

Wrong Uses in the Verification Procedures of Reliability and Validity of Research Instruments in Master's Theses in The College of Education at Sultan Qaboos University: An Evaluative Study

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Abstract

This study aimed at assessing the procedures followed in verifying the reliability and validity of the research instruments in master's theses in the College of Education at Sultan Qaboos University (SQU- College of Education master's theses). The sample of the study consisted of 260 master's theses in different majors in the College of Education. An analysis form was designed to collect primary data from the study sample. The findings of the study showed that more than two thirds of the graduate students in the College of Education at Sultan Qaboos University used only face validity to verify the validity of their research instruments and Cronbach's alpha coefficient to verify the reliability of their research instruments. The findings also revealed that (27%) of the total number of the master's theses used standardized or published research instruments. In addition, there were common mistakes in the verification procedures used in validating the reliability and validity of the research instruments. For example, in all the master's theses, validity was verified before reliability, while it should be the other way around. In all master's theses, the degree of consistency of the items in the instrument was not fully measured because the internal consistency of the instrument was excluded. The Kuder-Richardson formula was never used in the sample despite its importance in calculating the internal consistency of a test. (39%) of the MA theses used the test as one of their research tools. There was a disagreement in naming validity associated with content as some called it internal consistency validity despite the fact that internal consistency is one of the methods of checking reliability. Based on the findings, the study suggested a list of recommendations, one of which was to establish a center for statistical consultancy in the Faculty of Education at Sultan Qaboos University.

Keywords: Master's theses, reliability, Sultan Qaboos University, validity, wrong uses.

Introduction

Research plays a crucial role in the development of societies. It is one of the tools that helps make progress and achieve goals. Research also helps societies to overcome difficulties as it aims to settle issues and predicts solutions to new challenges. Moreover, based on research findings, right decisions can be taken to better serve the community. Educational research is as important as scientific research as the former deals with the study of human behavior that contributes to the development of research in general. Therefore, educational research requires more attention and precision in its preparation as well as following all the procedures that lead to accurate and valid results. In this context, it has been noted that some researchers do not have the necessary skills and competencies to conduct scientific research. As a result, they make many mistakes in research in general and in master's and PhD theses in particular (Al-Omar, 2020). This led many researchers such as Al-Wahaibi, (2020),

Mahmoud, (2019), Al-Omar, (2020), Dhabih, (2017), Al-Shafi'i, (2010), Belghit, (2020), Al-Askari and Ayez, (2012), Abdel-Fattah, (2015), Moawad and Eid, (2010), Al-Hosania and Al-Ghatami, (2021), Ben Brih, (2017, (Khudairi), 2021, Hassan, (2016) and Al Ratal, (2020) to review research studies and university dissertations to check whether the studies follow correct research procedures or not.

Problem Statement

In order to ensure the reliability, validity and significance of any research or educational study findings, it is necessary to ensure the correct implementation of research procedures and the accuracy of its elements. If the instrument used in the study is not characterized by good psychometric properties, it will yield misleading results and incorrect decisions. Therefore, to have solid and valid educational research, it is necessary to verify the validity and reliability of its instruments. It is also important to check whether the instruments used really measure what is intended to be measured. This is what the present study aspires to find out.

Research Questions

1. What are the procedures followed in verifying the reliability and validity of scientific research in SQU- College of Education master's theses?
2. What is the percentage of the dependency of SQU- College of Education master's theses on standardized or published research instruments?
3. What are the common mistakes made in the research procedures to verify the reliability and validity of the research instruments in SQU- College of Education master's theses?

Research Objectives

The study aims to:

- 1- Evaluate the procedures used in verifying the reliability and validity of scientific research instruments in SQU- College of Education master's theses;
- 2- Measure the ratio of dependency of SQU- College of Education master's theses on standardized or published research instruments;
- 3- Identify the wrong uses of the procedures followed while verifying the reliability and validity of scientific research instruments in SQU- College of Education's master's theses.

Significance of the Study

This study will guide and enlighten higher education students about the correct uses that should be followed to ensure the validity and reliability of their research instruments. Moreover, the study will help improve the quality of research findings which contribute to acquiring or increasing knowledge.

