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The Effectiveness Focusing And Switching Attention Training In Reducing Mind Wandering During E-Learning Among University Students

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Abstract:

The current study aimed to identify the effectiveness of attention training (training on focusing and switching attention) in reducing mind wandering during e-learning among university students. The research sample consisted of (52) male and female university students who were randomly distributed equally among the experimental and control groups. The study used measures: mind wandering scale, attention training tasks including: Stroop task and Switching Attention Task (SAT).

The results of the study resulted in statistically significant differences at the level of significance (0.01) between the mean[1] scores of the experimental group and the control group in the post-measurement of mind wandering in favor of the control group. There are also statistically significant differences at the level of significance (0.01) between the means of the scores of the pre and post scores of the experimental group in mind wandering. In favor of pre-testing. This finding indicates the effectiveness of switching and focusing attention training in reducing mind wandering in the experimental group.

Keywords: *focusing attention, switching attention, mind wandering, e-learning.*

Introduction

Mind wandering is one of the most important internal distractions for the learner that hinders their learning in academic situations. Digital media is also one of the most external distractions for students during learning, which has become a prominent problem in recent times; most teachers have stated that digital media significantly distracts students and interferes with learning. (Aagaard, 2015; Rosen, 2017)

Mind wandering occurs when the mind drifts or switches away from the task and focuses on internal thoughts and mind images that are not related to the current target task or situation (Shalabi and Ayed, 2021).

Mind wandering is defined as self-generated thoughts that are unrelated to the primary task and occur during a task or activity performed by the individual (Ostojic , 2018) as defined by Randall,(2015) as the failure to retain focus on ideas and activities related to the current task as a result of the occurrence of some internal and external stimuli that attract attention away from the task.

The concept of mind wandering has been derived from theories of executive control, which demonstrate an individual's ability to control and organize cognitive and attention resources in order to achieve goals and accomplish tasks, especially in the face of

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distractions or interference (Kane, Conway, Hambrick & Engle, 2007). The ability to executive control, or to maintain, focus and direct attention to the core task is usually determined by the working memory capacity of individuals; working memory is the mechanism by which individuals can focus attention on information that is relevant to the task while ignoring information that is not relevant to the task at the same time (Kane & Engle, 2002). Accordingly, mind wandering distracts the continuum of attention (i.e., thoughts and activities during a task) through internally or externally generated stimuli that interfere by drawing attention away from the primary task (McVay & Kane, 2012; Smallwood & Schooler, 2006).

Mind wandering is classified into two types: the first is intentional or intentional and the second is automatic or unintentional; intentional/intentional wandering refers to the deliberate aggregation of an individual's focus to process high-quality information such as self-reflection, it means self-generating inner thoughts that occur intentionally or intentionally. Unintentional or spontaneous wandering occurs when the mind drifts into thoughts that have nothing to do with the task and that generally obsess the individual's concentration to process a low level of information, and this type is closely related to ADHD. (Figueiredo & Mattos, 2021).

Mind wandering occurs during learning activities in varying proportions ranging from (20% -40%), which reflects negatively on learning outcomes (Mills , D'Mello ,Bosch &Olney, 2011; Schooler et. al., 2011). The results of recent studies indicate that mind wandering is highly frequent among most students, in addition to being the strongest influence on concentration during study (Marazeke, et al.2020).

Mind wandering is defined as an automatic switch in attention from the external environment to self-generated internal thoughts, unrelated to the current task, and disconnected from the current environment and perceptions (Smallwood & Schooler, 2015).

Mind wandering affects the learning process, as it changes the student's thinking and makes him think about things that have nothing to do with the current task, as it works to separate attention from the external stimulus to the internal thoughts (Wadaa, 2020). Mind wandering "by directing attention away from the primary task" negatively affects performance of the primary task including learning, mood, and significantly affects self-directed online learning. (Randall,2015).

As a result of the difficulty that mind wandering poses to the occurrence of effective learning, researchers have sought to study the factors that can reduce mind wandering. The results of studies have proven that mind wandering reduces students' ability to solve problems and affects students' academic performance. It also negatively affects reading comprehension skills and school integration. Mind wandering has also been positively associated with students' stress and bad mood (Oettingen & Schworer, 2013; Mrazek, Franklin ,Phillips, Baird & Schooler, 2013).

