

Effect Of Game Of Set On Adult Learners` Academic Achievement In Simple Arithmetic In Nsukka Local Government Area Studying Centres

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Abstract: This research was carried out to determine the effect of Game of Set on adult learners` academic achievement in simple arithmetic in Nsukka Local Government Area Studying Centres. The study adopted a descriptive survey research design. Three research questions and hypotheses guided the study. The study was conducted in Nsukka Local Government Area. The population of the study was 437 (156 male and 281 female), adult learners. The sample size was 48 and was obtained through a simple random sampling technique using intact classes of the two centres. The instrument for the study was Simple Arithmetic Achievement Test (SAAT) of 25 multi-choice objective questions. Using Kudar-Richarson 20, 0.96 was obtained on the reliability test instrument. Mean and the standard deviation was used to answer the research questions while Analysis of Covariance was used for the hypotheses. The study found out that adult learners taught simple arithmetic using Game of Set performed better than those taught with conventional method. Also, there was no significant difference in the mean achievement scores of male and female adult learners taught simple arithmetic using game of Set. In conclusion, Game of Set is effective in improving adult learners` achievement in simple arithmetic. Finally, some recommendations were made.

Keywords: Game of Set, Adult Learners, Academic Achievement, Simple Arithmetic and Gender

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I. Introduction

Despite educational games' popularity and aspirations, the spread and development of digital games in educational settings are still in their juvenile stage. Game of Set is culturally focused, with each culture having its own collection of games [1]. They emphasized that mathematical principles are universal and evolved through cultures. Numbers, logic, spatial arrangement, and, most significantly, the combination or organization of these into systems or structures are called mathematical ideas. Game of Set and concepts occur in different ways, which are either clear-cut or mutually exclusive, from culture to culture and within any culture. Furthermore, design problems relating to game-based learning environments (GBLEs) and recognizing their effect on learning and instruction are still in the juvenile stage [2]. Although time constraints, a lack of clear guidelines, and game costs are all potential explanations for restricted usage [3], the lack of strong, rigorous research on games and learning appears to be a decisive obstacle[4]. Game of set is seen as a promising medium for encouraging active engagement and engaged learning among students [5].

Claims made in the literature are often not empirically verified, and therefore are not proven or debunked. One example is the argument in the literature that instructional support features are required in GBLEs [2]. Without extra assistance, the player will only learn how to play the game rather than the educational material contained in it [6]. On the other hand, emphasize that incorporating instructional support to games is more complicated because the effect is based on some variables, including the form of support and the cognitive tasks targeted [7]. In their research, Vandercruyssen, ter Vrugte, de Jong, Wouters, Oostendorp, Verschaffel, Moeyaert, Elen [8] discovered that VSE students perform significantly better in proportional reasoning problems after using the Game base learning environment (GBLE). When looking at various reports, the influence of the form of support becomes apparent. Mayer and Johnson, for example, presented proof of the efficacy of reflection prompt in the form of feedback on conceptual learning in the classroom [9]. Another research, on the other hand, found that reflection only helps people remember things in some cases i.e., non-interactive environments [10]. Abonyi, Maduagwuna, and Ugama [11] find out in their study that the mathematical game approach is superior to the conventional approach in enhancing students' achievement in algebraic expressions. Their findings also revealed further that there is no significant difference between the mean achievement score of male and female students taught quadratic expression using the mathematical game

approach. Going by this finding, Game of Set is very effective in increasing the achievement of students in quadratic expression which is a topic under Mathematics since students taught using this Game of Set performed far better than those taught with the traditional or conventional teaching method.

Traditional teaching, also known as formal teaching, is a form of learning in which teachers and students communicate in a face-to-face environment in the classroom. These teachers lead classroom discussions and are solely concerned with mastering material from textbooks and notes. The knowledge is passively obtained by the students, who then repeat what they learned in the exams [12]. While Game of Set is not new in today's classrooms when teaching mathematics topics, many education systems are still constrained by traditional teaching and learning methods [13]. Many teachers continue to instruct their students in the same manner in which they were instructed and in which their teachers were instructed, with little progress in terms of teaching perspectives [14]. Teachers are afraid and hesitant to adapt to less traditional teaching methods because they find the change challenging and dangerous [15]. In traditional teaching classrooms, while the lecturer is explaining and writing on the paper, students are copying the same details onto their notes, some daydreaming, and others sleeping which is a very poor method to be used when teaching adult learners basic mathematics [16]. It would be difficult to discourage adult learners from copying solving from the board while still ensuring that every adult learner in the class was paying attention because the instructor was too preoccupied with solving the basic mathematic addition and subtraction. Liu states that traditional education often reduces the space for more innovative thinking and seldom takes into account individual differences. With regards to the literature reviewed, It is eminent to consider the shortcomings of traditional or conventional education and take steps forward to a modern way of teaching basic mathematics to adult learners.

