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The Effect of Self-Reference on Retrieval of Working Memory in Individuals With Independent Self-Construal

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Abstract

This research aims to find out the influence of self-referential stimuli on information retrieval from working memory in individuals with independent self-construal as a strategy for storing information in working memory. This research was conducted on 39 students using a within-participants post-test-only experimental design. The measuring instrument used is The Self-Construal Questionnaire with a Cronbach's alpha reliability value of more than 0.70 and a content validity index between 3–4. Information retrieval (information accuracy and response time) is measured by giving a delayed matched-to-sample working memory task in three different conditions, namely where the information refers to oneself, a friend and a stranger. Based on the average accuracy, information related to friends was found to have the highest accuracy compared to the others. However, from the results of Friedman's ANOVA test (p less than 0.05), the difference was not significant. The role of collectivist culture in Indonesia can make information with friend references considered more meaningful. Apart from that, there are differences in response time results where strangers require relatively faster time because they are influenced by information processing that involves a broader area of the brain.

Kata kunci:
self-reference effect;
working memory;
independent self-construal.

Abstrak

Penelitian ini bertujuan untuk menemukan bagaimana pengaruh *self-referential stimulus* terhadap *information retrieval* dari *working memory* pada individu dengan *independent self-construal* sebagai strategi untuk menyimpan informasi dalam *working memory*. Penelitian ini dilakukan pada 39 orang mahasiswa menggunakan rancangan eksperimen *within-participants post-test only*. Alat ukur yang digunakan adalah The Self-Construal Questionnaire dengan nilai reliabilitas *Cronbach's alpha* lebih dari 0.70 dan indeks validitas isi antara 3–4. *Information retrieval* (akurasi informasi dan *response time*) diukur dengan memberikan *delayed matched-to-sample working memory task* dalam tiga kondisi yang berbeda, yaitu dimana informasi merefe-rensikan diri sendiri (*self*), teman (*friend*), dan orang yang tidak dikenal

(*stranger*). Berdasarkan rerata akurasi, informasi yang berkaitan dengan teman ditemukan memiliki akurasi paling tinggi dibandingkan dengan yang lain meski dari hasil uji *Friedman's* ANOVA (p kurang dari 0.05) perbedaannya tidak signifikan. Peran budaya kolektivis di Indonesia dapat menjadi faktor yang dapat membuat informasi dengan referensi teman dinilai lebih bermakna. Di samping itu, terdapat perbedaan pada hasil *response time* dimana orang asing memerlukan waktu yang relatif lebih cepat karena dipengaruhi pemprosesan informasi yang melibatkan area lebih luas di otak.

INTRODUCTION

Students are required to be able to remember various kinds of information while studying in college. However, many still struggle to find easy-to-use strategies for remembering information. One strategy for remembering information is to use the self-reference effect. The self-reference effect is a person's tendency to remember more information if the information is related to that person or themselves (Matlin, 2013). Information associated with the person is also called self-referential stimulus. According to Yin et al. (2019), individuals tend to perceive self-referential stimuli more quickly. Therefore, individuals who retain information by associating the information with themselves tend to remember the information better than when they do not associate the information with themselves. In addition, individuals tend to process information related to themselves rather than information related to other people or other social information.

Self-referential stimuli have several advantages for the learning process. Hartlep & Forsyth (2000) revealed that learning using self-referencing techniques can facilitate retention. According to Benjamin (Hartlep & Forsyth, 2000), students can understand the material better when they can connect personal anecdotes with the material's content. Teaching students to reflect on how their daily lives relate to what they read can improve their retention of textbook material.

In numerous studies, self-reference has been shown to impact long-term memory. However, few studies has looked at how self-reference or self-referential stimuli in working memory. One of the studies examining self-reference in working memory was conducted by Yin et al. (2019), which shows that self-referential stimuli are automatically prioritized in working memory. This is indicated by the number of self-referential stimuli remembered more than other stimuli unrelated to self with a significant difference. Meanwhile, other study discusses self-reference more in contexts other than working memory, such as Sui and Humphreys (2015), which discusses self-prioritization effects and perceptual matching.

