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Development Intervention of Students for the Civil Engineering Course in the Diploma Programme through Cantas Gagal

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ABSTRACT

The complexity of the Civil Engineering Programme often challenges students, making intervention programmes essential. These programmes provide targeted support and personalized instruction to help students overcome academic obstacles and improve their performance. In addition to addressing academic difficulties, intervention programmes also tackle underlying barriers such as learning difficulties, attention issues, and personal circumstances. One of the intervention programmes is Cantas Gagal. In this study, Cantas Gagal was implemented in the hydraulic engineering course to investigate its impact on student performance. A survey was conducted among 25 students who participated in the programme; assessing their understanding of the intervention, the hydraulic engineering course, and their overall perception. The results indicated high awareness and a willingness to participate in the Cantas Gagal programme. Furthermore, the survey revealed students' perceived difficulty levels of course topics and subtopics, providing valuable insights for lecturers to design their teaching approaches. Overall, intervention programmes play a crucial role in supporting students› academic journey and enabling them to reach their full potential in civil engineering programme.

Keywords: Complexibility; civil engineering programme; intervention; targeted support; cantas gagal; student performance

INTRODUCTION

Civil engineering schools worldwide have the responsibility of producing highly educated and competent graduate engineers. This goal can be achieved through satisfactory academic performance and academic success. In order to perform well, civil engineering lecturers should make many efforts to ensure that students can apply the knowledge taught. There are many ways to improve student performance. The methods are not only aimed at engineering students but can be used for different multidisciplinaries. It is not only on the method used for improvement, but student performance can also be enhanced when both parties, lecturer and students, become active in the matter. For instance, Jeffreys (2012) pointed out for nursing school that if educators and nursing schools do not make extra efforts, students' academic performance may be inadequate, which could lead to a higher attrition rate in nursing education. Yusof et al. (2015) emphasise in relation to Technical and Vocational Education and Training (TVET) that efforts should be made to improve student performance by showing them that a well-educated individual must also have the right attitude to work and have the competence to perform a particular task in the workplace. Rosa (2024) enhanced that social-emotional learning as the most important aspect when it comes to the improvement of student development. Although emotional learning is important, the nature of the subject and the complexity of a particular subject also becomes the most important aspect to consider.

There is a parallel in the Diploma in Civil Engineering programmes, where the complexity (civil engineering complex problem is assessed) and the critical nature of the subject demand increased attention. Lecturers have the responsibility of not only imparting knowledge, but also actively involving students to ensure that they understand and master the subject. Given the complex concepts and practical applications involved, consistent efforts to

improve performance are essential. This includes utilising a variety of teaching methods, providing adequate resources and fostering an environment conducive to learning. By prioritising continuous improvement and providing targeted support, lecturers can effectively address challenges and promote student success. Ultimately, this proactive approach not only improves academic outcomes, but also helps produce competent professionals in the field of civil engineering.

Due to complexity of the Civil Engineering Programme, some of the students might fail and intervention programme should be carried out to overcome the problem. A diploma programme in civil engineering typically includes a comprehensive curriculum that includes foundational subjects such as mathematics, physics and basic engineering principles, as well as specialised courses that focus on civil engineering disciplines. These courses include, for example, structural analysis and design, traffic engineering, geotechnical engineering, construction management, surveying, hydraulic engineering and environmental engineering. Practical training through lab work, field work and internships is often incorporated to provide hands-on experience and prepare students for real-world challenges in the construction industry. In addition, courses may emphasise the use of computer-aided design (CAD) software and other relevant technologies to enhance students' skills in planning, analysing and effectively managing civil engineering projects.

Although there are many subjects in this programme, the intervention development programme is necessary to improve the quality of student performance, especially among repeaters. Chicote-Beato et al. (2024) report on an intervention programme against cyberbullying among students from their first contact with technology. More specifically, the report focuses on the effective management of cyberbullying and the reduction of associated behaviours. In particular, emotional literacy, self-regulation skills, school climate and online safety are factors that are present in programmes with positive outcomes in cyberbullying prevention. Although the research was related to cyberbullying, the technique for the intervention programme can also be applied to the civil engineering programme.

Intervention programmes are a lifeline for students facing academic challenges. Investigation on the intervention programme has been carried out by many researchers on various fields (Kim and Lee, 2024, Sengupta et al. 2024; Blewit et al. 2024; Martin Ruiz et al. 2024; Chen and Li, 2024; Tahan et al. 2024; Zhang et al. 2024; Alhumaid et al. 2022). These programmes provide targeted support that is often lacking in regular classrooms. Through one-on-one tutoring or small group instruction, students are given the opportunity to work on the areas in which they are struggling. This personalised approach helps them to better understand concepts and close knowledge gaps that may be holding them back. Intervention programmes also go beyond academics (Blewitt et al. 2024; Cattan et al. 2023; Jariego et al. 2024). They can address underlying barriers such as learning difficulties, attention issues or even personal situations outside of school. This multifaceted support can include social-emotional help, study skills development or even identification of learning disabilities. Ultimately, intervention programmes enable students to overcome these challenges, build self-confidence through their achievements and develop the strong academic foundation they need to reach their full potential.

Intervention programmes are critical for students with academic challenges (Cattan et al. 2023). In regular classrooms, it is often difficult to meet the unique needs of each student. Intervention programmes bridge this gap by providing targeted support through individual tutoring or small group instruction (National Centre on Learning Disabilities 2023). In this way, students can delve deeper into the areas in which they are struggling, developing a better understanding of concepts and closing knowledge gaps.

Beyond academics, intervention programmes address the underlying barriers to success. These can include learning difficulties, attention issues or even personal situations outside of school (Institute of Education Sciences 2020). The multifaceted support offered by intervention programmes may include social-emotional learning, study skills development, or even identification of learning disorders (National Centre for Learning Disabilities 2023). Ultimately, these programmes empower students to overcome challenges, build self-confidence through achievement, and develop a strong academic foundation to reach their full potential.