Adult education covers a wide range of topics such as basic arithmetic, spelling, pronunciation, family welfare, health, child development, and so on. Adult education is a process in which adults who have dropped out of school or who do not attend school on a regular or full-time basis engage in sequential and organized educational activities [17]. Adult education, according to Merriam and Brockett, is described as "activities deliberately designed to bring about learning among those whose age, social positions, or self-perception identify them as adults" [18]. Adult education seeks to improve the awareness, behaviors, skills, and abilities of adult learners who did not attend primary or secondary schools while they were younger, or who attended but later dropped out. Adult learners in the empirical stream pursue new knowledge through a rigorous investigation, while adult learners in the creative or intuitive/reflective stream create new meaning through instinct and examination of lived experiences [19].

Adult learners who are actively involved in their learning perform better in school [20]. Adult students carry their life experiences to new courses, and those experiences will affect how they interpret new material. Instructors should use the adult learners' diverse cultural backgrounds to develop activities that enable them to exchange ideas and learn from one another. Adult learners are more likely to participate and actively engaged in education that meets their interests and particular needs by integrating their life experiences and related subjects, one of which is simple arithmetic, which will assist them in their everyday financial transactions [21]. Experts recommend that adult learners should actively participate in the learning process by taking responsibility for their learning and setting personal academic goals [22]. Adult learners can take a more active role if an instructor uses Game of Set to teach them simple arithmetic.

Since using Game of Set in a simple arithmetic classroom can develop adult learners' thinking skills and assist them in understanding shapes, addition and subtraction, and all other areas of simple arithmetic that facilitate buying and selling, then it will be advisable for an instructor to use Game of Set when teaching adult learners. According to van Oers [23], an adult learner's simple arithmetic thinking is acquired from a cultural process. This cultural process includes the adult learners learning phase of understanding their behaviours. They get to know their own behavior meanings by resolving their problems collaboratively with other people who are more knowledgeable in particular contexts. In specific, Brandt [24] said that the concepts of simple arithmetic in adult learners are developed through learning practices carried out by instructors. Adult learners can learn simple arithmetic by integrating its concepts into their daily buying and selling activities [25]. As it stands, simple arithmetic is a science of logic- mathematical [26]. Thus, adult learners are thought to be challenged through some activities. Those activities should require them to think; to solve the problems through physical activities of buying and selling in which entail a higher level of thinking [27]. By having those intellectual challenges applied to adult learners, they would eventually obtain vast and solid mathematical and logical thinking [28]. Despite that, their experience gained from buying and selling at the market is the perfect match for adult learners' simple arithmetic learning. Adult learners can easily use the knowledge derived from issuing change out to customers to provide solutions to questions on addition, subtraction, and basic multiplication. If a create contains 30 eggs and you have 10 creates, how many eggs do you have altogether. This question is the same as when you ask an adult learner that 30×10 ? An adult learner can use the knowledge he or she derived from buying and selling to calculate and give the accurate answer which is 300 to the question. Therefore, adult learners' achievement in simple arithmetic could be promoted through life experience.

