CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter presents the research methodology to answer the research questions. This study aims to examine the relationship of using interactive multimedia on student perception, competencies and participation. This chapter also describes the research methods, approaches, research subjects and objects, population and sampling, data collection methods, and data analysis techniques.

3.2 Research Paradigm

There are at least four worldviews: positivist, constructivist, transformative, and pragmatic (Creswell, 2014). Based on the literature and subject of this research, this study adopted the pragmatic paradigm. The common research methodology for the pragmatic paradigm is mixed methods (Creswell, 2014). The mixed methods approach, also called combination research, combines quantitative and qualitative research methods. In mixed methods research, data collection is carried out using qualitative and quantitative means. Qualitative data are typically collected using predetermined questions and interviews, while quantitative data are usually gathered using questionnaires or psychological instruments (Creswell, 2014),

The mixed methods approach Involves collecting and Integrating both quantitative and qualitative data, as well as using distinct designs that may involve

philosophical assumptions and theoretical frameworks. The core assumption of this form of inquiry is that the combination of qualitative and quantitative approaches provides a more complete understanding of a research problem than either approach alone (Creswell, 2014). The mixed methods approach was adopted in this study to obtain in-depth information to answer the formulated problems.

3.3 Research Approach

This study employed the mixed methods approach because it affords deeper understanding and information than a single approach. Creswell (2014) explained that the mixed methods approach was developed to provide more understanding of the research problem. Almalki (2016) also said that the approach is suitable for all types of research because it can generate broader information that cannot be obtained with a single approach. Therefore, the mixed methods research design is used to cover the weaknesses of using only either the qualitative or quantitative approach. Thus, in this study, students' perceptual data can be described qualitatively as well as quantitatively.

There are three mixed methods models. First is convergent parallel mixed methods, where the researcher collects both quantitative and qualitative data and analyzes them separately. The results are then compared to see whether they confirm or negate each other. The key assumption of this approach is that both qualitative and quantitative data provide different types of information. The second is explanatory sequential mixed methods. In this approach, the researcher collects and analyzes quantitative data in the first phase, before using the results to plan (or build on to) the second qualitative phase. The qualitative data help explain in more detail the initial quantitative results. A typical procedure might involve collecting

survey data in the first phase, analyzing the data, and then following up with qualitative interviews to help explain the survey responses. The final model is the exploratory sequential mixed methods. This approach begins with the qualitative phase, followed by a quantitative phase. It is the opposite of the second model (Creswell, 2014).

This study used the convergent parallel mixed methods approach. In this approach, the researcher combined both quantitative and qualitative data, collecting and analyzing them separately before comparing the results of both. The reason for choosing this approach is to unite or compare, validate, and strengthen the results of the two forms of data to bring greater insight into the problem than would be obtained by analyzing only either type of data. Another reason is that it is the researcher's first time using the mixed methods approach. The use of this approach also does not just collect and analyze two types of data, but also involves the function of the two research approaches collectively so that the strength of the overall research is greater than only using qualitative and quantitative research. As Creswell (2014, p.269) suggested, the convergent parallel mixed methods approach is suitable for researchers who are employing mixed methods for the first time. In addition, this approach is preferred by most researchers as its design is more time- and cost-efficient.

