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Validity of The Career Interest Inventory Competence Instrument (K-IMK) Using the Fuzzy Delphi Method (FDM)

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ABSTRACT

This study aims to obtain expert agreement on the content validity of the Career Interest Inventory Competency Instrument (K-IMK). The K-IMK instrument contains three main constructs namely knowledge, skills and attitudes. There are 58 question items with a breakdown of each Attitude Construct 19 question items, Knowledge Construct 22 question items and Skill Construct 17 question items. In this study, the Fuzzy Delphi Method (FDM) uses five Likert scales to obtain expert agreement. A total of 15 experts in the field were used in this study to determine the value of the expert agreement. The results of this study found that the construct in this instrument got more than 75% and the threshold value is (d) < 0.2.

Contribution/Originality: This article contributes to existing literature related to the content validity of the Career Interest Inventory Competency instrument (K-IMK) for secondary school guidance and counseling teachers using the Fuzzy Delphi Method (FDM).

1. Introduction

The development of an instrument involves an important process. Among those processes is the process of validating an instrument. Validity can be defined as an instrument that can accurately measure something that we want to measure or the ability to measure something that should be measured (Mohammed Afandi et al., 2020). DeVellis (2017) and Furr (2014) argue that even if an instrument has high reliability it does not mean that the instrument does not have a good validity value because the psychometric characteristics of an instrument will be affected. The validation process is important to produce instruments that are accurate, useful, consistent, appropriate and meaningful (Furr 2014; Ghazali & Sufean, 2016).

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The Fuzzy Delphi Method (FDM) was introduced in 1985. Researchers named Murray, Pappino and Gisch introduced this technique by combining Fuzzy numbering sets with the traditional Delphi method. This method provides agreement by combining several experts to express ideas, criticize and improve the content of items that have been constructed by the researcher (Mohd Yusaini et al., 2020).

Competence is an important element in making the Malaysian Education Development Plan 2015-2025 a success. This is also important to drive the Industrial Revolution 4.0 that is taking place in Malaysia. Competence components according to Spencer and Spencer (1993) can be divided into 5 parts, namely knowledge, skills, motivation, traits and self-concept. Competence components can also be categorized into 2 parts according to the Spencer and Spencer (1993) iceberg model, which are visible components and hidden components.

Zahari (2018) states that competence can be classified into 3 parts namely knowledge competence, skill competence and attitude competence. Attitudinal competence can be built with training that combines aspects of individual knowledge and skills. However, a combination of these competency components is required to enable a teacher to carry out his duties well and effectively (Syed Jaafar, 2014; Mad Islaihi, 2017; Khuzaimah et al., 2019). This clearly shows that the combination of competency components is important in developing the quality of guidance counselors on psychometrics.

1.1. Statement of the Research Problem

Starting in 2007, the Malaysian Ministry of Education (MOE) introduced School-Based Assessment (SBA) for secondary schools throughout Malaysia. One of the PBS components is a psychometric test involving the Career Interest Inventory. This psychometric assessment has involved all 1st and 3rd -grade high school students throughout Malaysia. This assessment has a positive impact on the development of students' talents and potential in schools (Muzarina et al., 2019).

According to literature and reviews obtained from library research, after ten years of psychometric implementation in schools, there are no indicators or instruments that can be considered as a yardstick for the competence of guidance and counselling teacher regarding the Career Interest Inventory. This will make it difficult for the MOE to gauge the level of competence of the guidance counselor regarding the Career Interest Inventory. There is hardly any data related to the competence of guidance and counselling teacher regarding the Career Interest Inventory, which will pose difficulty for the MOE to effectively evaluate and design courses or programs related to psychometrics. Kaplan and Saccuzzo (2018) stated that the main issue in testing and measurement is the competence of psychologists to carry out the testing process without having formal qualifications and training regarding the tools used.

The issue of the competence of guidance and counselling teacher as well as ethical violations in the use of psychological tests often occurs. Shapiro (2016) stated that the lack of competence of guidance and counselling teacher in performing psychological tests will lead to issues and ethics during the use of psychological tests. Wright et al. (2020) stated that there is an increase in the training of psychologists in conducting psychological tests but there is a lack of clear guidance in implementing related practices. Sidek Noah (2005) states that if a guidance and counselling teacher does not have sufficient training in this field but tries to give and interpret the test, he is actually

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violating ethics. Different psychological testing tools require different levels of ability and knowledge to administer and interpret related testing tools. These findings are also supported by Jose and Hernandezy (2020), stating the need for continuous training to create competent psychologists in implementing various psychometric test tools.

