Original Article

The influence of analogies on the development of selective attention in novices in normal or stressful conditions

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ABSTRACT

The effect of explicit, implicit, and analogy learning methods on developing selective attention skills in young novice participants was examined under normal and stressful conditions. The 60 novice participants, aged 11-12 years old, followed a video simulation intervention program of 12 sessions (3 times * 4 weeks). They were tested four times (pre-test, post-test, retention, and stress test) to evaluate their reaction time and accuracy in selective attention skills. The differences among the groups and the measurements were analysed using a two-way mixed factorial ANOVA (4 groups * 4 measurements), and post-hoc Bonferroni evaluated significant differences among the groups. The results showed that all three experimental groups improved their performance in response reaction time and accuracy from the pre-test to the post-test and maintained their scores on the retention test. However, the analogy group had the best scores, followed by the implicit group, and they were both better than the explicit group. According to the stress test, the analogy and the implicit group remained unaffected while the explicit group showed a decrease in both reaction time and accuracy. Training by analogy was more effective in improving selective attention in novices in both normal and stressful conditions. Analogy learners probably developed an advanced mechanism that allowed them to quickly and accurately select the most useful information from the sport setting even in stressful conditions. This research highlights the advantages of simulation techniques; future research may assess selective attention in real conditions.

Keywords: Perceptual skills; Information processing; Analogy learning; Implicit learning; Explicit learning; Performance analysis of sport.

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INTRODUCTION

In competitive sports, when athletes are performing under stress they worry about optimal performance, which occupies parts of the working memory system needed for optimal performance (Hayes et al., 2008; Schmader & Johns, 2003). In stressful situations, when athletes are looking for the correct movement execution they try to remember explicit rules and thus they alternate their motor control from an automatic-implicit control to a more conscious-explicit control, hoping that this will ensure correct performance (Author, 2010).

Masters (1992) argued that when motor skills are learned implicitly, without early dependence on working memory, they are less affected in pressure situations since they do not acquire explicit rules to recall them. Several researchers (Liao & Masters, 2001; Masters, 1992; Maxwell et al., 2000) also argue that implicit learning is more effective than explicit in learning motor skills, especially in stressful situations, because the latter has been associated with working memory overload during execution, while implicit learning results in limited working memory overload and declarative knowledge storage, so there is no additional loading to impede automated movement. When athletes acquire skills through explicit methods they underperform when placed under psychological stress since they try to recall the rules of execution – a process similar to novice execution (Buszard et al., 2016; Maxwell et al., 2000). Masters (1992) called this situation "*reinvestment*"; according to the reinvestment hypothesis, athletes who learn motor skills through explicit learning methods reduce their performance under psychological pressure because they return to the information processing of the initial stages of learning. They divert their attention from the rich information provided by the environment while choosing to recall rules and instructions that they have already learned about the skill. Thus, the omission of explicit rules has a positive effect on performance, especially in stress conditions (Liao & Masters, 2001; Maxwell et al., 2003).

The explicit learning method is the most common training method used by coaches, especially for novices. In this mode of instruction, the coach sets out clear rules and gives verbal instructions on how to execute a particular movement or skill. Beilock and Carr (2001) argue that novice performance is based on explicit, declarative knowledge that is held in working memory and monitored in a step-by-step approach. It has been shown that explicit use of such rules places a heavy load on working memory resources; since working memory is extremely limited in both capacity and duration, this will impede learning (Maxwell et al., 2003). However, explicit learning is not a necessity in the initial phase of learning, since automatic, smooth, effortless, and fast control of goal-directed movements can also be acquired implicitly (Van der Kamp et al., 2003).

