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Effect of Online-Based Physical Activity vs. Art Activity on the Joint Attention of Students with ASD

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The aim of the study is to compare two online interventions proposed for enhancing support joint attention skills among ASD-level and find the effect of online learning mode on the interventions' effectiveness. The two online interventions were: 1) physical activity-based intervention and 2) Art activity-based intervention. The study conducted the three groups experimental design with the pre and post-tests. The tests were measure the joint attention level among school-aged participants before and after interventions. The results the significance of both online interventions, physical and art on enhancing both joint attention skills, response, and cue levels among ASD students. While the control group did not score any preference of joint attention skills, response, and cue level between pre and post measurement. Furthermore, the results refuted the significant effect in JTAT attributed to subject factors, namely, age, gender, ASD level, fellow assistance in the post-measurement. Comparing interventions, physical intervention impacts (87.2%) the joint attention (JTAT). While the intervention of art impacts (86.8%) joint attention (JTAT). Accordingly, the study emphasizes the effectiveness of both physical and art activities intervention delivered online for enhancing joint attention skills of students with ASD without a substantial difference between both interventions.

Keywords: virtual simulation, web-based application, multimedia, teaching, learning

INTRODUCTION

Background

American Psychiatric Association (APA), in the fifth edition of its mental disorder manual (DSM: Diagnostic and statistical manual of mental disorder), constituted that autism spectrum disorder (ASD) is a neurodevelopmental disorder that manifests early and induces various developmental impairments of personal, social, academic, and occupational functioning due to deficits and limitations in learning and regulating executive functioning (APA, 2013). The key utmost characteristic of autism spectrum disorder is:

> "*Persistent deficits in social communication and social interaction across different contexts, including deficits in social reciprocity, nonverbal*

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> *communicative behaviors used for social interaction, and skills in developing, maintaining, and understanding relationships*" (APA, 2013, p.31)

According to APA definition, ASD involves a range of social communication symptoms such as receptive and expressive deficits, and deficits in social interactions like lack of response to name or eye contact, body gestures, and imitations (Mundy et al., 2017; Mundy, 2016; Scholtens, 2019). Joint attention is a basic element of any social behavior, particularly the most complex ones. Joint attention is about sharing attention toward observing an object or event (Scholtens, 2019). Thus, it is a reciprocal process between two persons that typically develops in everyday interactions between parents and child since infancy (Hansen et al., 2018). Joint attention can be gauged in infancy for children at risk of ASD at the eighth to the ninth month of born (Mundy et al., 2017). The age of children presenting ASD is an associated factor of developing joint attention skills, concerning the complicated association between joint attention and other development communication and social skills. For instance, older autistic students exhibited a higher level of joint attention skills because they developed more language skills that facilitate generating a response to bids or initiate bids for attention, such as vocal bids. Otherwise, children with ASD at early age exhibits lower joint attention skills due to their lack of developing language skills since they cannot generate vocal bids for attention or provide vocal responses to bids (Ravindran et al., 2019). The two main categories of joint attention are (Scholtens, 2019): 1) Engaging JA as generating a response to bids (responsive JA). For example, infant shifts their eyes or heads toward a picture that parents pointed to it. 2) making an independent bid for joint attention. For example, a child points to a toy to get the attention of his parent. In this vein, the prior version of the DSM manual explicitly includes joint attention deficiency in the definition of autism spectrum disorder, stated a shortage of spontaneous interest sharing with others or lack of support expressing interest (Mundy et al., 2017).

There are different measures of joint attention at early childhood that considering eye gaze and pointing gesture as bids for attention, such as Early Social Communication Scales (ESCS) (Kaur et al., 2021; Hansen et al., 2018). The current study adopts standardized test of joint attention of school-aged children (JTAT) (between 7 years to 17 years) (Bean & Eigsti, 2012). The joint attention scale illustrated explicitly in the method section.