Achievement is seen in the Criteria for Test Construction [29] as a person's competence in a subject. Many intellectual and nonintellectual variables contribute to this competence. Data from experiments with word lists as well as the acquisition of diverse domains, such as computer programming, mathematics, or the way people solve physics problems, are all included in the scientific study of achievement. Achievement is often referred to as acquisition, understanding, or information representation at the experimental stage, depending on theoretical biases [30]. In the educational and psychometrics fields, the term "achievement" is also used to define the degree of inference needed on the part of the adult learner to respond, as well as the form of relation to a cognitive process made explicit in the measurement method. Typically, students in the 1950s and early 1960s had to learn "simple truth" [31] which meant reproducing declarative information. No matter how complex the inference needed from the student, it was assumed that these simple facts were required to construct more abstract rules, and little reference was made to possible cognitive processes. Singh [32] looked at higher secondary students' academic success and study habits. A total of 100 higher secondary students were chosen at random from two separate high schools for the study. The results show that learning behaviors and academic performance vary substantially between girls and boys. A finding of a study conducted in Nigeria shows that there is no significant difference between male and female students' achievement in mathematics who possess good study habits [33]. Bhan and Gupta [34] also looked into the study patterns and academic achievement of students from both scheduled and non-scheduled castes. The findings showed that, regardless of the gender of the students, sex has no significant effect on their study habits or academic achievement.

Many studies also focused on gender differences in mathematics achievement. Morgade and Bonder [35] found that females' mathematics achievement in the primary grades was the same, compared with that of males, but it decreased in the middle school. Also, Fennema and Sherman's [36] study showed that girl's mathematics ability tends to match that of boys in the earlier primary school years, but it deteriorates during high school. Khair, Khairani and Elrofi [37] finds out in their study that achievement in mathematics was strongly associated with gender differences, and it shown that females achievement was significantly upper than that of the males. This their finding can be justify with the assertion of Holmes [38] that despite they has been a lot of attention on girls' math achievement, researchers have also pointed out boys' underperformance as compared to girls' performance. Tilaye and Bedru [39] found out in their study that there is a major gender gap in math and science achievement in favor of males when compared to females. Similarly, Mullis, Martin, Beaton, Gonzalez, Gregory, and Garden [40] found that female students' mathematics achievement was substantially lower than that of their male counterparts. Leedy, LaLonde, and Runk [41] find that girls underachieve relative to boys due to mathematical attitudinal differences.

The problem most adult learners have that contributes to their poor performance in simple arithmetic is excess attention on buying and selling, lack of reading, and methods used by an instructor when teaching them. For an excellent performance, there is the need for the adult learner to form good studying habits and also for the instructor to use a good method that can foster their learning. From the assertion above, the work was conducted to examine the effect of Game of Set on adult learners' achievement in simple arithmetic in Nsukka Local Government Area Studying Centres.

The study aim was to ascertain the effects of Game of Set on adult learners' academic achievement in Nsukka Local Government Area studying centres. In particular, the study sought to:

- Find the mean achievement scores of adult learners taught simple arithmetic using Game of Set and those taught with the conventional teaching method.
- Find the mean achievement scores of male and female adult learners taught simple arithmetic using Game of Set.
- Determine the interaction effect of method and gender on the mean achievement scores of adult learners in simple arithmetic.

The following research questions guided the study.

- What are the mean achievement scores of adult learners taught simple arithmetic using Game of Set and those taught with conventional teaching method?
- What are the mean achievement scores of male and female adult learners taught simple arithmetic using Game of Set?
- What is the interaction effect of method and gender on the mean achievement scores of adult learners in simple arithmetic?

The following hypotheses formulated by the researchers guided the study.

Ho₁: There is no significant difference in the mean achievement scores of adult learners taught simple arithmetic using Game of Set and those taught with the conventional teaching method.

Ho₂: There is no significant difference in the mean achievement scores of male and female adult learners taught simple arithmetic using Game of Set.

Ho₃: There is no significant difference in the interaction effect of method and gender on the mean achievement scores of adult learners in simple arithmetic

II. Methods

The study was a quasi-experimental research design. Specifically, the non-equivalent pre-test post-test control group design since intact classes of the adult learners studying centres in Nsukka Local Government Area was used. Intact classes of the two learning centres were used in other to avoid selection bias among the adult learners and also to prevent the arrangement of the adult learners. Ali (2006) regards quasi-experimental research design as a research design in education which uses non-randomized group and these options occur when the researcher(s) cannot randomly sample some specific learners and there also assign the subjects. In support of this statement were Ezeudu, Jolaosho, Yahaya, Okpara, and Babalulu (2020) who asserted that quasi-experimental does not use random assignment of subjects, rather intact class is usually used and this serves as a justification for the use of quasi-experimental research design in this study. The study was conducted in Nsukka Local Government Area of Enugu State, Nigeria covering the three functioning adult learning centres in the Local Government. Nsukka Local Government is having an area of 1,810km² and houses the first indigenous university in Nigeria (University of Nigeria).

