

## Effect of Breathing Exercises Game-Based Learning on Asthmatic Children' Respiratory Health and their Learning Motivation

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### **Abstract:**

**Background:** Breathing exercises using game-based learning (GBL) strategy among asthmatic children' can help in increasing child health literacy, providing continuing interesting health education, improving respiratory health condition and stimulating the development of child learning motivation. Therefore, game-based learning is innovative educational method used with children, either traditional or digital, to provide a safe learning environment for practical experience. **Aim:** to determine the effect of breathing exercises game-based learning on asthmatic children' respiratory health and their learning motivation. **Setting:** A quasi-experimental design was conducted at the pediatric allergic center in Smouha clinic which affiliated to Health Insurance Hospital, in Alexandria, Egypt. **Subjects:** comprised of 70 school-age children who were selected conveniently and divided into control and study groups. **Tools:** Two tools were used. Tool one: "Pediatric Respiratory Assessment Measure (PRAM)". Tool two: "Asthmatic children' Learning motivation Questionnaire (ACLMQ)". **Results:** revealed that there was apparent improvement in the study group's scores than control group regarding asthma attacks characteristics, symptoms of asthma attacks, absenteeism from the school, frequency of using asthma treatment, physical examination, using breathing exercises for asthmatic children', asthma severity, and learning motivation levels after 3 months of applying the intervention. Thus, there was a statistically significant difference between the study and control groups after such intervention in favor of the study group. **Conclusion:** GBL in the field of health education is more effective than traditional teaching methods to encourage children to cope with chronic disease, enhance learning motivation, to master new skills, and gain information through trial and error in a fun game. **Recommendation:** Educational workshops should be conducted for all pediatric nurses, and also clinical nurse educators to increase their competencies in applying GBL strategy, and integrating GBL in the nursing curriculum as an educational tool.

**Keywords:** Game-based learning, breathing exercises, asthmatic children, respiratory health, learning motivation.

### **Introduction**

Health education with patients and families about managing chronic diseases is an important nursing responsibility at any age and at any setting. Such issues should make careful consideration by healthcare systems on a national and worldwide level. Many

patients with acute or long-term illnesses can control their conditions successfully with just health information literacy. Patients who receive health education are more prepared to actively participate in self-care and illness management decisions. Therefore, health education is an essential nursing intervention for patients with chronic diseases that helps the patients be independent when the nurses

or doctors are not present particularly with ill children (Fathi et al., 2020; Poureslami et al., 2017).

Bronchial asthma (BA) is the most prevalent chronic disease affecting people of all ages, including school-age children (6-12 years). Bronchial asthma is a disease of chronic airway inflammation, bronchial hyper-reactivity, and reversible airway obstruction. (American Lung Association, 2020; Al-Moamary et al, 2019). The disease varies from being mild to very severe, with frequent and even life-threatening exacerbations, and interrupting the child's daily life considerably (Donald et al., 2016). Also, it can have a significant effect on a child's ability to play, sleep, and learn. It also affects children's functioning, resulting in school absenteeism, diminished quality of life, and need expensive medical treatment (Serebrisky and Wiznia, 2019). Children with asthma tend to develop respiratory illness features because of ineffective airway clearance and ineffective breathing patterns as a result of dyspnea. Bronchial asthma hazards can be managed well by health literacy using breathing exercises (Mohammad, 2016; Macêdo et al., 2016).

Breathing exercises are considered a second line of asthma management after pharmacological therapy. Breathing exercises for asthmatic children can be broadly divided into three groups, which include: exercises aimed to manipulating the pattern of breathing as breathing retraining, exercises aimed to increasing the strength or endurance of the respiratory muscles as respiratory muscle training, and exercises aimed to increasing the flexibility of the thoracic cage and improving posture as musculoskeletal training (Thoma and Bruton, 2014; Macêdo et al., 2016).

Asthmatic children should be motivated to participate in attending health education sessions about their treatment and empowered to learn breathing exercise techniques (Reddel and Levy, 2015). Learning motivation is a key aspect of child

behavior that is most closely linked to his/her feelings of personal effectiveness in learning activities. To being motivated means being eager to do something. High learning motivation is directed toward increasing children's learning outcomes and encouraging their active role to achieve the goal of health education. There are two types of learning motivation, which are; intrinsic motivation, and extrinsic motivation. Intrinsic motivation, which refers to doing an activity for its inherent satisfaction rather than for its consequences. While, extrinsic motivation, is influenced by external incentives such as rewards and punishments. Obviously, game-based learning (GBL) among children has a constructive effect on both types of learning motivation (Serrano, 2019; Bakar, 2014).

