



Inspecting How Different Students' Personalities Affect Students' Performance in Calculus Practicum Courses Utilizing Peer Teaching Flipped Classroom Model

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ABSTRACT

Calculus Practicum is an essential component of calculus courses. Calculus practicum is beneficial for enhancing calculus academic achievement by utilizing technology to accomplish calculus learning goals. Calculus is a concept that students must acquire through theory and practice. Students, on the other hand, are divided into two primary personality types: extroverts and introverts. The study process was influenced by students' personality types. The purpose of this research aimed to investigate the effect of students' personalities on their conceptual understanding abilities. Personality surveys and conceptual understanding assessments used as research instruments. According to research findings, students' conceptual understanding in calculus practicum courses is heavily influenced by personality category when employing the peer teaching flipped classroom model. Experiments such as peer teaching flipped classrooms demonstrate that extrovert students have superior conceptual understanding skills than introvert students. Creating videos and establishing class discussions has a big impact on extroverted students. They can deepen their skills while also sharing their information and understanding with their peers.

Keywords: Personalities, Proficiency, Calculus Practicum Courses, Peer Teaching Flipped Classroom.



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1. INTRODUCTION

1.1. Research Background

Calculus Practicum is an essential component of calculus courses. In addition to theory, calculus lectures include practicum. This aims to support calculus learning goals by incorporating

technology into the achievement of calculus learning objectives. Mathematics students must understand how to calculate calculus problems manually and how to solve them using applications. Maple is a popular application for learning calculus. Using the menus available in the Maple application, you can solve various calculus problems. As a result, learning calculus is divided into two credit points for theory and one credit point for practicum.

According to Permendiknas No. 22 of 2006, the goals of learning mathematics are useful for students to be able to understand mathematical concepts, explain the interrelationships between concepts, and apply concepts or algorithms in solving problems in a flexible, accurate, efficient, and precise manner. Doly (2020: 142) defines conceptual understanding as students' ability to define, understand, restate, and apply the concepts to solve mathematical problems efficiently. One of the goals of learning mathematics is to understand the concept. The importance of understanding mathematical concepts for students is that, in addition to learning at school, students should be able to apply their understanding of these concepts in their daily activities. As according Hendriana (2017), understanding concepts is a crucial skill in mathematics that focuses on the ability to understand a subject's underlying principle, to recognize formula and mathematical concepts, and to pertain them in a variety of contexts, such as resolving a problem.

Personality differences could indeed influence students' understanding of concepts, and these differences affect perspectives in understanding and assessing a situation or circumstance. Personality refers to a person's distinct character and behavior that determines him apart from others. Integration of a person's structure, behavior patterns, interests, stances, abilities, and potential (Sjarkawi, 2008). Following Eysenck (1963), personality is the total pattern of an organism's actual or potential behavior that is determined by heredity and environment, all of which originate and develop through the functional interaction of four (four) main sectors, such as the subjective norm sector (character), the affective sector (temperament), the cognitive sector (intelligence), and the somatic sector (constitution). As according Eysenck (1963) personality influences intelligence, where intelligence is defined as students' understanding of the material taught or their ability to describe a problem in their own words. This is supported by Amelia's (2020) research findings, which state that there are differences in understanding concepts between extrovert and introvert students.

Students with introverted personalities seem to be calm, anxious, preferring to be alone, enjoying reading, having a tendency to plan ahead, being considerate, and controlling their impulses. They are also less aggressive, more trustworthy, pessimistic, and have high ethical standards. Students with an extrovert personality are typically sociable, have a large number of

friends, require someone to talk to, dislike reading, seek excitement, changeable, unpredictable actions, and are impulsive. They also enjoy light humor, are cheerful and optimistic, enjoy laughing and having fun, are active and involved in a variety of activities, and have an aggressive personality (Ulwiyah, 2021). It is adhered that these differences in students' personalities affect their understanding of concepts. This is also supported by previous research by her Sultiono (2015), who stated that a student's personality affects their understanding of concepts. With this in mind, this study aims to explore differences in students' understanding of concepts related to the personality of extroverts and introverts.

