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CHESS PLAYING AND GENDER EFFECT ON ATTENTION SKILL OF THE ADOLESCENT STUDENTS IN ANAMBRA STATE OF NIGERIA

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ABSTRACT

This study investigated on the effect of chess playing on the attention skill of the adolescent students in SS 2 in Anambra State. The study was guided by two research questions and three hypotheses. The study utilized non-randomized, pre-test, post-test control group quasi-experimental design. The population of the study consists of 12,277 (SS 2) students in the 204 co-educational secondary schools in Anambra State (Source: Post Primary Schools Services Commission, PPSSC, Awka Anambra State, 2022). Multi stage sampling procedure was adopted for this study. Four out of the six education zones in Anambra were used. A total of 200 students from the intact classes were used from the four sampled schools of the four zones. Mindful Attention Awareness Scale for Adolescent (MAAS-A) by Bruin, Zijlstra, Weijer-Bergsma and Bogels (2011) was the instrument used for data collection. It was adapted and revalidated. The reliability of the instrument was established at .77 coefficient using Cronbach Alpha method. In the experimental procedure, the chess trainers were instructed by the researcher and they trained the students for a total of 160 minutes per week for a period of 6 weeks. Pretest and posttest were collected and analysed with ANCOVA using SPSS version 2.0. The result showed that chess playing enhanced the attention skill of the experimental group though it showed gender bias against the female students. It was recommended that chess playing as a game-based approach to learning should be adapted in schools as an extra-curricular activity.

Keywords: Chess Playing, Attention Skill, Gender

Introduction

Over the years, the need for constant improvement of teaching and learning has become a driving force in educational research among educational psychologists, educators, policy makers and school managers. This concern has been generally narrowed down to some critical factors such as learning environment/situation, the learning process and the learner, which impact significantly on learning outcomes. Considering the irreplaceable role of the learner in all learning circumstances, scholars' attention have been given to a diverse of factors which affect learners' learning ability including physiological, psychological, socio-economic, cognitive and meta-cognitive factors. Despite the extensive researches on factors associated with learning outcomes, studies on the purview of cognitive skills, for example, thinking, reading, reasoning, remembering, and attention remain limited and as such needs to be explored. Currently, this

constitutes a great academic worry to the researcher especially as the factors of attention of adolescent students in Anambra state are concerned.

Attention is a state of mindfulness. It is an awareness of one's thought and/or action towards a particular phenomenon or situation. It is a cognitive skill, and could be understood as a conscious process of selecting, focusing or concentrating on insights or perceptual information with a view to creating meaningful outcomes from them (Reshma, 2020). Thus, Reshma's submission connotes that attention is a process which is carried out through cognitive abilities and helped by emotional and behavioural factors to select something out of the various stimuli present in one's environment and bring it in the centre of one's consciousness in order to perceive it clearly for deriving the desired end. Furthermore, attention could be studied as selective attention, divided attention, sustained attention and executive attention. According to Gross (2010) selective or focused attention is the mechanism by which certain information is registered and other information is rejected, whether or not the latter enters conscious awareness. Divided attention is a dual-task technique of attending and responding to more than one message at a time (Gross, 2010). According to Martin, Cornejo, and Luengo (2017) sustained attention is when one's attention span to performing a task can last for a reasonable long period of time that may count in hours. This is also known as concentration. Executive attention is understood as a long-term activity that demands continued and integrated effort to achieve. It is an extended form of sustained attention.

Sustained attention is cognitive skill that is necessary in learning outcomes. Alavi, Seng, Mustaffa, Ninggal, Amini, *et al.* (2019) have linked poor academic performance and achievement to lack of attention to insights or perceptual inputs. Accordingly, Grossberg (2005) in his adaptive resonance theory posited that attention can sensitize or stimulate neuronal connectivity which enhances information processing. Deductively, this presupposes that students who could not generate feedback of processed information from the short term memory (STM) or long term memory (LTM) have deficit in attention and this invariably, leads to poor academic achievement. Recent literature is still consistent with this finding, hence, Alfonsi, Palmizio, and DeGennaro (2020) pointed out that drop in attention capacity as a sleep during learning crucially affects attention and consequently undermine academic achievement. The researchers ascertained that sleep after learning stabilizes sustained attention, consolidates what was learnt during the day and enhances attention capacity. More so, that diurnal level of attentional vigilance may affect and determine knowledge acquisition, information retrieval and learning during school days. Therefore, having associated attention with academic achievement, the gap still remains that only a few literature has researched on how to tackle academic achievement through enhancement of students' attention capacity especially in Anambra State, Nigeria.