The population of the study was 437 (156 male and 281 female) adult learners in all the three functioning centres in Nsukka Local Government Area (Ugwuoye adult learning centre, Opi adult learning centre, and Edem adult learning centre). The sample size of the study was 48 adult learners in two out of the three functioning adult learning centres in the Local Government Area. A simple random sampling technique was used to select two centres out of the three centres. Simple Arithmetic Achievement Test (SAAT) was used as the instrument for collecting data. The SAAT was 25 items multi-choice objective questions adopted from their simple arithmetic learning materials. Three experts did face and content validation of the instruments. Two of the experts were in Adult Education and one in Measurement and Evaluation, all in the faculty of Education, University of Nigeria, Nsukka. The test instrument was subject to thorough scrutiny by these experts to ensure that its contents were in line with the purpose of the study, research questions and hypotheses formulated to guide the study. To ascertain the reliability level of the test instrument, a pilot study was conducted in Udenu Local Government Area which is not under the control of the study area or in any way related to the study area. Using Kuder Richardson 20 (K – R 20) reliability of 0.96 was obtained from the SAAT instrument which shows that the Simple Arithmetic Achievement Test instrument is highly reliable.

The instructor subjected the adult learners in both groups to pretesting before the experiment. Pretest on Simple Arithmetic Achievement Test (SAAT) was administered on both the experimental (Game of Set) and the control (Conventional) group. The researchers collated the answer sheet and marked them to obtain the pretest scores of both the experimental and the control group adult learners. Treatment commenced the same week the pretest was conducted and the treatment lasted for three weeks in which another test known as posttest was administered on both the experimental and the control group adult learners. The researchers again collated the answer sheets and marked them to obtain the post-test scores of both the experimental and the control group learners. The scores of adult learners in the two tests conducted were later subjected to statistical computation through statistical package for social sciences (SPSS) version 23. The three research questions that guided the study were answered using mean and standard deviation while the hypotheses were tested using Analysis of Covariance (ANCOVA). Hence, a hypothesis that is greater than 0.05 was accepted and a hypothesis that is less than 0.05 was rejected.

III. Result

Research Question 1

What are the mean achievement scores of adult learners taught simple arithmetic using Game of Set and those taught with conventional teaching method?

Table 1
Pre-test and Post-test Mean Scores of Game of Set and Conventional Method in the Achievement Test

Method	N	Pretest		Posttest		Mean Gain
		\bar{x}	SD	\bar{x}	SD	
Game of Set	25	26.84	7.05	66.96	5.89	40.12
Conventional	23	28.17	6.90	50.35	7.90	22.18

*N = Number of students, \bar{x} = Mean and SD = Standard Deviation

The data presented in Table 1 showed that the group which was taught using the Game of Set method (GS) had a pre-test mean achievement score of 26.84 with a standard deviation score of 7.05 and a post-test mean achievement score of 66.96 with a standard deviation score of 5.89. The difference between the pre-test and post-test mean for the group taught using Game of Set was 40.12. The conventional method group had a pre-test mean score of 28.17 with a standard deviation score of 6.90 and a posttest mean achievement score of 50.35 with a standard deviation score of 7.90. The difference between (mean gain) the pretest and posttest mean for the group taught using the conventional method was 22.18. This result reveals that the adult learners taught

simple arithmetic using Game of Set performed better in the achievement test than the adult learners taught with the conventional method. Therefore, Game of Set was more effective in enhancing adult learners` achievement in simple arithmetic.

Hypothesis One

Ho₁: There is no significant difference in the mean achievement scores of adult learners taught simple arithmetic using Game of Set and those taught with the conventional teaching method.

Table 2: Analysis of Covariance (ANCOVA) of the Significant Difference in the Mean Achievement Scores of Adult Simple Arithmetic Using Game of Set and Those Taught With Conventional Teaching Method.