Baddeley (Yin et al., 2019) stated that the mechanism of working memory is essential to research because working memory is a system for temporarily storing information to carry out other cognitive processes and to guide behavior. Working memory can also be used in various cognitive tasks, such as language comprehension, mental arithmetic, and reasoning (Matlin, 2013). According to Yin et al. (2019), bias can occur in working memory due to the self-reference effect, especially when maintaining a representation of a stimulus that is related to oneself. The results of research by Yin et al. (2019) revealed that locations with stimuli related to self received more attention compared to locations with stimuli related to other than self. Internal attention is a selection and modulation process that occurs internally in producing information, such as content in working memory, long-term memory, task sets, or selection of responses (Constantine et al., 2003).

Generally, research on the self-reference effect involves individuals in individualist cultures, where the self tends to be perceived as in-

dependent and different from others (Markus & Kitayama, 1991; Zhang et al., 2020). This supports that self-referential stimuli in memory are prioritized. In contrast to individualist cultures, collectivist cultures, such as Chinese and Taiwanese, value connectedness and integration of the self with others. The self is considered meaningful only if considered a harmonious part of a community (Markus & Kitayama, 1991; Yin & Yang, 2017).

As technology develops and transportation becomes more accessible, it becomes increasingly difficult for individuals to identify their cultural tendencies through places or the general characteristics of their people. For example, Jakarta has a heterogeneous society because many residents have moved from areas within Indonesia and abroad. Therefore, it is increasingly difficult to determine what culture someone follows if one merely considers their place of residence and the overall traits of the people around them. The difficulty of knowing whether someone is an individual belonging to a collectivist or individualist culture based on the culture in which they live can be overcome by looking at a person's self-construal.

Self-construal is how individuals see themselves in relationships with other people. Apart from that, self-construal can also be seen as how a person explains and makes meaning of himself (Cross et al., 2011). According to Markus and Kitayama (1991), there are two types of self-construal: independent and interdependent. Independent self is characterized by separating from others, paying attention to abilities, traits, preferences, desires, and prioritizing personal goals over group goals. In contrast, interdependent self is a feeling of connection with others, paying attention to one's role in a group, and prioritizing group goals over personal ones (Cross et al., 2011).

It is known that individuals with independent self-construal show better self-reference effects compared to individuals who have interdependent self-construal. This can happen because independent individuals have the assumption that social relationships are formed based on instrumental interests and individual goals. Meanwhile, interdependent people assume that individuals are connected and become meaningful through relationships. Thus, it can be said that self-construal influences self-functioning and psychological consequences, such as cognition, emotions, motivation, morality, relationships, and intergroup processes (Markus & Kitayama, 2010). Thus, this research aims to discover how self-reference influences retrieval from working memory in individuals with independent self-construal.

METHODS

Research Design

This research uses an experimental design with a within-participants post-test-only design. Research participants were given a package of questions using the OpenSesame program for creating digital psychological experiments. Participants were given three different conditions. In the first condition, participants were given a stimulus in the form of information that had to be associated with themselves, namely with the word 'me'. In the second condition, participants were given a stimulus in the form of information that had to be associated with a friend, namely with the words 'my friend'. In the third condition, participants were given a stimulus in the form of information that had to be associated with a stranger, namely with the words 'stranger'. Participants were asked to remember the information given in all three conditions. Information retrieval from the accuracy of the information that participants remember as well as the response time when participants are asked to remember this information, will be measured.

