



Program Design to Improve Punctual Graduates of Students in the Unsika Industrial Engineering Study Program by Using the 5C-4C Knowledge Conversion Method

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Abstract

The Faculty of Engineering, University of Singaperbangsa Karawang (Unsika) was established in 1995, one of which is the S1 Industrial Engineering (IT) Study Program, officially registered in 1996. Currently, the faculty is trying to achieve Superior Accreditation or A. The number of applicants for the Industrial Engineering Study Program will increase in 2023, reaching 891 prospective students through the SNBT route, but the capacity can only accommodate 56 people. However, it is in demand as the 4th out of 29 study programs at Unsika. The increase in the number of students is not in line with the on-time graduation rate. This study aims to identify the results of grouping students of the Industrial Engineering Study Program (S1) using the 5C-4C (Knowledge Conversion) process and then implement the relationship with learning activities for the 2017, 2018 and 2019 batches. Next, the data is transformed into information by using the 5C knowledge conversion method: contextualization, categorization, calculation, correction, and condensing. In order to build a program that increases the percentage of students who graduate on time, this information is transformed into knowledge utilizing the 4C knowledge conversion method: comparison, consequence, connections, and conversation. In this study, the population focus is on students of the Industrial Engineering Study Program from three batches, namely 2014, 2015, and 2016. The results of grouping Industrial Engineering students using the 5C process provide a deep understanding of the characteristics and factors that affect learning achievement. This provides a solid foundation for designing appropriate programs to increase the on-time graduation rate.

Introduction

Universities have a very important role in producing quality human resources and can make Indonesia a developed country (Joeliaty & Aryani, 2014; Purwantoro et al., 2022; Puspa et al., 2023; Yakup, 2018). Josiah et al. illustrated that the state will have hegemony in the world because of the *big cycle* of the eight powers it has. This strength begins with an education that produces high knowledge and skills for the nation (Josiah et al., 2022). Students play an important role in assessing the success and feasibility of a study program in higher education (Auliana & Nurasiah, 2018; Sukma et al., 2020; Vinc, 2018).

Assessment indicators involving students include a comparison between the number of applicants and those who pass the selection, the percentage of students who re-register, the

average GPA of students, academic and non-academic achievements during the college period, and the rate of on-time graduation (Fadli & Majidah, 2021; Wijaya & Gunawan, 2023).

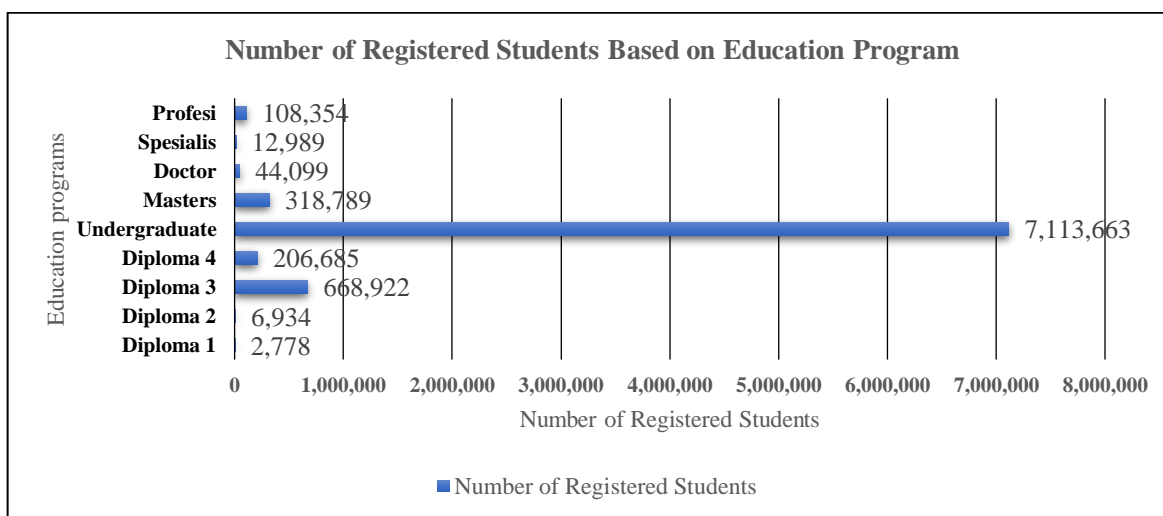


Figure 1. Number of Registered Students Based on Educational Programs

Source: (Tinggi, 2020)

Students from various study programs in higher education have different criteria for determining the punctuality of graduation (Gunawan & Kurniawan, 2020; Haedi, 2021; Haeli, 2020). For the D3 (Diploma) program, graduating on time means completing studies in three years or less, while graduating not on time means completing studies in more than three years (Haryono, 2018). Meanwhile, students of the S1 (Bachelor's) program are considered to graduate on time if they complete their studies in four years or less and not on time if they exceed four years (Kristiani, 2018). For students of the S2 (Master's) program, graduating on time means completing studies in two years or less, while not on time if it exceeds two years (Mardia & Mukhtar, 2022).

