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An analysis on students' thesis topics and research types in automotive engineering education program

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ABSTRACT

This study aims to analyze the topics and types/methods of research in the thesis of students of the Automotive Engineering Education study program, Universitas Negeri Yogyakarta. This research is descriptive research. The types/methods were descriptive models, Action Research, Ex Post-Facto, Research and Development, Evaluation, and Experimental Research (100, 69, 50, 35, 30, and 23 studies respectively). The study was conducted by analyzing 320 student thesis articles published from 2014 to 2018 in the Yogyakarta State University student e-journal. The results showed that the student's thesis topics consisted of 5 research topics, namely: education (139 topics), learning (120 topics), media development (43 topics), university issues (9 topics), and automotive engineering topics (9 pieces). Based on the results of the research, the types/research methods used were categorized into six methods, namely descriptive models (100 studies), classroom action research (69 studies), ex-post-facto (50 studies), research and development (48 studies), evaluation (30 studies), research and experimental (23 studies).

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INTRODUCTION

Tertiary education has been run for several models in Indonesia, such as academies, polytechnics, institutes, colleges, and universities as stipulated in Law of the Republic of Indonesia number 20 of 2003, article 20 paragraph one concerning the national education system. Higher education is expected to produce a well-rounded human resource who can compete in their fields at the national, regional, and international levels. To achieve this goal, higher education should maintain the learning quality and enhance the relevance of education based on the students' needs and the world of work. It has also become the focus of the Automotive Engineering Education Program, Faculty of Engineering, Universitas Negeri Yogyakarta, as one of the educational study programs aiming at producing prospective teachers for vocational high school (VHS), industrial training, as well as entrepreneurs in the automotive sector. Wagiran (2016) explains that graduates of educational programs and engineering/polytechnics have equal opportunities to become prospective teachers. It urges graduates of educational study programs to be ready to compete with non-educational competitors, especially in the job market for both VHS and industrial training.

Curriculum development in educational programs must cover the demand of the world of work, both in the field of education and non-education, based on the current challenges to ensure the

graduates have high competitiveness. In fact, Yuswono et al. (2014), in their research involving 50 teachers of automotive engineering, reveal that the number of teacher competencies is still below the standard. Hasanah and Malik (2018), in their results, highlights that the graduates' profile based on the industrial qualifications must have special skills, and their further career will be determined through their skill performance and a feasibility test. It motivates the educational study programs, including automotive engineering fields, to develop a suitable curriculum in answering the challenges from the world of education and industry.

Arifin et al. (2014) mention that the curriculum development of the Automotive Engineering Education Program, Faculty of Engineering, Universitas Negeri Yogyakarta, is designed referring to the needs of the world of work and the National Qualification Framework for each subject. Most graduates work as vocational school teachers in the automotive sector (52%), and others are in the industrial and entrepreneurial fields (Haryana et al., 2019). Suyanto et al. (2019) indicate that the graduates have good work performance based on the assessment results from the user. One of the strengths of the graduates is their ability to think systematically, which is gained from their research process and final thesis projects.

The Regulation of Universitas Negeri Yogyakarta Rector Number 1 of 2019 on the Academic Guidelines regulates that the Thesis Final Project course is mandatory. It must be taken and completed and function as a medium for actualizing the students' competencies in solving the problem based on the field of study, in addition to completing the thesis, based on the circular from the Ministry of Education and Culture of the Republic of Indonesia No. B/565/B.B1/HK.01.01/2019, students are required to produce a scientific paper through research that is published as one of the graduation requirements for the undergraduate program (S1). Research refers to creative and systematic work to improve or apply one or several fields of science in an integrated manner to benefit humans, culture, and society (Creswell, 2012). The research process includes collecting, identifying and analyzing information to enhance understanding of a topic or problem, draw conclusions, and generate new knowledge or applications in a particular field (Organisation for Economic Co-operation and Development, 2015).

The undergraduate thesis systematics consists of the title/topic, abstract, introduction, literature review, research method, results, discussion, conclusion, and bibliography. In research activities, the students must be able to identify important points raised as research topics. In addition, the methods used in research must be accountable to guarantee their valid and reliable output. After finishing writing the thesis report, the students will present the results to three examiners: the chairperson, the supervisor, the main examiner, and the examiner's secretary. The success in writing this thesis is greatly determined by the quality of the research reports and the performance of the presentation before those three examiners. The final thesis is the work students produce based on their competencies from the previous learning courses. The students must join the courses in educational research methodology and statistics to support their research capabilities. As for writing reports, they have taken Indonesian language courses. Meanwhile, students have taken other supporting courses like education and vocational competencies for educational and productive competence.

