Effects of imagery training to improve the quality of athletes' swimming skills: a mixed research method

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Abstract

**Purpose:** This study aims to investigate the effect of implementing Imagery training towards the quality of swimming skills among athletes through mixed research method.

**Material and methods.** This study adopted a quantitative and qualitative research (mixed research method). The participants involved in this study were beginner athletes from the Tirta Prima Medan Swimming Association (n=20) (Indonesia). Participants were divided into two groups, namely experimental group which consisted of 5 males and 5 females (age: 16.06±2.3 years, weight: 50.78±6.5 kg, height: 1.60±0.5 cm) and the control group which consisted of 5 males and 5 females (age: 16.57±0.9 years, weight: 51.65±5.8 kg, height: 1.61±0.3 cm). The quantitative instruments included tests for freestyle, backstroke, breaststroke and butterfly swimming style while the qualitative instruments included in-depth interviews. Quantitative statistical analysis was conducted using IBM SPSS, included: normality, mean and standard deviation. The differences of values in the experimental and control groups before and after the experiment was analyzed through the independent sample t-test and Paired sample t-test. While qualitative study used thematic analysis included recording, coding and categorized into three themes.

**Results** The quantitative study results showed several findings. First, there was no difference in the scores of swimming skills before the experiment between the experimental and control groups (p≥0.05). Second, there was differences in the scores of swimming skills between the experimental and control groups after the experiment (p≤0.05). Third, the experimental group had a significant effect to improve the quality of swimming skills (p≤0.05). On the contrary, the control group only had an effect on improving the quality of freestyle swimming skills (p≤0.05), but it had not affect in other styles (p≥0.05). Qualitative findings showed that participants considered that Imagery training has the advantage to recreate the training experience in the brain, however it would not be effective if athletes had weak memory abilities and it had a positive impact on improving the quality of swimming skills.

**Conclusions:** This study concluded that Imagery training was effective to improve the quality of athletes' swimming skills.

**Keywords:** imagery training, swimming skills, mixed research method

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Це дослідження має на меті дослідити вплив впровадження образного навчання на якість навичок плавання серед спортсменів: змішаний метод дослідження.

Мета: це дослідження має на меті дослідити вплив впровадження образного навчання на якість навичок плавання серед спортсменів: змішаний метод дослідження.

Матеріали і методи. У цьому дослідженні було використано кілька та якісне дослідження (змішаний метод дослідження). Учасники, залучені до цього дослідження, були спортсменами-початківцями з Асоціації плавання Tirta Prima Medan (n = 20) (Індонезія). Учасники були поділені на дві групи, а саме експериментальну групу, яка складалась з 5 чоловіків і 5 самиць (вік: 16,06±2,3 років, вага: 50,78±6,5 кг, зріст: 1,60±0,5 см) і контрольну групу, яка складалась з 5 чоловіків і 5 самок (вік: 16,57±0,9 років, вага: 51,65±5,8 кг, зріст: 1,61±0,3 см). Кількісні інструменти включали тести плавання вільним стилем, на спині, брассом і баттерфляєм, тоді як якісні інструменти включали детальні інтерв'ю. Кількісний статистичний аналіз проводився за допомогою IBM SPSS, включаючи: нормальності, середнє значення та стандартне відхилення. Відмінності значень в експериментальній та контрольній групах до та після експерименту аналізували за допомогою t-критерію незалежної відпівки та t-критерію парної відпівки. У той час як у якісному дослідженні використовувався тематичний аналіз, який включає записи, кодування та розділення на три теми.

Результати. Результати кількісного дослідження показали декілька висновків. По-перше, не було різниць в балах навичок плавання до експерименту між експериментальною та контрольною групами (p≥0,05). По-друге, спостерігалась рівність в оцінках навичок плавання між експериментальною та контрольною групами після експерименту (p≤0,05). По-третє, експериментальна група мала достовірний вплив на підвищення якості навичок плавання (p<0,05). Навпаки, контрольна група вплинула лише на покращення якості навичок плавання вільним стилем (p<0,05), але не вплинула на інші стилі (p≥0,05). Якісні результати показали, що учасники вважали, що тренування образів має перевагу у відтворенні тренувального досвіду в мозку, однак воно не було б ефективним, якби спортсмени мали слабкі здібності до пам'яті, і мало позитивний вплив на покращення якості навичок плавання.

Висновки. У цьому дослідженні було зроблено висновок, що тренування образів було ефективним для покращення якості навичок плавання спортсменів. Ключові слова: образне навчання, навички плавання, змішаний метод дослідження.