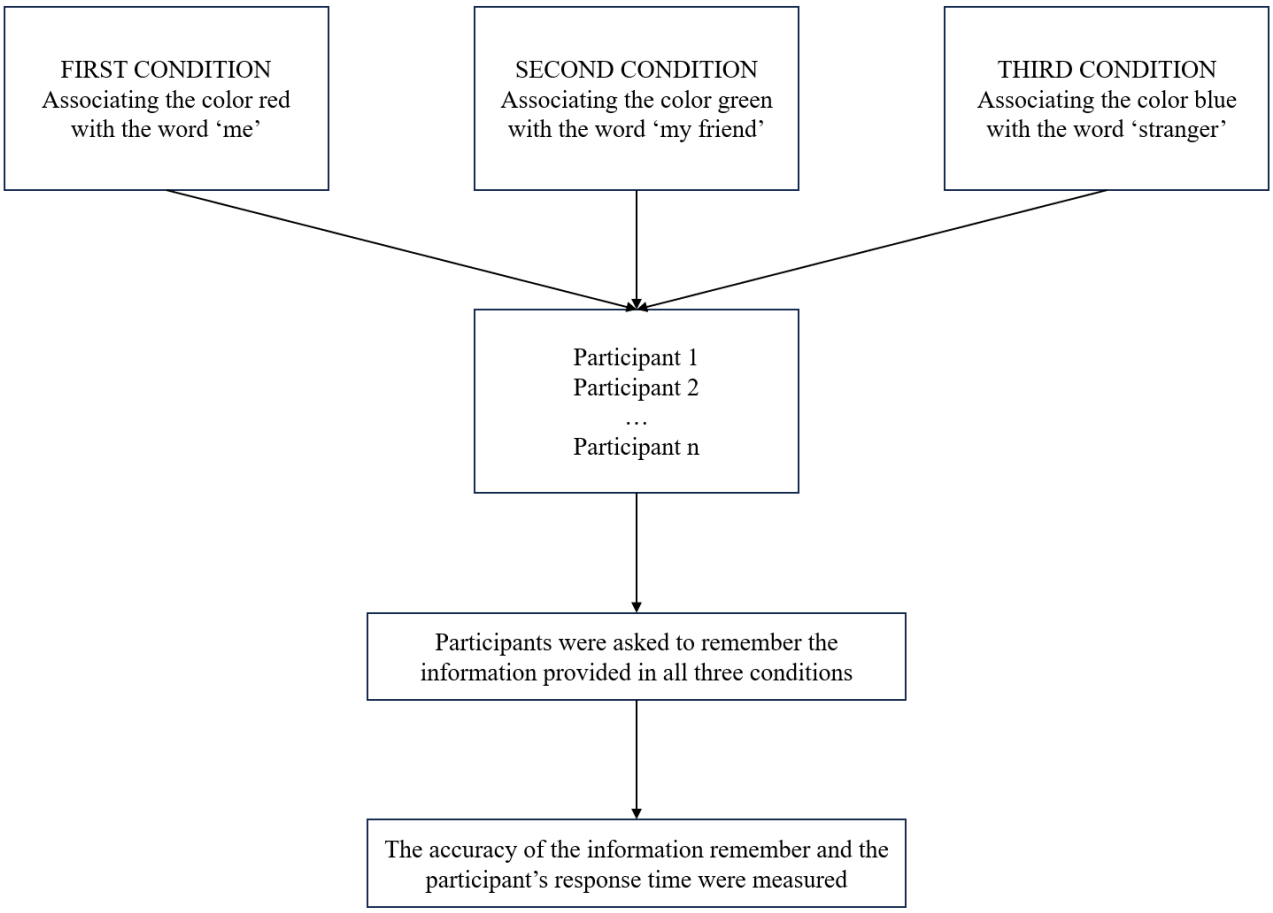

Figure 1.
Research Design on the Effect of Self-Reference Stimulus on Information Retrieval (Information Accuracy and Response Time)

Participants

The target population criteria for this research are: (1) active first-year students of the Faculty of Psychology, Padjadjaran University; (2) fill in initial data in the form of the Self-Construal Questionnaire and have the most common self-construal among students of his generation, namely independent self-construal; and (3) have never participated in research on self-reference and working memory with associative learning tasks and delayed matched-to-sample working memory tasks because research participants do not know in advance the purpose of the research and produce bias in the research results.

The target population is 53 people with a bound of error of 0.16 and an alpha level of 0.05. Sampling will be carried out using a random generator in Microsoft Excel 2017. A sample size of 39 people is taken with this method. The 39 research participants were given an explanation regarding the aim, objectives (researching working memory), risks, and benefits of the research one day before signing informed consent and stating their willingness. However, the data from three participants could not be used for analysis because the response time was less than 200 ms. This was done because, according to (Yin et al., 2019), a response time of less than 200 ms is an extreme value. Apart from that, one participant's data was also not used because there was an error in providing the question package during data collection. Therefore, the participant data used for this research is from 35 participants.

Instruments

The Self-Construal Questionnaire was used to identify self-construal in this research, adapted from Singelis (1994) into Indonesian and validated with expert judgment. Previous research shows that the independent sub-scale has a

Cronbach's alpha of 0.71, and the interdependent sub-scale has a Cronbach's alpha of 0.73 for the Indonesian sample. This shows moderate internal consistency (Vriends et al., 2013). An example of an item in the interdependent subscale is, "I sacrifice my personal interests for the benefit of my group", and an example of an item in the independent subscale is, "I enjoy being someone who is unique and different from other people in various ways". This questionnaire is given before participants are asked to come and work on questions in the OpenSesame program.