For the S3 (Doctoral) program, graduating on time means completing studies in three years or less (Utomo et al., 2020). Many factors affect the length of a student's studies, including internal (interests, motivation, and abilities) and external (environment, region of origin, and previous school). Variations in student characteristics cause variations in the length of study. This research is important to improve the quality of future graduates and prevent an increase in dropouts (Al Hafidz & Lubis, 2021; Dwi & Sofaliana, 2022; Nuringtyas & Susanto, 2022). The following is the Number of Passes Based on the Coaching Group in Figure 1.2.:

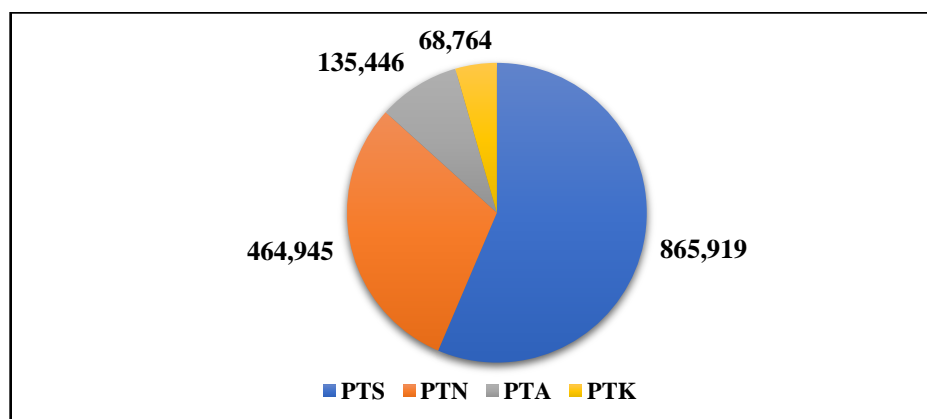


Figure 2. Number of Graduates Based on Coaching Groups

Source: (Tinggi, 2020)

The Faculty of Engineering, Universitas Singaperbangsa Karawang (Unsika), was established in 1995, one of which is the S1 Industrial Engineering (IT) Study Program, which was officially registered in 1996 (Satifa & Rusmana, 2023). This program achieved C Accreditation in 2002, Re-Accreditation C in 2012, and B Accreditation in 2017, extended in 2022. Currently, the faculty is trying to achieve Superior Accreditation or A. The number of applicants for the Industrial Engineering Study Program will increase in 2023, reaching 891 prospective students through the SNBT route, but the capacity can only accommodate 56 people. However, it is in demand as the 4th out of 29 study programs at Unsika. The increase in the number of students is not in line with the on-time graduation rate (Putri, 2023). The data shows that only 11.89% of the 269 students of the class of 2014 graduated on time, while the classes of 2015 and 2016 had graduation rates of 40.22% of 179 students and 55.68% of 176 students, respectively. This decrease in the graduation rate was caused by the number of students who did not graduate, namely 110 from the class of 2014, 57 from the class of 2015, and 37 from the class of 2016.

Based on the data above, actions are needed to increase the number of students who graduate on time in the next period. This study identifies factors related to learning achievement, such as lecturers, motivation, learning strategies, school and city backgrounds, activities in the previous semester, and scholarship receipts (Said et al., 2020; Soesanto et al., 2017). Furthermore, the research focuses on learning strategies because learning strategies include efforts in managing knowledge and thinking, including planning, *monitoring*, and modification related to understanding, effort in lectures, and remembering learning materials (Sentana & Yuniastari S, 2015; Sudarti & Fachrunnisa, 2020). The information processed is then conveyed and discussed with the parties forming the info. The goal is to obtain views and actions from them, which can be used as decision-making considerations. This process helps transform information into knowledge that can be applied in relevant contexts.