Game-based learning (GBL) is the most highly recommended for pediatric health education in which fun and behavior change are integrated. Games is a vital part of the child's development, and any alterations in this practice will surely have an effect on the child's intellectual, social, and emotional capabilities. GBL allowing children to adapt to the various negative consequences of their behavior in a safe and engaging context, and enhancing the adaptability of a child in their illness. Game-based learning offers an attractive way for the children to master new skills and gain information through trial and error in a fun game (Nijhof et al., 2018).

There are several guidelines for effective game implementation to complement the health education process, such as; games have to match the health education objectives, teaching content matter, and assessment. Also, games should be used frequently and for a sufficient amount of time to give children the chance to become familiar with, explore, experiment with, and create tactics inside the gaming environment. In addition, the game should be used to engage and stimulate learning by putting abstract knowledge in an attractive and engaging context. Finally, games should consider children's gaming personalities,

preferences, or characteristics (Moore-Russo et al., 2018; Love, 2017; Franco, 2018).

Internationally, several studies have been conducted to explore the use and applicability of game-based learning in students' education. For instance, Cheng and HoSu, (2012) evaluated a game-based learning system for improving students' learning effectiveness in a system analysis course. The results showed that the game-based learning system apparently improves the achievement of students and their learning motivation. As well, and recently, Serrano (2019) tested the effect of digital game-based learning on student learning and found that such a strategy has constructive effects on students' collaboration, learning engagement, motivation, and achievement.

There are very few studies about such an issue in Egypt and especially, in the health education field, particularly with school-aged asthmatic children. On the other hand, the use of game-based learning has a crucial impact on increasing child health literacy, providing continuing interesting health education and stimulating the development of child learning motivation, mainly in chronic diseases (Hegazy and Barakat, 2020).

Breathing exercises using game-based learning strategies in health education are considered to be new strategies for changing asthmatic children's behaviors and outcomes regarding their bronchial asthma management and empowering higher quality of life, less morbidity, slower progression of airway remodeling from inflammation, and a lower risk of dying among children with bronchial asthma (Reddel and Levy, 2015; Sarasmita et al., 2021). A major task of the nurse is to encourage the children with asthma about breathing exercises technique. Blowing bubbles, blowing cotton balls or ping pong balls on a table, blowing a pinwheel, can all be used as games for children at any time of the day to lengthen their expiratory time and increase expiratory pressure. These games are creative and age-appropriate. There is consensus that it is advisable to train asthmatic children on breathing exercises 4-5

times per day. It has been shown that session duration takes 5 to 10 minutes every day (Mcmanus, 2021; Hockenbery, et al., 2018; Patibanda et al., 2017; American lung association, 2020).

### ***Aim of the study***

This study aimed to determine the effect of breathing exercises game-based learning on asthmatic children' respiratory health and their learning motivation.

### ***Research hypotheses***

The following hypotheses were developed:

**\*H1:** Asthmatic children who are instructed by game-based learning strategy exhibit better respiratory health scores than those who do not.

**\*H2:** Asthmatic children who are instructed by game-based learning strategy exhibit higher learning motivation level than those who do not.

### ***Materials and method***

#### ***Materials***

**Design:** A quasi-experimental research design was used in this study.

**Settings:** This study was conducted at the pediatric allergic center in Smouha clinic, which is affiliated with Health Insurance Hospital, in Alexandria, Egypt.

**Subjects:** The subjects of this study included seventy (70) asthmatic children who were selected by convenience sampling technique and who regularly visited the previously mentioned settings, and fulfilled the following criteria; aged from 6-12 years, confirmed diagnosed with bronchial asthma and received treatment at least for one year, visits the pediatric allergic center regularly in the Smouha clinic for follow up (every one or three months), and free from any other diseases. The Epi info program V 7.0 was used to estimate the sample size.

**Tools:** Two tools were used in this study for data collection.

**Tool I: Pediatric Respiratory Assessment Measure (PRAM).**

This tool was developed by (Mohammad, 2016) to measure the level of respiratory health through determining the severity of the child's asthma. It was adapted by the researcher after a thorough review of related literature to assess the respiratory health condition of the child during bronchial asthma attacks. This assessment included determination of characteristics and clinical symptoms of bronchial asthma attacks, absenteeism from school and hospitalization due to asthma attacks, frequency of asthma treatment, and physical examination. It consisted of 15 questions. The scoring system of this questionnaire was distributed as follows: mild bronchial asthma indicated the score less than 33.3%, moderate bronchial asthma pointed to the score equal/ more than 33.3% to less than 66.7%, and severe bronchial asthma referred to the score equal/ more than 66.7%.