This research also uses the research instruments used by (Yin et al., 2019) with several modifications based on the tryout process carried out on students at the Faculty of Psychology, Padjadjaran University. Modifications were made to the instructions given, the information content that participants had to remember (color types), and the time each display appeared on the OpenSesame program.

The research instrument consists of three question packages designed in the OpenSesame program. These question packages are made based on different question sequences. In each question package, the order of the questions is randomly generated. The reliability values obtained with Cronbach's alpha for question packages one to three were 0.948, 0.972, and 0.969, respectively. Each question package is tested for validity using evidence based on test content using the content validity index (CVI). The items were reviewed by three experts, and the average was calculated. Each item obtained a CVI between 3–4 (scale 1–4). This means that each item has good validity.

Each question package has an associative learning task (session 1) and a delayed matched-to-sample working memory task (session 2). The question items are validated with expert judgment. Many studies have also used associative learning tasks to measure self-reference effects on perception, long-term memory, and working memory (Sui et al., 2013; Woźniak & Knoblich, 2019; Yin et al., 2019). A delayed matched-to-sample working memory task was also used by Yin et al. (2019) to measure the self-reference effect due to providing a self-referential stimulus in working memory.

Research Procedure

Participants were asked to read the informed consent displayed on the OpenSesame program carefully and were invited to choose whether to participate in this research. Participants were asked to state that they understood the aims and objectives of this research and were willing if they decided to participate. Participants were given individual instructions. In these instructions, it is explained that there are two sessions in this research. Participants will also do practice questions for each session first.

Session 1 is an associative learning task. Participants were given one minute to associate colors in a circle with words representing social labels. The color red is associated with the word 'me', the color green is associated with the word 'my friend', while the color blue is associated with the word 'stranger'. Participants were asked to determine whether the pair of colored circles and words given in each question matched the pair of colored circles and words they associated with. Session 1 was used just so that participants could practice remembering pairs of colored circles and the words they associated with them.

A red, green, and blue circle will appear above the focus point as a plus sign (+) for each question on the computer screen. Meanwhile, below the focus point, one of the words 'me', 'my friend', or 'stranger' will appear. Participants were asked to determine whether the color and word pairs matched the associations instructed by the experimenter. Participants were asked to press the letter Z on the keyboard if it matched. However, participants were asked to press the number M on the keyboard if it did not match. The focus point will appear for 500 ms, and the color pair with the word will appear for 500 ms. Then, a blank screen will appear, and participants are given 1500 ms to respond by typing the letter Z or M on the keyboard. This

session contained 27 questions (nine questions for the self, friend, and stranger conditions, each given three times). Before the actual task begins, participants will be given a practice session so that participants will be trained in responding by typing the letter Z or M on the keyboard. The practice session consists of nine questions. Each color and word pair appears the same number of times and appears randomly.

Session 2 is a delayed matched-to-sample working memory task. For each question item, a focus point appears as a plus sign (+) in the middle of the screen. This sign appeared for 700 ms. After that, two colored circles appeared (one colored circle was a stimulus whose position was tested on the participant and had to be remembered, then the other circle was a distractor) on the right and left sides of the screen for 1000 ms. Participants were asked to remember the location and words associated with the two colors that appeared. While participants were remembering, the two colors were removed for 5000 ms. A small box surrounded the plus sign for 300 ms to draw participants' attention back to the screen.

Then, a black circle will appear at the location that was previously the location of one of the colors. Participants were given 1500 ms to determine whether the black circle appearing at the previous location was the location of one of the colors. If the location is correct, the participant can press the number Z on the keyboard. However, if it is not correct, the participant presses the number M. If the participant thinks it does not match, the screen will change to a blank screen, and then the participant will continue to the next question. If it matches, the screen will change, and the color will be replaced by one of these words: 'me', 'my friend', and 'stranger' for 1500 ms. Participants were asked whether the word matched the color in the position marked with the white circle. Participants were given 2000 ms to determine the answer, which is determined by the associations participants have formed. There are 54 question items in session 2, preceded by five practice questions.

