

CHAPTER III

RESEARCH METHODOLOGY

3.1 Research Method

In carrying out the research objectives that are elaborated previously, this research employed a quantitative research method. The quantitative research method requires the researcher to gain thorough information from the selected research sample (Evans & Maiyo, 2015). This method generally separates facts from feelings, given its unbiased characteristic. The objectivity of this method was maximized by the designs used (Fraenkel et al., 2012; Ramlo, 2020).

The utilization of the quantitative method in this research is due to the data being in numerical form. The numerical data was generated from the questionnaires with the Likert scale. Furthermore, multiple linear regression was used in this study to investigate the effect of student motivation, study habits, and teaching strategies on academic performance during online science learning. Moreover, the outcomes of multiple linear regression analysis will be presented in tabulations that consist of numerical values.

3.2 Research Design

This study employed a survey research design to measure the research problem of this study. The purpose of using a survey research design was to investigate the relationship between students' academic achievement factors. The advantage of survey research is that it can provide a significant amount of data collected from a representative sample of individuals. Moreover, the survey design is the most frequently used descriptive methodology in educational research. Furthermore, survey data responses were in tabulation form, typically as frequencies or percentages (Fraenkel et al., 2012).

Accordingly, research questionnaires were used to collect data to analyze the influence of student motivation, study habits, and teaching strategies on academic performance during online science learning. The questionnaires were spread through online survey platforms to make them accessible to the teachers and students from the junior high school level. Further, the data obtained from the questionnaires are sorted using Microsoft Excel software and analyzed by IBM

SPSS 21 software afterward. Later, tabulations and graphs were constructed to express the data analysis, followed by the interpretations in the discussion section.

3.3 Population and Sample

This study was conducted online on seven (7) schools located in West Java, West Sumatra, North Sulawesi, and South Sulawesi. The population of this research was junior high school students from seventh, eighth, ninth-grader, and junior high school teachers conducting an online science learning during the pandemic.

The sample participants in this research were 393 students and nine (9) teachers. The population of students consists of 70 students of 7th-grade, 98 students of 8th-grade, and 224 students of 9th-grade. Meanwhile, the teachers who participate in this study comprise three teachers of 7th grade, two teachers of 8th-grade, and four teachers of 9th-grade. The data collection period was carried out around two weeks, from 15th to 27th of October 2021.

Due to being conducted virtually, the sampling technique used in this study is simple random sampling. The simple random sampling technique allows every member of the population to have an equal and independent chance of being chosen. This sampling technique is convenient to apply when the population is large (Fraenkel et al., 2012).

The first step of the sampling process is deciding the population size. This study had determined to take around 400-500 junior high school students for the population size. Afterward, approximately 200-300 junior high schools were chosen as the sample as this study used the 95% confidence level with a 5% margin error. The final sample size used in this study was 393 students. Last, the respondents were selected randomly before the analysis process.

3.4 Operational Definition

The following elaboration is the specific description of the independent variables and dependent variable limitations that are measured in this research to avoid ambiguity:

- 1) Student motivation discussed in this research refers to students' willingness to achieve goals to their satisfaction or enjoyment during online science learning. The student motivation was measured by three aspects; intrinsic motivation, self-efficacy, and mastery goal-oriented motivation using a questionnaire.

- 2) In this research, study habits refer to the routine employed by the students to support their learning activities outside the school schedule during online science learning. This study measured several study habits aspects such as individual study outside of school, note-taking, avoiding distraction during online learning, and working on practices through a questionnaire.
- 3) The teaching strategies discussed in this research refer to the three essential interactions (student-to-teacher, student-to-student, student-to-content) during online learning. Several aspects of teaching strategies such as content delivery of science subjects, communication with students, and learning methods (learning model, learning approach, and learning method) used during online learning were measured using a questionnaire.
- 4) The academic performance discussed in this research refers to students' knowledge of science subjects' examination results during online science learning. This research used students' examination scores from science midterm tests or daily exams conducted during distance learning in the first semester to measure academic performance.

3.5 Research Instrument

A research instrument is needed to answer the research problem proposed in the previous chapter. As for the assessment tool, a questionnaire is considered suitable for survey research. The construction process was divided into several stages to attain the desired questionnaire. The following Figure 3.1 shows the diagram of the development process.