Studies carried out on how to improve attention ability suggested that some variable manipulations could help, such as cognitive rehabilitation (Nejati, 2020), manual therapy (Bayo-Tallon, Esquirol-Caussa, Pamias-Massana, Planells-Keller, and Cascos-Rodriguez, 2020), chess playing (ElDaou and El-Shamieh, 2014), music therapy (Sze and Yu, 2004), and adopting some metacognitive skills like mind maps and sketch noting (Kajka, 2019). This brings to the fore the need to integrate some variables for optimal improvement on attention faculty and other cognitive skills.

While considering the strategy for optimal improvement on attention faculty, it should be noted that the subjects in question are adolescents in the era of forth industrial Revolution (4IR). Adolescent age is the age between 12 to 17 years. According to Unachukwu, Ebenebe and Nwosu (2019) this is a very sensitive age of development because it is characterized by rapid development in different aspects of their lives which include: cognitive, physical, emotional, moral, and social development. Each of these aspects of the adolescent development is critical to forming his/her personality type, and personality type is a strong predictor of learning as indicated in the educational implications of personality theories of Maslow, Freud, Bandura, Adler, Sullivan, Allport and Piaget (Unachukwu *et al.*, 2019). In consideration of the above distinct characteristics of the adolescents towards enhancing their learning outcomes especially as it pertains to attention skill certain prerequisites factors are to be considered in line with their developmental age and preferred learning style. Accordingly, Ikwuka (2019) proffered that the use of teaching methods should take cognizance of the learners' preferred learning style because they predict to a great significance the students' acquisition of knowledge.

Furthermore, the preferred learning style of the adolescents to be adopted for teaching and learning should be subjected to gender sensitivity considerations. Gender effects have been established in many learning situations and outcomes (Adedayo, 2020; Hsieh and Yu, 2022). Hence, in introducing any learning style for the improvement of learning outcomes like attention among the adolescents, gender differences and sensitivity to the style have to be factored in. However, some authors opined that gender discrepancies in learning approach and outcome have been known to be caused merely by stereotyping and socio-cultural factors especially regarding education of the girl child in Nigeria (Ajai and Imoko, 2015). Specifically, learning style based on gamification has received diverse views from researchers. Haruna, Zainuddin, Okoye, Mellecker, Hu, *et al.* (2021) observed that gamification improves learning outcomes and it has no interaction effect to gender. Backus, Cubel, Guid, Sanchez-Pages and Manas (2023) investigated on how chess game and gender interact to determine performance outcome of the professional chess players. They found that men continue playing against women even when they would resign if they were playing against men, a resilience which women can't sustain against men. Accordingly. De Sousa and

Hollard (2023) observe that women's cognitive processes may be negatively affected when competing against men either by stereotype threats or discouragement effects. More still, Nagahi, Hossain and Jaradat (2019) investigation on gender influence on the practioners' systemic thinking (ST) skill preferences shows that male practitioners have more systemic tendency in respect to systems worldview and change skills than female practitioners, though they are not significantly different from each other in the areas of interaction, independence, uncertainty, complexity, and flexibility. However, the findings of Alavi, Seng, Mustaffa, Ninggal, Amini, *et al.* (2019) who investigated on the relationships among attention, impulse control, gender, and academic achievement observe that while girls were rated with higher levels of attention and impulse control than boys, there was no gender interaction in the relationships between either attention and academic achievement or impulse control and academic achievement. Accordingly, Yu (2021) observed that gender interacted in the on-line learning outcomes of students in favour of the male students during the covid-19 pandemic.