On the other hand, the peer teaching flipped classroom has succeeded in increasing students' conceptual understanding skills (Adams, 2017; Lo, 2017; Zamorano, 2019; Ramadoni & Kao, 2023). Flipped classrooms, which include peer teaching, have grown in popularity in recent years as a way to help students better understand the concepts being taught (Sukma, 2022). The two main learning phases of the peer teaching flipped classroom are before and during class. Before class, students create instructional videos, evaluate them, and provide feedback. Numbering, submitting, thinking, responding, assessing, and reaching a conclusion are the phases that occur in class (Ramadoni & Mustafa, 2022). Based on the background above, the researcher then tried to examine more deeply about students' conceptual understanding by implementing the peer teaching flipped classroom model in calculus practicum courses which were reviewed based on student personalities.

1.2. Research Question

This study answers questions about students' conceptual understanding skills and differences in each student's personality in calculus practicum by applying peer teaching flipped classroom model.

1.3. Significance of the Research

This research is expected to make a constructive theoretical and practical contribution to mathematics teachers, students and future researchers. In theory, teachers can solve conceptual comprehension problems for different types of students. It is also hoped that this study will serve as a reference for future researchers when assessing students' calculus learning abilities.

2. METHOD

2.1. Research Design

The research designed using experimental research. This study was conducted with

Mathematics Education students at his PGRI University in West Sumatra during the odd semester of the 2022/2023 academic year.

2.2. Samples/Participants

According to Matta (2021), population is the most prominent group. Furthermore, Jack (2021) pointed out that respondents are individuals who play a role in the research process, especially quantitative research, by answering the researcher's questions. The survey respondents were students of Mathematics Education at PGRI University in West Sumatra during the odd semester of the 2022/2023 academic year. For the calculus internship course, researcher enrolled 28 students. Personality type was determined by dispensing the Eysenck (1963) personality type of questionnaire (see appendix).

2.3. Data Collecting Technique and Analysis

The data collecting technique means that the researchers get the data using the test and questionnaire. The test analysis technique was used with an analytic rubric, and the total score of the student was calculated. The students' personalities type questionnaire was scored and administered in the form of a closed questionnaire. The analytical technique used in this study is the one-way ANOVA test using the SPSS application.

3. FINDINGS AND DISCUSSION

Based on the data obtained from the given questionnaire, we obtained the results that 13 students were enrolled in the introverted category and 15 students were enrolled in the extroverted category. The following is the student personality data based on the questionnaire given:

Table 1: Students' Personality Category

No	Initials	Questionnaire Score	Personality category	No	Initials	Questionnaire Score	Personality category
1	YI	36	Extrovert	15	BAM	34	Introvert
2	NM	41	Extrovert	16	SRS	24	Introvert
3	RK	43	Extrovert	17	CR	33	Introvert
4	NRS	41	Extrovert	18	RN	28	Introvert

5	FA	47	Extrovert	19	SPY	33	Introvert
6	MI	39	Extrovert	20	HN	28	Extrovert
7	RS	43	Extrovert	21	MA	39	Introvert
8	TN	29	Introvert	22	WRR	32	Extrovert
9	FJ	33	Introvert	23	ATD	47	Introvert
10	TKN	37	Extrovert	24	DPS	29	Extrovert
11	RP	33	Introvert	25	ADZ	38	Introvert
12	MD	37	Extrovert	26	NH	22	Introvert
13	EM	34	Introvert	27	MN	28	Extrovert
14	FNH	36	Introvert	28	AY	42	Introvert

Extrovert → ≥ 36 ; Introvert → < 36 .

A conceptual comprehension test was then administered, and hypothesis testing was performed using SPSS. The following is the test result from SPSS:

Descriptive

Table 2. Calculus Practicum Test

	n	M	SD	SE	95% CI	
					LL	LR
Introvert	13	71.00	15.13	4.20	61.86	80.14
Extrovert	15	85.40	9.19	2.37	80.31	90.49
Total	28	78.71	14.11	2.67	73.24	84.18

Based on the data above, it can be seen that the average understanding of the concepts of extrovert students (71.00) is higher than that of introvert students (M=85.40). Judging from the standard deviation of the two groups, introvert students have a standard deviation (SD=15.13) which is greater than the standard deviation of extrovert students (SD=9.19), this means that the range of scores of introvert students is greater than that of extrovert students. To examine more deeply, then a one-way Anova test was carried out.

ANOVA

Calculus Practicum Test

	SS	df	MS	F	p
Between Groups	1444.11	1	1444.11	9.56**	.005
Within Groups	3929.60	26	151.14		
Total	5373.71	27			

* $p < .05$. ** $p < .01$.