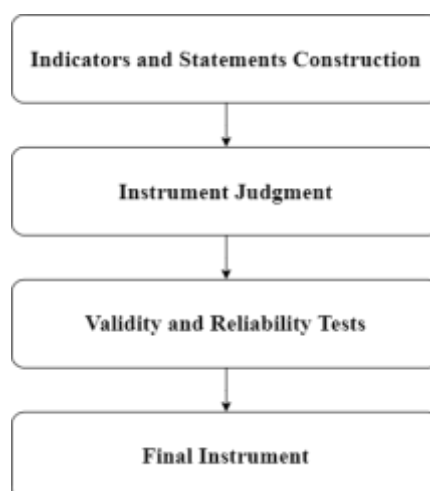


Figure 3.1 Questionnaire Development Process Diagram

The procedure depicted on the diagram had resulted in two questionnaires; Student Motivation and Study Habits during Online Science Learning Questionnaire and Teaching Strategies during Online Science Learning Questionnaire. Most of the items of both questionnaires were constructed by adapting from the existing questionnaires and journals. Consequently, the following section presents a thorough explanation of each step of the questionnaire development procedure.

3.5.1 Indicators and Statements Construction

In survey research, the use of questionnaires to acquire information about respondents' views and behavior can be applied in a wide variety of situations (Williams, 2003). Thus, the construction process of the questionnaires indicators was carried out to determine the scope measured. Therefore, the questionnaire items were chosen by utilizing existing inventories as references.

Several self-report inventories such as Motivated Strategies for Learning Questionnaire (MSLQ), Online Self-regulated Learning Questionnaire (OSLQ), and Study Habits Questionnaire (SHQ) were found (Barnard et al., 2009; Olutola et al., 2016; Pintrich & Groot, 1990). However, due to the accessibility of the self-report inventories items, the Motivated Strategies for Learning Questionnaire (MSLQ) and Online Self-regulated Learning Questionnaire (OSLQ) were chosen as the references for this study's questionnaires. Additionally, each questionnaire's items were adjusted due to the current online learning situation.

The MSLQ inventory comprises two (2) key elements, student motivation and self-regulated learning strategies. The student motivation element consists of intrinsic value, self-efficacy, and test anxiety. On the other hand, the self-regulated learning strategies focus more on cognitive strategy and self-regulation for learning. Each essential element item was described as shown in Table 3.1, which developed into 56 statements.

Table 3.1
The Original Composition of MSLQ Inventory

No.	Indicator	Description	Statement Numbers
1	Student Motivation		

	Intrinsic value	Intrinsic value was determined based on intrinsic motivation and perceived importance of course work, along with a preference for the challenge and mastery goals.	1, 2, 3, 5, 6, 7, 9, 10,11, 12, 13, 14, 15, 17, 18, 20, 21, 22,
	Self-efficacy	Self-efficacy criteria comprised questions about perceived competence and confidence in performing academic tasks.	23, 24, 25, 27
	Test anxiety	Test anxiety is focused on the fear of failing and cognitive interference during tests.	
2	Self-regulated learning strategies		
	Cognitive strategy	A cognitive strategy is associated with rehearsal strategies, elaboration strategies (e.g., summarizing and paraphrasing), and organizing strategies.	30, 31, 32, 33, 34, 35, 36, 38, 39, 40, 41, 42, 43, 44, 45,
	Self-regulation	Self-regulation was developed using the metacognitive and effort management elements, including planning, skimming, and comprehension monitoring.	46, 47, 53, 52, 54, 55, 56

(Pintrich & Groot, 1990)

Meanwhile, the OSLQ inventory comprises six (6) key elements. The critical elements of the OSLQ inventory consist of goal setting, environment structuring, task strategies, time management, help-seeking, and self-evaluation. Likewise, the original composition of the OSLQ inventory comprised 24 statements, with 4-5 statements for each essential element. Further elaboration of the OSLQ inventory key elements can be seen in Table 3.2.

Table 3.2

The Original Composition of OSLQ Inventory

No.	Indicator	Description	Statement Numbers
1	Goal setting	Refers to setting standards and goals for learning over some time during online learning.	1, 2, 3, 4, 5,

2	Environment structuring	Students were building an environment (location or time) for online learning.	6, 7, 8, 9,
3	Task strategies	Students strategize for assignments during online learning (e.g., taking notes, reading aloud to avoid distraction, preparing questions, and working on problems).	10, 11, 12, 13,
4	Time management	Students are allocating time outside of the school's online learning schedule dedicated to learning.	14, 15, 16,
5	Help seeking	Refers to the students' desire to seek assistance or help from instructors and peers during online learning.	17, 18, 19, 20
6	Self-evaluation	Students review and reflect on what the learners have learned during online learning.	21, 22, 23, 24

(Barnard et al., 2009)

Subsequently, the original MSLQ and OSLQ inventories were adjusted to the online setting to fit the context during online science learning. Furthermore, the questionnaire that has been adjusted was translated into Bahasa Indonesia as the population of this study comprised of public and private junior high school students that use Bahasa Indonesia as the primary language in the educational setting. Further details of the adapted Student Motivation and Study Habit Questionnaire key elements and their elaboration are presented in Table 3.3.