1.2. Purpose of the Study

This study aims to build a competency instrument for secondary guidance and counselling teacher for the implementation of the Career Interest Inventory in schools.

1.3. Research Objective

i. Identify the main constructs of the K-IMK questionnaire instrument based on expert consensus.
ii. Reviewing the priority order of K-IMK instrument constructs based on expert consensus.

2. Literature Review

2.1. Instrumental Constructs

The theoretical framework in this study is based on Hay McBer's Iceberg Model (Hay, 1996) and Spencer and Spencer's (1993) competency theory. According to Spencer and Spencer (1993), constructs such as knowledge and skills are competencies that can be seen, only on the surface and general characteristics of individuals. This type of competence is easier to apply especially through training and courses and can be linked to academic qualifications (Norzaini & Mohammed Sani, 2007). Personal traits and motivation are latent competencies, deep and related to individual personality. This type of competence is quite difficult to measure and implement through training. Self-concept such as attitude and value is a competency that is in the middle between these two dimensions. This type of competence can be cultivated through training but requires more time. Personal characteristics such as personal traits, motivation and self-concept are important to distinguish high-performing employees from average-performing employees (Norzaini & Mohammed Sani, 2007). However, in this study, the researcher has combined self-concept, personal traits and motivation into the attitude construct. This is in line with the studies of Zaiha Nabila (2014), Syed Jaafar (2014), Roslan (2015) and Zahari Suppian (2018).

2.2. Fuzzy Delphi Method (FDM)

The FDM method is widely accepted in Malaysia in contact with Education studies (Zarina & Azizah 2020). However, there have been many studies that use FDM such as design and development studies as well as in the instrument construction process. The FDM method for the validation of questionnaire instruments was employed by Mohd Yusaini et al. (2020) who used 15 experts as a study sample. The FDM method can provide answers to uncertainties related to an issue and it is more effective in providing answers (Zarina & Azizah, 2020). This attracts the interest of researchers to use the FDM method in providing answers to expert views related to an instrument. This approach has been used and accepted by other researchers to collect data based on the consensus of a group of experts on an issue under study (Zarina & Azizah, 2020). This method is

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based on the similarity function to measure the level of agreement and consensus between experts (Ramlan & Ghazali, 2018).

2.3. Issues in Psychological Testing

Career counseling services in Malaysia have long been introduced. Career Interest Inventory is synonymous with career counseling services. In Malaysia, there have been many studies related to the Career Interest Inventory. This is because many guidance and counselling teacher have used the Career Interest Inventory to help students make career-related decisions. Jose and Hernandezy (2020) stated that psychometric tests are tests that are widely used by psychologists to help clients make decisions. This test is used to collect data related to human behaviour, career interests and individual personality (Kaplan & Saccuzzo, 2009). However, in Malaysia, there is still a lack of research related to the competency of guidance and counselling teacher on the Career Interest Inventory.

Competency issues related to psychological tests commonly occur when guidance and counselling teacher do not have sufficient knowledge to administer psychological tests such as the Career Interest Inventory. This will lead to the misuse of psychological tests. Kaplan and Saccuzzo (2018) stated that the main issue in testing and measurement is competence where psychologists try to carry out the testing process without having formal qualifications and training regarding the tools being used. This point is supported by Reuben and Eremie (2020) stating that counselors need knowledge and skills in using psychological tests to avoid violations of issues and ethics of psychological tests.

Ability and competence in conducting a psychological test are important. Sidek Nor (2005) states that if a person does not have sufficient training in this field but tries to give and interpret the test, he has actually violated ethics. This is because different tests require different levels of ability and knowledge to administer, score, profile and interpret. This point is supported by Reyhan Arslan (2018) who states that the implementation of scoring and assessment of different psychological tests requires different levels of competence. A study by Xiuming Zhang et al. (2017) found that out of 11 psychologists, 2 of them were not competent in conducting psychological tests. This is even more surprising when the psychologist has 8 to 10 years of service experience. The study of Yigun Gan et al. (2012) stated that psychological tests are conducted by unqualified individuals and use psychological tests without psychometric manual information. This test is also used without a specific purpose and with the intention of fun.

