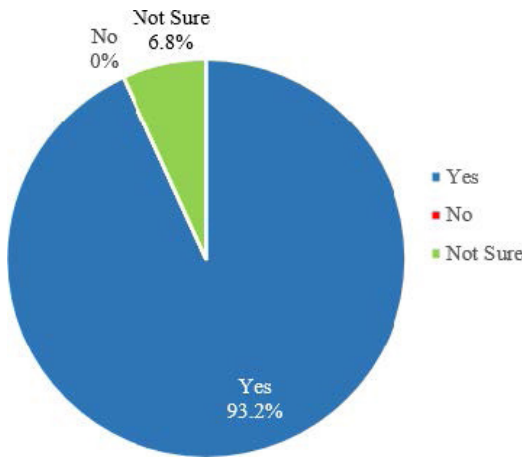


Fig. 4 Number of Registration Based on Model

Based on the survey as shown in Fig. 5, 93.2% (41 out of 44) of CCIM's lecturers agreed that collaborative teaching has an impact on their teaching, while 6.8% (3 out of 44) are not sure of the impact. However, none of the lecturers said that the collaboration did not have an impact on their teaching. These findings indicate that the majority of CCIM's lecturers recognize the positive influence of collaborative teaching on their instructional practices. The small percentage of uncertainty suggests a need for further investigation to understand the specific concerns or reservations held by these individuals.

Q2: From the Collaborative Teaching activities that have been carried out, what do you think of the benefits received by STUDENTS?

- “Students can use different mediums for teaching and learning that are available at any time and from any location.”
- “The assessment scoring technique is more egalitarian and fairer among groups. Students receive a more equitable evaluation when the equivalent of the assessment questions supplied to them is the same, even though they are on different study campuses.”
- “Students can learn from experienced instructors at other universities on various teaching strategies. This allows students to adjust to other learning environments. Students will have a stronger connection if they choose to continue studying afterwards.”
- “No benefit is received by the student because the questions are the same for every program that takes this paper. The same concept as the final exam.”

The input suggests that collaborative teaching can help students adjust to different learning environments and establish stronger connections. However, the data also reveals that some lecturers disagree on the benefits of collaborative teaching, while most lecturers in the CCIM support this teaching strategy. The disagreement over incorporating collaborative teaching among lecturers stems from the belief that students should be exposed to different types of assessments or models in order to develop a well-rounded understanding of the subject matter. However, by having access to instructors from other campuses, universities, and industries; students can benefit from a wider range of perspectives and expertise. Furthermore, this exposure to different teaching methods and approaches can enhance their overall learning experience and broaden their knowledge base.

Q3: From the Collaborative Teaching activities that have been carried out, what do you think of the benefits received by the LECTURERS?

- “Through this collaborative program, lecturers can learn teaching methods as well as knowledge, either with other lecturers at UiTM or other local or foreign universities, or with.”
- “Lecturers are more eager to create innovative teaching materials. Lecturers can expand opportunities for the development of cooperation networks with foreign and industry expertise.” • “Able to share previous career experience in practical and real-world vs. theory in books.”

The collaborative program allows lecturers to stay updated with the latest industry trends and practices, ensuring that they are equipping their students with relevant and practical knowledge. This exposure to real-world applications enhances the lecturers’ credibility and prepares students for the demands of the job market. Furthermore, by fostering a network for multi-party collaboration, lecturers can also engage in research projects and exchange ideas with professionals from various fields, broadening their horizons and expanding their professional connections.

Q4: From the Collaborative Teaching activities that have been carried out, what do you think of the benefits received by the INDUSTRY?

- “Be able to impart new knowledge to students and establish positive relationships with industry, lecturers, and the university. The industry can channel the most recent information and developments in related industries that are relevant to the current learning module.”
- “The industry is very interested in hearing about what is being done in their area as well as what the industry requires. Additionally, prepare to receive students in the industry based on their needs.”

Industry professionals can benefit from this collaboration by staying updated on the latest research and academic advancements, allowing them to continuously enhance their expertise and stay at the forefront of innovation. Furthermore, this collaboration can also lead to potential partnerships and collaborations between industry professionals and academic institutions, fostering a mutually beneficial relationship where both parties can exchange

knowledge and resources. Additionally, industry professionals can gain access to a pool of talented students who are equipped with the latest theoretical knowledge and practical skills, providing them with a valuable source of potential employees or interns.