Table 3.3

The Questionnaire Items Composition of Student Motivation and Study Habits during Online Science Learning

No.	Indicator	Description	Statement Numbers
1	Student demographics	Refers to the demographic information about students' grade levels, school status, devices, and learning aid platforms during online science learning.	1, 2, 3, 4

2	Student motivation		
	Intrinsic motivation	Students' willingness to do something for themselves is based on the benefit and satisfaction they will gain from it.	5, 6, 7, 8
	Self-efficacy	Students believe in their own capacity to perform in and handle science subjects.	9, 10, 11, 12
	Mastery goals	Students emphasize honing their skills and comprehending science subjects.	13, 14, 15, 16
3	Study habits	Personal routines that students follow to support their learning process.	17, 18, 19, 20

On the other hand, the Teaching Strategies Questionnaire's critical elements referred to Yang's (2017) statements of the frequently adopted strategies during online learning. The strategies are presented as follows,

- 1) Encouraging interaction through asynchronous and synchronous communication or delivery,
- 2) Facilitating the application of concepts (e.g., through the utilization of an appropriate learning model/approach/method),
- 3) Demonstrating tools and programs via video demonstrations, such as screencasts (e.g., offering video demonstration to deliver intricate concepts),
- 4) Teachers demonstrate a robust social presence or a sense of community members within a learning community (e.g., providing discussion and feedback for the students).

According to Moore (1991), there are three (3) essential interactions during distance learning; student-to-instructor, student-to-student, student-to-content. Synchronous and asynchronous communication can be utilized (Yang, 2017). Therefore, the key elements that composed the Teaching Strategies Questionnaire are presented in Table 3.4. Furthermore, the Teaching Strategies Questionnaire statements were also translated into Bahasa Indonesia along with the Student Motivation and Study Habits Questionnaire.

Table 3.4
The Questionnaire Items Composition of Teaching Strategies during
Online Science Learning

No.	Indicator	Description	Statement Numbers
1	Teachers' demographics	Refers to the demographic information about teachers such as grade levels taught, school status, and learning aid platforms during online science teaching.	1, 2, 3
2	Content delivery	The techniques that the teachers use to deliver science materials during online learning.	4, 5, 6, 7
3	Communication with students	Teachers made efforts to maintain communication between teacher to students and among the students.	8, 9, 10, 11,
4	Learning method used during online teaching	The learning models, approaches, and methods teachers used during online science learning.	12, 13, 14

A four-point Likert scale was used to measure Student Motivation and Study Habits Questionnaire and Teaching Strategies Questionnaire. A self-reporting instrument in which an individual indicates their level of agreement with a set of statements uses the Likert scale. Each option is assigned a numerical value, and the sum of the scores is assumed to represent the measured variable. Moreover, the Likert scale is a frequently used attitude scale in educational research (Fraenkel et al., 2012).

The Likert scale used to measure both questionnaires is presented in Table 3.5. The four-point Likert scale is structured as *strongly disagree or never* (1), *disagree or rarely* (2), *agree or often* (3), *strongly agree or always* (4). Additionally, the four-point Likert scale was used to prevent neutral answers from the participant. Therefore, the result of the analysis is not biased.

Table 3.5

Likert scale in Student Motivation and Study Habits Questionnaire

Indication	Value
Strongly disagree and/or Never	1
Disagree and/or Rarely	2
Agree and/or Often	3
Strongly agree and/or Always	4

3.5.2 Instrument Judgment

After the construction of the instruments had finished, experts' judgment was conducted. This procedure is essential to gain another point of view on the questionnaires' items. Three experts with science education backgrounds reviewed the questionnaires and gave their feedback on each questionnaire. The followings are several points taken from the experts' feedback:

- 1) Separate each indicator and create at least three (3) statements for every aspect of the student questionnaire.
- 2) Add questions or statements related to students' collaboration, the problem during online science learning, and how to overcome it—additionally, items to the content delivery aspect of the teacher questionnaire.
- 3) Translate the items into Bahasa Indonesia before distributing the instruments to the research participants.
- 4) The consistency of using several terms (e.g., *Sains* or *IPA*, Online or *Daring*).