Theoretical issues pertaining to the use of psychological tests are often being questioned. This is because guidance counselors in schools are less skilled in various theories. Zakaria (2010) stated that counselors' knowledge related to theory is weak and counselors do not understand theory in depth. This is because of their lack of emphasis on theoretical aspects. These findings are also supported by Wijaya et al. (2019) who states that the level of theoretical mastery by counselors is still at a low level.

3. Methodology

3.1. Research Design

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This study was conducted using quantitative methods. The selection of the FDM method was used to obtain expert agreement related to the constructs and items required in constructing the questionnaire. The views of 15 experts will be analyzed using Excel software to obtain expert agreement. This method can save time and analyze data accurately in addition being able to give consent is better and the guarantee of getting an agreement between experts is higher (Ramlan & Ghazali, 2018).

3.2. Sample Study

The study sample was selected based on experience and expertise in the field of guidance and counseling. The researcher has identified a total of 15 experts in the field consisting of excellent lecturers and teachers in this field. Ramlan and Ghazali (2018) and Clayton (1997) stated that the appropriate number of samples if they are uniform is between 10 to 15 people.

3.3. Study Instrument

The initial construction of constructs and instrument items was through literature highlights and expert interviews. This method is used to identify appropriate constructs and items in the K-IMK instrument. This questionnaire instrument is divided into 4 parts, namely part A is the respondent's demographics, part B is the attitude construct, part C is the knowledge construct and part D is the skill construct. The total number of items is 58 items. The use of a 5-point Likert scale was used in this instrument to determine the level of expert agreement.

3.4. Fuzzy Delphi Method Implementation Process

3.4.1. Step 1: Selection of Experts

The selection of experts in this study is based on Ramlan and Ghazali (2018) who prioritize expert's expertise, qualifications, time and experience. The selection of experts must be made precisely so that the results, opinions and views obtained are not doubted and disputed. Their expertise can be determined by their experience and the number of years of experience becomes an aspect or criterion in determining the expertise of an expert. Individuals with a lot of experience are classified as experts while individuals with less experience are classified as novices (Shanteau et al., 2002). Ramlan and Ghazali (2018) and M. Kaviza (2018) state that the term expert in the field refers to individuals who have more than 5 years of experience and based on their specific experience. While qualifications can be defined as a professional field where an individual will obtain accreditation or recognition based on the academic qualifications provided. In this study, the minimum qualification has been set, which is to have a master's degree in a field that is suitable for the study conducted by the researcher. The expert's time and experience is a minimum of 5 years in the field relevant to this study. The list of experts used can refer to Table 1.

Table 1: List of Experts Used

Position	Expertise	Experience	Institution
Professor	Construction of Guidance and Counseling Module and Inventory	22	UPSI
Associate Professor	Career Counseling	25	UPSI

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Associate Professor	Guidance and Counselling	18	UPSI
Associate Professor	Cognitive Psychology	15	UTM
Senior Lecturer	Testing and Measurement in Counseling	8	UPSI
Senior Lecturer	Guidance and Counselling	13	USM
Senior Lecturer	Psychology Testing and Measurement	14	USIM
Senior Lecturer	Development Studies	15	UITM
Senior Lecturer	Measurement and Evaluation in Guidance and Counseling	22	UPSI
Senior Lecturer	Guidance and Counselling	15	USAS
Senior Lecturer	Guidance and Counselling	17	UPM
Senior Lecturer	Guidance and Counselling	18	UPM
Lecturer IPGM	Guidance and Counselling	26	IPGM
Excellent Teacher	Guidance and Counselling	11	School
Psychometric Master Trainer	Guidance and Counselling	14	School
Total Experts	**15 People**		

3.4.2. Step 2: Determination of Linguistic Variables Based on Triangular Fuzzy Number

The researcher has chosen a 5-point Likert scale as the scale in the expert agreement instrument. After getting the value given by the expert, then this scale will be converted to Fuzzy triangle numbering that will be explained in Table 2. According to Cheng and Lin (2002), Triangular Fuzzy Number will represent the values of m1, m2 and m3. This value gives the meaning as the minimum value which is the m1 value while the reasonable value represents m2 and the highest value is m3. Refer to Figure 1.