Limitations of the Study

This study focuses only on master's theses that were approved in the College of Education at Sultan Qaboos University during the period (2001-2021). Therefore, this study has mainly spatial temporal limitations as it investigates the wrong uses in the verification procedures of the research instruments in a specific location and during a specific period of time.

Research Terminology

The reliability of the measurement instrument: it means when the instrument gives a close or the same result when applied more than once under similar conditions (Abbas et al., 2019).

The validity of the research instrument: it means whether the instrument measures what it aims to measure (Al-Dhaman, 2007; Golafshani, 2003).

Theoretical Framework

Reliability and validity are two terms that represent the psychometric properties of the research instrument or scale. Through them, the research strength or weakness is judged. They ascertain and reassure researchers about their decision to apply a certain scale or a research instrument to the study sample. In addition, the research findings can be validated and generalized to the research population through these two concepts.

Reliability and validity are concepts or terms that instruments must have in order to be usable

(Ahmed & Farhan, 2018; Albadrany, 2020). Thus, reliability and validity are regarded as major elements that researchers must consider when they design their research and analyze their research findings to accurately measure the quality of their research (Golafshani, 2003). Reliability and validity are closely related to each other. Validity is evidence of reliability. However, reliability does not mean the same as validity because a reliable instrument does not necessarily mean that it is valid (McGoey, et al., 2010). As mentioned by Hilsenroth, et al. (2004) and Hassan (2014), it is necessary first to verify reliability and then validity.

In this context, there are numerous ways to measure reliability. Researchers have agreed to name these ways as types of validity. However, the truth is that validity is one concept, but it is measured in different ways. So, there are no types of validity, but only methods for checking it. No one single method can be an alternative for the rest, but it measures one side of validity (Hassan, 2014; Mahmoud, 2019). The most common methods are statistical conclusion validity, internal validity, external validity, construct validity, content validity and criterion validity which consists of predictive validity and concurrent validity (Hassan, 2014, Drost, 2011).

Literature Review

Considering the common errors found in research in general, many studies have dealt with evaluating master's theses approved in different universities. Others have evaluated master's theses or published studies in light of specific methodological errors related to some aspects of the elements of scientific research, such as verifying the correct procedures for measuring the validity and reliability of the research instruments or the way of presenting the problem.

The following are some of these studies:

Al-Wahabi's study (2020) aimed to examine the reality of using indicators of statistical significance and the size of its impact in the educational master's theses approved in Omani universities. The study sample consisted of 628 master's theses from all Omani universities. The researcher created a new criterion which was different from Cohen's criterion (1988) to study and explain the value of the practical significance indicators. The

findings showed that the number of statistical tests used in master's theses reached 11926 tests. Practical significance indicators were used only in 7% of the total statistical tests. The findings also showed that 26.5% of the decisions reached by master's theses in Omani universities were inaccurate.

Mahmoud's study (2019) aimed at identifying common errors in the procedures followed in verifying the validity and reliability of the research instruments used in Arabic studies. The sample used for his study consisted of 72 research studies published in the Islamic University Journal of Educational and Psychology Studies in the period between 2012 and 2016. In his study, 92 research instruments were detected. The results of the study revealed that most of the instruments used were prepared by the researchers themselves, and only 15% of them were standardized or published tools. The results also revealed several common errors in the procedures followed in verifying the reliability and validity of the research instruments, including the failure to verify the availability of the conditions for using the correlation coefficient in calculating reliability through the re-application method. In addition, his study showed that the studies did not calculate the reliability of standardized measures although the principle is that reliability must be calculated even in standardized measures because it is specific to the sample and not to the scale.

Hassan's study (2016) aimed at examining the mistakes that researchers and investigators made in psychological and educational research. The study followed the qualitative method, and shed light on common mistakes found in scientific research that researchers make. Such mistakes were related to procedures for validating reliability and validity, such as the necessity of calculating reliability first and then validity, as well as the great confusion between validity and internal consistency, which is a method of calculating reliability.

Hardan (2014) conducted a study that aimed at evaluating and analyzing the scientific methodology of the educational master's theses at Sultan Qaboos University from 2002 to 2013. The sample of the study consisted of 144 master's theses. The results of the study revealed that more than two thirds of the theses used the descriptive method, and that descriptive statistical methods were the most common methods used in these scientific theses. The study also showed that the standards of scientific research were achieved respectively in the psychology, curriculum and management majors.