On the other hand, E-Learning is one of the modern learning methods that have become a strategic requirement in the modern era, as it uses modern communication mechanisms to communicate information to the learner in the shortest time and least effort without the need for direct face-to-face communication between students and teachers.

E-learning is a means of education through electronic environments where it relies on computers and networks in the transfer of knowledge and skills. Its applications include web learning, computer learning and virtual classrooms (Arafat, 2017).

E-learning is instruction via a web-based educational delivery system that includes software to provide a structured learning environment. It is an expansion of educational opportunities, which occur in a synchronous or asynchronous environment, and can be accessed across multiple settings (Baca, 2021).

E-learning has emerged as one of the learning styles imposed by the scientific and technological changes currently taking place in the world, and traditional methods and methods are no longer able to keep pace with those changes (Al-Otaibi, 2012).

However, the use of this technology in education is a double-edged sword. Despite the service provided by modern means of communication, which have proven their effectiveness and flexibility in learning and provide the appropriate environment supportive of the educational process and provide all the pillars and incentives, but without the need for active attention from the learner (Amasha and Al-Khalaf, 2015).

Although reliance on e-learning has become a trend in modern teaching and learning practices, e-learning environments are constrained by the inability of teachers to monitor learners' attention at the same time (simultaneously) because of the lack of face-to-face interaction (Chu &Chen, 2016).

Regardless of what e-learning provides of a learning environment characterized by flexibility and interaction through educational technologies and diversity in sources of knowledge, there may be a halt in the communication of students' attention and distraction from e-learning tasks because of the lack of face-to-face teacher supervision (Kim, Hong &Song, 2019).

This distraction and lack of communication by learners allows the phenomenon of mind wandering to occur as the learners' attention switch from current e-learning tasks to self-generating internal thoughts resulting in their separation from the outside world and the learning environment. (Londeree, 2015; Smallwood, & Schooler, 2015).

The Hollis &Was(2016) study examined the impact of social media and technology on students' mind wanderlust when they learn online on a sample of 126 university students. The results showed that higher levels of mind wandering were associated with lower levels of academic performance as mind wandering leads to errors in performance and accuracy during activities that require concentration, which causes an obstacle to their success. The nature of social media and distracting technology significantly increases the likelihood of mind wandering when students learn online.

The switch from traditional classrooms to the digital learning environment has posed many challenges for students' learning and adaptation to the digital learning environment (Tsai, 2009; Winters, Greene, & Costich, 2008). For these students to achieve high rates of success and academic integration, e-learning requires the use of digital technologies and technology to deal with the tools and possibilities provided by the digital learning environment. Park & Burford, 2015)

Recent studies have used a variety of intervention methods to reduce mind wandering, including mind alertness training (Mrazek, Franklin ,Phillips, Baird & Schooler, 2013b), self-regulation interventions (Gilbert& Randall, 2015) and Attention Training (AT) to reduce mind wandering (Mrazek et.al., 2020; Barth, Heitland1, Kruger, Kahl ,Sinke1, & Winte,2019).

The importance of attention training as an effective means of reducing distractions is highlighted by Marzek, et. al. 2020. The results of studies (Vega &Robb, 2019; Beland & Murphy, 2014) confirmed that attention training can reduce mind wandering, enhance the performance of academic tasks, and improve emotional regulation, as attention training is an effective direction in improving their focus and performance.

Attention training technology is a component of metacognitive therapy (MCT) to reduce cognitive attention dysfunction by redirecting attention, i.e. away from self-focus; the main focus of this technology is on improving attention control and attention flexibility.

Attention training improves the ability to switch attention from focusing on internal and unrelated stimuli (e.g., ruminating) to focusing on task-related stimuli and aims to increase

attention flexibility and attention control (Barth,et.al., 2019).Empirical evidence has also shown that attention training improves self-regulation (Murray et al., 2016.