**Tool II: Asthmatic children' Learning motivation Questionnaire (ACLMO).**

This tool was developed by (Vallerand et al., 1992) to assess students' learning motivation. It was modified by the researcher to be congruent with the study aim and to match its utilization in the clinics, not in the classroom. It consisted of 26 statements with a 5 point likert scale ranging from strongly disagree (1) to strongly agree (5). It included eight subscales; knowledge, which consists of 3 statements; accomplishment, which consists of 3 statements; stimulation, which consists of 4 statements; identified regulation, which consists of 4 statements; introjected regulation, which consists of 3 statements; external regulation, which consists of 3 statements; a motivation, which consists of 2 statements; and finally, self-efficacy, which consists of 3 statements. The scoring system of this questionnaire was distributed as follows: low learning motivation level

indicated the score less than 33.3%, moderate learning motivation level pointed to the score equal/ more than 33.3% to less than 66.7%, and high learning motivation level referred to the score equal/ more than 66.7%.

***Method***

Approval from the Research Ethics Committee (REC) of the faculty of nursing was obtained. An official approval to conduct this study was obtained after providing explanation of the aim of the study. Study tools adapted and tested for their content validity by five experts in the nursing education, pediatric nursing, and psychiatric nursing fields, and then the necessary modifications were made. Moreover, the study tools were tested for reliability using Cronbach's Alpha test. The tools were reliable and their coefficient values were 0.710 and 0.978 for tool I and tool II Respectively. A pilot study was conducted on 7 asthmatic school children out of the sample size for study and control groups using the study tools on an individual basis interviews to test the tool's clarity and applicability. All needed modifications were done.

**Data collection phases:**

The current study passed into three phases' preparation, implementation, and evaluation phase.

**Phase (I): Preparation phase:** During this phase the researcher, the teaching content, learning environment, and the asthmatic children and their caregivers were prepared.

**Phase (II): Implementation phase:** A pre-test was done for study and control groups using the study tools on an individual basis interviews as a **first assessment**.

**For the control group:** the control group received the routine care of the pediatric allergic center without any interference from the researcher.

**For study group:** the researcher prepared the asthmatic children and their caregivers,

assuring them that the proposed nursing interventions were safe and would not negatively affect their health and explaining the rules that must be followed in the intervention. In this phase, breathing exercises were taught to asthmatic children and their caregivers using the game-based learning strategy through two parts; theoretical and practical.

**A. The theoretical part for study group only (Ranged from 15-30 min):**

- The researcher explained to asthmatic children and their caregiver's definition, signs and symptoms, aggravating and relieving factors of bronchial asthma.
- The researcher used card games, photos, and painting, play in a team row, and toss play to clarify the importance of breathing exercise for asthma management, types of breathing exercise, and breathing exercise techniques.

**B. The practical part for study group only (Ranged from 60-45min):**

- The study group was divided into small groups. Each group contains of three to four children. After that, they were instructed about breathing exercises technique as deep breathing exercise, the researcher demonstrated the steps of breathing exercises technique through role play in front of children and their caregivers using games materials as (balloon, a pinwheel, whistle, bubbles), while discussing the rationale for each step using game cards.
- The researcher asked that every two children arrange breathing exercises cards on flannel board and then the researcher rewarded the best performance.
- At the end of the researcher's demonstration, the asthmatic children and their caregivers were asked about any unclear or vague steps that needed repetitions or explanations before their re-demonstration. Then, each child was allowed to re-demonstrate the procedure in front of their caregivers, the researcher, and other children in each group.

- Rewards were given to each child according to the best performance of breathing exercises to reinforce their repetitions of such procedures through gaming. The rewards were in the form of toys, wallet, flomaster colors, pens, headband, and hair bow.
- The implementation phase session lasted about two hours for each group of children the children who are in the experimental group.
- The researchers instructed the study group and their caregivers to repeat the game instructions, frequently at home (four times daily) and the researcher followed them by telephone or WhatsApp every two days.
- A developed breathing exercises using game-based learning content handout, games, and related materials were given to the children in the study group to be a reference for them at home.