Afterward, the suggestions from the experts were applied to the instruments. After the revision had been completed, the questionnaires were tested for their validity and reliability. Furthermore, the experts' judgments of both inventories are attached in Appendix A.1.

3.5.3 Validity and Reliability Test

A validity and reliability test is conducted to assess the accuracy and reliability of the questionnaire distributed to the participants. Reliability refers to the consistency of scores from one administration of an instrument to the next and one set of items to the next. Meanwhile, validity refers to the appropriateness, correctness, and significance of the data used to support any conclusions derived from the scores (Williams, 2003).

The questionnaires were distributed to 30 participants from various schools to conduct validity and reliability tests. The questionnaires were distributed through an online survey platform, Google Forms. The data collected was then downloaded from Google Forms and organized using Microsoft Excel. Subsequently, the data was inputted into IBM SPSS 21 software to be checked for its validity and reliability. The tests were carried out by using Reliability analysis and inter-item correlation features. Table 3.6 presents the reliability result of the student questionnaire, whereas Table 3.7 depicts the reliability result of the teacher questionnaire.

Table 3.6

Reliability Test Result for The Student Questionnaire

Cronbach's Alpha	N of Items
.799	13

As seen in Table 3.6, Cronbach's alpha coefficient for the Student Motivation and Study Habits Questionnaire is 0.799. On the other hand, in Table 3.7, the Teaching Strategies Questionnaire shows 0.875 Cronbach's alpha coefficient. The Cronbach's alpha coefficient measures an instrument's internal consistency or reliability using only one test administration. The Cronbach's alpha is a coefficient used to determine the reliability of items that do not require correct or incorrect answers. (Fraenkel et al., 2012).

Table 3.7

Reliability Test Result for The Teacher Questionnaire

Cronbach's Alpha	N of Items
.875	11

The instrument is not reliable if the Cronbach's alpha coefficient falls between $0.00 \leq \alpha < 0.40$ intervals; meanwhile, if the Cronbach's alpha coefficient falls between $0.40 \leq \alpha < 0.60$ intervals, the instrument's reliability is considered as low. Moreover, the instrument is quite acceptable if it falls between $0.60 \leq \alpha < 0.80$ intervals (Sahin & Yilmaz, 2020). Additionally, Kimberlin and Winterstein's (2008) findings demonstrated the interpretation of Cronbach's alpha coefficient for reliability test as presented in Table 3.8.

Table 3.8

The Interpretation of Cronbach's Alpha of Reliability Test

Correlation Coefficient	Reliability Category
0.80-1.00	Very High
0.60-0.79	High
0.40-0.59	Average
0.20-0.39	Low

(Kimberlin & Winterstein, 2008)

Therefore, according to the Cronbach's alpha interpretation, the Student Motivation and Study Habits Questionnaire ($\alpha = 0.799$) and Teaching Strategies Questionnaire ($\alpha = 0.875$) were considered high and very high reliability, respectively. Hence, the instruments were appropriate to examine the measured variable of this study. Furthermore, the details of validity and reliability test results generated by IBM SPSS 21 software of both questionnaires can be seen in Appendix A.2.

3.5.4 Final Instrument

The final instruments after the revision consist of 23 items for Student Motivation and Study Habits during Online Science Learning Questionnaire and 18 items for Teaching Strategies Questionnaire. The items comprise positive and negative statements, and the scale used is a four-point Likert scale. The indicators and the distribution of statement numbers are presented in Table 3.9.

The finished questionnaires and the total items on the Student Motivation and Study Habits Questionnaire and Teaching Strategies Questionnaire are displayed in Table 3.9. As depicted in Table 3.9, the critical elements of the Student Motivation and Study Habits Questionnaire consist of students' demographics, student motivation, and study habits. On the other hand, the Teaching Strategies Questionnaire comprises four key elements; teachers' demographics, content delivery, communication with students, and learning method used during online teaching. Furthermore, the final statements of the Student Motivation and Study Habits Questionnaire are attached in Appendix A.3.1, while the finalized instrument for the Teaching Strategies Questionnaire can be seen in Appendix A.3.3.