3.5. IMPROVEMENT AND SUGGESTION FOR BEST PRACTICE OF COLLABORATIVE TEACHING

Collaborative teaching skills can always be improved and refined by implementing best practices. Here are some additional suggestions for enhancing collaborative teaching skills and adopting best practices:

1) Regular Communication and Collaboration:

Create a climate where co-teachers regularly communicate and work together. Set aside specific planning sessions to go over lesson plans, teaching methods, and student development. To make communication and document sharing easier by using technology.

2) Clear Learning Objectives:

Establishing and communicating learning objectives in a clear manner can help ensure that all collaborative teaching uses the same instructional strategy. Create evaluations and activities collectively that focus on these goals to create a seamless learning environment.

3) Time Allotted for Structured Collaboration:

Allocate specific time for co-teachers to work together and discuss their collaborative teaching methods. Discuss any accomplishments, difficulties, or changes that need to be made for the next lesson during this time. Encourage constant interaction and cooperation among professionals.

4) Individualized Student Support:

To give students individualized support, draw on the knowledge of your other teachers. Find kids who could benefit from additional help or enrichment and work together to develop solutions to suit their specific needs.

5) Make use of Differentiation tactics:

Use differentiation tactics to address the various learning demands and learning preferences of your pupils. To engage all students, collaboratively create lessons that use a range of teaching strategies, tools, and evaluations.

6) Reflection and Continuous Improvement:

As a cooperative teaching team, regularly reflect and evaluate your performance. Analyze the efficiency of teaching methods, classroom management measures and general cooperation. Depending on comments and student performance, adjust and improve techniques.

4. CONCLUSION

This one-year (two academic terms) case study at the College of Computing, Informatics, and Mathematics (CCIM) at UiTM offers an example of the implementation of collaborative teaching in the education system. The aim of the study was to describe the implementation of collaborative teaching for the semesters of 20222 (October 2022–February 2023) and 20224 (March 2023–July 2023). Respondents from survey data were collected from three (3) schools of CCIM lecturers, which are the School of Computing Sciences, the School of Mathematical Sciences, and the School of Information Science, on their experience as well as their evaluation of conducting collaborative teaching during their teaching sessions. The survey data collected from the CCIM lecturers provided valuable insights into their experiences, evaluations, and perceptions when engaging in collaborative teaching.

The findings of the study show that this teaching strategy has been accepted to support diverse educational backgrounds due to the increasing number of lecturers participating from the three (3) schools of CCIM. The survey data indicates that the majority of the registered groups chose collaborative teaching within the UiTM domain, whether between lecturers of the same centre of study or between colleges, faculties, campuses, or academics. This indicates that the majority of CCIM, UiTM lecturers value and prioritize

collaborative teaching within the university's ecosystem. The finding from the survey also shows that the trend of selecting single-task models is more popular among the CCIM, UiTM lecturers compared to combinations of tasks between models. The overwhelming majority of lecturers that are opting for this model indicate that lecturers are shifting away from using the technique of combinations of tasks between models since this model requires extra tasks to complete compared to a single-task model. Lecturers might find it easier to focus on one specific task at a time, allowing them to allocate their resources and time more effectively.

The lecturers reported that collaborative teaching allowed them to gain new perspectives, learn from their colleagues, industry, and other countries regarding their experiences, and also enhance their own teaching skills. Additionally, the study found that students also benefited from collaborative teaching, as it provided them with a more interactive and engaging learning experience. Collaborative teaching allows lecturers to move away from the traditional model of one teacher stirring the entire class. This strategy encourages the integration of different perspectives and teaching styles. As a result, students receive a more thorough and well-rounded education. This method of teaching involves teachers complementing each other's skills, knowledge, and teaching methodologies. Collaborative teaching allows for a diverse range of perspectives and approaches to be incorporated into the classroom, catering to the individual needs and learning styles of students. Additionally, this approach fosters a sense of teamwork, collaboration, and cooperation among lecturers, creating a positive and supportive learning environment.

5. ACKNOWLEDGEMENT

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