**Phase (III): Evaluation phase**

- After four weeks, each asthmatic child in the both study groups was assessed individually and after three months after the implementation of the proposed nursing interventions using study tools. Analysis and comparison the results between both groups before, after 4 weeks and after 3 months to evaluate the effectiveness of the proposed breathing exercises nursing interventions using game based learning

**Ethical considerations**

A written informed consent was obtained from all children's caregivers after an explanation of the study aim. Confidentiality of the data was ensured. Children's privacy was considered. Children's participation on a voluntary basis and the caregivers' right to withdraw their children from the study at any time were emphasized.

**Statistical Analysis**

The collected Data were fed to the computer and analyzed using IBM SPSS software

package version 20.0. Qualitative data were described using number and percent. Quantitative data were described using mean and standard deviation. Significance of the obtained results was judged at the 5% level. Chi-square was used for test of significance with P values.

### Results

**Table I** shows the distribution of asthmatic children in the study and control groups according to their sociodemographic data as presented by number and percentage. It was observed that more than half of the asthmatic children in both groups were aged from 10 to 12 years (57.1% and 60.0% respectively). While, about two thirds (62.9% and 65.7%) of both groups were males. Concerning the educational level, it was found that more than one third of the asthmatic children in both groups at sixth level of primary school education (37.1% and 34.3% respectively). Regarding school achievement, about two thirds of the asthmatic children in both groups obtained excellent grades (60.0% and 65.7% respectively). In relation to the residence, almost all both of them were from the urban region (97.1% and 100.0% respectively). There is no statistically significant difference between the two groups concerning their socio-demographic characteristics.

**Table II** present the comparison between the study and control groups regards the asthma severity before, after 4 weeks and after 3 months of applying breathing exercises using game-based learning strategy as presented by number and percentage. Before the intervention, more than two thirds (88.6% and 71.4%) of the asthmatic children in both groups had a moderate bronchial asthma. After 4 weeks of applying the intervention, more than half (65.7% and 51.4%) of the asthmatic children in both groups had moderate bronchial asthma. After 3 months of applying the intervention, about two thirds (62.9%) of the asthmatic children in the control group had moderate bronchial asthma, while, more than two thirds (77.7%)

of the asthmatic children in the study group had mild bronchial asthma. There is an apparent improvement in the severity of bronchial asthma attacks from moderate to mild in favor of the study group after 3 months of applying breathing exercises game-based learning strategy. Furthermore, there was no statistically significant difference between the two groups in relation to their severity of bronchial asthma attacks after 4 weeks of applying the intervention ( $p=0.397$ ). While, there were a highly statistically significant differences between the both groups in relation to the severity of bronchial asthma attacks after 3 months of applying the intervention ( $p=0.001^*$ ) in favor of the study group.

**Table III** reveals comparison between the study and control groups in relation learning motivation levels before, after 4 weeks and after 3 months of applying breathing exercises using game-based learning strategy as presented by numbers and percentages. Before, after 4 weeks and after 3 months of applying the intervention, it was observed that control group have mean scores between 1.8 to 2.7 in all statements regarding to knowledge, accomplishment, stimulation, identified regulation, introjected regulation, extrinsic regulation, a motivation and self-efficacy dimensions of the learning motivation scale. This indicates a low and moderate level of learning motivation among control group. While, the study group, the mean scores were similar the control group before applying the intervention. But, after 4 weeks and after 3 months of applying the intervention, the study group, mean sores became between 4.1 to 4.9; which indicated high level of their learning motivation. Therefore, there is an apparent improvement in study group, learning motivation than the control group after 4 weeks and after 3 months of applying the intervention. Generally, there was a highly statistically significant difference between the both groups after 4 weeks and after 3 months of applying the intervention in relation to knowledge, accomplishment, stimulation, identified regulation, introjected regulation,

extrinsic regulation, a motivation and self-efficacy dimensions of the learning motivation scale in favor of the study group.

### *Discussion*

Regarding to sociodemographic data, the findings of the present study showed that about two thirds of the study and control groups were males. This study is consistent with the study done by Abdel-Hameed (2021) who reported that males had a higher risk of asthma during childhood than females, but both sexes became equal during puberty. Additionally, Kuti et al. (2017) stated that the majority of children who attended the pediatric chest clinic in the study were boys. Conversely, Useini & Newcomb (2017) showed that asthma symptoms were worse in females compared to boys.