Table 3.9
Final Composition of Student Motivation, Study Habits, and
Teaching Strategies Instrument

Student Motivation and Study Habits Learning Questionnaire		
No.	Indicator	Statement Numbers
1	Students' demographics	1, 2, 3, 4
2	Student motivation	
	Intrinsic motivation	5, 6, 7, 8,
	Self-efficacy	9, 10,
	Mastery goals motivation	11, 12, 13
3	Study habits	14, 15, 16
	Total	16
Teaching Strategies Questionnaire		
1	Teachers' demographics	1, 2, 3
2	Content delivery	4, 5, 6, 7
3	Communication with students	8, 9, 10, 11,
4	Learning method used during online teaching	12, 13, 14
	Total	14

3.6 Data Collection

The questionnaires for the students and the teachers were distributed through an online forms platform, Google Forms, for an accessible data collection process. Each questionnaire was divided into sections according to the indicators measured. The students' questionnaire was composed of three sections, i.e., students' demographic information, student motivation, and study habits during online science learning. On the other hand, the teachers' questionnaire consisted of four sections, i.e., teachers' demographic information, content delivery, communication, and learning methods used during online science teaching.

Subsequently, the questionnaires were accessed by the students and teachers through the links given (students' questionnaire: <http://tiny.cc/siswaskripsishafa> and teachers' questionnaire: <http://tiny.cc/guruskripsishafa>). Figure 3.2 displays the interface of the questionnaire in online forms. The data of students' academic performance, on the other hand, were collected from secondary data through the teachers of each participating school. The teachers sent the learning outcomes of midterm exams or daily exams via messaging application or Google Drive.

Kuesioner Latar Belakang, Motivasi, dan Kebiasaan Belajar Siswa selama Pembelajaran IPA secara Daring

Kepada Yth,
Saudara/i Responden.

Saya Shafa Rihadatul Aisy, mahasiswa prodi International Program on Science Education, Fakultas Pendidikan Matematika dan Ilmu Pengetahuan Alam, Universitas Pendidikan Indonesia (IPSE FPMIPA UPI). Saat ini, saya sedang melakukan penelitian dengan topik "Analisis Faktor yang Berhubungan dengan Pencapaian Akademik Siswa selama Pembelajaran IPA secara Daring". Penelitian ini ditujukan untuk menyelidiki korelasi diantara latar belakang, motivasi, kebiasaan belajar siswa, dan strategi guru mengajar terhadap pencapaian akademik siswa selama pembelajaran IPA secara daring.

Kriteria responden penelitian ini adalah sebagai berikut:

1. Siswa SMP dari jenjang kelas 1 sampai dengan 3,
2. Mempelajari Ilmu Pengetahuan Alam (IPA) melalui pembelajaran daring.

Kuesioner ini terdiri dari 5 bagian dan tidak ada jawaban yang benar ataupun salah. Oleh karena itu, mohon isi kuesioner ini dengan jujur. Identitas dan jawaban Saudara/i selaku responden penelitian dijamin kerahasiaannya karena data yang dikumpulkan dari kuesioner ini hanya untuk kepentingan penelitian semata.

Atas kesediaan dan kerja sama Saudara/i dalam mengisi kuesioner ini, saya ucapkan terima kasih.

Hormat saya,
Shafa Rihadatul Aisy

Narahubung: raisysra@upi.edu

(a)

Motivasi Belajar Siswa

Motivasi Intrinsik

Saya merasa dapat menggunakan hal yang saya pelajari selama pembelajaran IPA secara daring di masa yang akan datang *

- Sangat Setuju
- Setuju
- Tidak Setuju
- Sangat Tidak Setuju

Meskipun materi diajarkan secara daring, saya merasa apa yang saya pelajari di kelas IPA bermanfaat untuk dipahami *

- Sangat Setuju
- Setuju
- Tidak Setuju
- Sangat Tidak Setuju

(b)

Kuesioner Strategi Mengajar selama Pembelajaran IPA secara Daring

Kepada Yth,
Saudara/i Responden.

Saya Shafa Rihadatul Aisy, mahasiswa prodi International Program on Science Education, Fakultas Pendidikan Matematika dan Ilmu Pengetahuan Alam, Universitas Pendidikan Indonesia (IPSE FPMIPA UPI). Saat ini, saya sedang melakukan penelitian dengan topik "Analisis Faktor yang Berhubungan dengan Pencapaian Akademik Siswa selama Pembelajaran IPA secara Daring". Penelitian ini ditujukan untuk menyelidiki korelasi diantara latar belakang, motivasi, kebiasaan belajar siswa, dan strategi guru mengajar terhadap pencapaian akademik siswa selama pembelajaran IPA secara daring.