The cascading developmental consequences of the low joint attention level of autistic children negatively affect communication and social skills acquisition (Jaworski & Eigsti, 2017). Thus, Joint attention has been studied as the purpose of interventions for students presenting ASD. The physical activity-based intervention was one of the suggested interventions evident in its efficiency (Kaur et al., 2021). Physical activities, including Yoga, dance movements, is a mindfulness-based intervention (DeJesus et al., 2020; Radhakrishna, 2010). Physical activities incorporate coordinated movements, which afford an exciting tool to develop joint attention, imitation, and social-communication capabilities as well as reduce behavior challenges (Chan et al., 2020; Howells, et al., 2019). According to empirical evidence delivered by Radhakrishna (2010), Yoga therapy is a useful intervention tool applied to six children presenting

ASD to advance their imitation, cognitive skills, and social-communicative behavior. The therapy positively affected their imitation skills, including gross motor actions, vocalization, complex imitation, and oral-facial movements. And it was observed that autistic children also developed eye contact, sitting tolerance, non-verbal communication, and receptive skills to verbal commands related to the spatial relationship. Similar to reported results in DeJesus et al. (2020), yoga-based intervention enhanced socially directed verbal communication skills in children presenting ASD, they exhibited more spontaneous and responsive communication compared to their peers in the control group (academic group). Bass et al. (2009) established students presenting ASD showing profound development of attention after engaging in physical activity interventions. A randomized controlled trial study of students presenting ASD aged from 4 to 6 years old found that game-based exercises are sufficient to improve joint attention skills of participants, which were measured as secondary outcomes of the training program (Yu et al., 2018). However, the current study encompasses music within intervention sessions since music-based therapy is more profoundly affected joint attention development and encourages students to elicit a vocal response (Scholtens, 2019).

Another overlooked viable intervention to support joint attention is art therapy. Art therapy is mainly focused on the functions of eyes, vision, and joint attention toward the art object since "Looking together" is the common routine setting in art therapy (Durrani, 2020; Durrani, 2019; Emery, 2004; Isserow, 2008). A systematic review of the clinical application of art therapy on students presenting ASD emphasizes the efficacy of art therapy to the profound ability of students with ASD to relate, socialize and enhance their joint attention skills (Gazeas, 2012). Because students with ASD in the art therapy session communicate with a therapist and shared with him the attention presents the concept of the triadic relationship corporates students presenting ASD, therapist, and image. A similar qualitative systematic review of what works clinically of art therapy found that the typical art elements may improve social behavior and attention-abilities of autistics (Schweizer et al., 2014). A multi-case study design of art therapy intervention for students presenting ASD reported that overtime of art sessions therapist receives students' attention and gets a response also from students. Also, the therapist noticed that students presenting ASD after a while of intervention mimic vocal responses that the therapist used previously to induce response (Durrani, 2020).

According to a review of joint attention intervention literature (see White et al., 2011), majorities of interventions designs supporting joint attention took place in clinical and controlled settings, and the researcher were the primary instructors or are the vital role of instruction and training in the program without any mediating functioning of parents or care providers (Hansen et al., 2018). It is neglecting the truth of the typical development of joint attention is in everyday interaction with parents or care providers. Thus, the current research involves either one parent or care provider in the program with participants presenting ASD and takes place in students' familiar settings via online streams either at home or in their educational center. Furthermore, the current suggestion of investigation online intervention supporting attention joint is

accommodating with the recent trends of switching to online learning for special education (Esentürk & Yarımkaya, 2021; DeLainab et al., 2021).

The study contributes to discuss the effectiveness validity of two common interventions supporting joint attention of students presenting ASD delivered online. Furthermore, the study intends to provide evidence-based interventions delivered online and compare the two suggested interventions.