Through reviewing previous studies, the researcher found that the procedures of reliability and validity in SQU- College of Education's master's theses have not been evaluated. As far as the researcher is concerned, the two studies conducted on the master's theses at the College of Education at Sultan Qaboos University, (Al-Wahaibi, 2020; Hardan, 2014) did not address this topic. So, this study is the first of its kind, as far as the researcher is concerned, that addresses the topic of reliability and validity in the master's theses at Sultan Qaboos University.

Research Methodology

This study used a descriptive survey approach in analyzing the data. This approach is based on studying scientific phenomena according to their availability in reality, identifying the most widespread and obvious qualities in them, describing these qualities accurately and identifying the relevant components that represent these qualities. Descriptive analysis should

focus on adjusting patterns in the study data, diagnosing them and analyzing them to find out how to explain and interpret them appropriately (Al-Wahaibi, 2020).

Data Collection and Sampling

This study included all the MA theses submitted to different departments at the College of Education at Sultan Qaboos University from the opening of the master's programs in the college in 1992 till the end of 2021. All the MA theses were published in Dar Al-Manduma which represents the largest database for Arabic theses and dissertations. The number of the MA theses which were examined was 1640. The master's theses which were in education, Islamic sciences and English language curricula were excluded. A random sample of 260 MA theses was selected. The sample represented about 16% of the total submitted theses in various departments at the College of Education at Sultan Qaboos University as shown in Table 1.

| Major | Psychology Curriculum | Educational Management | Educational Technology | Physical Education | Total |
|---------------------|-----------------------|------------------------|------------------------|--------------------|-------|
| Number of MA Theses | 74 | 148 | 26 | 10 | 260 |

As shown in Table 1, more than half of the theses were from the major of curriculum, and this is because the specialization of the Master of Education in Curricula and Teaching Methods was one of the first specializations that were introduced to the university in 1992. This major includes subjects such as Islamic Education, Arabic, English, Mathematics, Social Studies and Science (Al-Wahaibi, 2020)

Research Instrument

To carry out the study, an analysis form was prepared to analyze the content of the SQU-College of Education's master's theses regarding the procedures used for verifying the reliability and validity of their measurement instruments. The instruments consisted of two main parts:

Part I: It included basic data such as specialization and year of the master's thesis defense.

Part 2: It dealt with the data that addressed the procedures followed in verifying the validity and reliability of the measurement instruments. It consisted of methods of measuring reliability and methods of measuring validity and details related to them. Table 2 shows the initial analysis form.

Table 2 *Initial image of the analysis form*

| Number of letter | Instrument | Validity instruments | Reliability instruments | Validity details/errors | Reliability details/errors | Notes |
|------------------|--|--|---|-------------------------|----------------------------|-------|
| 1 | <input type="checkbox"/> test <input type="checkbox"/> others <input type="checkbox"/> standardized <input type="checkbox"/> prepared by researcher | <input type="checkbox"/> face <input type="checkbox"/> content <input type="checkbox"/> concurrent <input type="checkbox"/> factorial <input type="checkbox"/> intrinsic <input type="checkbox"/> discriminant <input type="checkbox"/> others | <input type="checkbox"/> Alpha <input type="checkbox"/> split-half <input type="checkbox"/> reapplication <input type="checkbox"/> correction reliability <input type="checkbox"/> parallel forms <input type="checkbox"/> others | | | |
| 2 | | | | | | |

The analysis form was distributed to a group of reviewers. None of its details had been modified to ensure the face validity of the instrument and its convenience. Since this instrument does not measure opinions or perceptions but rather measures reliability and validity, it is considered constant, and there is no need to calculate its reliability (Al-Wahaibi, 2020).

Study Procedures

- 1) After producing the instrument in its final form, the researcher finalized the number of the SQU- College of Education master's theses by reviewing the dissertations published in Dar Al-Manduma as the university publishes all master's theses there periodically (Al-Wahaibi, 2020). After that, the selection of the study sample was made in a random way.
- 2) Subsequently, each MA methodology section was thoroughly scrutinized to extract the required data in the instruments.
- 3) Later, a statistical analysis of the extracted data was carried out, and the research questions were answered.
- 4) The statistical methods used in the study are the frequencies and percentages of the answers to the three study questions.