During the implicit learning method, the instructor does not give rules of execution but distracts the trainees' attention using a secondary stimulus (Jackson & Farrow, 2005; William et al., 2003; Author, 2010; Votsis et al., 2009), in order to develop procedural knowledge, bypassing working memory processing (Masters, 1992; Kleynen et al., 2014). Several researchers have proposed that the implicit learning method is more effective than the explicit because the latter has been associated with the distraction of attention during execution, while implicit learning results in limited declarative knowledge, so there is no additional loading to impede automated movement (Liao & Masters, 2001; Masters, 1992; Maxwell et al., 2000). Implicit learning techniques are thought to reduce the amount of attention required to acquire and perform cognitive tasks (Lam, Maxwell, & Masters, 2009). Thus, the omission of explicit rules has a positive effect on performance, especially in stress conditions or in complex situations (Liao & Masters, 2001; Maxwell et al., 2003). Van der Kamp et al. (2003) explain that this is because "*the liability to the well-known phenomenon of choking is diminished in comparison to explicitly learned movements, which are much more prone to the recurrence of* *explicit step-by-step monitoring (i.e., the reinvestment of verbalizable rules) as reflected in broken and stuttered movement execution*" (p. 506). Finally, Davids et al. (2001) suggest that the implicit learning method can be just as effective as explicit learning; however, the former is better in high-stress situations (Maxwell et al., 2000; Liao & Masters, 2001; Poolton, Masters, & Maxwell, 2006).

The analogy learning method is an implicit mode of learning (Koedijker et al., 2011; Lam et al., 2009a, 2009b, 2010; Liao & Masters, 2001; Masters, 1992, 2000; Poolton, Masters, et al., 2006; Poolton, Maxwell, et al., 2006) that combines the advantages of the implicit and explicit methods (Author, 2020). Analogy learning aids the learning of a new concept by expressing it in terms of a fundamentally similar concept (Gentner & Forbus, 2011) since the rules are "*hidden*" in the form of metaphors (analogies). It provides learners with information through biomechanical metaphors that disguise many of the technical rules ordinarily provided by explicit instruction (Masters, 2000). Thus, analogy learners have less access to declarative knowledge about the movement than explicit learners (Law et al., 2003; Liao & Masters, 2001; Poolton et al., 2005). Previous studies have shown that learning by analogy instructions is more robust than learning by explicit instructions in cognitively demanding situations, such as stress or dual-task conditions (Author, 2021a; Komar et al., 2014; Lam et al., 2009a; Lam et al., 2009b; Law et al., 2003; Poolton et al., 2007; Koedijker et al., 2011; Liao & Masters, 2001).

In open sports with a changing environment, the athlete's ability to adjust to the environment and the upcoming stimuli plays a crucial role. The rapid perception and processing of different stimuli which the athletes receive from the environment leads to the shortest time anticipation, then to correct decision-making, and finally to the most appropriate response-reaction (Janelle & Hillman, 2003). The mechanisms of attention are responsible for selecting the information that gains access to working memory where action plans can be elaborated (Knudsen, 2007). Thus, working memory is a system not only responsible for the storage of useful information but also for mechanisms of cognitive control and attention (Baddeley, 2003), making the concept applicable to complex behaviour.

Athletes often choke in stressful conditions, reducing their performance (Englert & Oudejans, 2014). Visual attentional control is sensitive to the influence of stress (Behan & Wilson, 2008; Vickers & Williams, 2007; Wilson et al., 2009; Wood & Wilson, 2010) by enhancing distraction and attentional narrowing and reducing processing efficiency (Gotardi et al., 2019). According to Englert and Oudejans (2014), there are two different approaches to explaining the negative stress-performance relationship:

a) distraction theories, which propose that anxiety consumes the limited attentional resources of an individual, leaving less attentional capacity for the actual ongoing task (Lewis & Linder, 1997). According to the "*Attentional Control Theory – ACT*" (Eysenck et al., 2007), anxiety causes a diversion of processing resources from task-relevant stimuli to task-irrelevant stimuli. This impairment and pre-empting of attentional resources leads to a shift in the attentional systems such that anxiety leads to increased reliance on the bottom-up, stimulus-driven attentional system. This is an expansion of Eysenck and Calvo's (1992) "*Processing Efficiency Theory – PET*" which was developed to clarify the link between performance and anxiety used the following two assumptions: i) cognitive anxiety establishes itself in the form of worrying thoughts which influence working memory by reducing the limited attentional resources, thus decreasing the quantity of free attentional capacity to involve in parallel task demands, and ii) anxiety leads to increased cognitive effort and the conquest of additional processing resources.