Аннотація

Суанді Селиан, Хідаят Хумайд, Абд-ul Суккур, Фірмансья Дліс, Нурхаяті Сіматупанг, Русді, Дікдік Фаузі Дермаван, Зи Сетіаван. Вплив образного тренування на качество плавательных навыков спортсменов: смешанный метод исследования.

Цель: это исследование направлено на изучение влияния обучения воображению на качество плавательных навыков у спортсменов с помощью смешанного метода исследования.

Материалы и методы: В данном исследовании применялись количественные и качественные исследования (смешанный метод исследования). Участниками этого исследования были начинающие спортсмены из Ассоциации плавания Tirta Prima Medan (n = 20) (Индонезия). Участники были разделены на две группы: экспериментальную группу, состоящую из 5 мужчин и 5 женщин (возраст: 16,06±2,3 года, вес: 50,78±6,5 кг, рост: 1,60±0,5 см) и контрольную группу, состоящую из 5 мужчин и 5 женщин (возраст: 16,57±0,9 года, вес: 51,65±5,8 кг, рост: 1,61±0,3 см). Количественные инструменты включали тесты для плавания вольным стилем, на спине, брассом и баттерфляем, тогда как качественные инструменты включали подробные интервью. Количественный статистический анализ проводился с использованием IBM SPSS, включая: нормальность, среднее значение и стандартное отклонение. Различия значений в экспериментальной и контрольной группах до и после эксперимента анализировали с помощью t-теста независимой выборки и t-теста парной выборки. В то время как качественное исследование использовало тематический анализ, включающий запись, кодировка и разделение на три темы.

Результаты. Количественные результаты исследования показали несколько выводов. Во-первых, различия в балах плавательных навыков до эксперимента между экспериментальной и контрольной группами не было (p≥0,05). Во-вторых, различия в балах плавательных навыков между экспериментальной и контрольной группами после эксперимента (p<0,05). В-третьих, экспериментальная группа показала значимое влияние на улучшение качества плавательных навыков (p<0,05). Наоборот, в контрольной группе это показывало только на улучшение качества навыков плавания вольным стилем (p<0,05), но не показало на другие стили (p≥0,05). Качественные результаты показали, что участники считали, что обучение воображению имеет преимущество в воссоздании тренировочного опыта в мозгу, однако оно было бы неэффективным, если бы у спортсменов были слабые способности памяти, и положительно повлияло на улучшение качества навыков плавания.

Выводы. В этом исследовании сделан вывод о том, что тренировка воображения эффективна для улучшения качества плавательных навыков спортсменов.

Ключевые слова: образная тренировка, навыки плавания, смешанный метод исследования.
Introduction

Swimming is a competitive sport, every athlete must compete to obtain high achievements [1, 2, 3]. Data reported that in order to become a successful athlete in swimming, they did not only focus on improving mental and physical fitness [4, 5, 6], but they should have an appropriate swimming skills [7, 8]. According to previous studies, swimming skills was one of the factors that contributed to accelerate the performance [9, 10, 11]. Therefore, it was needed several efforts to improve swimming skills among athletes through the implementation of Imagery training method.

Imagery is a mental training method with a particular operating system, including imagining, visualizing or replaying the memory in the brain about the past events [12]. In other words, Imagery training required athletes to imagine the trainings that had been carried out in memory [13, 14, 15]. This system was in line with the opinion of Uludag, Dorak, Vurgun, Yuzbasioglu, Ates [16], that Imagery was a particular training which involved imagining or recreating an experience of movement in mind. In Imagery training, athletes experienced visual, kinesthetic, auditory and olfactory processes [17, 18]. Visual and kinesthetic process were the most frequently and most widely used by athletes. The visual representation included information about the activities of athlete based on two different perspectives, namely the internal perspective, the athlete imagined himself doing a movement [19], and the external perspective, the athlete imagines someone other than himself was doing a movement, for example a coach [20] or professional athletes on YouTube, so that later it can become an imagined object. Basically, the main function of Imagery training can help athletes to remember how to carry out the correct movement and to fix the incorrect movement [21], so that athletes could optimally learn the skill. Previous studies had documented the benefits of properly implementing Imagery training, for example it was very popular for improving performance (e.g., tactics, technique) in sports [22] and can be used as rehabilitation for injured athletes [23], even effective for increasing or improving motoric movement [24].