Engineering programmes offer a variety of intervention strategies to support struggling students. Peer tutoring and Supplemental Instruction pair students with experienced peers who can provide personalised assistance and targeted review of difficult concepts (Lang 2013; Smith et al. 2009). Early warning systems proactively identify students at risk and enable early intervention and support to get them back on track (Gardner & Jones 2015). Project-based learning (PBL) fosters deeper understanding through the application of knowledge to real-world projects, while mentoring programmes connect students with faculty who provide guidance and personal support for their academic and professional development (Daugherty & Yasar 2015; Nora & Crisp 2008).

In addition, strategies to reinforce foundational academic skills are often used in engineering degree programmes. Learning communities form cohorts of students enrolled in the same courses and promote peer support and collaboration (Stassen et al. 2012). Study skills

workshops teach students how to effectively manage their time, take notes, and write tests (Ellis & Robbins, 2007; Md Nor et al. 2016). Computer-assisted instruction (CAI) provides personalised practise and feedback on specific learning objectives, while regular meetings with academic advisors help students with course selection and address academic issues (Kovacs 2019; Lundquist & Stoner 2015). Another method is known as Cantas Gagal (Md Nor 2021; Md Nor et al. 2016), which is conducted in a small group of students and taught by the lecturer or among excellent students. This multi-faceted approach ensures that struggling engineering students receive the support they need to succeed.

As there are many possibilities for the intervention programme, in this work the Cantas Gagal was carried out for the selected course of hydraulic engineering. The main objective of this study is to investigate the performance of students in the Hydraulic Engineering course when they participate in Cantas Gagal. For this purpose, a survey was conducted among 25 students who participated as first timer and repeaters for the course.

METHODOLOGY

SAMPLE SIZES FOR COLLECTION DATA

The study was conducted using a quantitative research design such as survey. The survey was distributed to collect responses from 25 students who were taking the Hydraulic Engineering course in semester 20234 (October 2023 – February 2024). All students were required to participate in the Cantas Gagal programme.

DATA COLLECTION METHOD

A total of 25 students answered all the questions. The survey was divided into four sections: Section A: Demographic profile of the students. Section B: Students' level of understanding of the Cantas Gagal programme organised by the faculty. Section C: The students' level of understanding of the hydraulic engineering course. Section D: General comments on the Hydraulic Engineering. All students were required to answer the survey using several Likert scales depending on the type of course. The data collection for each section is presented in Tables 1 to 4.

A survey was conducted to gauge student understanding of a specific hydraulic engineering course and a program called Cantas Gagal offered by the faculty. A total of 25 students participated and answered all the questions in the survey.

The survey itself was divided into four distinct sections. The first section, Section A, aimed to collect basic demographic information about the students taking the survey. This could include details like year of study, gender, or any other relevant information that might shed light on their background.

Sections B and C delved deeper into the students' specific understanding of two key areas. Section B focused on the Cantas Gagal program. The questions in this section likely assessed the students' awareness of the program's goals, content, and how it might benefit them. Section C then shifted gears to evaluate the students' level of understanding of the hydraulic engineering course itself. Here, the questions might have tested their grasp of core concepts, difficulty level of the material, or effectiveness of the teaching methods used in the course.

The final section, Section D, provided an opportunity for students to share more general comments or feedback on the hydraulic engineering course. This open-ended section could be particularly valuable in identifying areas for improvement or highlighting aspects of the course that students found particularly helpful. It's important to note that the survey likely used Likert scales throughout, which are questionnaires where respondents indicate their level of agreement or disagreement with a statement using a range of options (e.g., strongly disagree, disagree, neutral, agree, strongly agree). The specific type of Likert scale used might have varied depending on the question being asked within each section.

Last but not least, the students' achievements have been analyzed for two semesters, 20234 and 20224. A comparison can be made between these two semesters to assess the effectiveness of the Cantas Gagal program. Additionally, an analysis of each program outcome (PO) and course outcome (CO) was also conducted for both semesters.

TABLE 1. Surveys distributed to students in Cantas Gagal Programme for Section A

Sections	Remarks
Section A: Demographic profile of students	Name
	Student ID
	Group in Semester 20234
	Achievement in previous semester 20232

TABLE 2. Surveys distributed to students in Cantas Gagal Programme for Section B

Sections	Remarks
Section B: Students' level of understanding of the Cantas Gagal Programme	Awareness of the student intervention program or Cantas Gagal for Hydraulic (ECW241) before participating in it.
	Understanding about the student intervention program or Cantas Gagal for ECW241.
	Estimation on the percentage willingness to participate in this program before you participate in this program.
	Rate your overall satisfaction with the student intervention program or Cantas Gagal after you participate this program
	To what extent do you believe the intervention program has helped you in understanding Hydraulic Engineering concepts?

TABLE 3. Surveys distributed to students in Cantas Gagal Programme for Section C

Sections	Remarks
Section C: The students' level of understanding of the hydraulic engineering course.	How comfortable are you seeking help or clarification during the intervention sessions?
	Can you arrange the following topics (in scale 1 to 3) according to their level of difficulty so that the lecturer can pay more attention to them when teaching each topic?
	Can you arrange the following sub topics (in scale 1 to 10) in Pipe Flow Analyses according to their level of difficulty so that the lecturer can pay more attention to them when teaching each topic?
	Can you arrange the following sub topics (in scale 1 to 2) in open channel flow according to their level of difficulty so that the lecturer can pay more attention to them when teaching each topic?

TABLE 4. Surveys distributed to students in Cantas Gagal Programme for Section D

Sections	Remarks
Section D: General comments on the Hydraulic Engineering	Give a short answer from your understanding on Hydraulic Engineering.
	Is there anything that needs to be suggested to improve the performance of this programme?