b) the skill-focus theories propose that athletes under stress tend to shift their attention inwards since they increase the level of self-consciousness. Several studies have demonstrated that manipulation of feedback instructions that induce an external focus by directing performers' attention to the effects of their movements (external focus) rather than their body movements (internal focus) result in more effective motor performance and learning for either movement form or outcome (Wulf, 2013; Lohse et al., 2012). The external focus of attention provides a subconscious motor control that results in greater movement automaticity, compared to the internal focus of attention (Wulf, 2007; Wulf & Lewthwaite, 2010; Wulf, 2013; van der Graaff et al., 2018; Author, 2021b;c), even more in stressful conditions (Ong et al., 2010). In other words, external focus instructions are more beneficial for learners than internal focus instructions when practicing motor skills (Uehara et al., 2008).

Since the external focus of attention is related to implicit control processes, and also driven by the limited research on the acquisition of selective attention in novices under normal or stressful conditions, this study attempted to investigate the effects of different learning methods on selective attention for children in both normal and stress conditions. It was hypothesized that all three methods (implicit, explicit, and analogy) would improve the accuracy and speed of selective attention skills in normal conditions, but probably only the implicit and analogy methods would remain unaffected in stress conditions and improve the speed and accuracy of the selective attention.

MATERIAL AND METHODS

Participants

The participants were 60 novice children, aged 11-12 years old, with very little volleyball experience (6 training units). The participants were randomly selected and divided into four evenly matched groups: (a) explicit learning group, (b) implicit learning group, (c) analogy learning group, and (d) control group. The three experimental groups (explicit, implicit, and analogy) participated in all tests (pre-test, post-test, retention test, and stress test) and also in the intervention program, while the control group (d) only participated in the tests. All individuals who participated in the study voluntarily were healthy, and all ethics rules and participants' anonymity were adhered to throughout the study.

Measures

The design included the following independent variables: (a) "*group*" consisting of four levels (explicit, implicit, analogy, control) and (b) "*measurement periods*" consisting of four levels (pre-test, post-test, retention test, and stress test) (4 groups X 4 measurement periods). The dependent variables were the reaction time and accuracy of the selective attention skill, in which participants had to respond by pressing a button after viewing a visual stimulus (Williams et al., 2003). Reaction time was measured as the time (msec) from the stimulus (beginning of the video clip) to the response (pressing the button). The response accuracy was the percentage of the correct responses from the total number of trials.

All groups were measured in a pre-test on accuracy and reaction time of selective attention skills. The three experimental groups (implicit, explicit, analogy) followed an intervention program consisting of 12 training units (4 weeks X 3 times per week). This was followed by a post-test measurement. A retention test was conducted a week later. A stress test followed the next day. The researchers created stress conditions for participants, who completed the questionnaire for the evaluation of somatic and cognitive stress (Competitive State Anxiety Inventory-2) (CSAI-2; Martens et al., 1990) in its Greek version (Tsorbatzoudis et al., 1998), in order to ascertain whether they experienced psychological pressure while taking the test or not. The control group took part in all the tests but did not follow the intervention program. Both the intervention program and the tests were implemented under simulation conditions.

Intervention procedures

The three experimental groups followed a 12-week simulated conditions intervention program in a room next to the court (3 times a week for 4 weeks) lasting 30 minutes each. The control group only participated in the measurements. Most researchers (Liao & Masters, 2001; Masters, 1992; Maxwell, Masters, & Eves, 2000, 2003) investigating methods of practicing perceptual skills used simulation techniques through video projection.

The participants in the explicit group watched edited video clips from official volleyball matches, which showed the player performing the serve and the reception of the opposing team. In every video clip, the coach gave one (1) instruction out of ten (10). Five (5) explicit instructions concerned the movement form (technique), and five (5) instructions concerning volleyball tactics related to the serving skill.