In addition to being one of the factors that facilitate students to develop a systematic and scientific mindset, the final thesis project is also one of the inhibiting factors for students' learning completion (Siswanto & Sampurno, 2015). The study period average among undergraduate students in automotive engineering is 4.69 years in the 2019/2020 academic year, which is longer than the national standard. The problems faced by undergraduate students in writing their final thesis are finding problems and research topic ideas, collecting data, writing reports, and making journal articles since they are working independently under the supervision of their lecturers (Siswanto & Sampurno, 2015). Based on this background above, it is necessary to map out the results of the students' thesis in the Automotive engineering Education Program, Faculty of Engineering, Universitas Negeri Yogyakarta. The mapping results are expected to provide an overview of the research topics and methods that will be beneficial to be used in an evaluation and curriculum development process.

RESEARCH METHOD

This research is a descriptive study that aims to describe the topics trends and the research methods on the thesis among the students of the Automotive Engineering Education Program, Faculty of Engineering, Universitas Negeri Yogyakarta. The research data was obtained from the articles of the undergraduate students' final thesis from 2014-2018, as many as 320 articles. The articles produced by students of this study program were accessed in the student e-journal http://journal.student.uny.ac.id/ojs/ojs/index.php/otomotif-s1/issue/archive. The obtained articles were classified based on the topics and the research methods. The results obtained were then analyzed and interpreted to provide a complete picture of the topics and research methods.

RESULT AND DISCUSSION

Result

The Number of Final Project Articles of the Automotive Engineering Education Students

The final thesis course (6 credits) has become one of the students' graduation requirements for the automotive engineering education study program. The students should also publish the research results in scientific articles. From 2014-2018, there were 320 articles, and each article described the overall research carried out by students, including the topics and research methods. The number of articles produced varies from 2014 (80), 2015 (60), 2016 (40), 2017 (70), and 2018 (70), respectively. This varied number is influenced by the number of students who can complete their final thesis each year. Ideally, the number of articles produced should be 80 articles/year based on the quota of automotive engineering education students each year.

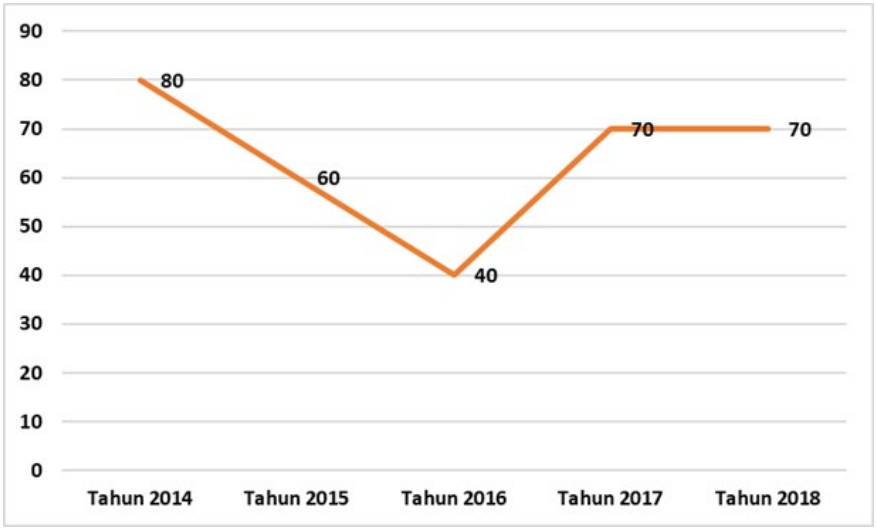

Figure 1. The Number of Final Project Articles of the Automotive Engineering Education Students (2014-2018)

The Research Topics on the Undergraduate Thesis of the Automotive Engineering Education Students

The research topic refers to the main ideas, thoughts, or problems in research that underlie the study. The research topics from 320 articles were grouped into five categories: learning, education, media development, university issues, and automotive engineering. The articles with the learning topics contained the implementation, model development, and models implementation or classroom learning models. The articles on the topic of education consisted of the components of eight educational standards, especially those in vocational high schools of Yogyakarta and the surrounding areas. The topic of media development mostly discussed the development of learning

media with android, videos, trainer kits, etc., to support learning in vocational high schools. The university topics mainly talked about the campus environment, such as the evaluation of the career unit and the implementation of students' industrial internships. Meanwhile, the articles on automotive engineering focused on the development of the university electric car named Garuda UNY and other relevant engineering studies.

The data on research topics for the student's final projects from 2014-2018 showed that there were articles on the topics of learning (120), education (139), media development (43), university issues (9), and automotive engineering (9) as presented in Table 1. From these data, the most dominant research topic is the area of education and learning, while the topics on media development, university, and automotive engineering were relatively few.