Research Results

The Answer to the First Question:

What are the procedures followed for verifying the stability and reliability of the research instruments in SQU -College of Education master's thesis?

To answer the first question, all the conventional instruments of reliability and validity recognized in educational research and used in the SQU - College of Education master's theses were collected. Since there were different research instruments used in the same thesis, the researcher of this study considered only one instrument from these that used similar methods in calculating the reliability and validity of all research instruments used in the same thesis. However, in theses that used different methods of calculating reliability and validity, all the instruments were included. Thus, the total number of instruments used in these theses was 260.

A. Methods of Calculating Reliability

The results of the analysis showed that more than (70%) of the SQU- College of Education MA theses were limited to the method of Cronbach alpha in calculating the reliability of their research instruments to answer their research questions. In the second place came the method of re-application which represented (6%) of the MA sample when used alone. Table 3 shows the frequencies and percentages of the methods of calculating reliability of MA theses at the College of Education in Sultan Qaboos University.

Table 3 *Frequencies and percentages of the methods of calculating reliability of MA theses at the College of Education in Sultan Qaboos University*

| NOMethod | | Frequency | Percentage |
|-----------------|--|------------------|-------------------|
| 1 | Internal consistency of Cronbach Alph method only | 186 | 72% |
| 2 | Internal consistency of split-half method only | 2 | 1% |
| 4 | Equivalent forms only | 4 | 2% |
| 5 | Reapplication only | 15 | 6% |
| 6 | Correction reliability only | 14 | 5% |
| 7 | Cronbach Alpha + reapplication | 16 | 6% |
| 8 | Cronbach Alpha + split-half method | 1 | 0% |
| 9 | Cronbach Alpha + equivalent forms | 1 | 0% |
| 10 | Cronbach Alpha + correction reliability | 1 | 0% |
| 11 | Cronbach Alpha + split-half method + reapplication | 1 | 0% |
| 12 | No calculation of reliability because of the use of a standardized scale | 13 | 5% |
| 13 | Cronbach Alpha +split-half method + equivalent forms | 1 | 0% |
| 14 | Cronbach Alpha + interclass correlation coefficient | 2 | 1% |
| 15 | Interclass correlation coefficient | 3 | 1% |
| Total | | 260 | %100 |

The study also found that the split-half- method was rarely used by MA students in checking the reliability of their research instruments. As the findings revealed, (2%) only used this method. The results also showed that the vast majority of the SQU- College of Education MA theses with a percentage of (85%) used only one method to verify the reliability of the research tools, and (8%) only used two methods to verify reliability. On the other hand, only two studies from the sample used three methods which are studies that aimed to reveal the psychometric properties of specific scales. With regard to the MA theses that used standardized or published scales, nearly one-fifth did not recalculate the reliability of these scales.

B. *Methods of Calculating Validity*

The analysis of the research results showed that more than two thirds of the MA theses in the study sample were satisfied with calculating only the apparent validity of the research tools that they used. (15%) of them calculated the validity of the content with the apparent reliability. While (11%) of the study sample did not calculate validity due to the use of a standardized or published scale. Table 4 shows the Frequencies and percentages of the methods of calculating validity of MA theses at the College of Education in Sultan Qaboos University.

Table 4 *Frequencies and percentages of the methods of calculating validity of MA theses at the College of Education in Sultan Qaboos University*

| NO | Method | Frequency | Percentage |
|----|---|------------|-------------|
| 1 | Face validity only | 174 | 67% |
| 2 | Content validity/internal consistency only | 1 | 0% |
| 3 | Discriminant validity only | 0 | 0% |
| 4 | Concurrent validity only | 0 | 0% |
| 5 | Factorial validity only | 1 | 0% |
| 6 | Face validity + internal consistency | 40 | 15% |
| 7 | Face validity + concurrent validity | 4 | 2% |
| 8 | Face validity + factorial validity | 2 | 1% |
| 9 | Face validity + Discriminant validity | 2 | 1% |
| 10 | Face validity + intrinsic validity | 1 | 0% |
| 11 | Face validity + more than one method | 6 | 2% |
| 12 | Face validity + factorial validity | 1 | 0% |
| 13 | No calculation of validity because of the use of a standardized scale | 28 | 11% |
| | Total | 260 | %100 |

As for the other types of validity, such as discriminant, factorial, content, or convergent validity, they were not used at all individually. However, some of them were used in very small percentages, and the percentage did not exceed (2%) with face validity. Concerning factorial validity, one study from the sample used it. One used it alone and another one used it with concurrent validity, and both studies aimed to verify the psychometric properties of a specific scale.