Although many studies have applied Imagery training in sports [25, 26, 27], most of the previous studies were carried out through experimental research [28] and a meta-analysis [29]. Therefore, to overcome this gap, the researchers presented a novelty in terms of implementing Imagery training using a mixed research method, namely a combination of quantitative and qualitative. It was expected that by using mixed research method, the effects of Imagery training can be evaluated and found out the results both quantitatively and qualitatively. This research contributes to the development of mental training in swimming, so that the beginner athletes can learn swimming skills optimally. Thus, this study aims to reveal the effect of implementing Imagery training on improving swimming skills through a mixed research method.

Material and methods

This study applied a mixed research method, namely a combination of quantitative (experimental) and qualitative (in-depth interviews) research. Based on previous studies, this method was effective in overcoming problems [5]. Quantitative research through experimental methods aims to obtain numerical data while qualitative research through in-depth interviews aims to obtain oral/description data. The detail of mixed methods design is presented in Figure 1.

![Fig. 1. Mixed methods research design](image)

Participants

This study was participated by beginner athletes from the Tirta Prima Medan Swimming Association (n= 20) (Indonesia). Participants were randomly divided into two groups, the experimental group that received Imagery training consisted of 5 males and 5 females (age: 16.06±2.3 years, weight: 50.78±6.5 kg, height: 1.60±0.5 cm) and the control group who carried out the daily training they usually did consisted of 5 males and 5 females (age: 16.57±0.9 years, weight: 51.65±5.8 kg, height: 1.61±0.3 cm). The G Power analysis generated a sample size of at least 10 swimmers per group. The inclusion criteria of participants was: history of participating in Imagery training, participants were physically active and healthy, have poor swimming
skills (beginner level). All participants were given information about the rules in this research activity before the research was begun. Then, they were required to make and sign a statement letter about their willingness to participate in this research. Participants involved in this study were given a reward of 10 USD.

**Instruments**

**Quantitative Instruments**

The quantitative instrument in this study was a swimming skills test consisting of:

- Freestyle swimming test (s). The freestyle swimming test was carried out in 25 meters. First, participants stood on the star block. Then, after the whistle was sounded, the participants swam using the freestyle as fast as possible to the finish line. The result was evaluated by calculating the fastest swimming time.

- Backstroke swimming test (s). The backstroke swimming test was carried out in 25 meters. First, participants stood on the star block. Then, after the whistle was sounded, the participants swim using the backstroke style as fast as possible to the finis lineh. The result was evaluated by calculating the fastest swimming time.

- Breaststroke swimming test (s). The breaststroke swimming test is carried out in 25 meters. First, participants stood on the star block. Then, after the whistle was sounded, the participants swim using the breaststroke as fast as possible to the finish line. The result was evaluated by calculating the fastest swimming time.

- Butterfly style swim test (s). The butterfly style swim test was carried out in 25 meters. First, participants stood on the star block. Then, the whistle was sounded the participants swim using the dolphin style as fast as possible to the finish line. The result was evaluated by calculating the fastest swimming time.

This instrument was tested previously in this study, the internal reliability coefficient was 0.87-0.93. The assessment in this test was carried out by researchers and assisted by 3 experts in swimming who possess the title of Dr and all of them are coaches/lecturers at several universities in Indonesia.

**Qualitative Instruments**

The qualitative instrument involved in-depth interviews for 30 minutes per individual [5]. Interviews were conducted in Bahasa, directly at the Tirta Prima Medan swimming pool.

**Research procedure**

This research was approved by the Jakarta State University (Indonesia) with number: 3309/UN39.6.Ps/LT/2022 and approved by the Medan Swimming Association Committee. In addition, this study followed the guidelines of the World Medical Association Code of Ethics (Helsinki Declaration for Humans).

Quantitative research through experiments was carried out on December 6, 2022, all participants carried out initial test activities in swimming skills. At the second meeting on 08 December 2022 participants in the experimental group carried out Imagery training and the control group carried out their daily routine activities until the 12th meeting (03 January 2023). In the last meeting (05 January 2023) all participants carried out the final test, namely swimming skills. The details of Imagery training program is presented in Table 1.

Qualitative research through in-depth interviews was carried out on 07-08 January 2023. The interviews were held at the Tirta Prima Medan swimming pool from 08.00 in the morning until finished. Interviews were conducted only in the experimental group, which was according to the objectives of this study. Interviews were conducted in Bahasa for 30 minutes regarding the advantages, disadvantages and impacts of using Imagery training. In one day the researchers interviewed 10 athletes. The results of the interviews were recorded and then analyzed by the research team and 3 experts in the field of sports psychology.