Despite these divergent views by authors, game-based learning approach is of special interest to the researcher because according to Teach.com (2020), it appeals to the adolescent by engaging them more actively in learning skills, making them problem solvers, encouraging mastery mindset rather than focus on grades, and to help them acquire prerequisite skills they need as adult. The game of chess is of special interest to the researcher because the cognitive abilities that its players virtually display like concentration while playing the game may be an indication of cognitive enhancement process. Chess is a historic recreational game (Murray, 2021). Some iconic chess researchers (Gao, Feng, Chen and Ping, 2021; Golombek, 1974; Murray, 2021) contend that chess playing is more than a recreation because while observing the players play the chess game, they tend to exhibit some traits of cognitive and metacognitive skills like planning, monitoring, concentration, attention, reflection, calculation, cogitation, more so they cherish cool atmosphere and abhor noise-making. These observed exhibition of cognitive and metacognitve components of the chess game have caught the interest of chess researchers especially as how these observed chess skills may be transferred to students' academic skill. For instance, Gao, Feng, Chen and Ping (2021) contended that chess skills can mediate the relationship between fluid intelligence and academic performance.

Considering the outcome of some researches in which chess is investigated in psychology, it is hypothetically considered recently as a model for cognitive processes and abilities such as perception, information management, attention, memory, logical thinking (Scholz, *et al.*, 2008); improvement of thinking skills, improvement of problem solving ability (Scholz *et al.*, 2008; Subia, Amaranto, Amaranto, Bustamante and Damaso, 2019); and better academic achievement (Subia, 2020). Thus, in their study in Romania on chess game playing among primary school students, Velea and Cojocaru (2019) found

that the students significantly improved on their attention skill through chess training. This findings was in line with the findings of Gindi and Pilpel (2020) that chess has a positive effect on attention skill among Attention Deficit Hyperactive Disorder (ADHD) students in Israel. The study shows that ADHD student that played chess exhibited higher attention level thereby making lesser mistakes in the tasks they were given than non-chess players irrespective of their diagnosis and medication. A similar study was conducted by Aciego, Garcia and Betancort (2012) in Spain. As the treatment group received chess instruction lessons, the control group was tutored in extra-curricular sports activities- basket or soccer. The result showed that the chess group recorded higher significant ability than the control group in problem solving capacity. Contrarily, Scholz, Niesch, Steffen, Ernst, Loeffler, *et al.* (2008) and Hong and Bart (2007) in their findings found no evidence of improvement on concentration ability on students trained with chess game and those who were not exposed to the training.

Although, several studies have been carried out on the influence of attention skill on academic achievements of students, very few have investigated on how to enhance the cognitive skill of attention among the adolescents. The few that have investigated on how to enhance attention skills using chess game where scarcely done in Nigeria and specifically in Anambra State of Nigeria. Therefore, to fill this gap in studies, the researcher is hypothesizing that chess as a game-based learning strategy may enhance students' attention skill among adolescents in Anambra State Secondary Schools based on the theory of transfer of learning by Thorndike and Woodworth (1901). The theory states that training in one kind of activity would transfer to another only if the activities shared common stimulus-response elements.

Research Questions and Hypotheses

To achieve this purpose, the study is guided by two research questions and three hypotheses.

1. What is the difference between pretest and posttest mean attention scores of students with exposure to chess playing and those without exposure to chess training?
2. What is the difference in the pretest and posttest mean attention scores of male and female students with exposure to chess playing?

Hypotheses

3. There is no significant difference in the mean attention scores of students with exposure to chess playing and those without exposure to chess training.
4. There is no significant difference in the mean attention scores of male and female students with exposure to chess playing.
5. There is no significant interaction effect of gender and treatment gap on the posttest mean attention scores of the students.

Research Method

The study utilized non-randomized, pre-test, post-test control group quasi-experimental