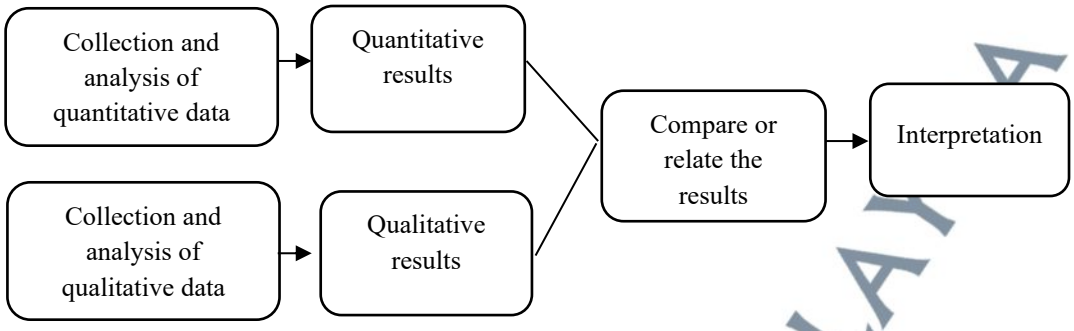

Figure 3.1.Research Flowchart

3.4 Hypotheses

Hypothesis 1

H_0 : Student perception does not significantly differ by grade, gender, and school origin.

H_a : Student perception significantly differs by grade, gender, and school origin.

Hypothesis 2

H_0 : Using interactive multimedia does not significantly affect student competencies.

H_a : Using interactive multimedia significantly affects student competencies.

Hypothesis 3.a

H_0 : Interactive multimedia device does not significantly affect student perception.

H_a : Interactive multimedia device significantly affects student perception.

Hypothesis 3.b

H_0 : Interactive multimedia device does not significantly affect student participation.

H_a : Interactive multimedia device significantly affects student participation.

Hypothesis 3.c

H_0 : Student perception does not significantly affect student participation.

H_a : Student perception significantly affects student participation.

Hypothesis 3.d

H_0 : Student perception does not mediate the relationship between interactive multimedia and student participation.

H_a: Student perception mediates the relationship between interactive multimedia and student participation.

3.5 Variables and Measurement

The dependent variables in this study were student participation and competencies. Competencies were measured using a test instrument developed by the PAI teachers. The data were in the form of student grades. The independent variables were interactive multimedia use, while the mediating variable was student perception. These three variables ware measured using a questionnaire whose items ware adapted from several sources (Teoh and Neo, 2007; Tago, 2012; Dixson, 2015). These items were screened using four criteria, namely validity, reliability, expertise, and number of citations.

3.5.1 Student Perception

The student perception questionnaire was adapted from Tago (2012). His paper has been widely cited and his questionnaire is considered valid and reliable, obtaining a Cronbach's alpha of 0.741 (Tago, 2012). The questionnaire has three dimensions, which are perceived ease of use, perceived usefulness, and attitude towards interactive multimedia device.

3.5.2 Interactive Multimedia

The interactive multimedia questionnaire was adapted from Teoh and Neo (2007). Teoh is an expert on interactive multimedia in Malaysia. This survey is deemed reliable as the Cronbach's alpha is 0.908. The items are grouped into learning motivation, content organization, navigation and graphical user interface (GUI), multimedia interactivity, and web feature.

3.5.3 Student Participation

The items were adapted from Dixson (2015). According to Google Scholar, his study has been widely cited. The questionnaire is regarded as valid and reliable, obtaining a Cronbach's alpha of 0.7.

3.6 Population and Sampling

The population in this study was students of SMP Al-Azhar 1 and SMP Al-Azhar 37. There were 785 students in total. The age range of grade seven students was 13-14, grade eight was 14-15, and grade nine was 15-16. Table 3.1 below details the population.

Table 3.1. Population Students of SMP IT Al-Azhar

No	Grade	SMP Al-Azhar 1	SMP Al-Azhar 37
1	7	240	61
2	8	240	44
3	9	198	2
Total		785	

To make an inference about the population and simplify the data collection process, a sample was selected. The size of the sample should be adequate to make appropriate generalizations and avoid sampling errors or bias (Taherdoost, 2017). Sample size was determined using Krejcie and Morgan's (1970) sampling table (Appendices I). Therefore, based on a 95% confidence level, the sample size was 260 people. The sample was stratified based on grade. Therefore, the participants were 81 students from grade seven, 91 students from grade eight, and 88 students from grade nine. The final sample was 205 students, as 55 students did not fill the distributed questionnaire. The sample distribution is shown in Table 3.2.