In relation to residence, the current study revealed that almost all of the control and study groups came from urban regions in Alexandria. It is expected results due to the place of the clinic. Congruent with this result, Eissa et al. (2017) & Achakulwisut et al. (2019) said that studied children with bronchial asthma mostly reside in urban areas. Also, Aref et al. (2020) mentioned that the prevalence of asthma among primary school students in urban areas in Alexandria is more than rural areas in Kafr El-Sheikh. Contradicting to these studies, Rashied et al (2020) and Attia et al (2020) found that children who live in rural areas had one and half time risk of developing asthma than children who live in urban areas.

The results of the present study may be attributed to many reasons. In urban areas; dust mites, high levels of vehicle emissions, industrialization, a westernized lifestyle, and the degree of urbanization itself are environmental risk factors that may have an impact on indoor and outdoor air quality. Also, outdoor pollutants including ozone and diesel exhaust. In addition, exposure to indoor pollutants such as tobacco smoke and NO<sub>2</sub> is common. Furthermore, atopy and allergy to house dust mites, followed by allergens from

animal dander, are the greatest risk factors for developing asthma in urban areas.

**In regard to the first hypothesis,** "Asthmatic children who are instructed by game-based learning strategy exhibit better respiratory health scores than those who do not." In the current study, there was a statistically significant difference between the study and control groups in relation to their asthma severity after 3 months of applying the breathing exercises using a game-based learning strategy **in favor of the study group.** Therefore, the results of this study validated the effect of the breathing exercises using GBL in decreasing the severity of bronchial asthma among school-age children. Accordingly, the first hypothesis was supported.

This clarified that the study group had a milder of bronchial asthma severity after 3 months of applying the intervention than the control group. Therefore, following and using breathing exercises as a game among the study group were a magic care in decreasing the severity of bronchial asthma. This finding is supported by Elwan et al. (2022) documented that there was a significant improvement in patients' severity of bronchial asthma after comparing pre and post-test for the Buteyko breathing technique used. In addition, Baptist et al. (2022) stated that participants with uncontrolled asthma showed a clinically significant improvement in asthma control and asthma management behaviors including physical activity, quality of life, symptoms, adherence, and exacerbation after using mobile game asthma management intervention.

**As regard to the second hypothesis,** "Asthmatic children who are instructed by game-based learning strategy exhibit higher learning motivation level than those who do not." In the current study, there was a highly statistically significant difference between the study and control groups in relation to their learning motivation after 4 weeks and after 3 months of applying the breathing exercises using a game-based learning strategy **in favor of the study group.** Therefore, this result

validated the effect of breathing exercises GBL in increasing learning motivation level among asthmatic school-aged children; therefore the second hypothesis was achieved.

In relation to learning motivation, the current study found that the study group learning motivation was improved significantly more than the control group after 4 weeks and 3 months of applying the intervention. So, GBL among the study group has a clear, positive, tangible effect on their levels of learning motivation than the control group. This finding is in line with the study of Zhang & Yu (2022) who stated that learners who used GBL had different significant higher degrees of intrinsic motivation, and extrinsic motivation. Also, Apriani & Prastiawan (2022) showed that there were significant differences in learning motivation scores between classes that used GBL and classes used conventional methods for senior learners' with high school in favor of classes used GBL. In contrast, Abdulkareem (2021) mentioned that there was no statistically significant difference between experimental and control groups in the overall motivation scores. The possible explanation of the current study result is that games helped asthmatic children to become a part of a team as well as, take responsibility for their own learning. Game-based learning motivates the children to share without fear of failure or bad grades. It also, offers opportunities for increased child engagement by adding a sense of fun to their learning experience and subsequently, increase their learning motivation. Games made the learning as a fun not an obligatory task.

### ***Conclusion***

It can be concluded from the current study that the breathing exercises using game-based learning (GBL) are a valuable intervention in the field of health education to monitor asthma severity among school-age children with bronchial asthma. GBL is important in reducing the frequency of asthma-related symptoms and pulmonary inflammation, as well as improving exercise capacity, asthma control, and quality of life. In addition, GBL motivates children to learn

through this style of active learning, and this motivation is prognostic of the attainment of learning outcomes. Furthermore, GBL offers an added learning method for healthcare professionals to encourage patients the greater retention of knowledge and the development of skills, and it is recommended for implementation particularly in clinical application of health education.