Based on the background described above, this study has the objectives of 1) Identifying the results of grouping students of the Industrial Engineering Study Program (S1) using the 5C process; 2) Identifying the outcomes of the 4C process that supports program design to increase the number of Industrial Engineering students who graduate on time (four years or less than four years); and 3) Implementing the relationship with learning activities for the class of 2017, 2018 and 2019. Meanwhile, as the scope of the research based on the background described above, the scope of this research includes 1) Analysis of students of the Industrial Engineering Study Program (S1) at the Faculty of Engineering, University of Singaperbangsa Karawang (Unsika) from 2014 to 2016; 2) The use of the 5C-4C knowledge conversion model to convert data into information and information into knowledge; and 3) Identify factors related to student learning achievement, such as lecturers, motivation, learning strategies, school and city background, activities in the previous semester, and scholarship acceptance.

Methods

Figure 3. below will provide an illustration of the flow of the conceptual model of program design used to improve the punctuality of graduation in each semester of each student of the Industrial Engineering Study Program. In the figure, you can also see the data collected in the study, including student personal data, Motivated Strategies for Learning Questionnaire (MSLQ) data, achievement index score data, and first-level teaching lecturer data. Before data collection is carried out, the study sets a minimum number of samples and uses appropriate sampling techniques (Iskandar & Syahrial, 2019; Zailani & Nisaa, 2020). In this context, the minimum number of samples is determined using the Slovin formula, and the sampling technique used is non-probability sampling with the purposive sampling method (Fahrizal, 2017; Mardiani, 2021).

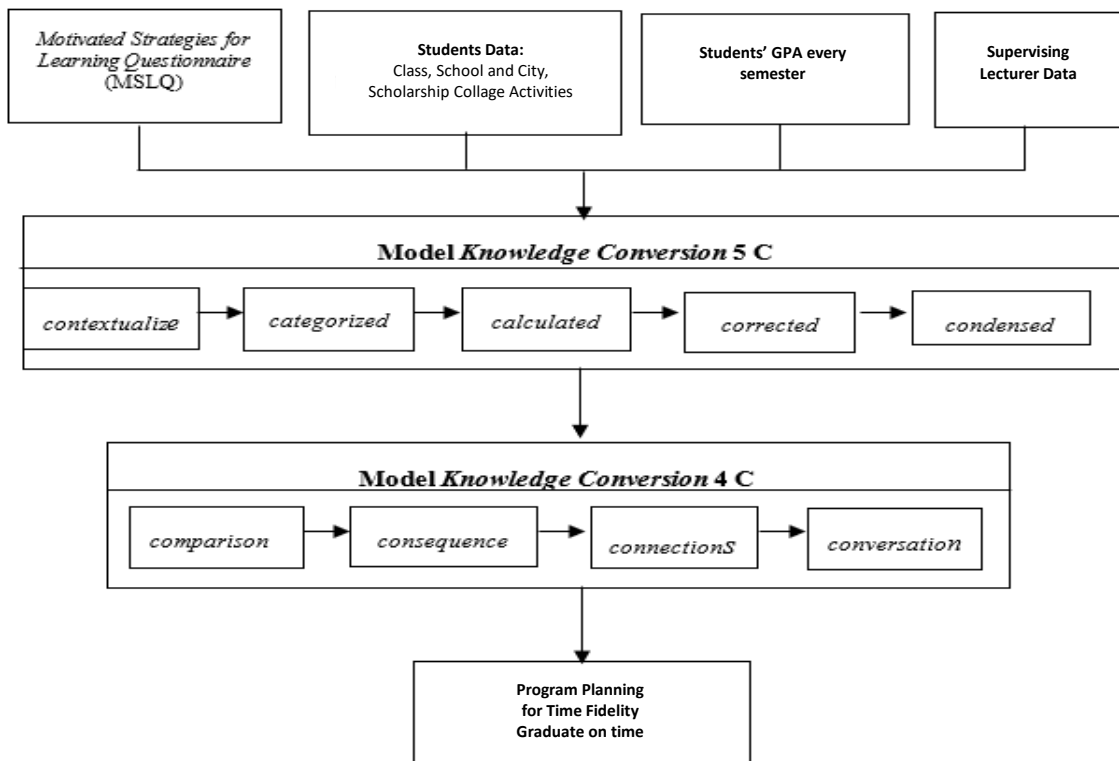


Figure 3. Conceptual Flow of Research

Source: (Ufaira & Kurniawati, 2018)

Student personal data and data from the *Motivated Strategies for Learning Questionnaire* (MSLQ) were obtained through questionnaires. In contrast, data on achievement index scores and data on teaching lecturers for each semester were obtained from the Industrial Engineering Study Program. Before the distribution of the questionnaire, a validity test was carried out using *content validity* and *face validity* techniques to assess the accuracy of each statement in the MSLQ. The 5C knowledge conversion procedure (contextualised, categorised, computed, corrected, condensed) is then used to all collected data in order to transform it into information. The 4C knowledge conversion process (comparison, consequence, connections, and conversation) is then applied to transform this data into knowledge, which is then utilised as a blueprint for creating a programme that will raise the proportion of students who graduate on schedule.

