Linear Congruential Method for Randomization of Test Item in Computer-Based Psychological Edwards Personal Preference Schedule (EPPS) Test

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Abstract. Psychological tests are used to determine human's attitude and behavior. In its application, psychological tests still use the old method. Objects are asked to answer questions and then the answers will be collected again to be calculated, and then conclusion will be drawn from the result. It will be time consuming and impractical. Computer-based psychological test have an answer to these deficiencies. By utilizing the ease of test item management in computer, this paper discusses the application of linear congruential method for randomization of test item in computer-based psychological Edwards personal preference schedule (EPPS) test developed by web-based programming. According to expert, the difference in the number of respondents who have the largest and smallest raw score aspects that are the same and not the same is considered not too significant that in this case randomization of test item can be applied to the EPPS test because the change in test results is not too significant and the scoring process is still valid

1. Introduction

The development of computer technology is increasing along with the increasing needs of various disciplines. Computers have a lot of advantages that are needed by many fields. The use of computers offers many advantages, especially in terms of accuracy, speed and ease of processing data into information [1]. Fields that utilize computer roles are the field of testing and assessment.

In psychology, personality tests or psychological tests are one of the methods of measuring one's personality. In its application, psychological tests still use the old method. Respondents asked to answer questions and then the answers will be collected again to be calculated, and then conclusion will be drawn from the result. It will be time consuming and impractical. This is considered to be time consuming and less effective [2]. Meanwhile the use of technology in carrying out psychological tests has a potential to be a practical, cost-effective, and meaningful tool for measuring individuals personality [3]. The application of technology to psychological tests can be in the form of computer-based testing, test item management, and ease of scoring. Management of test item on computer-based psychological tests can be applied with randomization of questions. Changes in the item of the test should be able to keep people's motivation high (Boecker et al, 1987).

EPPS (Edwards Personal Preference Schedule) psychological test is one of the psychological tests to measure or describe an individual's personality according to the theory of A. H. Murray's needs. In general, EPPS personality tests are more often used (Hartono, 2006). The development of a computer-
based psychological EPPS test is expected to create a new psychological test concept, especially in term of test item randomization.

2. Methods

2.1. Computer-based Psychological Test

Technology becomes a fixture in everyday human life, so psychological assessments as a tool to measure mental health must also follow development of the era. In recent years, the role of computers has increased significantly in the field of psychological testing and computers have produced more sophisticated psychometric techniques (Coyne & Bartram, 2006). In fact, computers continue to enhance their role in clinical assessment, interviews, diagnosis, instructions, treatment intervention, clinical consultation, and psychiatric interviews (Groth-Marnat, 2009).

![Context Diagram of The System](image)

**Figure 1.** Context Diagram of The System

Figure 1 shows that user is the main actor of this system. User must fill in their personal data before working on the test. If the user has completed the test, then the result will be displayed.

2.2. Edwards Personal Preference Schedule

The EPPS test is a personality test to find out how much a person's motivation, needs, and motives are, using forced-choice techniques where respondents are forced to choose one of the two most suitable choices. This test was compiled by Edward based on H.A Murray's theory of needs. There are fifteen needs measured by the EPPS test, including achievement, deference, order, exhibition, autonomy, affiliation, intraception, succorance, dominance, abasement, nurturance, change, endurance, heterosexual, and aggression. Each of the above needs is represented by nine statements. Statements from each need are paired twice with statements from each other need so that there are 210 comparison items.