Objectives

The main intends of the study was to determine if the effectiveness of interventions that support joint attention skills of students presenting ASD were demolished in the online learning environment. A second objective was to compare two common popular interventions supporting developing joint attention skills of students presenting ASD, which are: 1) physical activity-based intervention and 2) Art activity-based intervention. Accordingly, the study attempts to answer the following hypothesized questions:

- Is there a statistically significant difference between pre and post-JTAT (response, cue level) within groups (physical-based intervention, art-based intervention, control)?
- Is there a statistically significant difference in JTAT as within-subject factors (age, gender, ASD level, assistant)?
- What is the best intervention attributed to developing the JTAT (response, cue level) between the two online interventions?

METHOD

The study conducted an experimental three groups design with pre and post measurement of joint attention skills. The first group of participants is enrolled in the online physical activities-based intervention. The second group of participants is enrolled in the online physical activities-based intervention. The last group participants are the control group participants who are enrolled in their regular academic learning.

Participants

The researcher carefully and purposely selects study participants based on their profiles and diagnosis status. The study recruited 15 students presenting ASD at school aged. The sample size of the study was small because the children presenting ASD exhibit distinct and numerous reactions to workouts the exercises thus should be selected according to their physical fitness (Aksay & Alp, 2014). They study consisted of three groups; a physical training intervention program was applied on the first group, while the art intervention program applied on the second group, and the third group was the control group, which taught using the conventional online program that predesigned by the care-center. Each group represent (33.3%) of the study sample. The participants were divided based on gender, as shown in table 1, (Males = 66.7%), and (females =33.3%), as for age category was divided as follows; (40% Less than 10 years) and (60% More than 10 years). As for ASD level according to the DSM-5 categorizing; participants were chosen according to severity levels (3 levels), level 1 was (13.3%), level 2 (46.7%) and level 3 (40%) from study sample. Fellow mothers presenting (60%) while care providers (40%).

Table 1
Demographic Data of the study sample (N=15)

Demographic Variable	Frequency	%
Group		
Physical	5	33.3
Art	5	33.3
Control	5	33.3
Total	15	100.0
Gender		
Male	10	66.7
Female	5	33.3
Total	15	100.0
Age		
Less than 10 years	6	40.0
More than 10 years	9	60.0
Total	15	100.0
ASD Level		
Level 1	2	13.3
Level 2	7	46.7
Level 3	6	40.0
Total	15	100.0

Interventions

Online physical based intervention

Physical activities session was conducted three times a week for five months along 30-37 mins. The intervention is delivered online via a learning application (Microsoft teams). All mothers/care providers were prepared well to access the application successfully. Both mother/care providers accompanied the students presenting ASD in each session. The researcher selected Physical activities purposively according to students' preferences. Their parents/care providers also were consulted since the children with ASD exhibit distinct and numerous reactions to workouts. Thus, the exercises should be elected according to their physical fitness (Aksay & Alp, 2014).

The researcher includes music in the physical session along with workouts. Only two types of music were used to encourage students' communication and vocal response (Scholtens, 2019). 1) call and response songs such as "Over in the Meadow" 2) songs that require fill-in-blank responses, for example, "BINGO". The last type of music used in the intervention is calm piano playback as the background of Yoga exercises for cooling down purposes at the end of each session.

Physical exercises introduced in the intervention follow three main categories: 1) warm-up exercises in the first 5-10 mins, such as mild gait and rotation of knees. 2) one or two physical exercises performed between 15 to 20, such as those elected with parents/care providers (Karate exercise, horseback riding, dance movements). 3) Rest/cooling down exercises commonly "Yoga" with quite enough relaxing musical background for 5-7 mins.

Online Art based intervention

Art activities session was conducted three time in a week for 5 months along 25-30 mins. The intervention is delivered online via learning application (Microsoft teams). All mothers/care providers were prepared well to access the application successfully. Both mother/care providers accompanied the students presenting ASD in each session.

The researcher includes music in the art session a long with implementation. Only two types of music were used to encourage students' communication and vocal response (Scholtens, 2019). Rhythmic and melodic musical clips. The last type of music used in the intervention is applauding musical sounds at the end of each session.