design. Specifically, it is 2 X 2 factorial design in which the independent variables are the exposure to chess playing and gender while the dependent variable is attention. The 2 X 2 factorial design here entails that there are two independent variables (exposure to chess playing and gender). Exposure to chess playing has two levels: those exposed to chess playing and those not exposed to chess playing. Gender equally has two levels: male and female. The population of the study consists of 12,277 senior secondary two (SS 2) students in the 204 co-educational secondary schools in Anambra State (Source: Post Primary Schools Services Commission, PPSSC, Awka Anambra State, 2022). Multi stage sampling procedure was adopted for this study. Four out of the six education zones in Anambra were used. Awka and Ogidi, and Aguata and Onitsha as the experimental and control groups respectively. A total of 200 students from the intact classes were used from the four sampled schools of the four zones. Mindful Attention Awareness Scale for Adolescent (MAAS-A) by Bruin, Zijlstra, Weijer-Bergsma and Bogels (2011) was the instrument used for data collection. The MAAS-A standardized instrument has fourteen items. The items are answered on a six-point scale (6= Almost always; 5=often time, 4=sometimes, 3=occasionally, 2=rarely, 1=almost never) of which higher scores are indication of higher traits of mindfulness. The MAAS-A was adapted because the items of the original version were all negatively worded which has the criticism of not having a good check for participants who would fill these items without reading them with rapt attention. The instrument was revalidated by experts from the discipline of educational psychology, measurement and evaluation, and department of science education. The reliability was obtained by administering a single test form to a group of sixty Enugu state secondary school students with homogenous traits. Using Cronbach Alpha reliability coefficient, the result obtained showed a coefficient reliability of .77 which was statistically adjudged to be of good standard for an instrument.

Experimental Procedure

This experiment lasted for a period of nine weeks in the second term of the secondary school academic year beginning with the training of the research assistants in the first week. The research assistants for this study were three members of Anambra Chess Forum as chess trainers. The three chess trainers trained the students in the experimental group while the control group had no training in chess playing. Both groups attended school for the conventional teaching based on scheme of work for the term. The researcher in collaboration with chess trainers scrutinized the chess scheme of work and made necessary adjustments so as to suit the objectives of the research. They trained the students on the beginner's package covering basics moves, mates and tactics. During the training session, the chess trainers were monitored with a Fidelity Test Inventory designed by the researcher in line with five main components of Fidelity Test in research by Mitchell (2021).

Before the training began, three students who have learnt the game of chess were technically skipped by not using their scores for the analysis. Equally, the researcher did not use for analysis the scores of those

students who did not fall within the adolescent age range of 12-17 years as operationalized in the concept of adolescent in this study. As the researcher requested from the principals, the consent of the participants' parents or guardians was obtained through the principals during the Parent Teacher Association (P.T.A) meeting. The principals of the experimental schools explained to them that the exercise was geared towards improving teaching and learning for the students. This consent is necessary because some of the parents might misconstrue the playing of chess game as distraction to their children's or wards' academic programme. In the 2nd week, the pretest for the two groups was administered and training began on the 3rd week. The intact classes received chess training for 160 minutes every week during the periods mapped out in schools for extra-curricular activities on Thursdays and Fridays. At the end of the 6-week training, posttest was administered which items were reshuffled so as to forestall pretest effect.

Mean and standard deviation were used to answer the research questions based on the data from the pre-test and the post-test. Two-way analysis of covariance (ANCOVA) was used to test for significance difference at 0.05 alpha levels. The decision rule was to retain the null hypothesis (Ho) if the calculated p-value is greater than 0.05 (p>.05) while the null hypothesis (Ho) was rejected if the calculated p-value is less than or equals to the probability value of 0.05(p<.05).

Presentation of Results:

Research Question 1: What is the difference in the pretest and posttest mean attention scores of male and female students with exposure to chess playing?

Table 1: Mean Attention scores of students with exposure to chess playing and those without exposure to chess playing

Group	N	Pre-test		Post-test		Mean gain
		X	SD	X	SD	
Chess players	95	33.92	5.62	69.06	8.31	35.14
Non chess players	105	22.35	2.43	35.94	8.76	13.59
Mean Difference		**21.57**		**13.12**		**21.55**

Table 1 showed that students with exposure to chess playing had 33.92 as the pre-test mean score and 69.06 as the post-test mean score with 5.62 and 8.31 as their standard deviation respectively with a gain in mean of 35.14. The students without exposure to chess playing had 22.35 as the pre-test mean score and 35.94 as their post-test mean with 2.43 and 8.76 respectively as their standard deviation, with a gain in mean of 13.59. The analysis revealed that the mean attention scores of students with exposure to chess playing is higher than those without exposure to chess playing because the mean gain of 35.14 for the experimental group is greater than 13.59 mean gain of the control group.

The mean difference is 21.55 in favour of experimental group. The standard deviation of 8.31 for the experimental group is smaller than the 8.76 for the control group. This implied that the posttest mean attention scores of the experimental group is more homogenous than that of the control group.