**Table 1. Needs Measured by EPPS Test**

| Need          | Description                               | Need          | Description                               |
|---------------|-------------------------------------------|---------------|-------------------------------------------|
| Achievement (ach) | A need to accomplish tasks well          | Dominance (dom) | A need to be a leader and influence others |
| Deference (def)  | A need to conform to customs and defer to others | Abasement (aba) | A need to accept blame for problems and confess errors to others |
| Order (ord)     | A need to plan well and be organized      | Nurturance (nur) | A need to be of assistance to others      |
| Exhibition (exh) | A need to be the center of attention in a group | Change (chg) | A need to seek new experiences and avoid routine |
| Autonomy (aut)  | A need to be free of responsibilities and obligations | Endurance (end) | A need to follow through on tasks and complete assignments |
| Affiliation (aff) | A need to form strong friendships and attachments | Heterosexual (het) | A need to be associated with and attractive to members of the opposite sex |
| Intraception (int) | A need to analyze behaviors and feelings of others | Aggression (agg) | A need to express one's opinion and be critical of others |
| Succorance (suc) | A need to receive support and attention from others | | |
2.3. EPPS Test Scoring [1]

Figure 2. Answer Sheet of EPPS Test

Figure 2 is answer sheet of EPPS which contains personal data, 225 answer choices, the scoring section on the right side, and the consistency box on the bottom side.

2.3.1. Raw Score Scoring for Each Need

- Make red line through numbers:
  - 1, 7, 13, 19, 25
  - 101, 107, 113, 119, 125
  - 201, 207, 213, 219, 225
- Make blue line through numbers:
  - 26, 32, 38, 44, 50
  - 51, 57, 63, 69, 75
  - 151, 157, 163, 169, 175
- Count the number of 'A' answers which are circled in the first row and enter this number in the blank r (row) at the end of the first row. Answer 'A' with a red line is not counted.
- Count the number of 'A' answers which are circled in the second row and enter this number in the blank r (row) at the end of the second row. Answer 'A' with a red line is not counted.
- Repeat step c and d for each of the 15 rows.
- Count the number of 'B' answers which are circled in the first column and enter this number in the blank c (column) at the end of the first row. Answer 'B' with a red line is not counted.
- Count the number of 'B' answers which are circled in the second column and enter this number in the blank c (column) at the end of the second row. Answer 'B' with a red line is not counted.
- Repeat step f and g for each of the 15 rows.
- Add together the row and column score and enter the total in the blank s (sum) for each of the 15 needs.
- Sum shows a raw score.
Figure 3 shows that in this system, scoring is done by counting on the database how many answers are chosen by the user in each need. According to the explanation related to scoring above, out of 225 questions there are 15 numbers of answers that are not counted. It can be seen in the diagram above that the loop occurs 210 times, which is as much as the total number of answers that enter the database. The highest raw score for each need is 28 and the lowest raw score is 0. Examples of raw scores for each need are shown in table 2 below.

| Need       | Raw Score |
|------------|-----------|
| Achievement | 13        |
| Deference   | 12        |
| Order       | 21        |
| Exhibition  | 6         |
| Autonomy    | 10        |
| Affiliation | 12        |
| Intraception| 18        |
| Succorance  | 10        |
| Dominance   | 23        |
| Abasement   | 21        |
| Nurturance  | 23        |
| Change      | 8         |
| Endurance   | 18        |
| Heterosexual| 8         |
| Aggression  | 7         |

2.3.2. Consistency Scoring
- Compare the 'A' or 'B' answers vertically that are passed by the red line with those passed by the blue line.
- If the answer is the same, then mark the consistency box on the bottom side with checklist symbol.
- Repeat the step a and b until the last column.

Figure 4 below shows the flowchart of EPPS test consistency scoring.
As explained before, there are certain numbers that are marked with red lines and blue lines to measure consistency. The highest consistency score is 15 while the lowest consistency score is 0. Examples of consistency scores calculation are shown in table 3 below.