Session of art therapy were divided weekly according to the following art exercise. 1) working with colored playdough and foam for modelling purposes, such as making a ball, rectangle. 2) Tracing and drawing simple shapes, such as highlighted spotted surrounding line of circle. 3) Drawing and coloring simple figure, such as car, home.

Adjusting settings and preparing fellows (mother/care provider)

The researcher conducted two initiating preliminary meetings with mothers and care providers. In the meetings, the researcher explain the mother/care provider's role in the online sessions and ensure that they did not struggle to log in to the online learning application (Microsoft Teams). The researcher also equipped the mothers/ care providers manual for each session, in which all conducting activities, time, date, and duration were deliberated effectively. Before each intervention session, the researcher reminded mothers/care providers to revise the activity of the incoming session and encouraged them to talk positively about activities to their associating participants presenting ASD. Furthermore, the researcher asked mothers/care providers to award a bounty to their associating participants presenting ASD at the end of each week or session according to children's propensities.

For ensuring that mother/care providers did not face any emerged issue before, during, or after the session, the researcher established a WhatsApp group comprised of all participated mothers/care providers to discuss or give comments at any time. The strength of this group is its feasibility to motivate mothers/care providers and prompt social interaction between them. Mothers/care providers always discuss physical activities and children-related issues between them, and they share advanced clues about physical activities rather than what is provided by researcher within the manual, such as YouTube videos.

Mothers or care providers participating in the interventions are guided to well organizing the performing activities place. Taking in their concerns, eliminating any threatening factors of attention, health, safety, and free moving and practicing. Thus, the researcher asked the mother/care provider to elect an appropriate practicing room (hall), ensuring light and ventilation conditions are suitable for students. Also, the researcher paid the mothers' and care providers' attention to any obstacles that can distract the students, such as sounds, pictures, lights, toys, furniture, etc. It was preferred to conduct the session in an empty room.

Joint Attention Test (JTAT)

The current study adopts standardized test of joint attention of school-aged children (JTAT) (between 7 years to 17 years) (Bean & Eigsti, 2012). The only available scale for school-aged population to measure joint attention. The JTAT scored 0.94 inter-reliability score, which is high reliability. And it is effectively utilized among the school-aged population in various published studies (see Jaworski & Eigsti, 2017; Kaur et al., 2021; Srinivasan et al., 2016). The scale is conducted in one week duration pre and post intervention. The JTAT is an individualized single session. The researcher took place of tester and the participants set Infront of him. The researcher perform nine distinct prompts comprises four verbal prompts and 5 gestural prompts to stimuli students' response for attention. In some cases, taster may not obtain any response from students, thus he will introduce different cues until obtain a response. The tester registers two score categories. 1) Response scores, which are students' scores due to their responses to the prompts. 2) the cue level scores, which are scores for any additional cues that tester performed to get students' attention. Total JTAT score is the accumulated score of both response score and cue level score.

Response scores on JTAT

The response score in JTAT ranges from zero to 38. 38 is the highest and best performance students can obtain in response to JTAT. The scoring procedure is as follows for each prompt (bid): 1) the student gets one score if he successfully exhibits correct action to a bid, such as waving bye. 2) he gets an additional score if he exhibits appropriate direction similar to the tester, such as looking in the same direction that the tester looks. 3) if a student makes eye contact while responding to the same bid, he gains an additional score. 4) if the student induces a verbal response, he gets an additional score, such as spontaneous verbiage. Thus, for each prompt, there are four scores to obtain. As mentioned earlier, the prompts were nine. From these nine, students can gain an extra two scores for exhibiting a smile in two prompts ("wave hi" and "wave bye"). Accordingly, the total response score in this category is 38.