RESULTS AND DISCUSSION

RESULTS FOR SECTION A: DEMOGRAPHIC PROFILING OF THE RESPONDENTS

The demographic profiling of the respondents was the main element in order to get accurate information of the respondents. A total of 25 students involved in this study. Of the 25 respondents, 15 are male students and 10 are female students, representing 60% and 40% respectively. Based on the data collected on grade achievement in previous semester, indicated most of the students were first time taken Hydraulic Engineering course with the percentage of 72% in semester 20234 as shown in Figure 1. One student was response got F, D+ and C+ in the previous semester with the percentage of 4%.

As the demographic profiling of respondents based on their academic achievements in the previous semester. A striking 72% of the respondents are categorized as First time, indicating that a substantial majority of the students are in their initial semester or experiencing their first evaluation period. This high percentage could indicate that there is a large influx of new students or that a significant number of students being assessed for the first time have participated in the Cantas Gagal programme.

Comparing respondents' previous academic performance with their current performance provides a more nuanced understanding of the benefits of interventions Cantas Gagal programme. From Figure 1 shows that academic performance in the previous semester varied widely, with a large majority (72%) of students graded for the first time and the remaining 28% evenly distributed across six grade categories (F to C+). This distribution suggests that there is a mix of high and low performing students in the cohort.

For students who have previously performed poorly (categories F, E, D), participation in the Cantas Gagal programme could be of great benefit. These students make up 24% of returning respondents. By participating in Cantas Gagal, these students could receive targeted support

and resources to help them improve their academic skills, develop better study habits, and address personal or academic challenges. The programme can provide them with one-on-one guidance and mentoring, which could lead to a significant improvement in their current performance compared to the previous semester.

For students with mid-level grades (D+, C-, C+), Cantas Gagal could provide opportunities to refine their academic skills and bring their performance to a higher level. This group also makes up 24% of returning respondents. These students are not failing, but still have room for improvement. The programme could help them move from average to above average or even excellent performance. The programme's focus on academic excellence and resilience could create a supportive and motivating environment that enables these students to build on their existing knowledge and skills and achieve better results in the current semester. Overall, the comprehensive support provided by Cantas Gagal could lead to a positive change in academic performance across the board, benefiting all students involved.

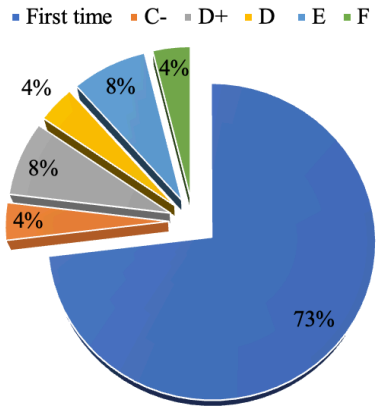

FIGURE 1. Grade or achievement in previous semester

SECTION B: STUDENTS' LEVEL OF UNDERSTANDING OF THE CANTAS GAGAL PROGRAMME

Figure 2 shows the results of a survey on awareness of the Cantas Gagal programme for the ECW241 course. All 25 students who participated in the survey answered yes or no to the question and it is clear that all students were aware of the existence of the Cantas Gagal programme with 100% answering yes. This clearly shows that students are aware of this programme which is designed to help them in ECW241 course.

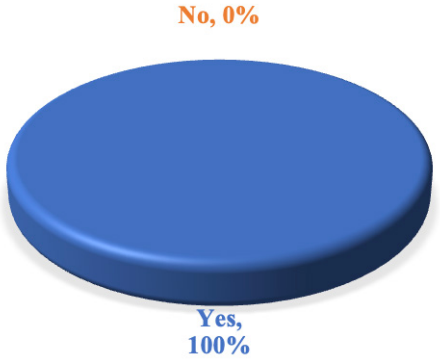

FIGURE 2. Awareness of the student intervention program or Cantas Gagal for Hydraulic Engineering

Understanding of how the student is engaged in the Cantas Gagal programme for the ECW241 course was also measured. This understanding was based on either in-class announcement, word of mouth, ordering from lecturers or friends. Figure 3 illustrates how students know about the Cantas Gagal for hydraulics engineering programme, showing the dominance of the lecturer's instruction with 64% compared to the announcement in class with 36%. This suggests that a more comprehensive approach is needed to ensure that all students are aware of this potential support.

While lecturer instruction and announcement methods were effective, they are primarily aimed at students who already attend classes regularly. To reach a wider participations of students, additional channels such as email newsletters, dedicated course websites and social media platforms suggested to be used. In addition, incorporating peer-to-peer advocacy can greatly increase the visibility of the programme. Encouraging students who have already benefited from Cantas Gagal to share their positive experiences in the form of testimonials in class, on social media or at student organisation meetings can create a sense of community and trust. Hosting information sessions or workshops about the programme during orientation weeks and other academic events can also ensure that all students, especially newcomers, are well informed. By diversifying communication channels and actively engaging the student body, the reach and impact of the Cantas Gagal programme can be maximised. This will ensure that every student has the opportunity to access and benefit from this valuable support system.

Figure 4 shows that almost half of the students (48%) have a positive attitude towards the Cantas Gagal programme for hydraulics engineering and 90 – 100% are willing to take part in it. However, a significant proportion (40%) is in the range of 70 – 89% to participate in this programme. The remainder of 12% are in the 50 – 69%

range and none have a percentage willingness of less than 50%. This indicates that students are aware of this programme and are willing to participate even if they do not take full advantage of it. A similar approach was used by Melo & Godwin (2021) in their study, in which they asked students about their willingness to participate in the programme they were running.

Figure 5 shows the overall satisfaction of the students who participated in the Cantas Gagal programme. A significant majority of respondents, 52%, indicated that they were *very satisfied* with the programme. In addition, 44% of participants said they were *satisfied*. Taken together, these figures show that a remarkable 96% of students have had a positive experience with the Cantas Gagal programme, highlighting its effectiveness and the value it provides to participants.