### Table 3. Example of Consistency Score Calculation

| Answer Comparison | Conclusion |
|-------------------|------------|
| 1 = 151           | Yes        |
| 7 = 157           | Yes        |
| 13 = 163          | No         |
| 19 = 169          | Yes        |
| 25 = 175          | Yes        |
| 26 = 101          | Yes        |
| 32 = 107          | Yes        |
| 38 = 113          | Yes        |
| 44 = 119          | Yes        |
| 50 = 125          | No         |
| 51 = 201          | Yes        |
| 38 = 113          | Yes        |
| 44 = 119          | Yes        |
| 50 = 125          | No         |
| 51 = 201          | Yes        |

### 2.4. EPPS Test Result

After getting the raw score for all needs and consistency, the raw score is converted to the predefined EPPS percentile score and EPPS norm score.

#### 2.4.1. EPPS Percentile Score

The percentile score will show the levels for each need and consistency. Here is a table of raw score conversions to the percentile score.

| Score | Ack | Def | Ord | Rel | Aut | Aff | Int | Sue | Dom | Int | Ahe | Nus | Chg | End | Int | Aug | Con |
|-------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| 28    |      |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 99  |
| 27    | 99  |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 98  |
| 26    | 99  | 99  |     |     |     |     |     |     |     |     |     |     |     |     |     |     | 97  |
| 25    | 99  | 99  | 99  |     |     |     |     |     |     |     |     |     |     |     |     |     | 96  |
| 24    | 99  | 99  | 99  | 99  |     |     |     |     |     |     |     |     |     |     |     |     | 95  |
| 23    | 99  | 99  | 99  | 99  | 99  |     |     |     |     |     |     |     |     |     |     |     | 94  |
| 22    | 99  | 99  | 99  | 99  | 99  | 99  |     |     |     |     |     |     |     |     |     |     | 93  |
| 21    | 99  | 99  | 99  | 99  | 99  | 99  | 99  |     |     |     |     |     |     |     |     |     | 92  |
| 20    | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  |     |     |     |     |     |     |     |     | 91  |
| 19    | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  |     |     |     |     |     |     |     | 90  |
| 18    | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  |     |     |     |     |     |     | 89  |
| 17    | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  |     |     |     |     |     | 88  |
| 16    | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  |     |     |     |     | 87  |
| 15    | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  |     |     |     | 86  |
| 14    | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  |     |     | 85  |
| 13    | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  |     | 84  |
| 12    | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 83  |
| 11    | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 82  |
| 10    | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 81  |
| 9     | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 80  |
| 8     | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 79  |
| 7     | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 78  |
| 6     | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 77  |
| 5     | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 76  |
| 4     | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 75  |
| 3     | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 74  |
| 2     | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 73  |
| 1     | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 99  | 72  |

**Figure 5.** EPPS Percentile Score Conversion Table [4]
Figure 5 shows that the highest percentile score is 99 and the lowest percentile score is 1. The raw score of a need has a range of 0 to 28. If the raw score of exhibition (exh) is 26, then the percentile score is 99. If the raw score of affiliation (aff) is 4, then the percentile score is 1.

Table 4 shows how to interpret the percentile score. If the percentile score of achievement (ach) is 20, the interpretation of percentile score of ach is average. This interpretation of percentile score is also used to measures the level of consistency of respondents in answering test questions.

Table 4. Interpretation of Percentile Score

| Percentile Score | Interpretation |
|------------------|----------------|
| 97 - 99          | Very High      |
| 85 - 96          | High           |
| 17 - 84          | Average        |
| 4 - 16           | Low            |
| 1 - 3            | Very Low       |

Table 5 shows the flowchart of determining EPPS test result for this system. From the raw scores shown in tables 2 and 3, the following tables are the test results obtained. Tables 5 shows the test results based on 15 EPPS needs and table 6 shows the test results based on the consistency score calculation.