Kriteria responden penelitian ini adalah sebagai berikut:

1. Guru mata pelajaran Ilmu Pengetahuan Alam (IPA) tingkat SMP,
2. Sedang mengajar mata pelajaran IPA secara daring.

Kuesioner ini terdiri dari 6 bagian dan tidak ada jawaban yang benar ataupun salah. Oleh karena itu, mohon isi kuesioner ini dengan jujur. Identitas dan jawaban Saudara/i selaku responden penelitian dijamin kerahasiaannya karena data yang dikumpulkan dari kuesioner ini hanya untuk kepentingan penelitian semata.

Atas kesediaan dan kerja sama Saudara/i dalam mengisi kuesioner ini, saya ucapkan terima kasih.

Hormat saya,
Shafa Rihadatul Aisy

Narahubung: raisysra@upi.edu

(c)

Penyampaian Materi

Bagian ini ditujukan untuk mengetahui cara responden menyampaikan materi selama pembelajaran IPA secara daring berlangsung melalui beberapa kriteria.

Selama pembelajaran IPA secara daring, saya lebih dominan mengajar secara... *

Pembelajaran Synchronous

Pembelajaran Asynchronous

Kombinasi pembelajaran Synchronous dan Asynchronous

Saya menggunakan Sistem Manajemen Pembelajaran untuk memfasilitasi pengajaran IPA secara daring. *

Selalu

Sering

Jarang

Tidak Pernah

(d)

Figure 3.2 Several Parts of The Online Questionnaires Interface

(a) The initial page of the students' questionnaire shows the research respondent

criteria, (b) The next section of the students' questionnaire with Likert scale statements, (c) The initial page of the teachers' questionnaire shows the research respondent criteria, (d) The next section of the teachers' questionnaire with Likert scale statements

3.7 Data Analysis Technique

In line with the research problem elaborated in the previous chapter, this study used a multiple linear regression (MLR) for the data analysis. Multiple linear regression is used when a study desires to discover the effect of one or more independent variables toward a dependent variable.

3.7.1 Assumption Testing

Prior to performing multiple linear regression, it is necessary to verify the data acquired using assumption testing. Assumption testing is necessary while performing multiple regression analysis (Williams et al., 2013). When these assumptions are violated, the following data may be untrustworthy, resulting in inaccuracies and over-or underestimates of significance or effect sizes (Osborne et al., 2002). Two hypothesis tests were used to determine the suitability of the data for analysis: normality and multicollinearity tests.

3.7.1.1 Normality Test

Multiple linear regression assumes that any arrangement of values on the predictor variables will result in a normal distribution of errors. In multiple linear regression, the errors indicate the difference between the observed values of the response variable for each subject and the values predicted by the regression model for the total population (Williams et al., 2013).

The normality of errors can be observed by examining the residual plot. According to Pallant (2007), normally distributed errors depict a diagonal line that starts from the bottom left to the top right of the diagram. If the plotline matches Pallant's description, there are no significant deviations from normality.

3.7.1.2 Multicollinearity Test

Multicollinearity is a statistical term that refers to a highly correlated relationship between the predictors or independent variables (Pallant, 2007). It would be possible to detect any existing collinearity between independent variables by examining multicollinearity. Collinearity between independent variables is

undesirable because it affects the result of regression analysis. According to Alita et al. (2021), if a correlation exists between the predictors, it will not be easy to distinguish the effect of the predictor variables on the response variables. Daoud (2017) also states that collinearity increases the standard error of predictors' coefficients, resulting in inflation of predictors' coefficients' variance.

It is best to examine tolerance values and VIF (Variance Inflation Factors) to determine multicollinearity. Tolerance values measure the variability in an independent variable unaccounted for by the other independent variables. According to Daoud (2017), tolerance values should preferably exceed 0.10, as a low tolerance value indicates collinearity. On the other hand, VIF is the inverse of tolerance which computes and quantifies the amount of inflation variance. VIF values greater than 10 indicate multicollinearity, which causes concern to carry out regression analysis (Chiarini & Brunetti, 2019).

3.7.2 Multiple Linear Regression

Multiple linear regression is appropriate to examine the influence of independent variables toward a dependent variable. It also allows discovering the overall and independent effect of the predictors on the dependent variable analysis within the set (Amoozad-Khalili et al., 2019; Chiarini & Brunetti, 2019). The equation of multiple linear regression is presented as follows,

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \dots + \beta_n X_n$$

Where:

Y = The dependent variable (output);

X = the explanatory variable (input);

β_0 = the intercept of the relationship; and

β_n = the n-th regression coefficient that determines the used weight by the equation on the n-th explanatory variable to provide the estimate output.