The results obtained from the statistical analysis of the data of the study also showed that there was a weakness in the accuracy of the research instruments due to the weak procedures followed in verifying their reliability and validity. This may suggest the inaccuracy of the results of the SQU- College of Education MA theses as the accuracy of the results and their strength in making the right decisions are related to the accuracy, reliability and validity of the research instruments used in the data collection. This result differs from the findings of Mahmood (2019) which revealed that the ratio of using face validity or Cronbach alpha was about one third of the study only.

The Answer to the Second Question

What is the ratio of dependency of SQU- College of Education MA theses on standardized or published research instruments?

To answer this question, the researcher identified the number of scales and research instruments which were standardized or used by other researchers and which the SQU- College of Education MA students had benefited from. There were about 70 scales with 27% of the total number of MA dissertations which were involved in the study sample. The MA students did not recalculate the reliability and validity of nearly two thirds of the instruments. The number of instruments which were not calculated was 41 instruments which represented 16% of the total master's theses. This is considered one common error in the procedures for checking the reliability and validity of scientific research tools as it is assumed that the reliability of standardized instruments and other instruments should, at least, be calculated. The conventional theory of measurement states that reliability is related to the study sample. This result is in line with the result of a study conducted by Mahmoud (2019). In addition,

this study revealed that the students who used standardized scales were the students of the Department of Psychology with a percentage of 56 %, and the students of curricula and methods of teaching mathematics and sciences with a percentage of 41%. This finding is expected as standardized psychological instruments are the most widespread compared to questionnaires used to measure educational and human phenomena in general. The students of the Department of Psychology had better skills in using the best methods in statistical analysis compared to the rest of the disciplines. This is due to the nature of the study in this department which is characterized by the depth of the statistical courses as the students study courses in research methods and educational statistics in addition to statistical courses that other MA students have in the other majors. For example, MA students who study Psychology at SQU study an advanced statistics course which introduces them to advanced statistical methods (Hardan, 2014). The students of Psychology seem to benefit from their professors in the Department of Psychology who are experts in statistics, measurement and assessment. The standards of statistical analysis are available more in Psychology than in the rest of the disciplines, followed by the curriculum specialization and then the management specialization. This finding is in line with the study of Moawad and Eid (2010) which indicated that the scientific errors in the research of the Department of Psychology are fewer than those in the research of the other disciplines such as management and curricula.

The Answer to the Third Question

What are the wrong uses in the procedures used for verifying the reliability and validity of the research instruments in master's theses at the College of Education at Sultan Qaboos University?

The study found that MA students at the College of Education at Sultan Qaboos University used wrong methods in the procedures which they followed to verify the validity and reliability of their research instruments which can be summarized as follows:

- 1) In all the SQU- College of Education MA theses involved in this study, validity was calculated before measuring reliability, and this practice was one of the common mistakes according to Hassan (2016, 2014) who mentioned that the right way is to measure reliability first and then validity. Common practice stipulates that each valid measurement is by default a reliable one, and not the other way around. As the tool can be reliable but does not measure the phenomenon that needs to be measured. Based on this, if we measure validity first and the tool was valid, there is no need to measure its reliability later on. Therefore, we must calculate reliability, and after getting rid of inconsistent items, we can measure validity. Moreover, reliability is one of the necessary conditions for validity, but it is not sufficient, as we need to measure it first and then calculate validity.
- 2) All SQU-College of Education MA theses which were involved in this study sample did not calculate the reliability of the items of the instruments which they used. Instead, they only calculated the total reliability of the instrument, and some calculated the reliability of the instrument items. However, it is more accurate for the researcher to refer to the reliability of each item of the instrument to specify the items that contribute a small percentage to the overall reliability of the instrument which the researcher can delete or modify to raise the total reliability of the instrument. This result agrees with the findings of Hassan (2016).
- 3) 102 MA theses i.e.,39% of the total number of the study sample used the test as one of the research instruments. All but one thesis used the Cronbach's alpha method to verify the reliability of the test. It was supposed to use the Kuder formula KR20 to