**Statistic analysis**

**Quantitative analysis**

All data was analyzed using IBM SPSS version 25.0 (Armonk, NY: IBM Corp). First, testing the normality of data through Shapiro-Wilk (p≥0.05). Second, conducting statistical descriptive testing which consists of the mean (μ) and standard deviation (S). Third, testing the differences in the scores of the experimental and control groups before the experiment. Fourth, testing the differences in the scores of the experimental and control groups after the experiment through the Independent sample t-test (p≤0.05). The last, testing the scores of swimming skills before and after the experiment through the Paired sample t-test (p≤0.05).

**Qualitative analysis**

Qualitative data was analyzed through qualitative thematics, namely by recording the results of in-depth interviews with participants, coded and categorized into three themes [5], consisting of: theme 1: advantages of Imagery training, theme 2: disadvantages of Imagery training and theme 3: impact of Imagery training.
Imagery Training Program

<table>
<thead>
<tr>
<th>Training Unit Components</th>
<th>Activities</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial activities</td>
<td>Inhale and exhale.</td>
<td>2 min</td>
</tr>
<tr>
<td></td>
<td>Warming-up.</td>
<td></td>
</tr>
<tr>
<td>Imagery training</td>
<td>• Watching videos of professional swimming athletes on YouTube for freestyle, back, breaststroke and butterfly swimming styles.</td>
<td>55 min</td>
</tr>
<tr>
<td></td>
<td>• The athlete imagined freestyle movement. This imagery training was performed for 5 minutes with 2 minutes rest before continuing to imagine other styles.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Athlete performed training that had been imagined previously.</td>
<td></td>
</tr>
<tr>
<td>Final activities</td>
<td>Inhale and exhale</td>
<td>3 min</td>
</tr>
<tr>
<td></td>
<td>Evaluation.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cooling-down.</td>
<td></td>
</tr>
</tbody>
</table>

Results

Quantitative results

Table 2 shows that the experimental and control groups have normally distributed data (p>0.05). Table 3 shows the mean and standard deviation values between the experimental and control groups. Table 4 shows that there was no difference in the scores of swimming skills in the experimental and control groups before the experiment (p≥0.05). While Table 5 shows that there were differences in the value of swimming skills in the experimental and control groups after the experiment (p≤0.05). Then the Paired sample t-test in Table 6 shows that the experimental group has a significant effect on improving the quality of swimming skills of athletes (p≤0.05). While the control group shows an effect on improving the quality of swimming skills only in freestyle (p≤0.05), but not in the other styles (p≥0.05) (Table 7).

Qualitative results

The qualitative research through in-depth interviews obtained following results:

Theme 1: The advantages of Imagery training

This first theme related to the advantages of the Imagery training that must be revealed from the participants' perceptions. In this case the participants argued that:

In our opinion, Imagery training has advantages in terms of complex training process, for example at the beginning we were required to watch Professional athletes carrying out freestyle, backstroke, breaststroke and butterfly swimming movements on youtube, then continued to imagine what we had seen in our minds and finally we practiced the movements that we had imagined. That process help us to learn swimming skills in all styles” (Interview results with participants 1, 3, 5, 6, 10).

We think that the advantage of Imagery training was it can recreate the experience of movement/training in the brain and during the process of imagining or visualizing we can found out the correct and incorrect swimming movements (Interview results with participants 2, 4, 7, 8, 9).

Theme 2: The disadvantages of Imagery training

The second theme that was revealed through in-depth interviews was the disadvantages of the Imagery training. In this case the participants argued that:

“In our opinion, the weakness of this Imagery training was not all athletes have good memory, so this training was inoptimal for athletes with low cognitive function” (Interview results with participants 3, 6, 7, 9, 10).

Another drawback was the conditions must be conducive or quiet during the Imagery training process, so that the athlete can focus on imagining every movement he had learned. However, if many athletes joking or lots of noise, this training will be ineffective (Interview results with participants 1, 2, 4, 5, 8).
Theme 3: The impact of Imagery training

The last theme related to the impact of using Imagery training towards participants. In this case the participants mentioned that: “Imagery trainings help us imagined each movement in detail in our minds, so that we can more easily remember and perform those movements” (Interview results with participants 1, 2, 5).

We are very happy to take part in this Imagery training program, because at the 7th meeting, we felt that our swimming skills have improved better than before (Interview results with participants 3, 7, 8). In addition, before joining Imagery training program it was very difficult to learn dolphin swimming style, but now we can master butterfly style well and we will continue to run this program even though this research has been completed (Interview results with participants 4, 6, 9, 10).