Based on the data above, it can be seen that there is a significant difference between extrovert students' conceptual understanding and introverted students with $F(1,26)=9.56^{**}$, $p=.005 < .05$. This means that students with extroverted personality have better conceptual comprehension skills than introverted students by using peer teaching flipped classroom models.

Using the peer teaching flipped classroom model in calculus practicum courses, it was discovered that the extrovert student's understanding of the concept was significantly better than the introverted student, with a p-value of .005. Extrovert students have an average score of 85.4, while introverted students have a score of 71. Moreover, the standard deviation of introvert students is greater than that of extrovert students, indicating that the range of scores of introvert students one and the other is greater than that of extrovert students. The researcher asked the students to make short videos by dividing the topics for each student's part with their respective creativity and technological abilities. This is due to the fact that extrovert students prefer the stages of creating videos to introvert students during the peer teaching flipped classroom process. All student videos can be seen on the YouTube link "<https://youtu.be/nes0IgcCRhU>" and shown in Figure 1:

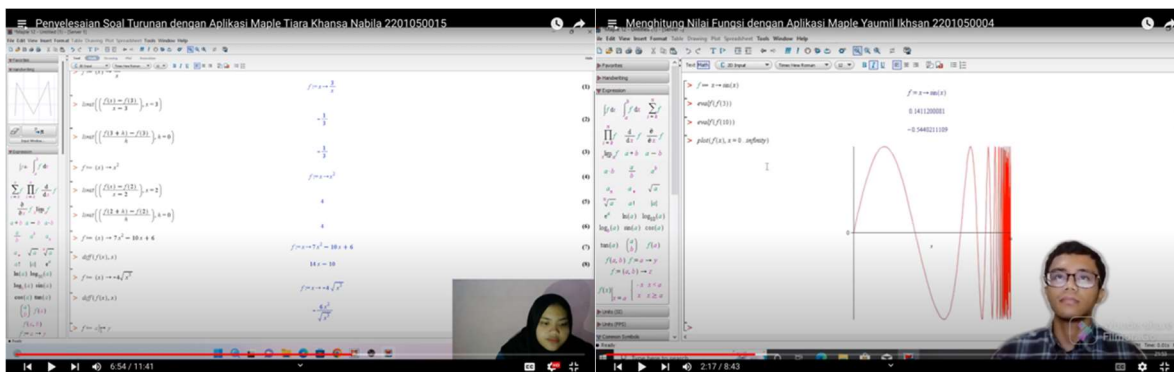


Figure 1. Students Extrovert Videos

When compared to introverted students, extrovert students are better at explaining. They teach material in the same way that teachers teach their students. Extrovert students are better at explaining than introvert students. Extrovert students are more likely to show their faces in video explanations, whereas introvert students are more likely to simply read out the results of their project without explanation. Students with extroverted personalities are more open, sociable, and

have the ability to communicate (Prayitno, 2018). In Figure 2, you can see an example of an introverted student video:

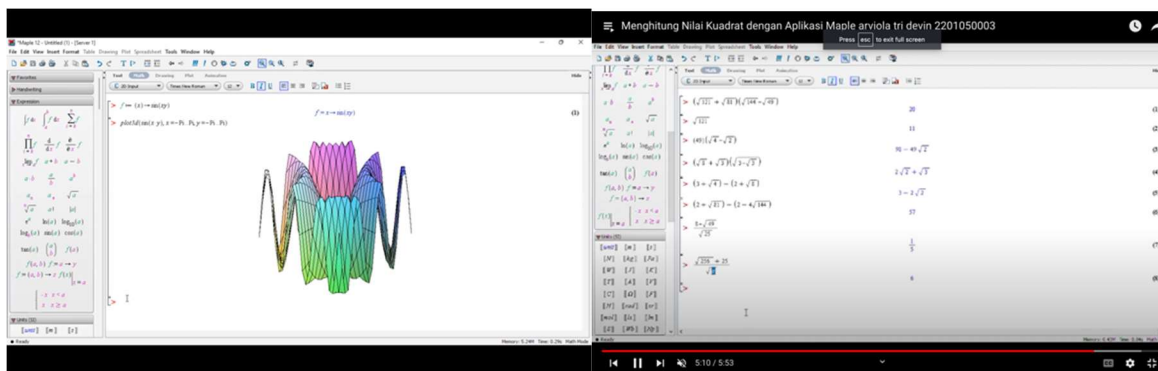


Figure 2. Students Introvert Videos

Figure 2 demonstrates that students with introverted personality types only read the consequences of their projects. However, once we dig deeper, we discover that introvert students could use technology more diversely than extravert students. Students' ability to draw graphs and see graphs in three dimensions and from slightly different angles.