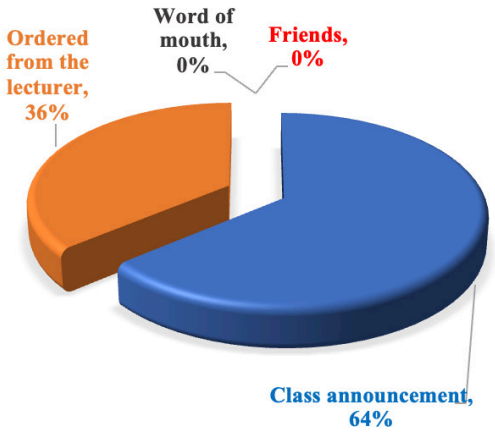

FIGURE 3. Understanding how the student is involved in the Cantas Gagal programme for the ECW241 course

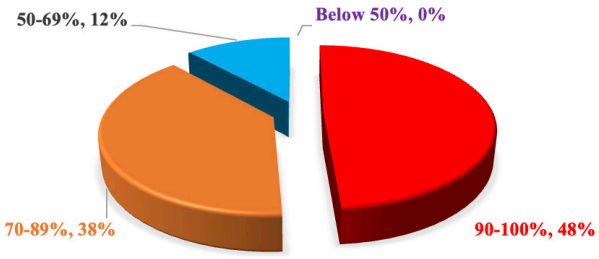

FIGURE 4. Estimation on the percentage willingness to participate in this program before the students participate in this program

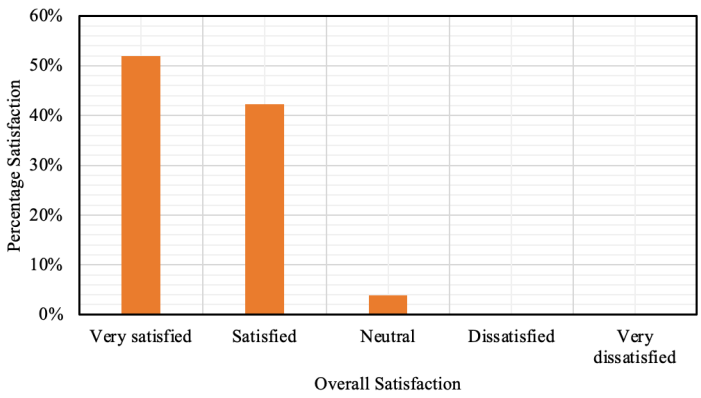

FIGURE 5. Overall satisfaction when join Cantas Gagal Programme

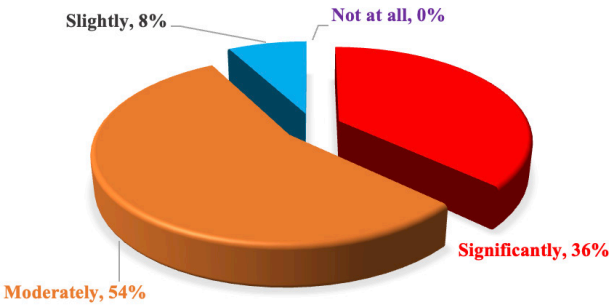

FIGURE 6. To what extent do you believe the intervention program has helped you in understanding Hydraulic Engineering concepts?

A small proportion of respondents, just 4%, were *neutral* about their experience, while no participants reported being *dissatisfied* or *very dissatisfied*. The lack of negative feedback underlines the success of the programme in meeting students' needs and expectations. The overwhelmingly positive satisfaction rates indicate that the programme is well received and likely plays an important role in promoting students' academic performance and overall well-being. In order to maintain and possibly increase this level of satisfaction, it would be beneficial to continue to monitor student feedback and make improvements to the programme where necessary.

Rather than understanding student satisfaction with participation in the Cantas Gagal programme, the extent to which students believe in this intervention programme becomes the primary aim. Figure 6 shows that students differ in their assessment of the extent to which the intervention programme has helped them to understand hydraulic engineering concepts. The highest percentage of 54% shows that a clear majority of students found the programme *moderately* very helpful in understanding hydraulic engineering concepts. This shows that the programme was successful for a large group of participants in a moderate way. The 36% represents a *significantly* proportion of students who felt that the programme clearly helped them in understanding the concepts. The smallest result of 8% indicates a small group of students who believe that the programme has *slightly* improved their understanding. Overall, the results are rather positive as no student stated that the programme was not helpful at all.

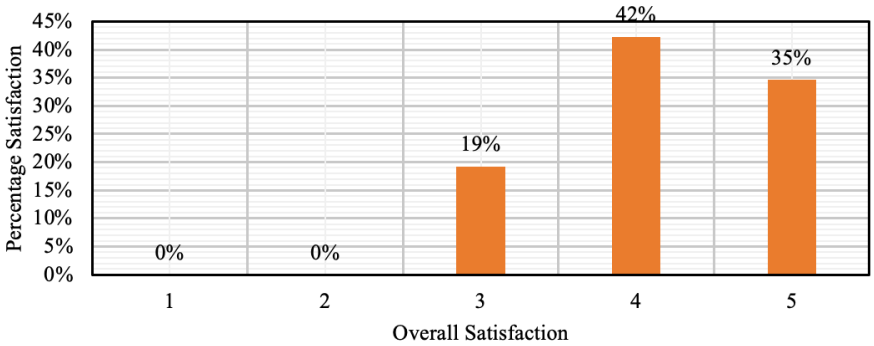

FIGURE 7. How comfortable are you seeking help or clarification during the intervention sessions?