Figure 1: Triangular Fuzzy Number

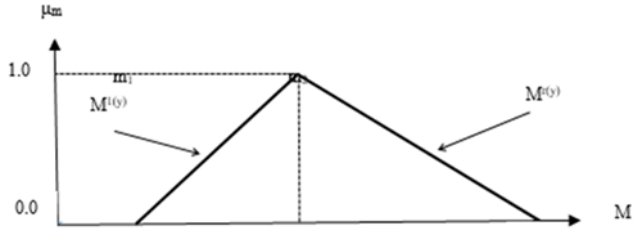


Table 2: Importance Level of 5 Point Fuzzy Scale

Linguistic Variables	Fuzzy Scale	Likert Scale
Very Important	(0.0, 0.0, 0.2)	5
Important	(0.0, 0.2, 0.4)	4
Moderately Important	(0.0, 0.4, 0.6)	3
Not Important	(0.4, 0.6, 0.8)	2
Very Unimportant	(0.6, 0.8, 1.0)	1

3.4.3. Step 3: Distance Determination Process to Determine the Threshold Value (d).

The value of the level of expert agreement between experts can refer to the Threshold Value. The Threshold value can be determined through the formula value:

$$d(m,n) = \sqrt{\tfrac{1}{3}\left[(m_1+n_1)2+(m_2-n_2)2+(m_3-n_3)2\right]}$$

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Threshold value "d" less than or equal to 0.2 (< 0.2) is considered that expert agreement has been reached (Chen & Lin, 2002). While the overall agreement must exceed 75% (>75%) agreement for each item.

3.4.4. Step 4: Determine Percentage of Group Agreement

A value of 75% is the minimum required to determine the level of acceptance of expert agreement as a whole (Chen & Lin, 2002). If the minimum value is not obtained, the item or construct must be discarded or a second round must be performed.

3.4.5. Step 5: Determining the Alpha Level of the Fuzzy Valuation Aggregate

One expert agreement is obtained by adding Fuzzy numbers for each item. Ridhuan et al. (2014) stated that the calculation and determination of the Fuzzy value is by using the formula: Amax= (1)/4 (m1+m2+m3).

3.4.6. Step 6: Difuzzication Process Phase

The value of Average Fuzzy Numbers is the α-cut value = the median value of '0' and '1', where α-cut = (0+1)/2 = 0.5 (Ridhuan et al., 2014). If the value of Average Fuzzy Numbers is less than the value of α-cut = 0.5 then the item will be rejected because it does not show expert agreement.

Step 7: Position Determination Process
The last step is the ranking process by choosing based on the Defuzzication value based on the expert consensus that the highest value is determined to be the most important position (Nor Aidillina & Marinah, 2020).

4. Result

Overall, this FDM analysis shows that not all items in the attitude construct, knowledge construct and skill construct get agreement from the experts. An expert panel of 15 people has provided a transparent evaluation and provided opinions and recommendations for each item evaluated. However, each construct has obtained expert agreement above 75% and threshold value (d) < 0.2.

4.1. Attitude constructs

The expert agreement value for the attitude construct is 82% and the threshold value (d) for the construct is 0.181. However, there is 1 item that has received an expert agreement of only 7%. This means that this item is not suitable to be used as a research instrument. Giovanni Morales et al. (2018) stated that if there is an item that is in the lowest ranking and only gets 20% expert agreement, then the item is not suitable to be used as a research instrument. while there are 3 items that will be improved based on expert views. The result of the order of the main items in this construct is item number 9, which is that I will be careful in calculating the Career Interest Inventory score. Table 3 below shows the study findings for the attitude construct:

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Table 3: Overall Findings of the Attitude Construct