Data Analysis

The data analyzed is information accuracy and response time, with the help of the IBM SPSS version 23 program. First, data that represents extreme values is sorted. The extreme value criteria used are a response time of no less than 200 ms and no more than 2.5 standard deviations (Yin et al., 2019). Then, researchers used the Kolmogorov-Smirnov test to determine the normality of the data. Accuracy and response time data for all conditions (self, friend, and stranger) were not normal in this reserach. Therefore, to test significance, researchers used Friedman's ANOVA.

RESULTS

From the data collection that has been carried out, the results obtained are that the average accuracy of information associated with self (*saya*) is 56.83% with a standard deviation of 24.311%, friend (*teman saya*) is 57.57% with a standard deviation of 26.861%, and stranger (*orang asing*) is 55.54% with a standard deviation of 27.048%. Meanwhile, the average response time for the self condition was 975.17 ms with a standard deviation of 463.391 ms, the friend condition was 991.23 ms with a standard deviation of 468.296 ms, and the stranger condition was 936.77 with a standard deviation of 475.356 ms. The average accuracy of the information and response time was obtained from each of the 18 question items in the delayed match-to-sample working memory task for each condition (self, friend, and stranger).

Table 1.
Descriptive Statistics Results

	N	Minimum	Maximum	Mean	Std. Deviation
Accuracy - Self	35	0	100	56.83	24.311
Accuracy - Friend	35	22	100	57.57	26.861
Accuracy - Stranger	35	6	94	55.54	27.048
RT - Self	35	232	2000	975.17	463.391
RT - Friend	35	305	1759	991.23	468.296
RT - Stranger	35	229	1721	936.77	475.356
Valid N (listwise)	35				

Normality Test

With $\alpha = 0.05$, H0a, H0d, H0e, and H0f are rejected because the p-value < α, so it can be concluded that the information accuracy data for the self condition, as well as the response time for all conditions, are not normally distributed. Meanwhile, H0b and H0c are accepted because p-value > α, so it can be concluded that the information accuracy data for friends and strangers is normally distributed. Due to the results of this normality test, further data testing was carried out using Friedman's ANOVA test.

Table 2.
Normality Test Results

	Kolmogorov-Smirnov			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Accuracy - Self	.148	35	.051	.961	35	.238
Accuracy - Friend	.155	35	.032	.915	35	.010
Accuracy - Stranger	.151	35	.041	.909	35	.007
RT - Self	.100	35	.200	.959	35	.211
RT - Friend	.111	35	.200	.938	35	.049
RT - Stranger	.106	35	.200	.936	35	.42

From the results of the ANOVA test that has been carried out, it can be concluded that there is no significant difference between information accuracy in the conditions of self (associating information with oneself), friend (associating information with friends), and stranger (associating information with other people). In other words, self-referential stimuli do not affect information retrieval (information accuracy) from working memory with independent self-construal. Then, tests were carried out on the response time speed in three conditions: self, friend, and stranger.

Table 3.
Friedman's ANOVA Test Results for Information Data Accuracy and Response Time Data

	Test Statistics	
	Information Data Accuracy	Response Time Data
N	35	35
Chi-Square	1.366	8.400
df	2	2
Asymp. Sig.	.505	.015

From the results of the ANOVA test in the table above, it can be concluded that there is a significant difference in response time in the conditions of self (associating information with oneself), friend (associating information with friends), and stranger (associating information with other people). The differences in average response time when retrieving information from working memory are shown in Table 4.

Table 4.
Differences in Mean Response Time in Retrieving Information

	N	Minimum	Maximum	Mean	Std. Deviation
RT - Self	35	232	2000	975.17	463.391
RT - Friend	35	305	1759	991.23	468.296
RT - Stranger	35	229	1721	936.77	475.356
Valid N (listwise)	35				

From the table above, it can be concluded that the average response time in the stranger condition is the fastest (936.77) than the response time in the self (975.17) and friend conditions (991.23). This shows that the difference in response time between the three conditions is significant, with associations to strangers being the fastest, followed by associations to self and then friends.

DISCUSSION

This research reveals that self-referential stimuli do not affect the accuracy of information from working memory in students with independent self-construal. There were no significant differences between conditions. The average information accuracy in previous research was higher than that in the current research. This research uses the associative learning task and the delayed matched-to-sample working memory task. Unlike previous research, participants were only given 54 question items in this study. With a larger number of question items, it is more possible to find higher accuracy of information. In addition, a larger number of participants may also influence the significance of information accuracy between different conditions.