SECTION C: THE STUDENTS' LEVEL OF UNDERSTANDING OF THE HYDRAULIC ENGINEERING COURSE

In this section, students were asked about their understanding of the hydraulic engineering course. Specific scales were used to analyse their understanding. On a scale of 1 (not comfortable) to 5 (very comfortable), students were asked how comfortable they felt asking for help or clarification during the intervention sessions. Figure 7 shows how comfortable students feel about seeking help during Cantas Gagal sessions. A high percentage of *very comfortable* (ideally) on scale 5 indicates a successful programme where students feel supported by participating in this programme (35%). An *comfortable* on scale 4 with a higher percentage

of 42% indicates a still successful programme where students feel they are using the programme to enhance their studies. Only 19% of students chose scale 3 to indicate that they felt *moderate comfortable* participating in the programme. The magnitude of each scale provides valuable insight into fostering a conducive learning environment.

The high percentages at the top end of the scale highlight the success of the programme in fostering a supportive learning environment where students feel encouraged to seek help and actively engage in their academic improvement. These findings underscore the importance of maintaining and continually improving the supportive atmosphere of Cantas Gagal so that all students feel comfortable and motivated to take full advantage of the programme.

After investigating students' comfort level with the intervention with Cantas Gagal, students were asked about the difficulty level of the three main topics in the hydraulic engineering course. The three topics were analysing pipe flow, open channel flow and hydraulic machines. The topics are categorised by level of difficulty (Figure 8), with scale 1 being the *easiest* and scale 3 the *most difficult* for the three topics of pipe flow analysis, open channel flow and hydraulic machines. Overall, all students rated each topic on scale 2, indicating a *intermediate* level of difficulty. For the pipe flow analysis topic, 12 students, or 48%, were more likely to select scale 2 than the other scales of *intermediate* difficulty. 5 students or 20% of the students chose scale 1 and categorised the topic as *easy*. Only 32% of the students chose the topic as *very difficult*. For the Open Channel Flow topic, 84% of the students rated this topic on Scale 2 or as *moderately* difficult in terms of difficulty. The remaining 16%, who chose scale 3, stated that this topic was *very* difficult. In the case of hydraulic machineries, the students also categorised this topic on scale 2, with 56% classifying it as *moderately* difficult and 44% was on scale 3 (*very difficult)*. This scaling of the individual topics allows the lecturer to pay more attention to them when teaching them based on the difficulty scale of the topic in question. In this way, students can effectively participate in this intervention programme to improve their studies for each topic.

1. Based on the study of students' well-being and the perceived difficulty of the three main topics in the Hydraulic Engineering course, the following suggestions may help lecturers improve their teaching strategies and increase the effectiveness of the Cantas Gagal programme:
2. Targeted review sessions for difficult topics: Since students find open-channel flow and hydraulic machinery topics *moderately* to *very difficult*, lecturers should consider organising special review sessions or workshops that focus specifically on these areas. These sessions could provide in-depth explanations, practical examples and problem-solving exercises to help students better understand the concepts. By addressing the difficult aspects of these topics, lecturers can ensure that students are better prepared and more confident in their understanding, leading to better performance in these areas.
3. Improved use of visual and interactive learning tools: For topics such as pipe flow analysis, where students have varying levels of difficulty, incorporating more visual aids and interactive learning tools can make the material more accessible. The use of simulations, flow visualisations and interactive models can help students to better understand the underlying principles and dynamics. In addition, group activities and collaborative projects can promote peer learning and provide multiple perspectives for solving complex problems. By diversifying teaching methods, instructors can cater to different learning styles and improve student engagement and understanding.

Regular feedback and assessment: To continuously monitor and remediate student difficulties, lecturers should implement regular feedback mechanisms and formative assessments. Short quizzes, surveys, and anonymous surveys can help gauge student understanding and identify areas where they are struggling. This continuous feedback loop allows instructors to adjust their teaching strategies in real time and offer targeted support when needed. In addition, one-on-one counselling or small group tutorials can provide personalised assistance and address individual issues to ensure that all students receive the support they need to succeed in the hydraulic engineering course.

With these suggestions, lecturers can create a supportive and effective learning environment that enables students to overcome challenges and achieve better results in their studies.

Two subtopics were analysed on the topic of open channel flow, namely steady uniform flow and steady non-uniform flow. Since only two subtopics belonged to this topic, a scale of 1 and 2 was used to analyse the degree of difficulty of these two subtopics. Scale 1 is considered *easy* and scale 2 is considered *difficult*.

Figure 9 shows that 56% of students categorised the subtopic of steady uniform flow as *easy* or under scale 1. This shows that a large majority of students find this subtopic easier to understand. However, 44% of students indicated that steady uniform flow was *difficult.* As the percentage of difficulty is high for this subtopic, lecturers

can focus more attention on this topic. The situation is different with the subtopic of steady non-uniform flow in Figure 9, where almost all students agreed that this subtopic is *difficult* to understand with a percentage of 84% (scale 2). This indicates that this subtopic is more *difficult* to understand than the steady uniform flow subtopic.

Based on these results, lecturers can prioritise their attention, even though a large proportion find this subtopic easy, lecturers can still spend some time to reinforce the basic concepts in this subtopic, especially steady non-uniform flow. Since flow is defined as uniform flow when the velocity and other hydrodynamic parameters do not change from point to point at any time in the flow field, steady flow is flow in which the velocity does not change with time at any point in the channel. This is because a good understanding of the concept of steady flow is often crucial to understanding hydraulic engineering.

SECTION D: GENERAL COMMENTS ON THE HYDRAULIC ENGINEERING

Section D is the general question that lecturers use to solicit feedback from students, particularly general comments on hydraulic engineering, as this plays a crucial role in summarising, interpreting and communicating the results and implications of a hydraulic engineering study, thus increasing its relevance, applicability and impact within the discipline.

The first step was for students to understand hydraulic engineering by giving a short answer. Most students answered with 72% (18 students) relating to the subject (Table 5), the remaining answers were not related to the subject. Some answers that were not related to the subject were still confused about this course, understandable and good.