The participants in the implicit group watched the same videos of expert players executing volleyball serves as the explicit group, but they also had to respond to a secondary dual cognitive task through random letter generation (MacMahon & Masters, 2002; Gröpel and Mesagno, 2017). The researchers explained the use of the secondary task to the implicit participants before the practice: in dual tasks the coach diverts the participants' attention away from task-relevant thoughts (Gröpel & Mesagno, 2017).

The participants in the analogy group watched the same video clips of expert players executing volleyball serves. The coach gave the same number (10) of instructions using a metaphor (Masters, 2000). More specifically, the coach gave five technical instructions via analogies concerning the movement form (i.e., "*See how the athlete hits the ball towards the target as if holding a stick and gives it a high trajectory as if passing over a mountain*") and five for tactical instructions via analogies concerning the serving to the "*weak zone*" (e.g., "*Imagine that the opponents' surface is covered with water. The server sends the ball where there is more water and no opponents on the court*").

Testing procedures

Pre, post, and retention test

Simulation conditions were used to evaluate selective attention. Each participant was asked a question on what she noticed in the visual stimuli she was watching and had to respond on a keyboard. The computer randomly selected 23 photos from a set of 300 (selected by three national volleyball coaches) which the participants viewed in actual size through a projector. The photos showed expert volleyball players executing serves. Each photo was displayed for 2 sec and then the system displayed a question asking the participant if she noticed anything in the image related to either the technique or the tactics of the skill (Abernethy, 1988): for example, the correct direction of the ball, the direction of the server's hand, etc. The questions were multiple-choice with three possible answers: a) Yes, b) No, and c) I didn't notice, and participants had to press the correct button accordingly. The selective attention score was the percentage of correct answers from the total number of attempts, but also the reaction time. Each participant had a time limit (5 sec) to answer the question, otherwise, it was recorded as a wrong answer. No feedback was given on the accuracy or speed of the response during the test. A software package (Superlab) evaluated the speed in msec (at a ratio of 100 Hz) and the accuracy (% optimal of the total) of the responses.

Before the study, the validity and reliability of the measuring instruments and the content used were checked. Three experienced volleyball coaches evaluated the photographs and decided unanimously on the correctness of each response.

Stress-test
The stress condition was implemented by falsely informing the participants that those with the best test scores in both reaction time and accuracy would be selected for a special talented team. The level of cognitive and body stress was assessed via the modified CSAI-2 questionnaire (Liao & Masters, 2001; Tsorbatzoudis et al., 1998) on a Likert scale (1 = not at all stressed to 4 = very stressed). The results confirmed that all measurements were performed without stress, except the stress test. During the stress test, all groups showed high levels of stress, at approximately the same levels.

Analysis
The differences among the groups and the measurements were analysed using a Two-Way Mixed Factorial ANOVA (4 groups X 4 measurements). Post hoc t-tests with Bonferroni corrections were conducted to account for any differences among groups and tests ($p < .05$).

RESULTS

Results on reaction time (msec)
A) There was a statistically significant main effect ($F_{(3,\ 168)} = 16055.31$, $p < .05$) between the four measurement periods on reaction time. More specifically, the implicit and the analogy group improved their reaction time performance from the pre-test to the post-test, while maintaining their performance on both the retention test and the stress test. The explicit group improved their reaction time performance from the pre-test to the post-test, but their performance deteriorated in the retention test and worsened even more in the stress test. For the control group, the mean performance did not improve from the pre-test to the post-test and the retention test but their reaction time worsened under stress conditions.

B) There was a statistically significant main effect ($F_{(3,\ 56)} = 7156.22$, $p < .05$) between the four groups on reaction time. More specifically, in the post-test, the analogy group was the best of all the groups, followed by the implicit group, then the explicit group, and lastly the control group. The retention test also showed that the analogy group was the best, followed by the implicit group, then the explicit group, and lastly the control group. The measurement under stress conditions showed that the analogy group was the best, while the implicit group was better than the explicit group and the control group. Finally, the explicit group had the same performance as the control group.

C) There was a statistically significant interaction ($F_{(9,\ 168)} = 4241.67$, $p < .05$) between the four measurement periods and the four groups on reaction time. The results are summarized in the table below (Table 1.).