Attention training (training on attention switching and focusing) aims to reduce cognitive attention imbalance by redirecting attention, that is, moving away from focusing on self-focus. The focus is on improving attention control and attention flexibility through training on tasks: selective attention, attention switching. (Wells, 2007)

Attention training focuses on modifying the cognitive and metacognitive factors that underlie dysfunction by enhancing the ability to focus on the task and improving the ability to focus on multiple stimuli at the same time. Training on switching and focusing attention increases attention control and reduces distracting internal thoughts (Papageorgiou & Wells, 2000; Levaux1, Frank, Meyer, Danion, & Linde, 2011).

Improving attention control and attentional flexibility is the cornerstone of metacognitive therapy, which is done using attention training. Attention control plays an important role in influencing information processing, and the ability to exercise top-down control when responding to distracting stimuli (Heitland ,et al.,2020).

Attention control consists of two basic processes: switching attention and focusing attention; switching attention refers to switching attention from a specific goal and switching attention to a new goal and then attracting attention to a new attention goal. Focusing attention means the ability to intentionally maintain and continue attention on desired stimuli and avoid switching attention to inappropriate or distracting stimuli (Heitland ,et al.2020).

Evidence has shown a positive effect of attention training on selective attention, leading to faster responses to relevant stimuli while ignoring irrelevant stimuli. The results also suggest that attentional flexibility can be trained by improving selective attentional control by training with this technique. The results of the studies also showed a significant improvement in terms of attention switching. Attention training leads to increased attention flexibility in the form of faster attention switching from inappropriate stimuli towards task-related stimuli. This technique also improved the ability to self-regulate (Papageorgiou &Wells, 2000; Wells, 2007; Murray, Theakston, & Wells, 2016).

Mrazek ,et al.(2020)A study aimed to find out the effect of the electronic attention training program in reducing mind wandering in high school students who suffer from frequent mind wandering and digital multitasking during the study .The results revealed an improvement in emotional regulation and a noticeable reduction in mind wandering during daily life after training, in addition to a noticeable improvement in concentration in the classroom. These findings support the importance of attention training as an effective strategy to reduce internal distractions resulting from mind wandering and external distractions of digital media.

The current research aims to reveal the effectiveness of using attention training (training on focusing and switching attention) in reducing wandering through the e-learning environment.

Research question:

What is the effectiveness of training on the processes of focusing and switching attention in reducing mind wandering during e-learning?

Research hypotheses:

H1: There are no statistically significant differences between the control and experimental groups in the means of mind wandering scores for post measurement.

H2: There are no statistically significant differences between the pre-measurement and the post-measurement of the experimental group in the means of mind wandering scores.

Method:

Research sample:

The research sample consisted of (52) male and female students from the Faculty of Education at King Khalid University who are studying electronic courses through the Blackboard platform. They were randomly distributed equally among the experimental and control groups, so the number in each group reached (26) male and female students.

Research measures:

1- Mind Wanderlust Scale: (Prepared by Researchers)

Scale Description

In its final form, the scale consists of 20 statements divided into four dimensions: failure to interact socially, failure to interact with things, lack of awareness, and inattention. The statements are corrected in the light of a five-point scale (always, often, sometimes, rarely, never), and a total score is obtained for the scale representing the degree of mind wandering, and a high score indicates the high degree of mind wandering in the individual.

Psychometric Characteristics of the Mind Wandering Scale:

- The correlation coefficient between the degree of the phrase and the total score was calculated on the scale after deleting the degree of the phrase, and the values of the correlation coefficients ranged from (0.48 to 0.72) and were all statistically significant at (0.01)

The confirmatory factor model, which consists of 20 independent variables (scale statements), was tested with four implicit variables (four latent factors). The proposed model was tested with four latent factors. The values of the indicators of good conformity came in the ideal range, which indicates that the proposed four-way measurement model (Figure 1) is identical to the empirical data of the sample.

-The stability of the scale was verified by calculating the stability coefficient of Alpha-Cronbach, where its value was (0.91)

- The stability of the scale was also verified by halving using the Spearman-Brown equation, where the total stability coefficient of the scale was (0.87).

