Google form in engineering mathematics: Innovation in assignment method

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Abstract This research is a developmental research on the engineering mathematics assignment using google form. There are three activities observed, namely constructing, collecting and evaluating. In constructing activities, there are two criteria, namely individuals and groups. In collecting there are two forms that are observed, namely giving answers directly and indirectly. Indirectly here means by uploading the answers. In this study six types of answer uploads were observed in the form of .ppt, .doc, .xls, .pdf, .jpg and .mp4. In evaluating include two conditions, namely assessment and giving feedback. The results of this study as follows: (i) individual assignments with direct answers, namely the peer assessment, when students assess their friends during presentation session; (ii) individual tasks with indirect answers in the form of routine tasks by uploading .pdf files; (iii) group assignments with indirect answers in three forms: (iii) mini-research assignments by uploading .pdf, image, audio and video files; (iv) group discussions on working out examples by uploading presentation files and (v) project based assignment on the Mathematics application in electrical circuits by uploading .pdf files. On the individual assignment with a direct answer, students are able to see their scores soon after the submission, while for the individual and group assignments with indirect answers, the evaluation can be done within the one-week maximum. This is because the assessment must be done carefully to anticipate plagiarism and providing objective feedback.

1. Introduction

With Google Forms (GF), users can create a form that can be found by everyone in the world. This feature can gather information from many respondents for various needs. Like Google Docs and Google Sheets, GF is one part of Google's features that can be accessed through a browser for free. To fill out a form that has been created on a Google Form, respondents do not need to have a Google account so that it can be said that the Form is general in nature. With all components and interfaces contained in GF, there will be no difficulty in using it. To add, subtract, or change each component on the form can be done simply by dragging and dropping. As a complement, Google Form is also equipped with various color palettes to enhance your design. Making Google Form can be done through laptops, computers, and even smartphones.

Google Form is synchronized with Google Docs. There are five choices of documents in Google Docs that can be made, namely text documents like Microsoft Word, presentation documents such as Microsoft Powerpoint, spreadsheet documents like Microsoft Excel, making images like using Paint, Photoshop, CorelDraw and so on, and finally creating an online questionnaire form. in the form selection. Out of the five files, Google Form will only be synchronized with a spreadsheet document like Microsoft Excel.

Google Forms provides survey results using the Docs application or Google Drive, and the information entered through GF will then be saved in a spreadsheet automatically. Besides storing, the data in a
spreadsheet can also be edited before it is further processed or sent to the recipient. The results can also be in the form of simple bar graphs, pie charts, or text views.

The use of GF has had an influence on the world of education [1], including the world of higher education in the Engineering Education [2, 3]. Moreover, the use of GF is very visible especially as the learning media [4, 5], grading and attendance records [6], collaboration and assessment [7], making tests [8-10] and learning evaluation for some social sciences [11-13]. However, there is still little research on the use of GF in developing comprehensive assignments in Mathematics Engineering. Comprehensive here means, the assignments were constructed for both individuals and groups, submission can be collected directly and indirectly and can be evaluated by giving assessment and feedback. Moreover most research address on the types of problems only. Here, the three activities methods, i.e. constructing, collecting and evaluating are the focus of the research.

This paper present the results of a developmental study on what and how to use GF in developing comprehensive assignments. It was further described the innovation assignments methods using GF as the Engineering Mathematics Assignments model in Politeknik Negeri Semarang (Polines).

2. Research Method
This research is a developmental study of the instructional in mathematics, namely innovation assignments methods using GF in the electronic engineering study program of electrical engineering department of Polines. There are three activities observed in this study, namely constructing, collecting and evaluating. In constructing activities, there are two criteria, namely individuals and groups. In collecting there are two forms that are observed, namely giving answers directly and indirectly. Indirectly here means by uploading the answers. In this study six types of answer uploads were observed in the form of .ppt, .doc, .xls, .pdf, .jpg and .mp4. Finally, in evaluating include two conditions, namely assessment and giving feedback.

There are fifty two students participated in this study. They were selected based on their response on the online tasks and paper questionnaire at the first meeting.

This research uses descriptive analysis of both the quantitative data and qualitative data. The first stage of this research was to review the literature. Second, construct the assignments using GF. The assignments here were constructed in two forms, i.e. individuals and groups assignments. The third stage, collect both individuals or groups results which were submitted directly or indirectly using GF. Finally, fourth stage, evaluate the students answers by giving assessment and feedback.

3. Results
This section will review the results of each stage of research on the use of GF in developing innovation in assignments methods for engineering mathematics.

3.1. Description of the Constructing Stage
This section explains how to construct assignments using GF for assignments with individuals and groups characteristics. Because these assignments are comprehensive, these two types must be present when designing assignments. Furthermore, because working in teams is one of the skills that must be mastered in the twenty-first century, the percentage of group assignments is greater than the individual assignments. In this paper presented two individual assignments and three groups assignments.