Cue level scores on JTAT

In this scoring category, scoring depends on the three cue levels. In which the scores are reversely provided for students. For instance, if a student responds appropriately to the level one cue, he gets three scores and vice versa. And he gets two scores if he responds to level two cues. The cue levels are a) level one of the cues is cues that involve minimal cues such as saying, "look at that!". b) For any additional cues, for example calling a student's name added to the level one cue, it is considered a level two cue. The last level, c) Level three cue comprises more than two cues mentioned in the prior levels. Tester transformed to the next level of the cue if he did not get the student's response within 10 seconds. These three levels of responding are for only eight prompts. The last prompt has only one level of response. If the student appropriately responds to a follow-up question, he will get one additional score. Accordingly, the highest score that students can obtain in this test is 25.

FINDINGS

Test Equivalence

The Mean, Standard Deviation and One Way ANOVA test were used to show the equivalences between group as following results (Table 2, Table 3):

Table 2
Mean and Standard Deviation to show the equivalences between group

		N	Mean	Std. Deviation	Level
pre Response Scores on the JTAT.	Physical	5	13.00	4.69	Medium
	Art	5	14.60	4.39	Medium
	Control	5	13.20	6.02	Medium
	Total	15	13.60	4.76	Medium
pre Cue Level Scores	Physical	5	11.40	5.32	Medium
	Art	5	11.80	4.09	Medium
	Control	5	11.40	4.72	Medium
	Total	15	11.53	4.39	Medium
total pre JTAT	Physical	5	24.40	9.96	Medium
	Art	5	26.40	8.41	Medium
	Control	5	24.60	10.21	Medium
	Total	15	25.13	8.90	Medium

The results showed that there were a apparent differences in the Mean values between the pre response on the JTAT and Pre Cue level scores and the total score according to the group, the level was in the medium level, and to show the statistically significant differences, One Way ANOVA test was used as shown in table (3)

Table 3
One Way ANOVA test to show the equivalences between group

		Sum of Squares	df	Mean Square	F	Sig.
Pre-Response Scores on the JTAT.	Between Groups	7.600	2	3.800	.147	.865
	Within Groups	310.000	12	25.833		
	Total	317.600	14			
Pre-Cue Level Scores	Between Groups	.533	2	.267	.012	.988
	Within Groups	269.200	12	22.433		
	Total	269.733	14			
Total pre JTAT	Between Groups	12.133	2	6.067	.066	.936
	Within Groups	1097.600	12	91.467		
	Total	1109.733	14			

One Way ANOVA test showed that (F) values for the Pre-Response Scores on the JTAT, Pre-Cue level scores and total pre JTAT were (0.147, 0.012, 0.066) and it is not significant at level of (0.05) this indicates that the group were equivalences on the pre-test.

Effectiveness of online based intervention

- Is there a statistically significant difference between pre and post-JTAT (response, cue level) within groups (physical-based intervention, art-based intervention, control)?

The study used Mean, Standard Deviation, to show the statistically significant differences between pre-and Post – tests JTAT (Response, cue level) within groups (Physical, Art, Control) as shown in table (4)

Table 4
Mean and standard deviation to show the differences between pre-and post-tests JTAT within groups

		Pre-test				Post - test			Mean difference	(t) value	Sig
	Group	N	Mean	Std. Deviation	Level	Mean	Std. Deviation	Level			
Response Scores on the JTAT	Physical	5	13.00	4.69	Medium	30.00	8.37	High	-17.00	-6.668	0.003*
	Art	5	14.60	4.39	Medium	26.40	7.30	High	-11.80	-8.472	0.001*
	Control	5	13.20	6.02	Medium	12.60	5.73	Low	0.60	1.000	0.374
Cue Level Scores	Physical	5	11.40	5.32	Medium	20.40	3.85	High	-9.00	-5.582	0.005*
	Art	5	11.80	4.09	Medium	19.40	4.83	High	-7.60	-4.660	0.010*
	Control	5	11.40	4.72	Medium	12.60	3.91	Medium	-1.20	-2.058	0.109
total JTAT	Physical	5	24.40	9.96	Medium	50.40	11.89	High	-26.00	-7.839	0.001*
	Art	5	26.40	8.41	Medium	45.80	11.52	High	-19.40	-8.380	0.001*
	Control	5	24.60	10.21	Medium	25.20	9.15	Medium	-0.60	-0.535	0.621
	Total	15	25.13	8.90	Medium	40.47	15.19	Medium	-15.333	-4.861	0.000*