In this study, the population focus is on students of the Industrial Engineering Study Program from three batches, namely 2014, 2015, and 2016. This was chosen because they have completed the study program and will be compared with students from the next three batches, namely 2017, 2018, and 2019. The minimum number of respondents was calculated using the Slovin formula with an error tolerance limit of 5% to ensure the sample's representativeness. With the total population of Industrial Engineering students in the 2017, 2018, and 2019 batches of 452 people, the minimum number of samples required is 250.

Results and Discussion

Starting data processing with the 5C knowledge conversion approach (Contextualised, Categorised, Calculated, Corrected, and Condensed) to turn data into information.

Results of Grouping Students of the Industrial Engineering (IT) Study Program Using the 5C Process

Contextualized

The context analysis of the number of Industrial Engineering students who have graduated shows as shown in Table 1.1 below:

Table 1. Number of Industrial Engineering Student Graduates

Year of Entry	Number of Students Accepted: 1)	Number of Students Who Graduated in					Number of Graduates to the End of TS	Average Study Period
		End of TS-4	End of TS-3	End of TS-2	End of TS-1	End of TS		
TS-6	176	-	97	15	9	15	136	4.574
TS-5	186	-	0	91	40	6	137	4.380
TS-4	235	-	-	0	133	20	153	4.131
TS-3	227	-	-	0	0	178	178	4.000
Sum	824	-	97	106	182	219	604	26.084

Categorized

The data is divided into sections at the classified stage in order to examine the uses and advantages of the data in greater depth. The quantity and name of each data category can change based on the information you are looking for. Less categorization groups are used and data from cities and universities are categorised by province to make data processing easier.

The Industrial Engineering programme has nine sub-sections containing data on study objectives, and fourteen sub-sections covering learning methodologies. Nine categories are used to group the learning objectives and IP score data for each sub-section. the quantity of groups or classes that resulted from computations in mathematics. Different values are employed in each category to ascertain the attributes of the students. Based on the outcomes of mathematical calculations, each category that each data belongs to has a different range of values. The K Means algorithm grouping was used to classify students in the Industrial Engineering degree programme. The purpose of grouping pupils is to place them in groups according to shared attributes. Hence, it may be claimed that every student in a cluster or group shares the same traits. 22 groups are created by the grouping method. Stated differently, the study programme in Industrial Engineering is divided into 22 groups.

Calculated

The data utilised in this investigation are currently computed mathematically. in order to make the data's value more apparent and to enable the calculation of the number of responders or pupils in each category using the data that is already available. similar to the results of the prior determination, particularly in the section that was classified.

Corrected

At this point, it was discovered that the data—specifically, the repeat course data—were not very important in supporting this study. Because it is unable to determine the course name and total semester credit units (SKS) using the data on recurring courses, its utility is limited. This data does not contain any information that could affect the study's methodology or conclusions; rather, it can only be used to assess the course's timeliness.

Condensed

At this point, tables are created to transform data into information as a consequence of data processing. The material has been enhanced and the data has been computed. It is presented in an easier-to-understand style, such as tables that provide a comparison histogram of schools

attended based on recommendations for on-time graduation. Table 1.2 contains the following. The quantity of on-time passes in each batch yields this outcome.

Table 2. Number of On-Time Passes of each Batch

Force	Enter		Graduated on Time	Graduated until 8-14 Semester	Punctual Graduates (%)	Number of Passes (%)	Number of Non-Graduates	Not Passed (%)
	Real	Quasi						
2014	269	269	32	159	11,89	59,10	110	40,89
2015	159	179	72	122	40,22	68,15	37	31,84
2016	176	176	98	139	55,68	78,97	37	21,02
2017	186	186	117	153	62,90	82,25	33	17,74
2018	235	196	157	177	80,10	90,30	58	9,69
2019	227	198	178	184	89,89	92,92	43	7,07

Results of the 4C Process that Supports Program Design

Comparison

To assess development, the analysis's findings are contrasted with earlier circumstances. It is at this point that the average of all sorted qualities is used to compare groupings. This is done in order to find the clusters' properties and rank them from highest to lowest values. This is the point when group comparisons are also performed using the sorted total average. This is done in order to sort the clusters according to their attributes and average values, from highest to lowest.