Table 1. The Students Research Topics

No.	Research Topics	Number	Percentage
1	Learning	120	37.5%
2	Education	139	43.4%
3	Media Development	43	13.4%
4	University Issues	9	2.8%
5	Automotive Engineering	9	2.8%
	Number	320	100%

The Research Methods on the Undergraduate Thesis of the Automotive Engineering Education Students

The research method is to formulate an approach for a certain problem or what is being studied in the research. Various types of research methods exist, ranging from descriptive, classroom action research, experiment, evaluation, research and development, and ex-post-facto. The analysis results on the types/research methods used in the undergraduate thesis among the students of Automotive Engineering Education, Faculty of Engineering, Universitas Negeri Yogyakarta in the last five years showed respectively the descriptive method approach (100), classroom action research (69), experiment (23), evaluation (30), development (48), ex post facto (50) as presented in Table 2.

Table 2. The Students Research Methods/Types

No.	Research Methods/Types	Number	Percentage (%)
1	Descriptive	100	31,2
2	Classroom Action Research	69	21.5
3	Experiment	23	7.2
4	Evaluation	30	9.4
5	Research and Development	48	15
6	Ex Post Fact	50	15.6
	Number	320	100

Discussion

Students' Undergraduate Thesis

The learning outcome of the Automotive Engineering Education Program, Faculty of Engineering, Universitas Negeri Yogyakarta is in the form of scientific work in the form of an undergraduate thesis project included in the research course (6 credits). Based on the mapping results for the last five years, 2014-2018, there were 320 theses. The average number for each year was 64 works. The highest number was found in 2014 with 80 research reports, while the least was 40 reports in 2016. It shows that the number of students in the automotive engineering education program who completed their studies on time was still less than the number of newly enrolled students. The data

also indicate that the academic learning time among the automotive engineering education program students is still more than four years. It is necessary to look for strategies to accelerate their learning time. Based on research conducted by Siswanto and Sampurno (2015), one of the major causes of the students' learning time is the completion of the undergraduate thesis.

Furthermore, starting in 2014, several improvements were made to the management of thesis final project management by building a synergy between the educational research methodology course and the submission of the title of the undergraduate thesis. The process of the supervisor appointment was also improved to ensure the progress of the thesis completion. As a result, in three years later, the average of the students' learning time is getting better from 5.64 (2014/2015) to 4.69 (2019/2020) (http://akreditas.uny.ac.id). Those improvements must be improved so that the average learning period can meet the expected target of 4.65 in 2021.

Topics of Undergraduate Thesis Projects

The analysis results of the student's theses in the Automotive Engineering Education Study Program, Faculty of Engineering, Universitas Negeri Yogyakarta from 2014 to 2018 showed 320 thesis works that are mostly dominated on the topics of learning (120) and education (139). Though the research topic of learning and education is in line with the automotive engineering education study program, these topics are over-used, and the choice of this topic must be reconsidered to avoid repetition. The repetitive research topics can reduce the stimulus for students to think creatively.

The topic of media development topics (43) are a few, and they need to be further emphasized for students. The topic of media development research agrees with the campus mission to develop automotive learning media which is appropriate for the development of science and technology. The ability of education graduates to develop media is crucial in the future (Emilio Álvarez-Arregui et al., 2017; Uerz et al., 2018). The needed media development skills in the future are learning video (Warju et al., 2020), online learning media (Surani et al., 2020), interactive learning media, and virtual reality or augmented reality (Fehling et al., 2016; Jan Spilski et al., 2019). The competencies that can support students to be able to develop these media need to be nurtured through formal teaching like learning media courses. In addition, almost all research on learning media is limited to testing the feasibility of the developed media. The lecturers or the management need to ensure that the developed media can be applied by testing its effectiveness, or at least it must be published to be accessed by public users.

Some research topics about universities (9) and automotive engineering (9) are still rarely discussed by the students. This topic is relevant to the missions of the Automotive Engineering Education Program, Faculty of Engineering, Universitas Negeri Yogyakarta, to carry out basic and applied research based on the current developments in science and technology. The research on-campus dynamics or study programs can also be employed as a means for self-evaluation. For instance, the university's research on the career unit can provide beneficial inputs to optimize the unit's work in building partnerships with the relevant industries. On the other hand, studies in the field of engineering can assist the lecturers in deepening their technical expertise and applying the research results to the appropriate engineering learning process.

Methods/Types of Undergraduate Thesis Projects

The analysis results show that from 2014 to 2018, there were 320 thesis works with various research methods. The most widely used type/method of the students' works is descriptive research (100). The descriptive model aims at identifying or providing a clear picture of something, for example, a study on the feasibility of practical facilities or infrastructure to carry out light vehicle engineering competency testing activities in vocational high school (Setiawan & Yuswono, 2017), a study on the management of learning facilities for autoerotic technique practice in vocational high school (Hastowo & Haryana, 2016), and a study on the factors that affect low learning motivation among vocational high school students and efforts to improve them (Santosa & Us, 2016). In general, descriptive research is carried out using quantitative methods instead of qualitative ones.