Another finding based on field notes was that extrovert students were better at discussing during group learning in class. In-class student interactions differ depending on the student personality type (Ulwiyah, 2021). Introvert personalities are shy and only want to be listeners, so they are less able to train than extrovert personalities (Butsi, 2016). Extrovert students work well in groups, whereas introvert students prefer to work independently and passively. Extrovert students are also more likely than introvert students to present the results of their discussions in front of the class, whereas introvert students tend to be shy and hesitant to explain in front of the class. The introvert personality type is shy and finds it difficult to adapt to new situations (Tarmidzi, 2012). Students with introverted personalities typically struggle with verbal communication, specifically expressing what is on their hearts, as opposed to extroverted personalities (Zubaidah, 2017). Extrovert personality traits include being more open and sociable (Azizah, 2016). These two major factors have a significant impact on students' conceptual understanding in calculus practicum courses that use the peer teaching flipped classroom models.

4. CONCLUSION AND SUGGESTIONS

According to research findings, when using the peer teaching flipped classroom model, students' conceptual understanding in calculus practicum courses is influenced by personality category. The results of experiments such as peer teaching flipped classrooms show that extrovert students have better conceptual understanding skills than introvert students. Making videos and

organizing class discussions has a big impact on students who are outgoing. They can improve their skills while also sharing their knowledge and information with their classmates.

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Appendix

The following are the question items from the distributed questionnaire:

No	Items
1	Do you often miss the excitement?
2	Do you often need an understanding friend to cheer you up?
3	Are you the typical carefree person?
4	Do you find it very difficult to take no for an answer from other people?
5	Do you think everything through before doing anything?
7	If you say you're going to do something, do you always keep your word, no matter how uncomfortable doing it is?
8	Does your mood fluctuate?
9	Do you usually do and say things quickly without stopping to think?
10	Have you ever felt 'unhappy/depressed' for no apparent reason?
11	Would you do almost anything for a challenge?
12	Do you suddenly feel shy when you want to talk to an attractive stranger?
13	Do you occasionally lose your temper and get angry?
14	Do you often do things on the spur of the moment?
15	Do you often worry about the things you do or say?
16	Do you prefer reading to meeting people?
17	Are you the type who is easily hurt/offended?
18	Do you like traveling?
19	Do you sometimes have thoughts that you don't want others to know about?
20	Are you sometimes very excited and sometimes very sluggish?
21	Would you prefer to have few but special friends?
22	Do you daydream a lot?
23	When people yell at you, do you yell back?
24	Do you often have feelings of guilt?
25	Are all your habits classified as good and much desired by others?
26	Can you like go and have fun at a merry party?
27	Are you the type who is often nervous about doing something?
28	Do other people find you very passionate?
29	After you do something important, do you walk away feeling that you could have done it better?
30	Are you mostly quiet when you are with other people?
31	Do you like to gossip?
32	Do you like to think so you can't sleep?
33	If there's something you want to know, would you rather look it up in a book than talk about it with someone?
34	Are you one of those people who often get excited when doing something?
35	Do you like the types of activities that require your attention?
36	Are you one of those people who often shake?
37	Will you always report your obligations, even though you know you'll never be caught?
38	Don't you like being with a crowd of people joking around?
39	Are you an easily offended person?
40	Do you like to do things where you have to act quickly?

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- 41 Are you worried about bad things that might happen?
 - 42 Are you slow and unhurried in your actions?
 - 43 Have you ever been late for an appointment?
 - 44 Do you often have nightmares?
 - 45 Do you really like talking to people, including talking to people you don't know?
 - 46 Are you bothered by any illness?
 - 47 Would you be very unhappy if you couldn't see many people throughout the day?
 - 48 Are you a nervous person?
 - 49 Of all the people you know, are there some people you don't like?
 - 50 Are you a fairly confident person?
 - 51 Are you easily hurt when others blame you for your work?
 - 52 Do you find it difficult to enjoy a lively party?
 - 53 Are you bothered by feelings of inferiority?
 - 54 Are you having trouble enjoying a party?
 - 55 Do you sometimes talk about things you know nothing about?
 - 56 Are you worried about your health?
 - 57 Do you like pranking other people?
 - 58 Do you suffer from sleeplessness?
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