Table 3.2. Research Sampling

No	Grade	SMP Al-Azhar 1		SMP Al-Azhar 37	
		Population	Sample	Population	Sample
1	7	186	60	64	21
2	8	218	71	62	20
3	9	231	75	41	13
	Total	635	206	107	54

3.7 Data Collection

Data were collected using questionnaires (Appendices A) and interviews (Appendices B). The former was distributed to obtain quantitative data, while the latter to obtain qualitative data. Figure 3.2 illustrates the data collection procedure.

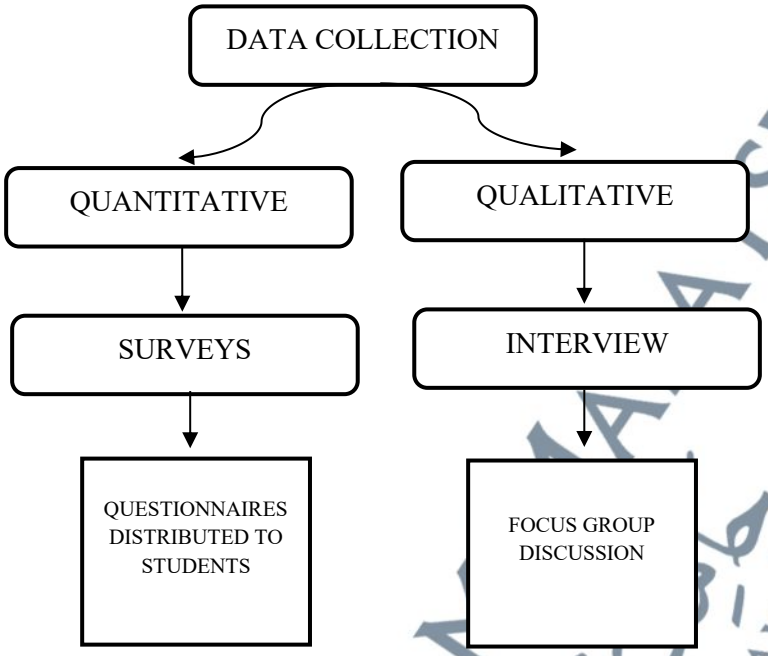

Figure 3.2. Data Collection Procedure

3.7.1 Questionnaires

Questionnaire is a data collection technique where a set of questions or written statements are presented to respondents to be answered (Sugiono, 2013). In this study, data on perception, participation, and interactive multimedia use will be collected using closed questionnaires (Appendices A). The questionnaire uses a five-point Likert scale: "strongly agree", "agree", "neutral", "disagree", and "strongly disagree". The items were adapted from Teoh and Neo (2007), Tago (2012), and Dixson (2015).

Before distributing the questionnaires, the researcher first sought the approval of the principals. The questionnaires were then distributed with the assistance of the PAI teacher or homeroom teacher. The homeroom teacher or teacher was also present to remind all respondents to fill out the questionnaire. It would be better if the researcher himself had directly given the questionnaire to the students. However, this was not possible due to the pandemic.

The researcher shared a Google Form link with the principals, who then sent it to the PAI teachers or homeroom teachers. They then forwarded the links to the respondents so that they can fill out the questionnaires. This was done to ensure that all respondents gave their responses. The instrument was in Bahasa Indonesia. Because the items were adapted from English sources, they were translated to minimize misapprehension and facilitate the respondents' understanding. Translation was done by a native professional Indonesian translator with a background in education and understands English-speaking culture.

3.7.2 Test Instrument

A test instrument was used to collect quantitative data related to the student's cognitive, psychomotor, and affective competencies. The instrument was developed by the teacher to measure the student's abilities. Teachers are professionally required to be able to assess and evaluate students, as stipulated in Law 14/2005 on Teachers and Lecturers. During the learning process, the teacher was required to do pre- and post-tests. To assess affective and psychomotor competencies, teachers are required to be professionally able to develop instruments in the form of rubrics, portfolios, observation sheets, and attitude rating scales. The results of the evaluation are recorded in the students' report books and are organized according to Curriculum 2013 (K-13), the Indonesian national curriculum. The midterm assessment results (PTS) were used as data for the competency variable.