It is crucial for teachers and curriculum developers to determine students' level of understanding of hydraulic engineering through a concise question in order to effectively customise teaching materials. By asking students for a short answer, lecturers gain insight into learners' basic knowledge, misconceptions and areas of interest so that they can adapt teaching strategies accordingly. This assessment not only helps lecturers evaluate the effectiveness of previous lessons, but also serves as a basis for planning future lessons to ensure that course content is aligned with students' learning needs and goals. In addition, it promotes a student-centred approach to education by encouraging active engagement and reflection on the subject matter, which ultimately enhances the overall learning experience in hydraulic engineering.

As for the Cantas Gagal programme, the results of this programme are essential for stakeholders to assess its effectiveness in supporting at-risk students. Analysing the impact on student retention and academic performance can inform future interventions and the allocation of educational resources.

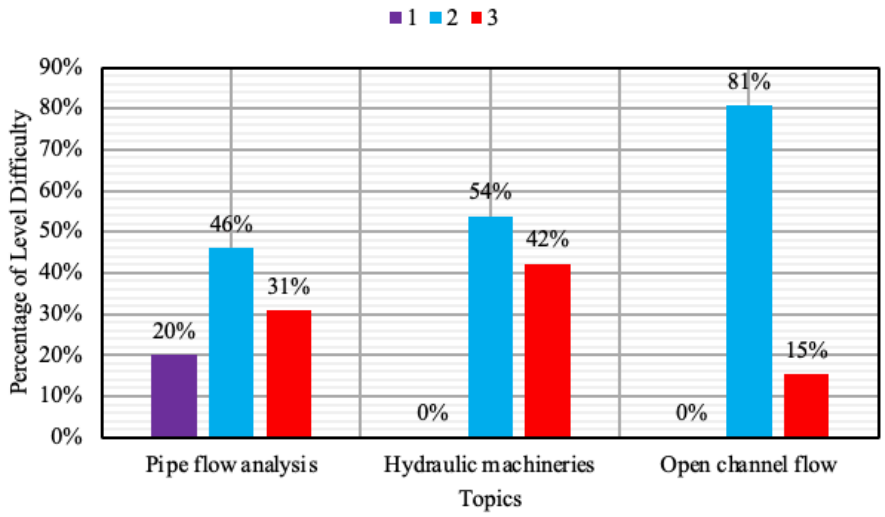

FIGURE 8. Can you arrange the following topics (in scale 1 to 3) according to their level of difficulty so that the lecturer can pay more attention to them when teaching each topic?

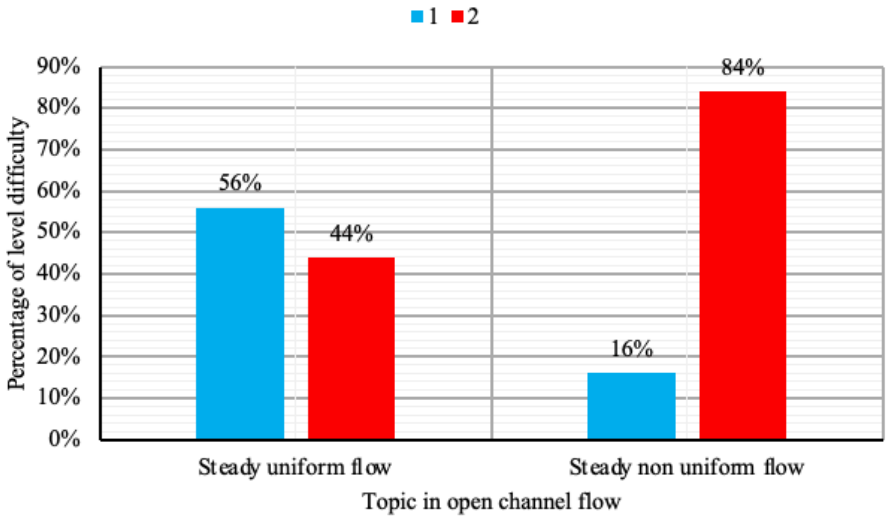

FIGURE 9. Results based on the level of difficulty of the subject of steady uniform flow and steady non uniform flow

TABLE 5. Surveys distributed to students in Cantas Gagal Programme for Hydraulic Engineering course

No.	General feedback from students (related to subjects or not)	No. of students
1.	Related to subjects	18
2.	Not related to subjects	7

RESULTS OF THE CANTAS GAGAL PROGRAMME IN TERMS OF STUDENTS PERFORMANCE

Figure 10 shows the performance of students enrolled in two cohorts for the Hydraulics programme between the semester semester 20224, which is considered the previous semester, and semester 20234, which is noted as the current semester. The main difference between the two semester is that the students of semester 20234 participated in the Cantas Gagal programme, while the students of semester 20242 did not. Both semesters were Part 5 students in the year in which the data was collected. In Figure 10 illustrates the performance of students who have participated in the Cantas Gagal programme and compares past performance (semester 20224) with current performance (20234). The grade categories are divided into six groups: A+ to A-, B+ to B-, C+ to C, C- to D, E and F. The data shows significant improvements in most categories, especially in the middle grade ranges. For example, the number of students achieving a grade of B+ to B- increased dramatically from 2 to 9. The number of students achieving grades C+ to C also increased from 6 to 7.

Whilst the rise in middle grades is a positive sign, the data also shows some areas of concern. In particular, there was a slight increase in the number of students achieving grades in the C- to D range, from 0 to 2. In addition, the number of students achieving E grades increased from 2 to 4. These shifts suggest that while some students have improved significantly, there is still a portion of the cohort that is struggling, with more students falling into the lower grade categories than before.

The results show that the pass rate is between 76% and 84% for both semesters. In contrast, the fail rate is 16-24%. Students who were able to achieve a grade B and above were 15% more likely to do so in semester 20234 than those who were in semester 20234. This is a great achievement that shows that Cantas Gagal can improve student performance.

The percentage of students who can reach for A and higher is about 5% lower for semester 20234 than for semester 20224 The results differ because the understanding of the topic of pipe flow analysis is slightly lower than that of the subtopics of flow in open channels and hydraulic machineries. This can be clearly seen in the average results for PO and CO, as shown in Table 6 and Figure 11.