Results on accuracy (%)
A) There was a statistically significant main effect ($F_{(3,\ 168)} = 3278.09$, $p < .05$) between the four measurement periods on response accuracy. More specifically, the implicit and the analogy group performance improved their performance from the pre-test to the post-test, while maintaining their performance in both the retention test and the stress test. The performance of the explicit group improved from the pre-test to the post and retention test but worsened in the stress measurement. The control group did not improve from the pre-test to the post and the retention test but worsened in the test under stress conditions.

B) There was a statistically significant main effect ($F_{(3,\ 56)} = 921.87$, $p < .05$) between the four groups on response accuracy. More specifically, during the post-test, the analogy group was the best, followed by the implicit group, then the explicit group, and lastly the control group. Similarly, in the retention test, the analogy group was the best, followed by the implicit group, then the explicit group, and lastly the control group.

Table 1. Main effects of post hoc Tukey between the groups and the measurements on selective attention reaction time.

	Implicit			**Analogy**			**Explicit**			**Control**			*Post hoc*
	M	sd	se	M	sd	se	M	sd	se	M	sd	se	
Pre-test	831.12	102.51	26.47	840.23	113.85	29.40	838.17	122.48	31.62	841.58	104.6	27.01	im=an=ex=co
Post-test	574.27	83.74	21.62	485.26	96.39	24.89	715.24	102.43	26.45	828.15	113.41	29.28	an<im<ex<co
Retention test	587.48	98.37	25.40	479.68	94.92	24.51	742.14	111.3	28.74	839.19	109.52	28.28	an<im<ex<co
Stress test	595.73	110.46	28.52	490.51	102.6	26.49	950.27	132.36	34.18	958.56	124.67	32.1897	an<im<ex=co
Post hoc	pre>post. post=ret. ret=str			pre>post. post=ret. ret=str			pre>post. post=ret. ret>str			pre=post. post=ret. ret>str			

Note: Pre = pre-test, post = Post-test, ret = Retention test, str = Stress test. Im = Implicit, an = Analogy, ex = Explicit, co = Control.

Table 2. Main effects of post hoc Tukey between the groups and the measurements on selective attention accuracy.

	Implicit			**Analogy**			**Explicit**			**Control**			*Post hoc*
	M	sd	se	M	sd	se	M	sd	se	M	sd	se	
Pre-test	36.41	10.03	2.59	35.67	12.43	3.21	34.78	11.46	2.96	35.37	10.69	2.76	im=an=ex=co
Post-test	68.28	13.83	3.57	79.76	15.88	4.1	55.24	14.79	3.82	34.56	9.57	2.47	an>im>ex>co
Retention test	67.83	15.22	3.93	80.35	16.85	4.35	54.56	15.38	3.97	35.84	11.27	2.91	an>im>ex>co
Stress test	67.01	17.62	4.55	79.51	21.84	5.64	41.77	17.54	4.53	31.54	13.87	3.58	an>im>ex>co
Post hoc	pre<post. post=ret. ret=str			pre<post. post=ret. ret=str			pre<post. post=ret. ret>str			pre=post. post=ret. ret>str			

Note: Pre = pre-test, post = Post-test, ret = Retention test, str = Stress test. Im = Implicit, an = Analogy, ex = Explicit, co = Control.

The measurement under stress conditions also showed that the analogy group was the best, followed by the implicit group, then the explicit group, and lastly the control group.

C) There was a statistically significant interaction ($F_{(9,168)} = 657.41$, $p < .05$) between the four measurement periods and the four groups in response accuracy. The results are summarized in the table below (Table 2).

DISCUSSION

This study compared the effects of different learning methods (implicit, explicit, and analogy) on selective attention in children under both normal and stressful conditions. The results of the different measurement periods showed that all three experimental groups improved their accuracy and their reaction time in the selective attention skill after they participated in the intervention program and maintained their scores in the retention test. Although the implicit and analogy group maintained their scores in the stress condition, the performance of the explicit group worsened. The group comparisons showed that the analogy group had better scores than the implicit and explicit groups in both accuracy and reaction time, during the post, retention, and stress test. The implicit group had better scores than the explicit group during the post, retention, and stress test. All experimental groups were better than the control group.