3.7.3 Focus Group Discussion

Focus group discussion (FGD) is frequently used in qualitative research to gain in-depth understanding of social issues. The method aims to obtain data from a purposively selected group of individuals rather than from a statistically representative sample of a broader population (Nyumba et al., 2018). FGD was conducted with a selected group of students, taking into account their gender, grade, class, activeness in class, ability to use interactive multimedia, and willingness to participate in the FGD. The sample was determined purposively, and 12 students were selected. Each grade was represented by two students, one male and one female. However, only 11 students were willing to be interviewed. FGD was carried out with the help of the principals. Before carrying out the FGD, the researchers together with the principals made a schedule for the FGD. On the day of the FGD, the researcher created a Zoom link. The link was sent to the principals, who forwarded it to the PAI teachers or homeroom teachers. They then forwarded it once more to the participants. The FGD was carried out online via the Zoom platform. It was carried out in three sessions with different schedules after the distribution of the questionnaires. Those involved in the FGD were the researcher and 11 students. The FGD focused on information related to the students' perception towards the use of interactive multimedia. Perception was measured using four indicators.

3.8 Pilot Study

A pilot study was conducted prior to primary data collection on 30 students in different subjects. The instrument was tested to determine its validity and reliability (Appendices J). These are detailed as follows.

3.8.1 Reliability

Reliability analysis was carried out to determine that the instrument is a reliable data collection tool. The test used the following formula:

$$r_{11} = \left(\frac{n}{n-1}\right)\left(1 - \frac{\Sigma Si^2}{S_t^2}\right)$$

where:

r_{11} : reliability coefficient
n : number of test items
S_t^2 : standard deviation
P_1 : correct response
P_2 : incorrect response
$\sum Si^2$: variance of each item

Criteria:

0.8 < r > 1.0 = very high
0.6 < r > 0.8 = high
0.4 < r > 0.6 = moderate
0.2 < r > 0.4 = low
r ≤ 0.2 = very low

The r_{table} is set at a significance level of 5% and *k* is the total number of items. If $r_{11} > r_{table}$, the item is considered reliable.

In this study, the reliability test was carried out using the SPSS program. The results of the reliability test for each variable are as follows:

Reliability of Variable X (Interactive Multimedia iPad)

Below are the results of the reliability test analysis for variable X.

Table 3.3. Reliability Variable X

Cronbach's Alpha	N of Items
.942	19

Based on Table 3.4 above, a Cronbach's alpha of 0.942 was obtained. Therefore, variable X was reliable because its value is greater than r_{table} (0.361)

Reliability of Variable Z (Students' Perception)

Table 3.5 shows the results of the reliability test analysis for variable Z.

Table 3.4. Reliability of Variable Z

Cronbach's Alpha	N of Items
.948	20

Table 3.5 shows that the Cronbach's alpha was 0.948. Thus, variable Z was reliable because its value is greater than r_{table} (0.361).

Reliability of Variable Y (Students' Participation)

The reliability of variable Z can be seen in the results of the reliability analysis (Table 3.6).

Table 3.5. Reliability of Variable Y

Cronbach's Alpha	N of Items
.953	19

Table 3.5 shows that the Cronbach's alpha was 0.953. Thus, variable Y was reliable because its value is greater than r_{table} (0.361).

3.8.2 Validity

An instrument is valid if its items precisely measure what it intends to measure. Instrument validity was assessed using Pearson's product-moment correlation (Appendices J):

$$r_{XY} = \frac{N\sum XY - (\sum X)(\sum Y)}{\sqrt{\{N\sum X^2 - (\sum X)^2\}\{N\sum Y^2 - (\sum Y)^2\}}}$$

where:

r_{xy} : correlation coefficient between variable X and Y

N : sample size

$\sum X$: item score

$\sum Y$: total score

At a significance level of 5%, an item is considered valid if $r_{count} > r_{table}$.