PO is the programme outcome that corresponds to the course outcome (CO). POs for this course are listed as PO1 and PO2, with PO1 related to the application of mathematics, natural science, engineering fundamentals, and specialisation to a wide range of practical procedures and practices, and PO2 related to the identification and analysis of well-defined engineering problems using codified methods of analysis specific to water engineering. PO1 is mapped to CO1, and PO2 is mapped to CO2. Overall, the achievement percentages for PO1-CO1 and PO2-CO2 are also significant. The accomplishment of PO2-CO2 has been extraordinarily successful, with a 6% increase in student

knowledge for the current semester at the subtopic of open channel flow and hydraulic machinery.

This achievement demonstrates that, after completing the Cantas Gagal programme, students expand their learning, apply the knowledge during the provided assessment, and successfully portray their understanding by achieving an excellent grade, as shown in Figure 10.

Figure 12 shows a comparison of the percentage changes between PO1 and PO2 as well as CO1 and CO2 for the two semesters 20224 and 20234. It shows that PO1 and CO1 show an increase from semester 20224 to 20234 with a percentage increase of 1.56%. This indicates that both PO1 and CO1 have experienced the same degree of improvement, reflecting a synchronous positive trend, especially after participation in the Cantas Gagal intervention programme.

In contrast, the percentage values for PO2 and CO2 differed significantly. Both results show a negative change, with both decreasing by 13.63%. This parallel decrease indicates that both PO2 and CO2 were affected in a similar way and decreased at the same rate. The consistent decrease in these parameters underlines a negative trend that could indicate underlying problems that were not addressed by the intervention programme.

Given the positive results for PO1 and CO1 and the negative results for PO2 and CO2, it is clear that a more targeted approach is required. The Cantas Gagal intervention programme proved beneficial for PO1 and CO1, but the significant decrease in PO2 and CO2 suggests that additional or different strategies should be implemented. Therefore, a further intervention programme should be implemented in the next semester to address the issues affecting PO2 and CO2 and promote improvements in these areas.

To further increase the effectiveness of the Cantas Gagal programme, it is important to address the needs of these struggling students. Tailored interventions, such as individualised tutoring or additional resources, could help these students improve their performance. In addition, regular assessments and feedback can ensure that students stay on track and get the help they need in a timely manner. By focusing on these areas, the programme can aim to reduce the number of students achieving lower grades and increase overall academic success.

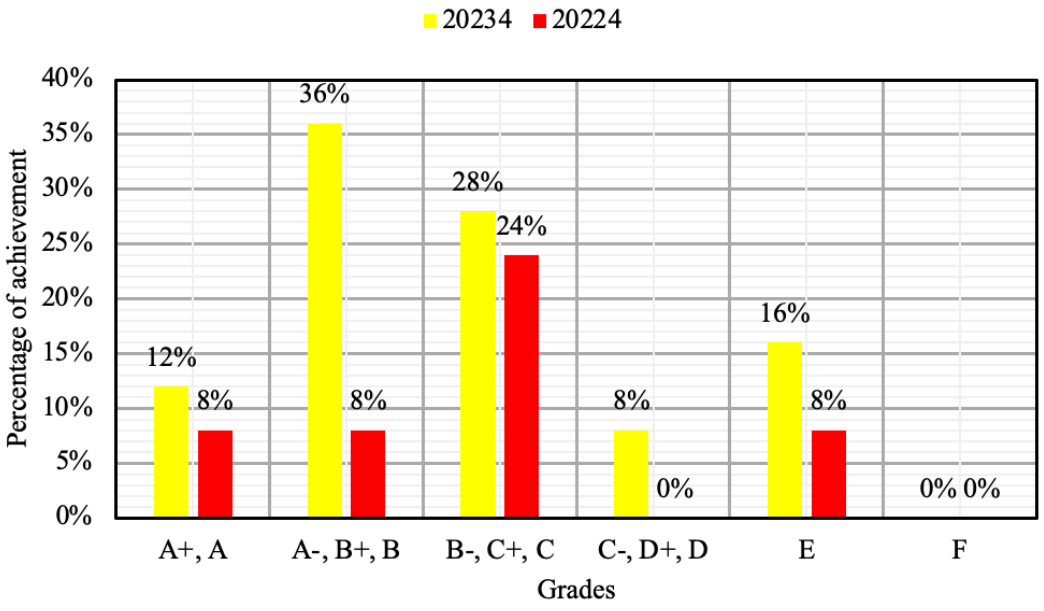

FIGURE 10. Results based on the grade achievements

TABLE 6. Percentage of program outcome (PO) and course outcome (CO) attainment of the students based on two cohorts of semester 20224and semester 20234