2- Attention Training Tasks

It includes two training tasks (the overlap task, and the attention diversion task) . These tasks have been programmed on the computer, where the examiner continues to train on each task separately until he reaches the stage of relative stability, which is determined by the learning curve of each examiner. The computer program allows the examiner to train on the task to an infinite number of attempts until stability occurs. The following is a description of these three tasks:

Stroop task

The Overlap Task is used to practice selective attention and focusing attention.
(Heitland ,et al.2020).

By comparing the speed at which colors can be named (reaction time) in both consistency and inconsistency states, we measure the level of interference and dispersion measured by competing color names (Boctig, & Marquard, 2001; Sabri, Robert , Melara & Algom 2001).

The mission was programmed on a computer. The performance indicator on the task is the return time in bits per second (by computer) for each correct attempt, where the average return times are calculated in the case of congruence, neutrality, and mismatch. The current researcher will rely on the indicator of the average return times in milliseconds in the case of mismatch (overlap return time), where a decrease in the return time in the case of mismatch indicates an improvement in the process of selective attention.

Switching Attention Task (SAT)

This task aims to train to switching attention, as performance on this task is related to the ability to switching attention between more than one stimuli, based on changing the rule on which the examined corresponds – on the basis of shape or on the basis of color – between the geometric shape displayed at the top of the computer screen and the two geometric shapes displayed below. Thomas & Johnson , 2006. The current study relied on the indicator of the number of correct attentions switching responses, as the increase in this indicator indicates an improvement in the attention switching process.

Results:

Before presenting the results of the current study, we first present the results of verifying the equivalence of the two study groups in the pre-test on the mind wandering scale. Table (1) shows the results of this

Table (1) t-Test for the differences between the experimental and control groups in the pre-test measurements of mind wandering.

Variable	HSA Group	(n)	means	SD	df	t	Significance
Mind wandering	control	26	64.57	7.71	50	0.87	(Non-significant)
	Experimental	26	66:46	7.88			

It is clear from the results presented in Table (1) that the values of (t) are not statistically significant, which means the equivalence of the control and experimental research groups in the pre-measurement of mind wandering. The results of testing the validity of the research hypotheses are as follows:

Result of First Hypothesis:

To test the validity of this hypothesis, a T-test was used for independent samples to verify the significance of the differences between the experimental and control groups in the telemetry of mind wandering. Table (2) shows the results of this.

Table (2) T-test for independent samples for significance of the differences between the experimental and control groups in the post-measurement of mind wandering

Dimension of mind wandering	HSA Group	(n)	means	SD	df	t-value	Significance	(η2)
Social interaction	control	26	16.76	2,06	50	5.40	0.01	0.37
	Experimental	26	13.88	1.77				
Failed to interact with objects	control	26	14.96	3.64	50	3.11	0.01	0.16
	Experimental	26	12.07	3.01				
Unconsciousness	control	26	12.26	2,53	50	4.43	0.01	0.28
	Experimental	26	9.84	1.16				
Inattention /	control	26	21.61	2.72	50	5.58	0.01	0.30
	Experimental	26	18.30	2.48				
Total	control	26	65.73	8.50	50	5.66	0.01	0.39
	Experimental	26	54.30	5.81				

It is clear from the results presented in Table (2) that there are statistically significant differences at the level of significance (0.01) between the mean scores of the experimental group and the control group in the post measurement of mind wandering, for the sub-dimensions and the total score on the mind wandering scale. The differences were in favor of the control group (the larger average), which means that there was a statistically significant decrease in the mind wandering of the experimental group compared to the control group. This supports the presence of a significant effect of the attention training technique in reducing mind wandering. This result leads to the rejection of the zero first hypothesis and the acceptance of the alternative hypothesis.
The values of (η2), which determine the size of the impact of the training, exceeded the value (0.14), which means that there is a large impact of the training in reducing mind wandering in the experimental group.