The r_{table} with a sample (n) of 30 students and a significance level of 5% was 0.361. The results of the item validity test using the SPSS program for variables X1, X2, and Z (interactive multimedia, perception, and participation) are shown in Table 3.3. The table shows that the r_{count} of all variables were above the r_{table} (0.361). Therefore, all variables were valid.

Table 3.6. Item Validity for All Variables

No	Item			R count			Status
	X	Z	Y	X	Z	Y	
1	Im1	Pc1	En1	.741*	.800**	.790**	Valid
2	Im2	Pc2	En2	.528	.649	.649*	Valid
3	Im3	Pc3	En3	.700**	.718*	.800**	Valid
4	Im4	Pc4	En4	.666**	.784**	.755*	Valid
5	Im5	Pc5	En5	.682**	.601**	.734**	Valid
6	Im6	Pc6	En6	.669	.790**	.761	Valid

7	Im7	Pc7	En7	.780**	.703	.773**	Valid
8	Im8	Pc8	En8	.704	.736	.807**	Valid
9	Im9	Pc9	En9	.723*	.554**	.712**	Valid
10	Im10	Pc10	En10	.697	.689*	.729**	Valid
11	Im11	Pc11	En11	.682*	.717**	.702*	Valid
12	Im12	Pc12	En12	.710	.701	.600*	Valid
13	Im13	Pc13	En13	.734**	.763*	.734*	Valid
14	Im14	Pc14	En14	.811*	.712**	.795**	Valid
15	Im15	Pc15	En15	.647**	.779**	.761**	Valid
16	Im16	Pc16	En16	.756**	.761	.721**	Valid
17	Im17	Pc17	En17	.672	.631**	.782**	Valid
18	Im18	Pc18	En18	.712	.728**	.624**	Valid
19	Im19	Pc19	En19	.721*	.676*	.791*	Valid
20		Pc20			.762**		Valid

X= Interactive Multimedia (Im)
Z= Perception (Pc)
Y= Participation (En)

3.9 Data Analysis

3.9.1 Quantitative Analysis

This study used three statistical techniques: simple regression, ANOVA, and path analysis. Regression was used to analyze the effect of using interactive multimedia on student competencies. ANOVA was used to look for differences in student perception by grade, gender, and school. This technique was used to test the first hypothesis.

Regression and ANOVA were run using SPPS version 12. The analysis was carried out by the researcher alone. Before analyzing the data, the researcher analyzed the normality and multicollinearity of the data. The results of the normality test and other tests are described in Chapter 4.

Path analysis is an extension of multiple linear regression which allows analysis of more complex models (Streiner, 2005, as cited in Sarwono, 2011). The path analysis model used in this study was the mediation model (Jonathan Sarwono, 2011) (Figure 3.3)

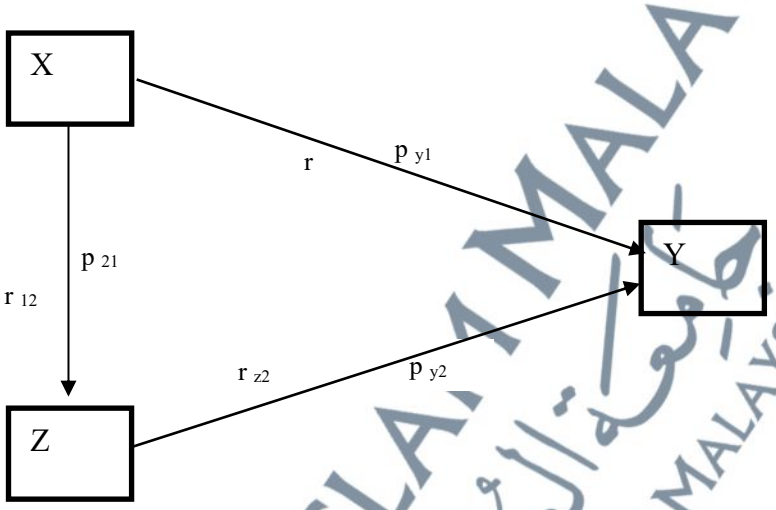

Figure 3.3. Path Analysis, Mediation Model

Where *X* is the independent exogenous variable, *Z* is the endogenous mediating variable, and *Y* is the dependent endogenous variable. This technique was used to test hypothesis 3.b.