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.
Corrected Model	3446.399 ^a	4	861.600	17.936	.000
Intercept	7422.598	1	7422.598	154.518	.000
Pretest	136.721	1	136.721	2.846	.099
Method	3073.310	1	3073.310	63.978	.000
Gender	2.432	1	2.432	.051	.823
Method * Gender	2.540	1	2.540	.053	.819
Error	2065.601	43	48.037		
Total	172600.000	48			
Corrected Total	5512.000	47			

The result in Table 2 shows that an F-cal of 63.978 with an associated probability of 0.000 was obtained with respect to the difference in the mean achievement scores of adult learners taught simple arithmetic using Game of Set and those taught with the conventional method. Since the associated probability (0.000) was less than 0.05 level of the significant set as the benchmark for taking a decision, the null hypothesis (Ho₁) was rejected. The inference drawn was that there was a significant difference in the mean achievement scores of adult learners taught simple arithmetic using Game of Set and those taught with the conventional method.

Research Question 2

What are the mean achievement scores of male and female adult learners taught simple arithmetic using Game of Set?

**Table 3
Pre-test and Post-test Mean Scores of Male and Female Adult Learners Taught Simple Arithmetic using Game of Set in the Achievement Test**

Gender	N	Pretest		Posttest		Mean Gain
		\bar{x}	SD	\bar{x}	SD	
Male	9	27.22	2.64	66.44	5.27	39.22
Female	16	26.63	8.69	67.25	6.36	40.62

*N = Number of students, \bar{x} = Mean and SD = Standard Deviation

The result presented on Table 3 shows that the male group had a pretest mean achievement score of 27.22 with a standard deviation score of 2.64 and a posttest mean achievement score of 66.44 with a standard deviation score of 5.27. The difference between (mean gain) the pretest and posttest for the male group was 39.22. The female group had a pretest mean achievement score of 26.63 with a standard deviation score of 8.69 and a posttest mean achievement score of 67.25 with a standard deviation of 6.36. The difference between (mean gain) the pretest and posttest mean score for the female group is 40.62. For each of both male and female, the posttest achievement mean was greater than the pretest achievement means with the female group having a higher mean gain. This shows that Game of Set appears to have improved the achievement score of both the male and the female adult learners.

Hypothesis 2

Ho₂: There is no significant difference in the mean achievement scores of male and adult learners taught simple arithmetic using Game of Set.

The result in Table 2 shows that an F-ratio of .051 with an associated probability value of .819 obtained with respect to the difference in the mean achievement scores of male and female adult learners taught simple arithmetic using Game of Set (GS). Since the associated probability (.819) was greater than 0.05 set as the level of significance and criterion for taking a decision, the null hypothesis (Ho₂) was accepted. Based on this, it was therefore concluded that there was no significant difference in the mean achievement scores of male and adult learners taught simple arithmetic using Game of Set.

Research Question 3

What is the interaction effect of method and gender on the mean achievement scores of adult learners in simple arithmetic?

Table 4
Mean and Standard Deviation of the Interaction Effect of Method and Gender on the Mean Achievement Scores of Adult Learners in Simple Arithmetic

Method	Variables		N	Pretest		Posttest		Mean Gain
	Gender			\bar{x}	SD	\bar{x}	SD	
Game of Set	Male		9	27.22	2.64	66.44	5.27	37.22
	Female		16	26.63	8.69	67.25	6.36	40.62
Conventional	Male		8	27.75	6.36	50.25	2.71	22.50
	Female		15	28.40	7.38	50.40	9.72	22.00

*N = Number of students, \bar{x} = Mean and SD = Standard Deviation

The result presented in Table 7 shows the interaction between method and gender on the mean achievement scores of adult learners in simple arithmetic. The result shows that the male group of those adult learners taught Simple Arithmetic using Game of Set had a pretest mean of 27.22 with a standard deviation of 2.64 and a posttest mean of 66.44 with a standard deviation of 5.27. The difference between (mean gain) the pretest and posttest for male group is 37.22. The female group had a pretest mean of 26.63 with a standard deviation of 8.69 and a posttest mean of 67.25 with a standard deviation of 6.36. The difference between (mean gain) the pretest and posttest mean for the female group was 40.62. For each of the two genders, the posttest achievement means were greater than the pretest achievement means with the female group having a higher mean gain. This is indicative that Game of Set appears to have improved the achievement score of both male and female adult learners. The result in Table 4 also shows that the male group of those adult learners taught Simple Arithmetic using Game of Set had a pretest mean of 27.75 with a standard deviation of 6.36 and a posttest mean of 50.25 with a standard deviation of 2.71. The difference between the pretest and posttest means for the male group was 22.50. The female group had a pretest mean score of 28.40 with a standard deviation score of 7.38 and a posttest mean score of 50.40 with a standard deviation of 9.72. The difference between the pretest and the posttest mean for the female group was 22.00. For each of the two groups, the posttest means score was greater than the pretest means scores. The female group in the Game of Set gained more scores than the male group while the male of the conventional group gained more scores than their female counterpart. This means there was no interaction between method and gender on adult learners` achievement in Simple Arithmetic.