The next type or method that is often used by the students is Classroom Action Research (CAR), with 69 works. Some examples of classroom action research are improving students' learning outcomes by applying peer tutoring methods to vocational high school students (Fitrianto &

Sudiyanto, 2018), improving activities and learning outcomes in PSPTKR subjects with the snowball throwing learning model (Yulfika & Us, 2017), and jigsaw learning model (Muhlisin & Yuswono, 2018). A teacher should be able to implement CAR in their daily teaching activities. In the teacher profession education program (PPG), each participant is required to plan, implement, and report in the classroom action research. Considering the importance of CAR for the students of educational programs, they should have experience with it, at least in the form of simulations in appropriate educational courses, such as micro-teaching or vocational learning. The use of the CAR method in students' thesis should also be managed by reviewing the repetition factor that can hinder students' creativity. The application of the CAR method should also consider the subjects or the vocational schools as the research target. The implementation of CAR in the students' thesis should genuinely make a real contribution to partner schools.

Another common type of research is ex post facto, with 50 studies. This research is mainly used to determine the relationship or influence of a variable on other variables. Several research titles which are included in this research model are the extent to which family status affects the interest of vocational students to pursue to college level (Purnama & Sudiyanto Sudiyatno, 2017), the extent to which interest in learning and learning facilities influence the learning achievement of vocational students in the subject of fuel system service (Aditya & Sutiman, 2017), and the extent to which learning motivation, study habits, and learning environment affect student achievement (Wicaksono & Sofyan, 2017). This type of research is expected to provide a deeper understanding to students of various factors that can affect a student's learning achievement. This research method tends to be a repetition and without any follow-up actions. Further research needs to be done to contribute to the real learning process. For example, after it is known that the learning environment has a positive and significant influence on learning achievement, it needs to be followed up with research on what kind of learning environment which are considered good and how to build the environment.

Development research has become one of the research types used by students (48 studies). This method is generally used by students who develop learning media such as the development of signal generators in analog and digital electronics courses (Irawan & Solikin, 2017), design for FG16 competition vehicle aerodynamic devices (Murwanto & Wakid, 2017), and learning media development for coupling system subjects in vocational high school (Syakura & Us, 2017). The use of development methods helps students to sharpen their skills for analyzing problems and needs, designing, developing, as well as assessing the feasibility of a developed product. This research can also create a useful product for the study programs or the public. It is hoped that the research products can be followed up with the submission of Intellectual Property Rights (HAKI) in the form of Copyrights or patents, as well as wider publications so that they can be accessed by the public. In addition, the product also needs to be tested for its effectiveness within the learning process to guarantee sustainable improvements and support the supervisor's field of expertise.

The next research type/method category is evaluation (30 studies), including the test development or evaluation of a certain program. The examples of research for this category are the evaluation of the implementation of education quality assurance carried out at SMKN 1 Magelang (Sodiq & Haryana, 2017), item analysis for the end-semester test instrument for the light vehicle electrical maintenance course (Shodiq, 2018), and an analysis of work productivity in the Nissan workshop in Yogyakarta (An analysis of work motivation and productivity of the technicians) (Fathumina, 2018). Evaluation research, especially on item analysis, needs to be improved to assist the supervisors in developing a product in the form of a valid and reliable test instrument so that it can be used by teachers in assessing students learning outcomes in vocational high school.

The least type of research or method is the experiment model (23 results). Experimental research requires high competencies in statistics and a deep understanding of research methodology. It may decrease the students' interest in dealing with this kind of research. The lecturers should encourage the use of the experimental method for the students' thesis, especially to examine the developed learning media for the previous students or other product developments.

CONCLUSION

The learning outcome in the form of thesis projects in the Automotive Engineering Education Program, Faculty of Engineering, Universitas Negeri Yogyakarta, is 320 works. The topics used by the students can be categorized into five research topics, namely education (139), learning (120), media development topics (43), university issues (9), and automotive engineering (9 pieces). The research topics carried out need to be varied and balanced to help realize the mission of the Automotive Engineering Education program in carrying out educational and engineering studies and integrating them within the learning process. The research methods in the students' thesis can be classified into six, including descriptive (100), Classroom Action Research (69), Ex Post Facto Research (50), Research and Development (48), Evaluation (30 pieces), and Experimental Research (23 pieces). These studies need to be followed up like registering intellectual property rights and research publications, while the developed products like learning media need to be tested for their effectiveness when applied to the learning process.

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