Table 5. Example of Test Result

| Need | Percentile Interpretation |
|------|---------------------------|
| ach  | Average                   |
| def  | Average                   |
| ord  | High                      |
| exh  | Low                       |
| aut  | Average                   |
| aff  | Average                   |
| int  | Average                   |
| suc  | Average                   |
| dom  | High                      |
| aba  | High                      |
| nur  | High                      |
| chg  | Low                       |
| end  | Average                   |
| het  | Average                   |
| agg  | Low                       |

Table 6. Example of Consistency Result

| Consistency Score | Interpretation of Consistency Percentile Score |
|-------------------|-----------------------------------------------|
| 11                | Average                                       |

2.5. Linear Congruential Method

In tests, questions are usually presented in random order. The aim is to reduce the certainty of answers and falsehood. Changes of the contents of the test should be able to keep people's motivation always high (Boecker, Keil, Eiser, & Kline, 1987). Regarding randomization of questions in psychological tests, there is no difference in randomization and grouping of questions related to reliability and validity as indicated by measurements of one's work and life satisfaction (Schriesheim, Kopelman, & Solomon, 1989), which makes it possible to apply randomization of test item to psychological tests.
Linear congruential method is one method of random number generator. This method represented by formula [5]:

\[ X_{n+1} = (aX_n + c) \mod m \]  

(1)

Where:
- \( X_{n+1} \) = random number n+1
- \( X_n \) = random number n
- \( a \) = multiplication factor
- \( c \) = increment
- \( m \) = modulus

Determination of \( a \), \( c \), and \( m \) generates a good random number as if there is no repetition on it. The other key of this generator are \( X_0 \) or called bait or seed. Seed can be obtained from 0 to \( m-1 \) as the starting value. While the \( m \) value determines the period, if \( m = 16 \) and when \( n = 17 \) the value of \( X_{17} \) will return to \( X_1 \). In Figure 7 below which shows flowchart of item randomization, it appears that the thing that must be done before randomizing test item is to determine the constants \( a \), \( c \), \( m \) and \( X_0 \). Then, the calculation of the formula will be done as much as the number of test item.

In this psychological test system the author has set the values in \( a \), \( c \), and \( m \) based on existing references. The values are \( a = 31 \), \( c = 19 \), and \( m = 9 \). The values \( a \) and \( c \) are chosen because they can produce a full period series of random number. The value of \( m \) is determined by the amount of data in the database to be randomized, they are the number of statement for each need. While the value of \( X_0 \) is determined randomly with a range of 1 to 9 using the rand function \((1, 9)\). The \( X_0 \) value that is always random every time the user opens the question page is the key to randomizing questions in this system. The final result will be added to one, to avoid zeros as the final result.

Below is an example of generating 31 random numbers with constants \( a = 31 \), \( c = 19 \), \( m = 9 \), and \( X_0 = 8 \).

| \( n \) | \( X_{n+1} \) | \( X_n \) | \( n \) | \( X_{n+1} \) | \( X_n \) |
|-------|--------------|----------|-------|--------------|----------|
| 1     | 8            | 7        | 17    | 1            | 6        |
| 2     | 7            | 3        | 18    | 6            | 8        |
| 3     | 3            | 5        | 19    | 8            | 7        |
| 4     | 5            | 4        | 20    | 7            | 3        |
| 5     | 4            | 9        | 21    | 3            | 5        |
| 6     | 9            | 2        | 22    | 5            | 4        |
| 7     | 2            | 1        | 23    | 4            | 9        |
| 8     | 1            | 6        | 24    | 9            | 2        |
| 9     | 6            | 8        | 25    | 2            | 1        |
| 10    | 8            | 7        | 26    | 1            | 6        |
| 11    | 7            | 3        | 27    | 6            | 8        |
| 12    | 3            | 5        | 28    | 8            | 7        |
| 13    | 5            | 4        | 29    | 7            | 3        |
| 14    | 4            | 9        | 30    | 3            | 5        |
| 15    | 9            | 2        | 31    | 5            | 4        |
| 16    | 2            | 1        |

The table 7 above shows that random numbers are generated 31 times according to the most number of questions for each need of personality that will be displayed later. The results of \( X_n \) show the id of the test item from every need. So the first id is 7, then the second id is 3, and so on until 31st id. After getting the whole test item id, the next step is to determine the test item that will be displayed.
The table 8 is a test item database of achievement need along with the test item's id. In accordance with the explanation in the EPPS test scoring before and according to the reference of EPPS test item obtained, achievement's test items appear 31 times at numbers 1, 2, 3, 4, 5, 6, 11, 16, 21, 26, 31, 36, 41, 46, 51, 56, 61, 66, 71, 76, 77, 78, 79, 80, 101, 151, 152, 153, 154, 155, and 201. Then the sequence of achievement's test item is showed in the table 9a and 9b below.