Multiple regression analysis generates three tabulations results. The first one is the model summary table. It presents the multiple correlations (R), coefficient of determination (R Square), Adjusted R Square, and Standard Error of the Estimate. According to Pallant (2007), the coefficient of determination, also depicted as R Square, indicates the amount of variance in the dependent variable that independent

variables can explain. This is used to analyze the relationship of student motivation, study habits, and teaching strategies toward academic performance.

The second table contains the results of the ANOVA test. The F-test was used to determine the regression's statistical significance. This test determines whether the independent variables are simultaneously significant on the dependent variable (Deming & Morgan, 1987). If the null hypothesis is accepted, it indicates that all of the coefficients in the model are equal to zero (Konasani & Kadre, 2015). The hypotheses are presented as the followings,

H₀: $\beta_i = 0$, There is no significant relationship between student motivation, study habits, and teaching strategies on academic performance during online science learning simultaneously.

H₁: $\beta_i \neq 0$, There is a significant relationship between student motivation, study habits, and teaching strategies on academic performance during online science learning simultaneously.

The acceptance rate for the F test is as follows if the F-value is less than F-table (F-value < F-table) and the *p*-value is greater than 0.05 (Sig. > 0.05), then the null hypothesis (H₀) is accepted. It indicates that the independent variables were not simultaneously influencing the dependent variable. On the other hand, if the F-value is greater than F-table (F-value > F-table) and the *p*-value is less than 0.05 (Sig. < 0.05), then the alternate hypothesis (H₁) is accepted. It can be concluded that the independent variables simultaneously influenced the dependent variable.

The coefficients table is the final table to be analyzed. It summarizes the study's independent variables, the unstandardized coefficients (B and Standard Error), standard errors (Beta), t-values, and *p*-values. Additionally, beta values on standardized coefficients are examined to compare the effect of each independent variable on academic performance. Standardized coefficients are values for each variable converted to a standard scale to facilitate comparison (Pallant, 2007). Thus, it is possible to compare the increase in the independent variable with the increase in the dependent variable on a standard deviation scale.

Following that, the t-value and *p*-value were calculated to determine whether the influence of student motivation, study habits, and teaching strategies on students' academic performance is significant, respectively (Konasani & Kadre,

2015). This test determines whether the independent variables are significant on the dependent variable. The following hypotheses are presented,

a. **H₀**: There is no significant relationship between student motivation and academic performance during online science learning.

H₁: There is a significant relationship between student motivation and academic performance during online science learning.

b. **H₀**: There is no significant relationship between study habits and academic performance during online science learning.

H₁: There is a significant relationship between study habits and academic performance during online science learning.

c. **H₀**: There is no significant relationship between teaching strategies and academic performance during online science learning.

H₁: There is a significant relationship between teaching strategies and academic performance during online science learning.

If the t-value is less than t-table ($t\text{-value} < t\text{-table}$) and the p -value is greater than 0.05 (Sig. > 0.05), then the null hypothesis (H_0) is accepted. It indicates that the independent variables are not significantly related to the dependent variable. However, if the t-value is greater than the t-table ($t\text{-value} > t\text{-table}$) and the p -value is less than 0.05 (Sig. < 0.05), then the alternate hypothesis (H_1) is accepted. Therefore, it can be summarized that there is a significant relationship between the independent variables and the dependent variable.

3.8 Research Procedure

This research is implemented using a systematically arranged procedure. It is divided into three main stages that include the preparation stage, the implementation stage, and the completion stage. Each step elaborated as follows:

1) Preparation Stage

The preparation stage is the initial step of this research. The following are the steps included in this stage:

- a) Formulate the research problem followed by classifying the problem into research questions.
- b) Determine the research variables to be measured.

- c) Conduct literature review related to students' backgrounds, motivation, study habits, teaching strategies, and academic performance.
 - d) Arrange the research proposal.
 - e) Construct research instruments by modifying existing instrument items.
 - f) Research instruments judgment by experts followed by revising it according to the experts' feedback.
 - g) Check validity and reliability of instruments items.
 - h) Input final research instruments into online forms platform (Google Forms).
 - i) Prepare the permission letter.
- 2) Implementation Stage

In the implementation stage, the instruments are ready to be carried out to obtain the data. The following are the steps included in this stage:

- a) Determine the sample of the study.
 - b) Distribute and test the instruments to the research sample.
 - c) Gather the data obtained from online forms.
- 3) Completion Stage

During the completion stage, the recorded data are ready to be analyzed. The following are the steps included in this stage:

- a) Analyze the data obtained statistically.
- b) Discuss and conclude based on the data analysis result.
- c) Arrange and complete the research report.