Item Number	Terms of Triangular Fuzzy Numbers		Expert Agreement	Element Accepted	Ranking
	Threshold Value, (d)	Percentage of Expert Group Agreement			
1	0.136	100%	Accepted	0.733	3
2	0.196	93%	Accepted	0.693	9
3	0.136	100%	Accepted	0.733	3
4	0.190	87%	Accepted	0.667	12
5	0.098	80%	Accepted	0.760	2
6	0.377	7%	Rejected	0.640	
7	0.136	100%	Accepted	0.733	3
8	0.171	93%	Accepted	0.707	8
9	0.098	80%	Accepted	0.760	1
10	0.190	93%	Accepted	0.667	12
11	0.136	100%	Accepted	0.733	3
12	0.190	87%	Accepted	0.667	12
13	0.190	87%	Accepted	0.667	12
14	0.228	40%	Improved	0.640	
15	0.196	93%	Accepted	0.693	9
16	0.217	87%	Improved	0.667	
17	0.174	93%	Accepted	0.693	9
18	0.209	40%	Improved	0.653	
19	0.179	93%	Accepted	0.720	7

4.2. Knowledge Construct

Overall, the expert agreement value in this construct is 85% and the threshold value (d) for the construct is 0.114. However, there are 4 items that do not meet the requirements of Triangular Fuzzy Numbers. This item has had to be improved based on the views that have been given by experts. The result of the priority order of the items in this construct is item number 6, which is that I choose a conducive place to conduct the Career Interest Inventory test. Table 4 below shows the overall findings of the items in the knowledge construct:

Table 4: Overall Findings of Knowledge Constructs

Item Number	Terms of Triangular Fuzzy Numbers		Expert Agreement	Element Accepted	Ranking
	Threshold Value, (d)	Percentage of Expert Group Agreement			
1	0.119	73%	Improved	0.747	
2	0.071	87%	Accepted	0.773	5
3	0.098	80%	Accepted	0.760	11
4	0.098	80%	Accepted	0.760	11
5	0.147	100%	Accepted	0.720	14
6	0.000	100%	Accepted	0.800	1
7	0.163	93%	Accepted	0.720	14
8	0.179	93%	Accepted	0.720	14
9	0.038	93%	Accepted	0.787	2
10	0.220	87%	Improved	0.680	

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11	0.196	87%	Accepted	0.680	18
12	0.228	87%	Improved	0.707	
13	0.038	93%	Accepted	0.787	2
14	0.038	93%	Accepted	0.787	2
15	0.071	87%	Accepted	0.773	5
16	0.071	87%	Accepted	0.773	10
17	0.071	87%	Accepted	0.773	5
18	0.071	87%	Accepted	0.773	5
19	0.098	80%	Accepted	0.760	11
20	0.071	87%	Accepted	0.773	5
21	0.247	27%	Improved	0.627	
22	0.174	93%	Accepted	0.693	17

4.3. Skill Construct

Overall, the skill construct has received 85% expert agreement and the threshold value (d) for this construct is 0.132. However, there are 5 items that do not meet the conditions of Triangular Fuzzy Numbers. This item will be improved and refined based on expert opinion. The findings related to the sequence of items in this construct, the main one is item number 7 which is that I can comply with the procedure set when conducting the Career Interest Inventory and number 17 is that I can help students use the results of the Career Interest Inventory to set their career goals. Table 5 below is the overall findings of the skill construct:

Table 5: Overall Findings of the Skill Construct

Item Number	**Terms of Triangular Fuzzy Numbers**		**Expert Agreement**	**Element ACCEPTED**	**Ranking**
	Threshold Value, (d)	**Percentage of Expert Group Agreement**			
1	0.098	80%	Accepted	0.760	5
2	0.119	73%	Improved	0.747	
3	0.119	73%	Improved	0.747	
4	0.152	100%	Accepted	0.707	11
5	0.217	87%	Improved	0.667	
6	0.171	93%	Accepted	0.707	11
7	0.071	87%	Accepted	0.773	1
8	0.106	87%	Accepted	0.760	3
9	0.136	100%	Accepted	0.733	8
10	0.119	73%	Improved	0.747	
11	0.098	80%	Accepted	0.760	3
12	0.163	87%	Accepted	0.733	8
13	0.244	87%	Improved	0.667	
14	0.136	100%	Accepted	0.733	8
15	0.130	80%	Accepted	0.747	7
16	0.098	80%	Accepted	0.760	5
17	0.071	87%	Accepted	0.773	1

Overall, the items and constructs in this K-IMK instrument have obtained the expert agreement of over 75% and the threshold value (d) < 0.2. The total number of items evaluated by experts was 58 items. Based on the FDM analysis, 1 item will be rejected because it has less than 20% expert agreement. While 12 items will be improved and

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refined based on expert opinion. In this study, the expert panel has also given suggestions that there are 3 items added to strengthen the construct.