Table 8. Test Item Database of Achievement Need

| id_ach | item_ach                                                                 |
|--------|---------------------------------------------------------------------------|
| 1      | I like to be a recognized as an expert in a job, position or special field |
| 2      | I want to write a good novel or drama                                     |
| 3      | I like solving puzzles and problems that are difficult for others to deal with |
| 4      | I like to succeed in the things I do                                      |
| 5      | I want to achieve something very important                                |
| 6      | I like to complete tasks that others recognize as tasks that require skill and effort |
| 7      | I like being able to say that I have done a difficult job well            |
| 8      | I like being able to do things better than others                         |
| 9      | I want to do any job as well as possible                                  |

Table 9a. Example of Achievement's Test Item Order

| n   | id_ach | Test Item's Number | Test Item                                      | n   | id_ach | Test Item's Number | Test Item                                      |
|-----|--------|--------------------|-----------------------------------------------|-----|--------|--------------------|-----------------------------------------------|
| 1   | 7      | 1                  | I like being able to say that I have done a difficult job well | 6   | 2      | 6                  | I want to write a good novel or drama          |
| 2   | 3      | 2                  | I like solving puzzles and problems that are difficult for others to deal with | 7   | 1      | 11                 | I like to be a recognized as an expert in a job, position or special field |
| 3   | 5      | 3                  | I want to achieve something very important    | 8   | 6      | 16                 | I like to complete tasks that others recognize as tasks that require skill and effort |
| 4   | 4      | 4                  | I like to succeed in the things I do          | 9   | 8      | 21                 | I like being able to do things better than others |
| 5   | 9      | 5                  | I want to do any job as well as possible      | 10  | 7      | 26                 | I like being able to say that I have done a difficult job well |

The steps to randomize test item above are applied to all need of personality. So that the paired statements displayed for each user will be different but still corresponds to the standard EPPS test item pattern.

3. Experiment Scenario
The implementation of the computer-based EPPS psychological test was held in class SK 42-05 at Telkom University. The test was held 3 times with details of 2 times CBT and 1 time PBT. The first implementation of the application as the computer-based test was held on Monday, 19th November 2018 with 32 respondents. The paper-based test was carried out a week after the first CBT with 32 respondents. The second implementation of the application as the computer-based test was held one week after the last paper-based test with 32 respondents. After doing 3 tests and getting the results of each test, students will be given a questionnaire and asked to fill it out.

The first and third tests are computer-based test tests, so the scenario is the same. In accordance with the EPPS test standard, the test was carried out with a duration of 1 hour. First, respondents were given directions to open a laptop and connect the laptop network to wifi that the author has connected to the server. Second, respondents can directly access to the address that is instructed by the author. Then the respondent can start the test. In the end, if the user has already completed the test, the test results will be displayed immediately and the author gives directions to save the test results in PDF format. The goal of the implementationof these tests is that the 2 results of the tests can be compared.
4. Result and Discussion

4.1. Questionnaire's Data
From the software engineering questionnaire, it was concluded that 71.9% of respondents agreed that the EPPS psychological test application was effective in facilitating the implementation of psychological tests and distribution of test results, 71.9% of respondents agreed that randomization of test questions could be applied to the test system, and 21.9% of respondents strongly agree and 50% agree that computer-based EPPS psychological testing is preferred over paper-based EPPS psychological tests.