Figure 3.3 shows the flowchart that outlines the entire research procedure.

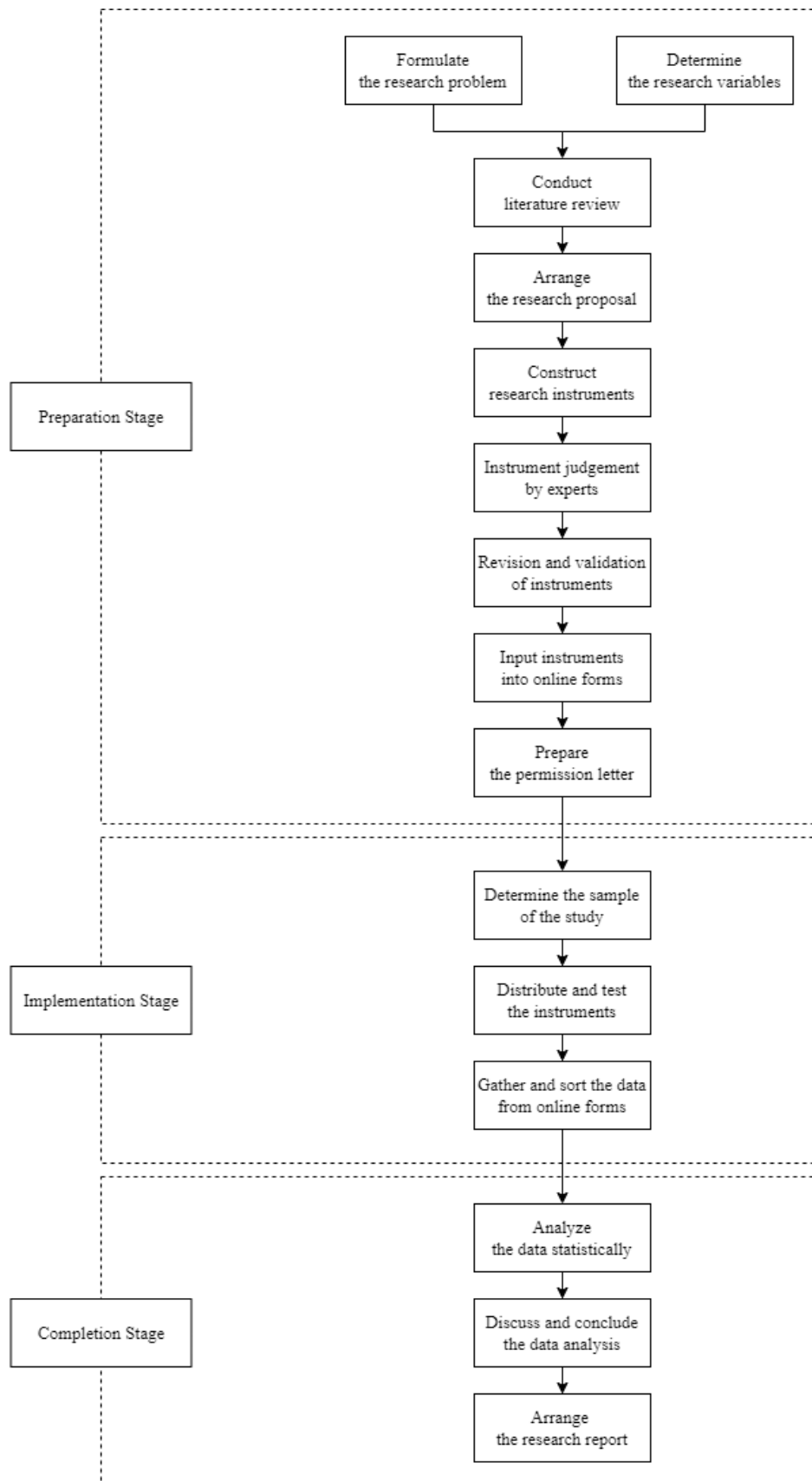


Figure 3.3 The Flowchart of Research Procedure