In individual assignments, there are only two types of individual assignment design using GF. First namely peer assessment, i.e. an assignment to assess of peer performance during their presentation when sharing their group discussions results. This peer assessment consists of four sections. First, the directions. Here, detailed information related to the task was given. Second, the identity of the grading student. There are three questions related to this, namely student email, student name and student class. Third, the presenter's identity which includes the group name and presentation date. Fourth, assessment. There are three questions, namely the overall score, detailed score in terms of time management, group work, unity and structure of presentation, language and creativity and last question is giving comments. The form of the individual peer assessment assignment design can be seen in Figure 1.
Second, namely individual routine task assignment, i.e. an assignment to measure students’ understanding on the specific topics. This task consists of two sections, i.e. the direction part and the upload part. In the direction part, detailed information related to the task was given. In the upload part, each student require to upload document or pdf file with maximum size of 1MB. The form of the individual routine task assignment design can be seen in Figure 2.
After completion of construction, the task is sent by providing the link that has been named so that it can be arranged and easily remembered by using the technology namely bit.ly. The results after linking with bit.ly can be seen in Figure 3 dan Figure 4.

![Figure 3](image1.jpg)

**Figure 3.** The use of bit.ly to shorten the google form link for the individual peer assessment

![Figure 4](image2.jpg)

**Figure 4.** The use of bit.ly to shorten the google form link for the individual routine task

Meanwhile in group assignments, there are three design of the group assignments using GF, namely group work on mini research, work-out examples and the mathematics application. During groups discussion, students are divided into small groups of 3-4 people. The collection of each assignment is limited to only once from one member. Furthermore, the design of mini research group assignment can be seen in Figure 5.
Figure 5. The use of google form in the groups assignment mini research

Seen above in the design of mini research group assignments, students are allowed to upload pdf files or videos or images or audio. Furthermore, the design of the assignment group work-out examples can be seen in Figure 6.

Figure 6. The use of google form in the groups assignment work-out examples

Seen above in the design of group work-out examples assignment, students are asked to upload answers in the presentation file. Furthermore, the design of mathematics application group assignments can be seen in Figure 7.
Figure 7. The use of google form in the groups work on the math application in electrical network

Seen above when designing a Mathematics application group assignment, students are asked to upload answers in pdf file. In this Mathematics application group assignments also only focus on qualitative data collection that is uploading pdf files.

3.2. Description of the collecting stage
This section explains about the process of gathering answers from students. During individual assignments, each student must provide an answer at the specified time. The task collection activities for individual peer assessment tasks are shown in Figure 8.

Figure 8. The direct collection data from the individual peer assignment

For individual peer assessment tasks, it can be seen that after students click on the link provided they can directly give an assessment. After making an assessment students can directly submit answers. In other
words, individual peer assessment tasks are collected directly. In addition, from this peer assessment there is quantitative data in the form of numbers from section one to three and the qualitative data in the form of sentences of the comments in section four. In other words, there are both quantitative and qualitative data were directly collected through this assignment. This consideration was used to get variations of answers in this task design.

While in individual routine assigment, the activity of collecting can be seen in Figure 9.

![Image](image1.png)

**Figure 9.** The indirect collection data from the individual routine task

As described in Figure 2, for individual routine assignment, students should upload either a document or pdf file. The file contains the students' explanations related to certain topic, e.g. complex numbers. Students have to explain what complex numbers are, how to draw them in Argand Diagram and convert one form to another forms. Because the form of answers in the pdf file, the lecturer must first download the file sent by students to be able to provide an assessment and feedback. In other words, in this Individual Routine Task there is indirect qualitative data collection. Furthermore, the data collection activities will be described in the three group works. The first group work on mini research can be seen in Figure 10.

![Image](image2.png)

**Figure 10.** The indirect collection data from the group work on mini research

As described in Figure 5, for mini research group assignments, students may upload either a pdf, video, image or audio file. The file contains student exposure when explaining about activities. Since starting to describe the library work hours, obligations and rights of students while at the library in Polines library.
Various activities that can be described here. Since the answers can be in the form of description, video, image or audio, the lecturer must first download the file sent by the student to be able to give an assessment and feedback. In other words, in this Group Work on Mini Research there is indirect qualitative data collection. Next will be explained about the data collection activities of the Group Work on Work-Out Examples. This activity can be seen in Figure 11.