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Unit</th>
<th>Experimental Group (n=10)</th>
<th>p</th>
<th>Control Group (n=10)</th>
<th>p</th>
<th>Description</th>
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<tbody>
<tr>
<td>Swimming Skills</td>
<td></td>
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<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>Freestyle (second)</td>
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<td>Pre-test 0.095</td>
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<td></td>
<td></td>
<td>Post-test 0.133</td>
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<td>Post-test 0.265</td>
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<tr>
<td>Breaststroke style (second)</td>
<td>s</td>
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<td>Pre-test 0.170</td>
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<td>Post-test 0.155</td>
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<td>Post-test 0.172</td>
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<td>Post-test 0.118</td>
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Table 2

Descriptive Statistics

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<tr>
<td></td>
<td></td>
<td>Pre</td>
<td>Post</td>
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<tr>
<td>Swimming Skills</td>
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<td>Freestyle (second)</td>
<td>s</td>
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<td>18.00</td>
<td>0.70</td>
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<td>Butterfly style (second)</td>
<td>s</td>
<td>14.80</td>
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The differences in swimming skills between the experimental (n=10) and control (n=10) groups before the experiment

<table>
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<th>Statistical Indicators</th>
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<tr>
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<tr>
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<td></td>
<td></td>
<td>Control</td>
<td>18.70</td>
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<tr>
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<td>Experimental</td>
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<tr>
<td></td>
<td></td>
<td>Control</td>
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</table>

The differences in swimming skills between the experimental (n=10) and control (n=10) groups after the experiment

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Unit</th>
<th>Group</th>
<th>Statistical Indicators</th>
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<tr>
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<tr>
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<td>Experimental</td>
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</tr>
<tr>
<td></td>
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<td>Control</td>
<td>14.40</td>
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<td>Experimental</td>
<td>14.40</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Control</td>
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<td></td>
<td></td>
<td>Control</td>
<td>18.30</td>
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<tr>
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<td>Experimental</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>Control</td>
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</table>

The results of the Paired Samples t-test

<table>
<thead>
<tr>
<th>Dependent Variable</th>
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<th>Experimental Group Pre-Post</th>
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<tr>
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<td>Male (n=5)</td>
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<tr>
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<td>Butterfly style (second)</td>
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</tbody>
</table>

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### Discussion

Our research aims to investigate the effect of implementing Imagery training on improving athletes' swimming skills through a mixed research method.

The quantitative results showed several results. First, there was no difference in the scores of swimming skills between the experimental and control groups before the experiment. Second, there were differences in the scores of swimming skills between the experimental and control groups after the experiment. Third, based on the results of the Paired sample t-test, it showed that the experimental group had a significant effect on improving the quality of athletes' swimming skills. Fourth, the control group also had an effect on improving the quality of swimming skills in the freestyle, but there was no effect for backstroke, breaststroke and butterfly swimming style.

The improvement in swimming skills in the experimental group was due to the capability of Imagery training in promoting a conducive, quiet or without distraction training condition, so that athletes could focus on imagining every movement they had previously learned. This was in line with Pedro et al [20], Imagery was a training that generated visualization or imagination in the brain, as if we were carrying out a movement as if it were actually happening. The results of previous research also supported this study, imagery training had been proven to positively improve athlete performance in sports [30, 31]. Uludag, Dorak, Vurgun, Yüzbasioglu & Ateş [16], also reported similar results, there were 29 basketball players who had increased free-throw performance after participating in the Imagery training program. The main strength of Imagery training was it could promote longer time for the athlete to study each movement with the details in mind [28]. In addition, Imagery has the advantage of being able to present a simulation of motion or training experience [32, 29], so that indirectly the athlete learned or fixed training movement in their mind [13, 25]. While, the freestyle swimming skills showed an improvement in the control group because this is the most basic and easiest skill to master in swimming, so with routine trainings that they usually carry out every day had been proven effective.

Qualitative findings showed that the participants (athletes) revealed various perceptions, for example Imagery training has the advantage to recreate the experience of movement/training in the brain, so that these movements can be mastered properly [33, 34] and participants explained that this Imagery training was not effective if athletes had limited memory abilities. In addition, participants also believed that Imagery training had an effective impact on improving the quality of swimming skills. Thus, the uniqueness and novelty in this study was the imagery training have an effect on improving the quality of athletes' swimming skills through the a mixed research method.

### Conclusions

Based on the results and discussion, it can be concluded that the Imagery training program...
has effective to improve the quality of athletes’ swimming skills. However, this study still has limitations in terms of the limited number of participants who are swimming athletes. Therefore, future research needs to be carried out by involving more athletes from other sports such as martial arts, handball or archery. This research contributes to the development of psychological training methods for swimming athletes, so that they can continuously training with this method in order to develop their swimming skills.

**Conflict of interest**

We, as the authors of this study, agree that there is no conflict of interest in this research.

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