The path analysis was run using PLS-SEM 3.0. First, the analysis was conducted using the computed PLS algorithm. The indicators of the results were then checked. This was done to ensure that all indicators met the requirements of validity and reliability.

3.9.2 Qualitative Analysis

The collected qualitative data were analyzed using thematic analysis. It is a qualitative research analysis technique that can identify, analyze, and report the patterns contained in the data and present them in detail and in full (Braun & Clark,

2006). Taylor and Ussher (2001) added that it could be used to interpret various subjects. Thematic analysis is most appropriate for research that uses interpretation as one of the data analysis techniques. It is systematic, allowing researchers to reveal the themes emerging from the data.

There are six steps of thematic data analysis (Braun & Clark, 2006):

a. Recognizing data. The author collects the data by interviewing the respondent and uses a recorder to record the interview. The author then transcribes the oral interview. Transcripts can be an excellent way to get to know the data. They help the researcher to find patterns and codes and identify potential themes. After the transcript is completed, the author checks the original recording once again to maintain its accuracy. He then reads the interview transcript carefully to find interesting ideas or terms that are considered important to be analyzed. There are two main forms of coding, data-driven and theory-driven. Coding will to some extent depend on whether the theme is more driven by data or theory. For the first, the theme will depend on the data, but for the second, the researcher might approach the data with pre-conceived ideas and codes.
b. Initializing code. Generate the initial code from the data. The author encodes the results of reading the interview transcript carefully by making notes under each interview question to show potential patterns. The researcher starts by listing the categories first and then looking for data in the text that match this predetermined category. The purpose of the qualitative part of this study is to explain in more depth the quantitative results. Therefore, in the second stage of the analysis of this study, the data were coded based on the quantitative results.

c. Looking for themes, which are broader meanings of codes. They are coherent and meaningful patterns of data that answer the research questions. In this phase, the author begins to sort and compile different codes into potential themes.

d. Reviewing themes. The author revisits the generated themes. The relationship between the themes and code must be clear and coherent. Therefore, researchers need to re-read the codes compiled under each theme. If there are themes that are considered inappropriate, they should be reduced or eliminated. Potential themes can also emerge at this stage. This stage is carried out to find accurate themes.

e. Defining and naming the theme to describe the main points of the data that have been compiled into themes and to make an analytical narrative of how the themes are appropriate for solving the research problems. The researcher decided to do a semantic level analysis to identify the theme. It is used to look deeper into what the respondent says and relate it to relevant literature.

f. Generating reports. Writing reports based on the results of thematic analysis to tell and convince readers with sufficient evidence (Braun and Clarke, 2006). At this stage, the researcher has analyzed the data in such a way to provide a concise, coherent, and interesting story about the data. The researcher produces an analysis report by linking back to the research questions and literature.

The alignment of research objectives, questions, and methods are shown in Table 3.7.

Table 3.7. Alignment of Research Objectives, Questions, and Methods

No	Research objective	Research question	Data collection	Data analysis
1.	a. To investigate the perception of students towards using interactive multimedia device	How do students perceive using interactive multimedia to learn PAI	- Interview - Questionnaire	- Thematic analysis - Descriptive analysis
	b. To investigate the effect of interactive multimedia on student participation	Does student perception towards using interactive multimedia significantly differ by grade level, gender, and school origin?	Questionnaire	- ANOVA
2	To investigate the effect of using interactive multimedia on student competencies	Does interactive multimedia influence student competencies?	Questionnaire Midterm exam results	- Simple Regression - Thematic
3	To investigate the mediating effect of student perception on the relationships between interactive multimedia and student participation	Does student perception mediate the relationship between interactive multimedia and student participation?	Questionnaire	- Path analysis