Consequence

The identification and explanation of the analysis findings' consequences for decision-making have been provided. In order to identify implications that may be used to improvement, the link between the information and other data from the comparison stage is examined in the consequence stage. The timeliness of the Industrial Engineering study programme is known to have a link with the founding of the school and the goal of continuing their studies, based on a variety of data gathered from the analysis findings at the consequence stage. Furthermore, a contradiction was discovered at the consequence stage between the school's founding and the objective of further study, as shown by the accomplishment index value.

Connections

Research has shown a link between the variables influencing learning performance. It was discovered at this point that the data produced from the consequence stage had a link with one another. A correlation was discovered between the average semester performance index, study programme choice, and school origin based on the data gathered from the consequence stage. This information is gathered because it is predicated on the traits that cluster 1, the cluster with the greatest overall average value and "special" traits, has.

Conversations

To get many inputs, the thoughts and viewpoints of different parties on the analytical findings have been shared. At this point, additional specialists are consulted about the information that has been through the phases of repercussions and connections in order to acquire fresh insight into the suggested programme to enhance the industrial engineering students' graduation timeliness. There were conversations with the director of the research programme. Following the formulation of the discussion outcomes, the following tactics may be used to increase student graduation: Programme design to increase on-time graduation is created by incorporating problem-based learning into the curriculum and upgrading it. Students are grouped according to abilities and research types, learning activities are designed to introduce school culture and field practice in schools or industries; project-based learning is applied in

subject research methods with outputs in the form of proposals; and the mentoring process is closely monitored.

The Relationship Between Learning Activities and On-Time Graduation Rates

Analysis of Learning Activities

The analysis showed the relationship between learning activities, such as group work, practicum, and additional activities. This has a more or less impact on the results of the on-time graduation rate, so these activities can continue to be improved, and students are given significant motivation to learn.

On-time Graduation Rate

It was found that factors such as motivation, learning strategies, and school background affect the on-time graduation rate. This is because these factors have become fundamental for students in undergoing lecture activities. So, the best design and strategy must be given, seeing that the results are very significant to the on-time graduation rate.

The results of grouping Industrial Engineering students using the 5C process provide a deep understanding of the characteristics and factors that affect learning achievement. This provides a strong foundation for designing appropriate programs to increase the on-time graduation rate (Ardi, 2013; Mardiani, 2021). Furthermore, the results of the 4C process make it possible to evaluate the implications of the factors that have been identified. With a deeper understanding of the relationship between learning activities and graduation rates, specific programs can be designed to support Industrial Engineering students in achieving on-time graduation (Liesnaningsih, 2016). It should be noted that this study makes an important contribution to understanding the factors that affect the learning achievement of Industrial Engineering students, as well as providing a foundation for the design of programs that can increase the on-time graduation rate.

Conclusion

The data processing process using the 5C knowledge conversion method has contributed to data understanding and analysis. Through the steps of Contextualized, Categorized, Calculated, Corrected, and Condensed, the initial data has been transformed into more meaningful information that can be used to make better decisions. Grouping data into relevant contexts, identification of units of analysis, mathematical analysis, error correction, and presentation of abbreviated information has helped in understanding the characteristics and factors that affect the learning achievement of students of the S1 Industrial Engineering Study Program at the University of Singaperbangsa Karawang (Unsika).

Based on the results of the data processing and analysis carried out, some suggestions can be proposed, namely 1) More Comprehensive Use of Data: more comprehensive data collection, including longitudinal data or data from other sources, may be needed to gain a deeper understanding of the factors that affect learning achievement; 2) Implementation of Self-Development Programs: based on the analysis of learning activities and factors that affect learning achievement, institutions can design self-development programs or additional learning to support students in achieving on-time graduation; 3) Continuous Monitoring and Evaluation: it is important to continuously monitor and evaluate the effectiveness of the programs implemented in increasing the on-time graduation rate. Periodic evaluations can help in adjusting these programs according to the needs and changes that occur; and 4) Collaboration with Related Parties: cooperation with related parties, such as lecturers, students, and administration, can help in designing and implementing more effective programs to improve student learning achievement. With the implementation of the above suggestions, it is hoped that a significant increase can be achieved in the on-time graduation

rate of students of the S1 Industrial Engineering Study Program at the University of Singaperbangsa Karawang.

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