Analogy learners acquired selective attention skills via a process where the skill was taught through familiar metaphorical concepts and images (Liao & Masters, 2001). Presentation of the analogy instruction to novices, with relatively "*unintegrated*" movement control structures (Beilock & Carr, 2004), appears to have reduced the need to remember and recall instructions that develop declarative knowledge. They probably developed an advanced mechanism that allowed them to quickly and accurately select the most useful information from the sport setting without overloading working memory or developing declarative knowledge. This is in line with Koedijker et al. (2011), who state that analogy learning seems to by-pass the use of working memory early in learning, thus reducing the need for novices to direct attention to the execution of the movements (declarative knowledge), and as a result, the control structures that preside over the performance of the novice might be more procedural than declarative. It also seems that analogy learning combines the benefits of both explicit and implicit learning without the disadvantages of working memory overload of the explicit learning or the implementation difficulties (due to the dual-task demands for novices) of the implicit learning. The fact that the analogy learners' performance, in both reaction time and accuracy, did not decline under the stress conditions compared to the performance of the explicit learners, seems to agree with Masters' (1992) "*reinvestment of explicit knowledge hypothesis*", that the less explicit knowledge the performer has, the less performance will be interfered with by conscious processing such as under stress conditions (Liao & Masters, 2001). Since the analogy learners collected less explicit knowledge than the explicit learners, they had much less to reinvest, and in stress conditions, the metaphors used probably did not burden the working memory. Koedijker et al. (2011) suggest that since teaching analogically relies less heavily on declarative components of performance, this may promote expert-like attention control structures without necessarily leading to expert-like motor execution. It is speculated that when stress conditions were induced, spare resources were allocated to the task because of stress, and, consequently, performance was maintained in high scores. Liao and Masters (2001) stated, "*If the task does not demand a lot of information processing resources and many spare resources are available, the motivational function of psychological stress may be likely to have a positive influence on performance*" (p. 318).

Implicit learning seems to be an effective method for the development of speed and accuracy of selective attention in novices over time. Poolton et al. (2005) showed implicit learning advantages (robust performance under physiological stress) to be retained following a 1-year interval without rehearsal. The implicit learning group was better than the explicit learning group. Koedijker et al. (2011) found that novices were also not affected by implicit (dual-task) conditions. They explained that few attention resources can be disruptive, or perhaps allowed novices to switch their attention between the main and dual tasks. Van der Kamp et al. (2003) found similar results and recommended that the implicit rather than explicit instruction led the learners to attend to more useful sources of information. Perhaps implicit learning frees up limited memory resources, to be able to perform the secondary task (Ewolds et al., 2017). According to Neumann (1984), three sources specify the parameters that are necessary to accomplish an action: a) input information from the sport setting, b) attentional mechanisms, and c) processes stored in long-term memory (skills). Ewolds et al. (2017) argue that in implicit learning, the input information directly determines the output of the movement, without the use of attention, and without leading to conscious awareness. However, there is evidence that the implicit and explicit learning systems can operate in parallel (Ewolds et al., 2017Author, 2010). The fact that stress conditions did not affect the response time and accuracy of selective attention for the implicit group was in line with other studies where implicitly learned motor or perceptual skills were robust to stress conditions induced anxiety (Bennet, 2000; Liao, & Masters, 2001; Masters 1992; Masters, 2000; Maxwell et al., 2000; Smeeton et al., 2005; Poolton et al., 2007).