Hypothesis 3

Ho₃: There is no significant difference in the interaction effect of method and gender on the mean achievement scores of adult learners in simple arithmetic.

The result in Table 2 shows that an F-ratio of .053 with an associated probability value of .819 was obtained with respect to the interaction effect of method and gender on adult learners` achievement scores in Simple Arithmetic. Since the associated probability (.819) was greater than 0.05 level of significance set as the criterion for making a decision, the null hypothesis (Ho₃) was accepted. Thus, the conclusion drawn was that there is no significant interaction effect of method and gender on the mean achievement scores of adult learners in Simple Arithmetic.

IV. Findings and Discussion

As shown in Table 1, there is a different between the mean achievement scores of the two groups of adult learners taught Simple Arithmetic (Game of Set Group and Conventional Method Group). The analysis revealed that adult learners taught using Game of Set performed significantly better in Simple Arithmetic Achievement Test than their counterparts who were taught with Conventional Method. Results in table 2 further confirmed this finding by indicating a significant difference in both groups. Table 2 shows an F – cal of 63.978 with the probability value of 0.000 which was significant at 0.05 level of confidence testifies the result. This implies that the efficacy of the Game of set and Conventional method with regards to academic achievement of adult learners in Simple Arithmetic is not the same. In other words, the adult learners` achievement using Game of Set appears better than with the Conventional method. This study was in line with the finding of Maduagwuna and Ugama (2014) who find out in their study that the mathematical game approach is superior to the conventional approach in enhancing students' achievement in algebraic expressions. Their findings also revealed further that there is no significant difference between the mean achievement score of male and female students taught quadratic expression using the mathematical game approach.

The data in Table 3 has shown that there is a slight difference between the mean achievement scores of male and female adult learners taught Simple Arithmetic using Game of Set. As shown in Table 2, the F – cal of .051 over the observed probability value of .823 which was not significant at 0.05 level of confidence testifies the result. The female students' score was slightly higher than the male adult learner score with the female students having a higher mean gain over the male adult learners. This finding is in line with Khair, Khairani, and Elrofi (2012) who finds out in their study that achievement in mathematics was strongly associated with gender differences, and it is shown that females achievement was significantly upper than that of the males. The result of this study is at variance with Mullis, Martin, Beaton, Gonzalez, Gregory, and Garden (2000) found that female students' mathematics achievement was substantially lower than that of their male counterparts.

It has been established in this study (Table 2) that there is no significant interaction effect of method and gender on the mean scores in the post-test Simple Arithmetic Achievement Test of adult learners taught Simple Arithmetic, Table 2 testify to the result with F – cal of .053 over the observed probability value of .819. This finding aligns with Morgade and Bonder (1995) found that females' mathematics achievement in the primary grades was the same, compared with that of males, but it decreased in the middle school.

V. Conclusions

From the foregoing findings, and discussion it could be concluded that adult learners taught Siple Arithmetic using Game of Set performed excellently than those adult learners taught Simple Arithmetic using Conventional method. This shows that Game of Set was more effective than the Conventional method in adult learners` achievement in Simple Arithmetic while the female group taught Simple Arithmetic using Game of Set mean achievement score was slightly higher than their male counterpart but was not statistically significant. Finally, there was no significant interaction effect of method and gender on the mean achievement scores of the adult learners taught Simple Arithmetic.

VI. Recommendations

The study, therefore, made the following recommendations:

- As the use of Game of Set has been found effective in promoting Nsukka adult learners` achievement in Simple Arithmetic, it should be used in other adult learning centres in Enugu State as a whole.
- Adult instructors in Nigeria as a whole should also be educated on how they can use Game of Set when teaching adult learners any aspect of basic mathematics.

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