### ***Recommendations***

Based on the findings of the present study, the following recommendations are offered:

- Educational workshops should be conducted for all pediatric nurses, and also clinical nurse educators to increase their competencies in applying GBL strategy.
- Nurse educators should use game-based learning in the nursing curriculum as an educational tool.
- Breathing exercises using a game-based learning handout should be given to all asthmatic children.
- Extending the duration of breathing exercises to 6 months for more reinforcement of the result, better improvement, and reduction of asthma severity.
- Application of breathing exercises using game-based learning, alongside traditional treatment modalities, is recommended to be provided for children with asthma.



Table (1): Distribution of the study and control groups according to their sociodemographic data as presented by number and percentages.

Sociodemographic data		Control Group (N = 35)		Study Group (N = 35)		Test of Sig.
		No.	%	No.	%	
Age	6 < 8 years	9	25.7	8	22.8	—
	8 < 10 years	6	17.2	6	17.2	
	10 ≤ 12 years	20	57.1	21	60.0	
		SD ±Mean 2.18±9.60		SD ±Mean 2.21±9.57		
Gender	Male	22	62.9%	23	65.7%	$\chi^2= 0.062$ (0.803)
	Female	13	37.1%	12	34.3%	
Educational level	Primary 1	9	25.7%	7	20.0%	$^{MC}p=0.195$
	Primary 2	0	0.0%	5	14.2%	
	Primary 3	6	17.2%	2	5.7%	
	Primary 4	3	8.6%	6	17.2%	
	Primary 5	4	11.4%	3	8.6%	
	Primary 6	13	37.1%	12	34.3%	
School achievement	Fair	0	0.0%	0	0.0%	$\chi^2= 1.567$ (0.457)
	Good	9	25.7%	5	14.3%	
	V. Good	5	14.3%	7	20.0%	
	Excellent	21	60.0%	23	65.7%	
Residence	Rural	1	2.9%	0	0.0%	0.999 <sup>F</sup>
	Urban	34	97.1%	35	100.0%	

$\chi^2$ : Chi square test for comparing between the two groups.

$^{MC}p$ : p value for Monte Carlo significance for comparing between the two groups.

F: Fisher test

\*: Statistically significant at  $p \leq 0.05$

Table (2): A comparison between the study and control groups regards the severity of bronchial asthma before, after 4 weeks and after 3 months of applying breathing exercises using game-based learning strategy as presented by numbers and percentages.

Severity of bronchial asthma	Control Group (N=35)						Study Group (N=35)						Test of Sig.
	Before		After 4 Weeks		After 3 months		Before		After 4 Weeks		After 3 months		
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
Mild	2	5.7	10	28.6	8	22.8	1	2.9	16	45.7	27	77.1	$X^2=7.363$ $^{MC}p1=0.018^*$  $X^2=2.328$ $^{MC}p2=0.397$  $X^2=21.848$ $^{MC}p3= <0.001^*$
Moderate	31	88.6	23	65.7	22	62.9	25	71.4	18	51.4	8	22.9	
Severe	2	5.7	2	5.7	5	14.3	9	25.7	1	2.9	0	0.0	

$\chi^2$ : Chi square test for comparing between the two groups.

$^{MC}p$ : p value for Monte Carlo significance for comparing between the two groups.

$p_1$ : p value for comparing between the studied groups in before period

$p_2$ : p value for comparing between the studied groups in after 4 weeks period

$p_3$ : p value for comparing between the studied groups in after 3 months period

\*: Statistically significant at  $p \leq 0.05$

U: Mann Whitney test

Table (3): A comparison between the study and control groups regards the learning motivation levels before, after 4 weeks and after 3 months of applying breathing exercises using game-based learning strategy as presented by numbers and percentages.

Learning motivation levels	Control Group (N=35)						Study Group (N=35)						Test of Sig.
	Before		After 4 Weeks		After 3 months		Before		After 4 Weeks		After 3 months		
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	
Low	9	25.7%	9	25.7%	9	25.7%	20	57.1%	0	0.0%	0	0.0%	P1= 0.027†* MC P2= 0.000* MC P3= 0.000*
Moderate	16	45.7%	25	71.4%	25	71.4%	10	28.6%	0	0.0%	3	8.6%	
High	10	28.6%	1	2.9%	1	2.9%	5	14.3%	35	100%	32	91.4%	

†: chi-square

U: Mann Whitney test

<sup>MC</sup>p: p value for Monte Carlo significance for comparing between the two groups

p1: p value for comparing between the studied groups in before period

p2: p value for comparing between the studied groups in after 4 weeks period

p3: p value for comparing between the studied groups in after 3 months period

\*: Statistically significant at  $p \leq 0.05$

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