a. Reliability of Qualitative Data

The reliability of qualitative data in this study was ensured by referring to several considerations proposed by experts, namely through the consistency of data obtained from various sources (Fraenkel & Wallen 1993). Merriam (1990)

proposed three strategies to ensure the reliability of research data, namely explaining the position of the researcher, triangulating, and reporting the audit trail (Appendices E). According to Lincoln and Guba (1985), an audit trail is a detailed description of how data were collected, how categories were obtained, and how decisions were made during the research. Reliability can also be ensured by using various sources and various data collection methods. This method is also known as triangulation (Bogdan & Bilken, 2003; Creswell, 1994).

b. Cohen's Kappa Agreement Coefficient

The findings of this study are entirely based on the researcher's own interpretation, so certain steps have been taken to ensure the validity and reliability of the interpretation. Therefore, to determine the validity and reliability of the interpretation, Cohen's kappa was computed. Its aim was to find the degree of agreement of the unit of analysis with the theme or construct being studied. Expert agreement on the constructed theme is important because it indicates the inter-rater reliability of the themes generated by the researcher (Cohen 2000).

The researcher received the assistance of three lecturers who are experts in qualitative research methods, education, educational technology, and Islamic education to revise the constructed themes (Appendices G). To carry out this procedure, interview transcripts that have been coded to themes and sub-themes, as well as the unit of analysis, were submitted to the reviewers. They then made individual reviews of all the items. They marked either "agree" or "disagree" on each item and provided comments when necessary. When there was no

agreement on the code and definition provided by the researcher, the code or definition was changed to be more accurate.

The researcher selected 39 lines of the interview transcripts that relating to the themes and sub-themes of student perception towards the use of interactive multimedia in PAI learning. Following the review, the researcher used the following formula to find the coefficient of agreement:

$$K = \frac{f_a - f_c}{N - f_c}$$

Where K = Coefficient of agreement

f_a = Approval unit

f_c = 50% expectation of agreement

N = The number of units tested is the approval value.

The units of agreement (f_a) obtained in this study were as follows: expert A = 38 coding units, expert B = 37 coding units, and expert C = 36 coding units. The expected agreement (f_c) was 19.5 and N was 39. Table 3.7 shows the computed Cohen's kappa coefficient.

Table 3.8 Inter-rater Agreement

No.	Name	Position	Specialization	Cohen Kappa (Score)
1.	Expert A	Professor	Education	Very High (0.95)
2.	Expert B	Senior Lecturer, Dr.	Educational technology	High (0.8)
3	Expert C	Senior Lecturer, Dr.	PAI	High (0.8)

The coefficient of agreement from the three reviewers was 0.89, which is in the high category (Table 3.8). The high level of agreement based on Cohen's kappa coefficient indicates the high reliability of the data of this study.

Table 3.9 Cohen Kappa Approval Level Indicator

Cohen's Kappa	Indicator
> 0.90	Very High
0.70 – 0.89	High
0.30 – 0.69	Normal
< 0.30	Low

Source: Wiersma (2000)

3.10 Conclusion

This chapter has explained the methods used to examine the effect of interactive multimedia on student competencies, mediated by student perception. This study employed the mixed methods approach, combining qualitative and quantitative methodologies. It is used to explore a phenomenon in more depth by examining it using quantitative and qualitative data. The population of this study was all students at SMPIT al-Azhar 1 and SMPIT Al-Azhar 37. The qualitative sample of 11 students was selected using a purposive sampling technique. The quantitative sample of 205 students was selected using a stratified random sampling technique.

To accomplish the research objectives, the researcher collected data through an FGD and by distributing questionnaires to the sample. The data were analyzed qualitatively and quantitatively. Qualitative data were analyzed using thematic analysis, while quantitative data were analyzed using Smart-PLS and SPSS.