Research Question 2: What is the difference in the pretest and posttest mean attention scores of male and female with exposure to chess playing?

Table 2: Mean Attention Scores of Male and Female Students with Exposure to Chess Playing

Gender	N	Pretest		Post-test		Mean gain
		$\overline{X}$	SD	$\overline{X}$	SD	
Male	44	23.67	3.65	71.56	2.98	47.89
Female	51	21.11	3.88	66.93	3.03	45.82
Mean Difference		**2.56**		**4.63**		**2.07**

Data analysis in Table 2 revealed that the male students had mean attention scores of 23.67 and 71.56 for their pre-test and post-test respectively with standard deviation scores of 3.65 and 2.98 for their pre-test and post-test scores. Also, female students had mean attention scores of 21.11 and 66.93 for their pre-test and post-test respectively with standard deviation scores of 3.88 and 3.03 for their pre-test and post-test scores. The gain in mean of 47.89 for male students was higher than that of their female counterpart with 45.82 gain in mean. This means that the mean attention scores of male students with exposure to chess playing is higher than their female counterparts with exposure to chess playing. The posttest standard deviation of 2.98 for the male students is lower than that of the female students which showed a more uniform distribution of scores for the male students.

Hypothesis 1: There is no significant difference in the mean attention scores of students taught mathematics with exposure to chess playing and those taught without exposure.

Table 3: ANCOVA test of no significant difference in the mean attention scores of students with exposure to chess playing and those without exposure

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	23368.950[a]	2	11684.475	671.669	.000	.872
Intercept	4160.020	1	4160.020	239.134	.000	.548
Attention	155.396	1	155.396	8.933	.003	.043
Group	16435.245	1	16435.245	944.761	.000	.827
Error	3427.050	197	17.396			
Total	128948.000	200				
Corrected Total	26796.000	199				

a. R Squared = .872 (Adjusted R Squared = .871)

Table 3 revealed the significant difference in the mean attention scores of students with exposure to chess playing and those without exposure; F(1,197) = 944.761, P= 0.000 < 0.05. Therefore, the null hypothesis is rejected; this means that there is significant difference between the mean attention scores of students with exposure to chess playing and those without exposure.

Hypothesis 2: There is no significant difference in the mean attention scores of male and female students with exposure to chess playing

Table 4: ANCOVA test of significant difference in the mean attention scores of male and female students with exposure to chess playing

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	8173.498[a]	2	4086.749	43.232	.000	.305
Intercept	382.396	1	382.396	4.045	.046	.020
Post_ MAASA	7385.961	1	7385.961	78.133	.000	.284
Gender	1239.792	1	1239.792	13.115	.000	.062
Error	18622.502	93	94.530			
Total	128948.000	95				
Corrected Total	26796.000	94				

a. R Squared = .305 (Adjusted R Squared = .298)

Table 4 revealed the significance in the mean attention scores of male and female students with exposure to chess playing; F (1, 93) = 0.000, P= 0.000< 0.05. Therefore, the null hypothesis is rejected, thus, there is a significant difference in the mean attention scores of male and female students with exposure to chess playing.

Hypothesis 3: There is no significant interaction effect of gender and treatment gap on the posttest mean attention scores of the students.

Table 5: ANCOVA test of significant interaction effect of gender and treatment gap on the posttest mean attention scores of the students

Source	Type III Sum of Squares	Df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	24246.355[a]	4	6061.589	463.598	.000	.905
Intercept	2296.878	1	2296.878	175.668	.000	.474
Post_ MAASA	2.753	1	2.753	.211	.647	.001
Group	14042.506	1	14042.506	1073.988	.000	.846
Gender	749.754	1	749.754	57.342	.000	.227
group * gender	205.571	1	205.571	15.722	.000	.075
Error	2549.645	195	13.075			
Total	128948.000	200				
Corrected Total	26796.000	199				

a. R Squared = .905 (Adjusted R Squared = .903)

Table 5 revealed the significant interaction effect of gender and treatment gap on the posttest mean attention scores of the students; F (4,195) = 15.722, P= 0.000 < 0.05. Therefore, the null hypothesis was rejected; this means that there is a significant interaction effect of gender and treatment gap on the posttest mean attention scores of the students.