5. Discussion

The FDM method used by the researcher has provided a content validity value for the K-IMK instrument. The FDM method in this study provides that the quality of this instrument can be improved through the use of a panel of experts with various fields and experiences. The diversity and number of experts involved in this study indirectly give confidence to others that this instrument is valid, precise, clear and able to measure the things to be measured (Mohammed Afandi et al., 2020). The expert agreement score of more than 75% apparently gives a clear picture that this instrument can be used and can measure the studied construct. Although there are items rejected by the experts, the agreement of the experts on each construct found in this instrument is still high. Based on the views and recommendations of the expert panel, the researcher will emphasize the use of item vocabulary to further increase the validity of the content in this instrument.

There are suggestions for the addition of items by an expert panel. The researcher believes that the use of the Instrument Specification Table (JSI) is a process for better instrument construction. JSI is important to prevent researchers from being careless and straying from things that include the constructs and items needed in an instrument (Mohd Hussin et al., 2020). JSI covers the constructs, items, traits, variables and scales required in an instrument (Mohd Faizal & Leow, 2017). This matter needs to be refined by the researcher to increase the validity and reliability of an instrument.

A suggestion from the researcher, the Content Validity Ratio (CVR) method is seen to increase the validity of the content. The CVR method has advantages such as being more transparent, directed and user-friendly (Mohammed Afandi et al., 2020). Dewi Rooslani and Ly-Fie (2006) stated that CVR is a classical measurement method that is more practical in terms of time and cost in addition to being simple and fast. In addition, the CVR method also provides a schedule for determining the critical value that needs to be achieved (Mohammed Afandi et al., 2020). This method can also help researchers make decisions to maintain or drop items on the instrument through CVR calculations.

The use of the Rasch Measurement Model after this study will be able to prove the accuracy of the instrument. This model is able to determine the validity and reliability of items through analyses such as item polarity, item-individual map, item-individual mismatch, item-individual isolation, unidimensionality, item-individual compatibility and rating scale (Rasch, 1980; Bond & Fox, 2007). The Rasch model has advantages in the process of validity and reliability by taking into account the abilities or abilities of each individual who answers the questionnaire, test or instrument and the difficulty of the items for each test or item (Rafidah & Mohd Effendi, 2019).

5.1. Study Implications

This study is important for secondary guidance and counselling teacher to assess the level of competence clearly pertaining to the Career Interest Inventory. It is hoped that secondary guidance and counselling teacher can improve their level of competence through specific and continuous training. Through this initiative, the level of competence of secondary guidance and counselling teacher can be improved to the highest level.

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The instruments produced in this study can benefit the MOE to measure the level of competence of secondary guidance and counselling teacher on the Career Interest Inventory throughout the country. This will make it easier for the State Education Department and the MOE to plan courses and training that are focused on secondary guidance and counselling teacher. This will avoid wasting time, energy and money in trying to train or provide courses for secondary guidance and counselling teacher.

6. Conclusion

Overall, the results of this study found that the items and constructs in this instrument meet the requirements of Triangular Fuzzy Numbers in FDM. There are also items that will be refined in terms of sentence structure or the language used. The addition of 3 items by experts will increase the strength of the construct. Only 1 item will be discarded because it got expert agreement value and got a very low percentage of expert agreement. After the refinement and improvement process of the items, this instrument will be conducted as a pilot study to obtain a reliability value.

Ethics Approval and Consent to Participate

The researchers used the research ethics provided by the Research Ethics Committee of Universiti Kebangsaan Malaysia (RECUKM). All procedures performed in this study involving human participants were conducted in accordance with the ethical standards of the institutional research committee. Informed consent was obtained from all participants according to the Declaration of Helsinki.

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Conflict of Interests

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