- calculate reliability. It fits objective items or correct and wrong items that take one of two possibilities 0 or 1 as an answer (Abbas et al., 2019).
- 4) Some master theses which used the test as one of their instruments neglected to find the coefficients of difficulty and discrimination for these tests as one of the verification procedures of validity and reliability. The theses that discussed the coefficients of difficulty did not exceed 12%. Only 18% of the MA theses that used the test calculated the coefficients of discrimination for the tests. This may lead to question the strength of the tests used in these MA theses as one of the features of a good test is that it is characterized by good difficulty and discrimination coefficients.
 - 5) The restriction of the SQU- College of Education MA theses to the use of Cronbach's alpha coefficient and the method of re-application to verify the reliability of the research instruments and scales was another weakness. Other methods such as the split-half method were neglected. This method was used only in 4 out of 260 theses. There was also a limited use of equivalent forms time interval which were used in only 2% of the total MA theses. Moreover, the limited use of certain methods such as Cronbach's Alpha method to calculate reliability indicates the limited understanding and knowledge of SQU-College of Education MA students of these methods.
 - 6) What is mentioned in the previous part about having one or two ways to measure the reliability of the thesis instruments applies also to the methods used to calculate the validity of the instruments. Two thirds of the students were limited to using face validity to verify the validity of their instruments. As far discriminant validity is concerned, it was used by 3 theses only. intrinsic validity, which is equal to the root of the reliability coefficient, was used in 2 master's theses only.
 - 7) There was no agreement on naming validity associated with content. Some called it the validity of items, and others did not give it any name and only wrote "validity". However, others called it the validity of internal consistency. Although internal consistency is one of the ways to check reliability and validity. This result is in line with what was indicated by a study conducted by Hassan (2016) in that reliability is related to the consistency of the measure over a period of time, or the reliability of the measure in different circumstances. In addition, this was confirmed by the study of Zabihi (2017) who thinks that researchers get confused between validity and internal consistency.
 - 8) There was a shortcoming in describing the procedures used to analyze the results of face validity related to the opinions of the reviewers about the research instruments. About 42 % of the MA theses that used face validity to check the validity of their tools did not mention the analysis of the reviewers' responses. They commented only on editing the research tools based on the reviewers' comments and opinions.
 - 9) Factorial validity was not addressed as one of the procedures for calculating the validity of the research tool except in 3 MA theses, and these master's theses aimed at examining the psychometric properties of the research instruments.
 - 10) In all master's theses of the study sample, there was no verification of the conditions and assumptions of using correlation coefficients such as moderation and homogeneity when using Pearson correlation coefficient in the re-application method to calculate reliability. This result agrees with the results of the studies conducted by Al-Hazmi (2003), Mahmoud (2019) and Al-Wahaibi, (2020).
 - 11) In the method of re-application to calculate reliability, there was no clear justification for determining the duration between the two applications. It is supposed to be determined based on the nature of the sample or the nature of the target phenomenon (Mahmoud, 2019). The MA students just mentioned the period of time which varied between 2 to 4 weeks.

Study Recommendations and Suggestions

Based on the study findings, several recommendations and suggestions can be made, most important of which are as follows:

- 1) MA students at the College of Education at Sultan Qaboos University should be guided through the methods used in the procedures for verifying the validity and reliability of research tools.
- 2) A center for statistical consultancy at the university should be established to review the statistical aspects used in master's theses before they are approved to check their validity and reliability.
- 3) Students' awareness of the importance of benefiting from standardized and published instruments should be raised so that the students can rely on these instruments when they write their theses.
- 4) This study can be applied to other MA theses from the colleges of humanities at Sultan Qaboos University such as the College of Economics and Political Science, and the Department of Sociology at the College of Arts.
- 5) More studies should be conducted to verify the wrong uses of the various statistical methods used in MA theses in the College of Arts and Humanities at Sultan Qaboos University.

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