4.2. Randomization of Test Items
This part aims to ensure that the sequence of test items for each user and each time is different. This result obtained by taking sample data from a sequence of test items of 5 users. In table 10 below, it can be seen that the seed and sequence in the implementation of the first computer-based EPPS psychological test. By coincidence, there is the same seed value between user 2 and user 5 which causes the same sequence of numbers. While the sequence of questions between users 1, 3, and 4 remain different.

| Table 10. Example Result of Test Items Randomization on 1st CBT |
| --- |
| No. User | No. User |
| 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| Seed | Seed |
| 1 | 8 | 7 | 6 | 8 | 1 | 8 | 7 | 6 | 8 |
| Test Items' Order | Test Item's Order |
| 1 | 6 | 7 | 3 | 8 | 7 | 6 | 4 | 2 | 1 | 9 | 2 |
| 2 | 8 | 3 | 5 | 7 | 3 | 7 | 9 | 1 | 6 | 2 | 1 |
| 3 | 7 | 5 | 4 | 3 | 5 | 8 | 2 | 6 | 8 | 1 | 6 |
| 4 | 3 | 4 | 9 | 5 | 4 | 9 | 1 | 8 | 7 | 6 | 8 |
| 5 | 5 | 9 | 2 | 4 | 9 | 10 | 6 | 7 | 3 | 8 | 7 |

In table 11 below, it can be seen the seed and sequence in the implementation of the second computer-based EPPS psychological test. The test item order between users 1, 2 and 3 is different because the seed is different. But by coincidence users 4 and 5 have the same seed value so the sequence of questions is the same.

| Table 11. Example Result of Test Items Randomization on 2nd CBT |
| --- |
| No. User | No. User |
| 1 | 2 | 3 | 4 | 5 | 1 | 2 | 3 | 4 | 5 |
| Seed | Seed |
| 3 | 2 | 1 | 4 | 4 | 3 | 2 | 1 | 4 | 4 |
| Test Items' Order | Test Item's Order |
| 1 | 5 | 1 | 6 | 9 | 9 | 6 | 6 | 5 | 4 | 7 | 7 |
| 2 | 4 | 6 | 8 | 2 | 2 | 7 | 8 | 4 | 9 | 3 | 3 |
| 3 | 9 | 8 | 7 | 1 | 1 | 8 | 7 | 9 | 2 | 5 | 5 |
| 4 | 2 | 7 | 3 | 6 | 6 | 9 | 3 | 2 | 1 | 4 | 4 |
| 5 | 1 | 3 | 5 | 8 | 8 | 10 | 5 | 1 | 6 | 9 | 9 |

From the tables 10 and 11 above, it can be seen that the test item order of each user in the two implementations of computer-based tests is different. For example, user 1 has the value of seed 1 on the implementation of the first test, but has a value of seed 3 on the implementation of the second test. User 4 has seed value 6 in the first test, but has seed value 4 in the second test. This proves that randomization of questions is applied to different users and times.
4.3. Expert Review
According to expert, until now there have been no studies that discuss the randomization of test item on EPPS psychological tests so that expert cannot yet determine that randomization of questions can be applied to the EPPS test. Expert suggests comparing the results of the tests that have been obtained by looking at aspects that have the largest and smallest raw scores for each test.

According to experts, the difference in the number of respondents who have the largest and smallest raw score aspects that are the same and not the same is considered not too significant that in this case randomization of test item can be applied to the EPPS test because the change in test results is not too significant and the scoring process is still valid.

5. Conclusion
From this research it can be concluded that computer-based EPPS psychological tests are preferred over paper-based psychological tests. By utilizing the ease of managing test items on computers, linear congruential method can be applied to computer-based EPPS psychological tests. It can be concluded that the difference in results on first CBT and second CBT can occur due to other factors such as human factors. The application of test items' randomization on this psychological test still must consider the standard of test items' pattern that have been determined by the original EPPS test so that the results of the tests remain valid.

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