*: Significant at level of (0.05)

The results showed that there were differences in the mean values between the pre and post- tests within the two groups, and it was noted that the level of the post-measurement increased, so, to verify the significance of the differences, Paired Sample T-test was used to show the statistically significance differences, this show that there were a statistically significant differences between the (Pre and Post-tests) in the Response and Cue Level Scores and the total JTAT in both physical and art groups in favor of the Post test.

It is also notice that there is no statistically significance differences between the (Pre and Post-tests) in the Response, Cue Scores and the total score JTAT within the Control Group, and the differences between means values - if found, is not significant at level of (0.05).

- Is there a statistically significant difference in JTAT as within-subject factors (age, gender, ASD level, assistant)?

The study used Mean, Standard Deviation and four-way ANOVA test to show the statistically significant difference in JTAT as within subject factor (age, gender, ASD level, assistant in the post test as following:

Table 5
Disruptive results

		N	Mean	Std. Deviation
Age	Less than 10	6	38.83	16.61
	More than 10	9	41.56	15.11
Gender	Male	10	42.50	15.83
	Female	5	36.40	14.60
ASD level	Level 1	2	45.50	17.68
	Level 2	7	49.00	12.86
	Level 3	6	28.83	10.53
Assistant	Mother	9	42.89	15.93
	Carepro	6	36.83	14.63

The result of table (6) showed that there were apparent differenced in the means values in JTAT as withing subject factors (Age, Gender, ASD level and assistant in the post test, Four Way ANOVA test was used, to show the statistically significant differences as shown in table (6).

Table 6
Four Way ANOVA test

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Age	.275	1	.275	.002	.969
Gender	5.774	1	5.774	.035	.857
ASD_level	1256.673	2	628.337	3.762	.065
Assistant	338.017	1	338.017	2.024	.189
Error	1503.351	9	167.039		
Total	27795.000	15			
Corrected Total	3231.733	14			

The result of ANOVA test showed that there were no statistically significant differences in JTAT as withing subject factors (Age, Gender, ASD level and assistant in the post test, (F) values were (0.002, 0.035, 3.762, 2.024) respectively, and its not significant at level of (0.05).

Comparison between two the interventions

- What is the best intervention attributed to developing the JTAT (response, cue level) between the two online interventions?

The study used Two Way ANCOVA test to show the highest impact intervention on the JTAT (response, Cue Level (Total) between physical and art as shown in table 7.

Table 7
Two Way ANCOVA test

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Total Pre	662.619	1	662.619	19.540	.003	.736
Physical	1610.214	1	1610.214	47.483	.000	.872
Error	237.381	7	33.912			
Total	16776.000	10				
Corrected Total	2487.600	9				
Total Pre	733.584	1	733.584	38.897	.000	.847
Art	869.586	1	869.586	46.109	.000	.868
Error	132.016	7	18.859			
Total	14529.000	10				
Corrected Total	1926.500	9				

The result of table 7 showed that there were statistically significant differences between Pre and Posttests in the groups (Physical and Control), (Art and Control), were (F) values = (47.483, 46.109) respectively, which were significance at level of (0.05) and the variance was in favor of the Physical and Art Group, this leading to show that the intervention of Physical was an impact of (87.2%) in the JTAT and the intervention of Art was an impact of (86.8%) in the JTAT.

