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The Difference of User-Friendly Level Between Mathematic Learning in Blind Students

Using Braille Book And Using Audiotactual Book

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***Abstract*— This research is aimed to examine the difference of user-friendly level between the students who learning mathematics with Braille book and those with audiotactual (audiotac) book. The research design employed in this research was quasi experiment-Posttest-Only Control Design. The population of research was the 7th blind graders throughout Indonesia. The sampling technique employed was purposive sampling. The subject of research consisted of 38 students affiliated in 8 SLBs (Special Schools for Disabled Students) in 6 provinces in Indonesia. Techniques of collecting data used were questionnaire and test. Instrument validation was carried out using content validity, while reliability test was conducted using *inter-rater* technique. Technique of analyzing data used in this experimental study was t-test data analysis. The result of research showed that t statistic was -4.955 at sig. 0.00 meaning that there was a significant difference of user-friendly level between the use of Braille and audiotac books. The mean difference of Braille and Audiotac book uses was – 12.016 – 5.036. The easiness of learning using Braille book is different from that using AUDIOTAC book, with the difference of mean score of 8.527 (36.684-28.157), so that it could be concluded that the user-friendly levels between mathematics Braille and audiotac book uses had significant difference.**

Keywords—user friendly; braille; audio-tactual; audiotac; mathematics; blind.

I. INTRODUCTION

Kubiak describing the effect of sight loss on mathematics learning showing that direction, quantity, form and logical attribute is the heart of mathematics [1]. Most mathematical languages are highly dependent on visual reference. Attractive description of mathematic concepts visually can be enjoyed by sighted students. Unfortunately, the blind students need much more cognitive processing process than the sighted ones. The use of unique Braille mathematic symbols needs specific skill, the mathematic concept, and Braille code skills. This competency scarcity leads to the limited number of mathematics Braille book.

Learning mathematics using Braille book by blind students takes longer time than sighted students who use printed letters. Simon & Huertas suggest that sighted readers absorb written information through visual fixation, in which the perception plane of each visual fixation covers at least 15 letters (characters) [2]. In the term of reading Braille, tactile fixation is not comparable to visual fixation because tactual reading involves finger, hand, and arm movement coordination. Auditory fixation is broader than tactual fixation, so that blind students acquire information more lately than their sighted counterpart. In acquiring information through book, blind students have reading speed not more than a third of the sighted students' reading speed [3]. A way of solving with the problem is to utilize audio fixation in learning using mathematics audio book equipped with tactual fixation through mathematics tactual supplement.

This end of decade, audio teaching material has been developed for many subjects. Blind students and teachers enthusiastically welcome the presence of teaching material putatively affecting positively the development of learning to blind students. Audio book produced for blind students can create environment to provide, to enrich, to inform, to guide, and to teach subject comprehensively by creating learning environment and developing learning skill independently to solve problem, to answer question, and to discuss various related topic [4]. The audio book production in Indonesia conducted by Mitranetra Foundation, BPMR of Education and Culture Ministry, and Indonesian Braille Offset Center tends to produce text-based audio book rather than numeric-based one or mathematics and statistics books equipped with tactual supplement.

The objective of audio book is primarily to help blind students. In its development, audio book is enjoyed by sighted people as well. Because by having audio book, people can read book without reading, but by listening to it through car tape, at home, or on the trip.

The utilization of the two media has strength and weakness. Braille mathematics book has weaknesses as: a) high-cost production; b) complicatedness; c) taking time for exploring its content; and d) impracticality. The strengths of Mathematics Braille book are, among others: a) presented in detail; and b) technology is not required. The weaknesses of mathematics audio book are, among others: a) not all students are technology-literate; b) not give understanding in writing; and c) not all materials can be converted into audio format. The strengths of mathematics audio book are, among others: a) practical; b) producible; c) speeding the exploration of its

content; d) the readers can learn without reading. Therefore, one possible solution to the problem is to develop tool kit which integrating the high- and low-technology sets of equipment manually, and representing when and how to use each of them. Perhaps, they are not always the newest ones, but kit and manual will provide an information source in a limited number of tools, and how to use it for each topic [5]. For example, Audiomath+T is mathematics audio book equipped with Braille/tactual supplement.

Considering this fact, the author is encouraged to examine the user-friendliness of Braille book and audiomath+T to blind students. The user-friendly media is the one which is friendly to the users, in this case the blind students who will use BSA mathematics book. It means that BSA can be used by the blinds because it is easy to learn, use, and understand, so that the blind students' problem in acquiring complete information through textbook, particularly in mathematics subject, can be solved and the objective of learning can be achieved.

II. METHOD

The population of research was the 7th blind graders throughout Indonesia. Sampling technique employed in this study was purposive sampling, obtaining 38 students coming from 8 SLBs in 6 provinces of Indonesia.

The research design employed in this study was quasi experiment-Posttest-Only Control Design, recalling that not all variable (phenomena arising) and experiment conditions can be organized and controlled tightly. Arikunto defines experimental research as the one intended to find out whether or not there is a consequence of treatment on the subject investigated [6]. It can be accomplished by comparing one or more experiment group treated in which one control group untreated. Sample was divided into two groups: one group was treated with learning using Braille mathematics book and another group was treated with mathematic learning using audio mathematics book. Each of group consisted of 19 blind students taken not randomly.

Techniques of collecting data used were questionnaire and test. Instrument validation was conducted using content validity. Guion said that content validity can be determined based on experts' judgment" [7]. Reliability test was conducted using inter-rater technique. Reliability study involving rater is usually called inter-rater agreement or inter-rater reliability. Raters having high agreement can be seen from the position of subject observed. If the orders of subject scores from Rater A and B are similar, the two raters have high agreement [8].