Compared with the average information accuracy of participants alone, the information accuracy for the self condition was lower than the information accuracy for the friend condition but higher than the stranger condition. Many studies have proven that self-referential stimuli influence long-term memory and working memory (Golubickis et al., 2019; Yin et al., 2019). However, several other studies (Bentley et al., 2017; Klein, 2012; Sparks et al., 2016) show that information can be remembered as well or even better when associated with other close people such as the word 'mother'. The word 'my friend' in this research also refers to other close people. This could indicate that referencing information with the closest people can cause the information to be remembered better. Sparks et al. (2016) explained that this difference is caused by a collectivist culture that influences individuals in the development of self-construal so that individual self-construal tends to be interdependent.

However, participants in this study had independent self-construal. According to Markus and Kitayama (Giacomin & Jordan, 2016), self-construal refers to how individuals represent themselves. If an individual represents himself as a self that is related or related to other individuals, then he has an interdependent self-construal. If an individual represents himself as unique and different from other individuals, then he has an independent self-construal.

Individuals can have both types of self-construal, but there is one type of self-construal that is dominant in each person. Interdependent self-construal tends to appear in collectivist cultures, such as Indonesia and Japan, while independent self-construal tends to appear in individualist cultures, such as Western countries. Individual-

ism and collectivism are not the same as the two types of self-construal. Individualism and collectivism refer to culture. However, cultural context can support the development of a person's dominant self-construal (Giacomin & Jordan, 2016). Individualist cultures support the development of independent self-construal, while collectivist cultures support the development of interdependent self-construal. Thus, self-construal depends on the priming effects of the cultures to which individuals are exposed.

If we refer to self-construal theory and previous research regarding the influence of self-construal on self-referential effects, then in this study, the participants had independent self-construals (and by referring to the theory as well, had received a priming effect from an individualistic culture), participants should show a self-reference effect or the influence of self-referential stimuli on information retrieval from working memory. However, the results of this study do not match the hypothesis. Therefore, other things are assumed to influence the results of this research, such as sample size.

In contrast to the data regarding information accuracy, there were significant differences between response times in the self, friend and stranger conditions. This finding shows that the response time in the stranger condition was higher than in the self and friend conditions. Individuals will react more quickly if the information obtained relates to unknown people. This is one of the alertness mechanisms. Suppose the information obtained is related to friends. In that case, the individual will refer the information to other close people who are felt to be more meaningful for most people with collectivist cultures compared to other unknown people so that the reaction takes longer. Information related to strangers will require processing in larger areas of the brain compared to information related to oneself and friends (Sui & Humphreys, 2015).

Apart from that, several other things might influence the results of this research, including the influence of the operationalization of the self-reference effect, which is expected to emerge when providing a self-referential stimulus. In this study, participants were asked to associate two new pieces of information, namely colors and arbitrary words, which did not have any relevance to the participants except when participants were given instructions to associate the color red with the word 'me'. Meanwhile, several studies have been carried out using different shapes that are explicitly associated with the self, such as faces and flat shapes or associating an object with self-ownership. This kind of task is considered to be more generalizable to self-referencing processes in everyday life (Golubickis et al., 2019).

Research Limitations

The total question items in this study were 81 question items (27 question items and 54 question items, respectively). The average time to complete these two tasks is 20 to 30 minutes. From the unstructured observations that were carried out, it was discovered that the participants looked tired and bored when working on both tasks. When trying out the measuring instrument with the same number of question items as those given in the actual experiment, participants said that the questions that had to be done were relatively large and could cause fatigue and lack of focus. This lack of focus can cause participants to be unable to direct their internal attention to the stimuli that must be remembered and associated, as well as to the stimuli given in each question item. Therefore, for future research, it is necessary to reconsider the number of items and the length of time during data collection so that participants stay energized.

CONCLUSION

Based on the results of this study, self-referential stimuli have no effect on information retrieval from working memory in individuals with independent self-construal. Information retrieval in this study was measured based on information accuracy and response time. The results of the research show that when information

is referenced in the condition of another person who is considered close, it will have the highest average accuracy value compared to the self or stranger condition. However, the results of the difference are not statistically significant.

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