DISCUSSION

The results revealed statistically significant differences between the (Pre and Post-tests) in the response, cue Level scores, and the total JTAT in both physical activity and art activities interventions for supporting joint attention in favor of the posttest. Accordingly, the statistical analysis addressed that the effectiveness of the online intervention is stated as well as the face-to-face intervention. However, it is worth mentioning that the study does not statistically compare between online delivered intervention and face-to-face interventions. But the study here reported the effectiveness of the online intervention is occurred and not demolished due to changing delivery environment. The researcher interpreted the effectiveness of both interventions to mothers'/ care providers' involvement in the session since the students are already familiar and have a prior relationship with them. Thus, the students with ASD engage profoundly with them agreed to what was disclosed by Hansen et al. (2018). Another aspect, both intervention (i.e., physical activities and art activities) are a promising intervention that developed social-communicative skills of autistic children that facilitates developing response for attention either gestural or vocal. Furthermore, the intervention was supported by music therapy, which is effective for developing social behavior skills of autistic children as addressed by Scholtens (2019). The results of physical activities intervention agreed with previous studies (Bass et al., 2009; Chan et al., 2020; DeJesus et al., 2020; Howells, et al., 2019; Kaur et al., 2021; Radhakrishna, 2010; Yu et al., 2018). Similar to the results of art activities intervention agreed with previous studies (Durrani, 2020; Durrani, 2019; Emery, 2004; Gazeas, 2012; Isserow, 2008; Schweizer et al., 2014). However, the study did not reveal any significant differences in JTAT as withing subject factors, namely, age, gender, ASD level, fellow assistant in the post-measurement. This could contradictor with expectation since age is an influential factor among children presenting ASD on developing joint attention skills, concerning the complicated association between joint attention and other development communication and social skills. As Ravindran et al. (2019) illustrated that older autistic students exhibited a higher level of joint attention skills because they developed more language skills that facilitate generating a response to bids or initiate bids for attention, such as vocal bids. Otherwise, children with ASD at early age exhibits lower joint attention skills due to their lack of developing language skills since they cannot generate vocal bids for attention or provide vocal responses to bids. However, the researcher attribute this to the small size of the study sample that cannot significantly reveal differences and due to the small age ranges recruited in the study. This is shown in the equivalence between groups.

CONCLUSION

The study aimed to determine if the effectiveness of interventions that support joint attention skills of students presenting ASD were negatively demolished in the online learning environment. A second objective was to compare two common popular interventions supporting developing joint attention skills of students presenting ASD, which are: 1) physical activity-based intervention and 2) Art activity-based intervention. The study conducted an experimental three groups design with pre and post

measurement of joint attention skills. Each group includes five students presenting ASD at school-aged. The results revealed statistically significant differences between the (Pre and Post-tests) in the response, cue Level scores, and the total JTAT in both physical activity and art activities interventions for supporting joint attention in favor of the posttest without any statistically significant differences in JTAT as withing subject factors, namely, age, gender, ASD level, fellow assistant in the post-measurement. The intervention of Physical has an impact of (87.2%) on the JTAT while the intervention of art has an impact of (86.8%) on joint attention (JTAT). In which the difference can be subjected to other factors did not consider in the study. Accordingly, the study emphasizes the effectiveness of both physical and art activities intervention delivered online for enhancing joint attention skills of students with ASD. The study asserted the importance of articulating physical and art therapists about students with ASD and their attributes since both interventions are promising interventions for developing the social-communicative skills of autistic children.

The limited sample size of the study was one of the study limitations that constrained moderation analysis validity. Furthermore, the study design did not involve exploration differences in the effectiveness of intervention delivered online vs. face-to-face. However, this study did not manifest any additional information about mothers or care providers backgrounds (such as educational background, number of years having a child with ASD) or any auxiliary variable that could be a plausible reason for interpreting intervention effectiveness or demonstrating differences between mother mediated intervention vs. care providers mediated intervention. The small sample size is also a reason for this deficiency.

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