Results of second hypothesis:
To test the validity of this hypothesis, a -t test was used for linked samples to verify the significance of the differences between the pre and post measurements of the experimental group in the means of mind wandering scores. Table (3) shows the results of this

Table (3) T- test results for the paired samples for the significance of the differences between the pre and post measurements of the experimental group in the means of mind wandering scores

Dimensions of mind wandering	Measurement	(n)	means	SD	df	t-value	Significance
Social interaction	Pre	26	92	2.09	25	5.58	0.01
	Post	26	13.88	1.77			
Failed to interact with objects	Pre	26	15.11	3.46	25	4.11	0.01
	Post	26	12.07	3.01			
Unconsciousness	Pre	26	12.53	2.25	25	4.84	0.01
	Post	26	9.84	1.16			
Inattention	Pre	26	21.88	2.68	25	5.18	0.01
	Post	26	18.30	2.48			
Total	Pre	26	66.46	7.88	25	6.87	0.01
	Post		54.30	5.82			

It is clear from the results presented in Table (3) that there are statistically significant differences at the level of significance (0.01) between the means of the scores of the pre and post scores of the experimental group in mind wandering, for the sub-dimensions and the total score on the scale . The differences were in favor of pre-measurement (the larger average), which means that there was a statistically significant decrease in the post-measurement of the experimental group compared to the pre-measurement. This supports the presence of a significant effect of the attention training technique in reducing mind wandering. This result leads to the rejection of the second zero hypothesis and the acceptance of the alternative hypothesis.

The results of the validity test of the first and second hypotheses support the existence of a statistically significant effect of attention training in reducing mind wandering in the experimental group.

Discussion:
Referring to the result of the first and second hypotheses in tables (2 , 3), the result of testing the hypotheses indicates the effectiveness of attention training in reducing mind wandering in the experimental group. The magnitude of the impact of the training used to reduce mind wanderlust supports this finding.

These results are consistent with what was mentioned in the theoretical framework of the current study, and supported by the results of its previous studies that dealt with the effectiveness of attention training in improving attention performance and reducing mind wandering, including the study of Brath ,et al.(2019)Heitland et al.(2020)Their results indicated the effectiveness of Attention Training Technology (ATT) in improving attentional performance, cognitive performance, and selective attention. As well as the study of Usui et al. (2020)The results confirmed that the attention training technique brings about changes in electrical brain activity, especially in areas where attention or executive control is increased. These findings are also consistent with those of Mrazek ,et al.(2020)The results showed that attention training is an effective strategy to reduce internal distractions resulting from mind wandering and external distractions of digital media.

This finding is in part consistent with the findings of the Randall (2015) study which found that training in self-control skills reduced mind wandering.

This finding also supports what was confirmed by the results of studies (Vega & Robb, 2019; Beland & Murphy, 2014;Smallwood & Schler, 2015) that attention training reduces mind wandering and enhances the

performance of academic tasks, and improves emotional regulation, as attention training is an effective trend in improving concentration and performance among students.

This result is also supported by the evidence that there is a positive effect of attention training on selective attention, as it led to faster responses to relevant stimuli while ignoring irrelevant stimuli, and that attention flexibility can be trained by improving selective attentional control through training using this technique, as well as improving attention diversion. Attention training leads to increased attention flexibility in the form of faster attention diversion from inappropriate stimuli towards task-related stimuli.

(Papageorgiou &Wells, 2000; Wells, 2007; Murray, Theakston, & Wells, 2016)

This finding can be interpreted in light of what Brath et al.(2019) have pointed out Attention training improves the ability to switch attention from focusing on internal and unrelated stimuli (such as ruminating thoughts) to focusing on task-related stimuli. It also increases attention flexibility and attention control. Attention training reduces cognitive dysfunction by redirecting attention away from self-focus.

Attention control plays an important role in influencing information processing, and the ability to exercise top-down control when responding to distracting stimuli. (Heitland et al.2020)

Whereas mind wandering represents the failure to retain focus on ideas and activities related to the current task as a result of the occurrence of some internal and external stimuli that attract attention away from the task , and where the distraction in attention and lack of communication by the individual allows the occurrence of the phenomenon of mind wandering, where the individual's attention is switched from the current task to self-generating internal thoughts, resulting in their separation from the outside world and the learning environment, the increased ability to control attention reduces the level of distraction in attention and increases the ability to continue attention through attention training technology that works to modify the cognitive and metacognitive factors that lie behind the attention dysfunction by enhancing the ability to focus on the task and improving the ability to focus on multiple stimuli at the same time. Training in attention training technology leads to increased attention control and reduced distracting internal thoughts.

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