Discussion of Findings

The findings obtained from the research revealed that chess game playing had a positive effect on the attention skills of the secondary school students. Furthermore, comparing the result of the research question one in table one with hypothesis one in table 3, the null hypothesis was rejected. Thus, it revealed that there is significant difference between the mean attention scores of students with exposure to chess playing and those without exposure. This entails that playing of chess game by students invariably enhanced their attention skill. This finding is supported by the study conducted by Velea and Cojocaru (2019) in Romania on chess game playing among primary school students who significantly improved on their attention skill through chess training. More so, Gindi and Pilpel's (2020) findings on the positive effect of chess on attention among ADHD students is supported by this current study. The findings of Aciego, Garcia and Betancort (2012) and ElDaou and El-Shamieh (2014) are in support of this current finding.

However, this current finding is not consistent with the findings of Scholz *et al.* (2008) and

Hong and Bart (2007) that showed no evidence of improvement on concentration ability on students trained with chess game and those who were not exposed to the training. This could be as a result of the participants' characteristics who are children with learning disabilities as dyscalculia and lower intelligence quotients range of 70 to 85. This current study was composed of normal students without such learning disabilities which made transfer of learning to have no interference.

This current finding and the previous findings that supported it are in line with the theory of identical element of transfer of learning by Thorndike and Woodworth (1901) which states that training in one kind of activity would transfer to another only if the activities shared common stimulus-response elements. Chess training given to the experimental group transferred into attention enhancement among the students.

In table 2, the finding reveals that the male students responded more positively to the effect of chess game training on attention than their female counterparts with more uniform distribution. In table 4, further analysis into this finding reveals that the effect was significant in favour of the male students of Anambra State secondary schools. The research further made inquiry to ascertain if gender interacted with the treatment gap of chess training to produce such result that gave the male students advantage in the treatment. It was found that there is a significant interaction effect of gender and treatment gap on attention skill of the students. This means that male students gained more due to chess training which female students did not gain in their attention skill. Hence, chess game introduced gender bias in the attention skill outcome of the experimental group. This finding is supported by the study of Backus, Cubel, Guid, Sanchez-Pages, and Manas (2023) who observe in their study that gender was sensitive towards the dominant performance of men in the game of chess. The authors opined that men maintained sustained attention and endurance towards their female counterparts in the competitive game of chess with strong willingness to win. The authors however maintained that such dominance was triggered by gender superiority complex exerted by men over women because when a gender-blind competition was conducted over the internet-based chess platforms, the effect disappears. More so, the work of De Sousa and Hollard (2023) lends credence to the findings of this current work of gender sensitivity. The authors found that the gender gaps observed were significantly different to the detriment of the women chess players and this robustness of the micro gender gap is tailored to psychological explanations, which suggest that women's cognitive processes may be negatively affected when competing against men. This current finding filled this gap in knowledge by observing that cognitive process of attention is what put women at disadvantage when playing against men in chess game. The findings of Nagahi, Hossain and Jaradat (2019) and Yu (2021) supported

the view of gender interference to the detriment of the female participants.

This current finding was not supported by the findings of Alavi, Seng, Mustaffa, Ninggal, Amini, *et al.* (2019) which observed that girls were rated with higher levels of attention and impulse control than boys, and gender did not moderate relationships between either attention and academic achievement or impulse control and academic achievement. Also, Haruna *et al.* (2021) observed that though gamification improves learning outcomes, it has no interaction effect to gender.

Conclusion

Considering the findings of this study, there is need to enhance students' attention skill using preferred learning style that is akin to the adolescent students which chess playing as a game-based approach to this academic problem is supported by this study. More so, gender sensitivity should be considered while adopting game-based approach to attention skill enhancement. Gamification should be adapted in consideration of this factor for an optimum learning outcome of attention skill among adolescents.

Recommendations

1. Based on the findings of this study, the researcher recommends that education policy makers and school managers should invest on cognitive education by using gamification like chess game to make students fit into the demands of the 4IR.
2. Teachers should integrate modern teaching techniques and not stick to only the conventional method of teaching that could be boring for some students. Gamification, especially chess game is a recreational game which has the capacity to inculcate cognitive (attention) skill. Hence, this game should be learnt by teachers as well, who should encourage students to learn it for their cognitive development and recreation.

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