	Semester 20224		Semester 20234	
Percentage PO and CO attainment (%)	64	44	63	50

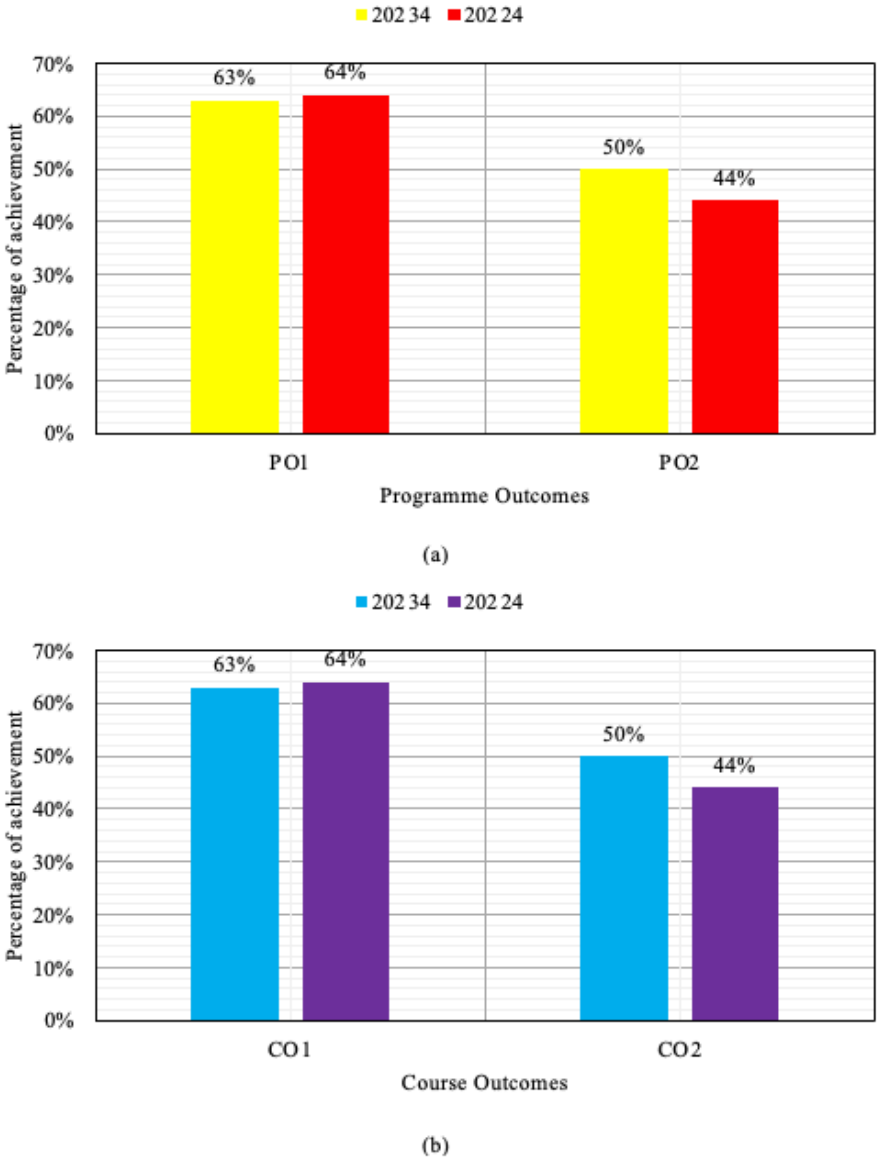

FIGURE 11. Results based on a) the average PO and b) CO attainment for both semesters

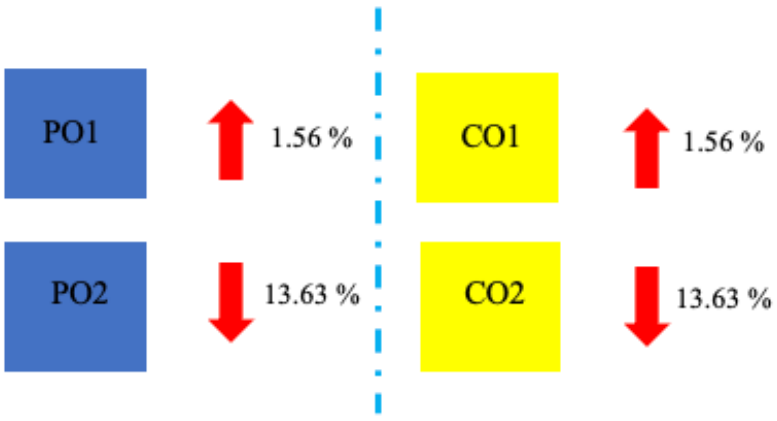

FIGURE 12. Percentage different for both POs and COs between semesters 20224 and 20234

CONCLUSION

In a nutshell, the following conclusions are addressed:

1. The demographic profile shows that 73% of respondents are first year hydraulic engineering students, highlighting the reach of the programme. Cantas Gagal is particularly beneficial for the 27% of returning students who have previously performed poorly, as it provides targeted support to improve academic skills. The programme also helps mid-achieving students to improve their performance and resilience.
2. Students' understanding of the Cantas Gagal programme indicates that the subject ECW241 has a high level of awareness and engagement, with 100% recognising it and 48% willing to participate. Satisfaction is 96% and 92% find it useful for understanding hydraulic engineering concepts. Continuous improvements and diversified communication could further increase its reach and impact.
3. The Cantas Gagal programme effectively supports hydraulic engineering students. 84% of students feel comfortable seeking help. Open channel flow and hydraulic machinery are challenging topics, indicating a need for targeted reviews and enhanced learning tools. Regular feedback, assessments, and targeted teaching strategies can improve understanding and academic success.
4. The Cantas Gagal programme has significantly improved the academic results of many students in hydraulic engineering. However, some still have problems, particularly with flow in open channels and hydraulic machinery. Most students showed a good understanding of the subject, with 76% passed the subject in semester 20234. Some approaches can be done by lecturers such as further interventions, individualised tutoring and improved feedback mechanisms can further increase effectiveness and reduce lower grades such as C- to D and E.

The intervention program conducted for hydraulic engineering students provided valuable insights into their attitudes and comprehension levels. The findings revealed that almost half of the students had a positive attitude towards the Cantas Gagal program. However, certain subtopics like steady uniform flow and steady non-uniform flow were found to be challenging for some students. These findings emphasize the need for targeted instructional support to reinforce fundamental concepts, such as steady flow, which are crucial for a comprehensive understanding of hydraulic engineering. Moreover, Cantas Gagal program strongly advocates for a student-centered approach by actively engaging and reflecting, thereby vastly improving the overall learning experience in hydraulic engineering. With regards to the Cantas Gagal program, its outcomes hold immense significance for stakeholders to evaluate its efficacy in supporting at-risk students. By rigorously analyzing its impact on student retention and academic performance, can guide future interventions and resource allocation, thereby facilitating targeted support for vulnerable students.

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DECLARATION OF COMPETING INTEREST

None.

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