As described in Figure 5, for group work-out example assignments, students should only upload presentation files. The file contains a presentation of the student discussions results when working out examples. It starts with providing preliminary information or what data is known from the problem, then tells which method was chosen to answer the problem followed by how to elaborate the answers to get results and ends by evaluating the answers obtained. Because the answers were in a presentation file, the lecturer must first download the file sent by the student to be able to give an assessment and feedback. In other words, in this Group Work on Work-Out Example there is an indirect qualitative data collection. Next will be described about the data collection activities of the Group Work on Mathematics Application in Electrical Circuit. This activity can be seen in Figure 12.
As described in Figure 7, for group work on the mathematics application in electrical networks, students may only upload the pdf files. In this file students describe the results of the discussion about how to apply mathematics to calculate the strong currents in an electrical circuit. In this presentation, students explained how to connect the pictures of the given electrical circuits to be converted into complex numbers or matrices. Then the most appropriate method is chosen with its justification. Next, the calculated current strength is calculated. After obtaining the results and evaluating these results. If the answer is not appropriate, check is done since the stage of changing from the form of an electrical circuit image to the selected mathematical form. Perform the steps again until the evaluation to get the desired answer. Because the answer is in the form of an upload .pdf file, the lecturer must first download the file sent by the student to be able to give an assessment. In other words, in this Group Work on Mathematics Application there is indirect qualitative data collection. Next will be explained about the Evaluation activities.

3.3. Description of the Evaluating Stage
This section will explain the evaluation process of each task given. The evaluation process differs based on the type of answer collection. In other words there are three types of evaluation processes in this article, namely evaluations for direct individual assignments, evaluations for indirect individual assignments and evaluations for indirect group assignments.

In the direct individual assignment of peer assessment, the lecturer does not give grades but only summarizes and gives an average grade in each section. For the comments section, the lecturer also summarizes the activities. Because the comments are in the form of qualitative data, the lecturer does the coding to get a common thread from answers that vary in the length of his writing.

In the indirect individual task, in this case the Individual Routine Task and Group Work there are three stages of evaluation, namely downloading files, giving feedback and grading. For example, after closing the time for sending answers to the Individual Routine Task the lecturer must first download each answer that enters Google Drive, then correct it as when correcting it on paper. Then giving the comments and feedback are given by annotating the corrected file page. After the correction process is complete, the lecturer gives a grade according to the results collected. Because when collecting answers to indirect assignments students must include an email address that is still active, so after lecturer saves all changes, i.e. comments and feedback, students will receive a notification on their email that their answers have been corrected and given a grade. Students can see each comment and feedback and their grades. If there are objections to the results given, students can communicate with the lecturer.

The stages of the evaluation process are the same for all three types of Group Work tasks. It's just that comments and feedback given for Group not for individual. Then proceed with the assessment process. For groups whose grades are less requested to make improvements first, then collect to the improvement lecturer by meeting face to face with the lecturer with all group members. If the improvement has been done well, the value improvement process can be carried out.

4. Discussion
This research is a developmental research on designing comprehensive assignments using GF. It is said to be comprehensive because in the design of this task there are variations in construction objectives, collection methods and evaluation methods. The goal of the construction task is twofold, i.e. individuals and groups. There are two ways to collect, i.e. direct and indirect. There are three ways of evaluating, i.e. evaluation of direct individual assignments, evaluation of indirect individual assignments and evaluation of indirect group assignments. The design of tasks with GF in this article complements the results of the research [1, 2, 4, 7].

In this article, the developing assignments focuses on three activities methods, i.e. constructing, collecting and evaluating instead of the types of problem. Since in Polines blended learning system is used in teaching Mathematics, the assignment materials are given during face to face classroom. This consideration was taken into account to provide clarity of the objectives of the task and the manner of collection. Because if there is unclear instruction, there will exist misperceptions [5, 9] and the students’ result is not maximum [6].
In addition, in this article the focus is variations on the types of documents that must be uploaded in the indirectly assignments. This is due to following vocational education standards in Polines, that students are required to actively use various kinds of technology in learning. When writing a report, students are accustomed to using detailed and structured document files, then describe the results of their work with attractive presentation files and are able to add images, audio and video so that the presentation files become more interesting. With the ability to integrate various technologies, students are expected to have a strong foundation to produce work or product innovation [1, 2].

5. Conclusion
This article presents the results of innovative development assignments for Mathematics Subjects in the Electronic Engineering Study Program Department of Electrical Engineering Polines using GF. The intended innovation is the existence of five task designs by considering three activities. These are the target of task construction, i.e. individuals and groups; how to collect tasks, i.e. direct and indirect; and how to evaluate tasks, i.e. evaluation of direct individual assignments, evaluation of indirect individual assignments and evaluation of indirect group assignments.

The five tasks are: direct individual peer assessment tasks, indirect individual routine assignment, mini research group assignment, group work-out example assignment and Mathematical application group assignment.

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