Technique of analyzing data used in this experiment research was t-test data analysis. Data analyzed using t-test was converted into numeric format. This technique aimed to find out the difference of user-friendly levels between groups: experiment, and control.

III. RESULT AND DISCUSSION

A. Result

The difference of user-friendly effect between Braille mathematics and audiomath+T books was studied by analyzing the difference of score data in the two groups, in this case conducted using independent sample t-test. The result of independent sample t-test on user friendly level of mathematics learning using Braille and audiomath+T books can be seen in Table I. From Table I, it can be seen that F value = 2.267 with probability (sig) of 0.141. Meanwhile, the criterion of decision-making uses Ho principle as user-friendly variance indicating that there is no significant difference between Braille and AUDIOTAC mathematics books, and H1 as user friendly variance indicating that there is significant difference between Braille and AUDIOTAC mathematics books. The criteria used are: a) if probability (sig) > 0.05, Ho is supported; b) if probability (sig) <0.05, Ho is not supported. Table 1 shows that F statistic value = 2.267 with sig 0.141, so that Ho is supported. The conclusion is that there is no variance difference between Braille and AUDIOTAC data, so that the data is considered as homogeneous.

TABLE I. RESULT OF T-TEST

		Levene's Test for Equality of Variances		t-test for equality of means			
		F	*Sig*	*t*	*df*	*Sig.(2-tailed)*	*Mean Difference*
Sid. Var 00001	Equal variances assumed	2.267	.141	-4.955	36	.000	-8.526
	Equal variances not assumed			-4.955	32.7	.000	-8.526

The analysis on the difference of user-friendly level between learning using Braille and that using audiotac books is conducted using criteria that Ho indicates that there is no significant difference of effect between learning using Braille and that using audiotac book on user-friendly level, while H_1 indicates that there is a significant difference of effect between learning using Braille and one who using audiotac book on user-friendly level. The criteria used are that H_o is supported when probability value (sig) > 0.05 and H_o is not supported when probability value (sig) < 0.05. Table II shows t statistic value of -4.955 with sig 0.00 meaning that H_o is not supported meaning that there is a significant difference between Braille and audiotac book uses in getting learning easiness.

TABLE II. DIFFERENCE OF INTER-GROUP MEAN

	VAR00002	N	Mean	Std. Deviation	Std. Error Mean
VAR00001	1.00	19	28.1579	4.38765	1.00660
	2.00	19	36.6842	6.08324	1.39559

Considering the data shown in Table II indicating confidence interval of 95%, the mean difference of Braille and audiotac book uses ranges between -12.016 and -5.036. Then, learning using Braille and audiotac books has mean difference

of 8.527 (36.684-28.157), meaning that the uses of Braille and audio mathematics books has significant different mean score of user-friendly level.

B. Discussion

The use of audiotac and Braille books has significant difference (mean difference of 8.527). It indicates that the user-friendly level of mathematics book used with audiotac equipped with tactual/Braille supplement for the 7th blind graders is significantly better than Braille book use.

New technology changes the individual's way of dealing with visual disorder in accessing and sharing information, but Braille remains to be fundamental tool for freedom in the 21st and even millennium century. Audio set is the useful source of information, but individual with total sight loss still needs Braille. Recalling the relationship between low literacy and learning failure in blind students, some researchers were encouraged to identify an effective Braille reading method [9]. Although audio technology has changed the paradigm and the students' learning method, Braille reading speed should be improved continuously. Audiotac provides extraordinary exploration speed, while reading Braille provides in-depth understanding level. Audio mathematics book accommodates the strength of both of them. It provides blind students can listen to reading material very quickly. For any difficulty to hear (listen to), Braille/tactual supplement is provided to be associated with what has been heard.

The result of Liu, Hsieh, Cho, & Schallert's study showed that the use of technology improves achievement and self-efficacy [10]. However, some studies showed that the uses of technology in certain area is not useful for students. It is in line with this current study finding which showed that the use of audiotac usage in mathematic subjects results in students' understanding is lower than the use of Braille mathematics book. After the audio mathematics book is added with tactual/Braille supplement (audiomath+T), the score of understanding is higher than the use of audio mathematics book without tactual/Braille supplement.

Along with the technology advance, the demand for literacy is increasing very rapidly. Along with the increase in the demand for reading volume, blind students are recommended or taught to equip Braille text reading with digital book, audiobook, or other digital recording [3]. Supplementation with audiotac is considered as a media which is necessary used to improve the access of information. It happened not to compensate the delayed reading level, but because Braille printed material is not always available when necessary. Teacher often ignores Braille reading speed and emphasizes more on the students' final achievement, while those two elements are interrelated. It is in line with the result of study finding that there is a highly significant correlation between reading smoothness and reading comprehension [11]. Oakley found that the fluent readers tend to enjoy more readings, have positive attitude in reading and have more positive self-concept as reader than the less fluent one [12].

IV. CONCLUSION

Considering the result of research showing t statistic of -4.955 with sig. 0.00, it can be seen that there is a significant difference of user-friendly level between Braille and AUDIOTAC book uses. The difference is indicated with the mean difference between Braille and audiotac range between -12.016 and -5.036. User-friendly level of learning with Braille book and that with audiotac book has mean difference of 8.527 (36.684-28.157). it can be inferred it can be concluded that there is a substantial and significant difference of user-friendly level between Braille mathematics and audiomath+T book uses.

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