The speed and accuracy of selective attention also improved in the explicit group, probably because the participants followed the guidance through specific explicit instructions towards information-rich areas of the environment (Author, 2012; Memmert, 2009). Through explicit practice, focusing attention on the key points allows athletes to recognize the appropriate stimuli, analyse them, and process them for the correct response (Jackson & Farrow, 2005). Jackson and Farrow (2005) mention that guidance through video and explicit instruction leads players to learn the critical key points of the sport's performance. The explicit group probably had lower scores than the implicit and analogy groups because the participants focused on specific points (key points of the execution), and perhaps "*missed*" other important information of the game scene which, if they had noticed it, would have allowed them to developed knowledge of tactical play and respond quickly and accurately. Numerous studies have confirmed that movement preparation, relative to execution, is more demanding of attentional resources (e.g., Holroyd et al., 2005; Lam, Maxwell, & Masters, 2009), suggesting that the majority of cognitive processing occurs in the preparation phase. The fact that the explicit learners tried to remember the rules learned during training to respond probably resulted in longer response times and fewer correct answers compared to the other two experimental groups. In addition, the explicit group experienced a decrease in selective attention performance (in both reaction time and accuracy) during the stress test. Masters (1992) explained, using the "*reinvestment theory*", that explicit learners fail to respond under pressure because they try to recall an earlier, verbal mode of control which is a typical process of early stages of learning. In other words, explicit learners are thinking too much about the skill when executing the task and try to recall verbal rules or knowledge acquired when the skill was originally developed. Thus, this return to verbally mediated action leads to a decrease in response speed or accuracy (Author, 2010). Moreover, the additional cognitive load (explicit knowledge) via explicit rules provided to the explicit group may have placed more demands on working memory, driving an overload in working memory capacity (Eysenck and Calvo, 1992).

The majority of researchers (Liao & Masters, 2001; Masters, 1992; Maxwell, Masters, & Eves, 2000; 2003) who applied methods of practicing perceptual skills used simulation techniques through video projection. The advantages of the simulation techniques are that they can adapt the learning to the personal rhythm of each trainee, they can be used when the athlete is absent from training due to injury or fatigue, they can easily be used by people with mobility difficulties, the equipment is cheap and affordable, and finally, they can be applied to all sports. Through the technical simulation, one can adjust the possibilities provided to ensure different training methods. For example, in a picture view, one can emphasize different parts of the visual scene (explicit practice) or block them (implicit practice). Simulation systems and virtual reality techniques will probably soon be used for the basic practice of perceptual skills. Simulation systems provide a seemingly natural racing scene, while virtual reality techniques provide the racing environment through computer units (Lee et al., 2001). Using virtual reality systems, perceptual skills can be developed, even in beginners, because they are not bound by the technique of movement. These systems provide precision in movement and are recommended for practicing selective attention.

CONCLUSIONS

In conclusion, extending the view of Liao and Masters (2001) that analogy learning may be an effective method for teaching skills implicitly in sports, and according to the results of the present study, analogy learning seems to be the most appropriate method for teaching selective attention in volleyball novices. The analogy method is proposed for the development of selective attention skills in novices, since: a) it is fully understood by children, b) it contains a playful form that is fully well-suited with children, c) it is more enjoyable for children, d) learning outcomes are maintained over time, e) learning outcomes are retained even in stressful conditions, and f) it is very simple to teach, as long as the coaches find the suitable analogies. It seems that analogy learning interventions use the benefits of implicit learning without the difficulties that arise from the implicit (dual-task) condition, especially in novices. Finally, this research highlights the advantages of simulation techniques in selective attention acquisition under normal or stressful conditions.

This study is limited by the fact that both the testing procedure and the intervention program, are implemented via simulated conditions. The experiment did not require the participants to perform the movement, but they were asked if they noticed specific critical elements concerning either the technique of performing the skill or the tactics. Implementing this experiment, the researchers aimed to determine if the different training methods have any effect on the selective attention skill only in the early phase of movement preparation, where the brain shapes the movement structure (information processing) and makes a decision only perceptually about the technique or the tactics of the execution. It is not recommended to make any generalizations that go beyond the aim and the sample of the present research. Future research can evaluate selective attention in real conditions, including stress or physical fatigue parameters.

AUTHOR CONTRIBUTIONS

Author's name (typed, start from surnames)		Authors' contribution A – Study Design; B – Data Collection; C – Statistical Analysis; D – Manuscript Preparation; E – Funds Collection.
1	Lola Afroditi	A, B, C, D
2	George Giatsis	A, C, D
3	Jose Antonio Pérez-Turpin	A, D
4	George C. Tzetzis	A, C

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