Swimming skills acquisition among aquatically inexperienced college students: deep vs shallow swimming pool

Adquisición de habilidades de natación en estudiantes universitarios sin experiencia acuática: comparación entre piscinas profundas y poco profundas

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Abstract

Introduction: Lack of swimming skills is common in developing countries and learning to swim rarely starts at an early age. Many factors affect swimming skills acquisition; swimming pool depth has been addressed as one of the main factors.
Objective: To compare swimming skills acquisition between deep-water swimming pool (DSP) and shallow-water swimming pool (SSP) among students with no previous experience in swimming.
Methodology: 288 physical education college students were the sample of the study. The deep swimming pool group consisted of 186 students, whereas the shallow swimming pool group consisted of 102 students. Learning process lasted 12 weeks. The evaluation criteria consisted of the following 6 parameters of the front crawl stroke: the parameters were body position, head position, breathing, leg kicks, arm stroke & recovery, and general fluency & synchronization. Three swimming professionals participated in the evaluation process.
Results: The shallow swimming pool group showed a significant improvement in arm stroke & recovery, general fluency and synchronization. However, there were no significant differences between the two groups in body position, head position, breathing, and leg kicks.
Conclusion: Training in a shallow swimming pool seems to facilitate swimming skills acquisition compared to deep swimming pools in adults with no previous experience in swimming. Furthermore, shallow swimming pools has fewer financial demands, especially in developing countries, where swimming illiteracy is prevalent.

Keywords

Arm stroke; buoyancy; deep water; gliding; leg kick; shallow pool depth.

Resumen

Introducción: La falta de habilidades de natación es común en los países en desarrollo, y el aprendizaje de la natación rara vez comienza a edades tempranas. Existen numerosos factores que influyen en la adquisición de habilidades acuáticas; entre ellos, la profundidad de la piscina ha sido considerada uno de los más importantes.
Objetivo: Comparar la adquisición de habilidades de natación entre una piscina profunda (DSP) y una piscina poco profunda (SSP) en estudiantes sin experiencia previa en natación.
Metodología: La muestra del estudio estuvo compuesta por 288 estudiantes universitarios de Educación Física. El grupo de piscina profunda estuvo formado por 186 estudiantes, mientras que el grupo de piscina poco profunda estuvo compuesto por 102 estudiantes. El proceso de aprendizaje tuvo una duración de 12 semanas. Los criterios de evaluación incluyeron seis parámetros del estilo crol: posición corporal, posición de la cabeza, respiración, patada, brazada y recobro, así como fluidez general y sincronización. En el proceso de evaluación participaron tres profesionales especializados en natación.
Resultados: El grupo de piscina poco profunda mostró una mejora significativa en la brazada y el recobro, así como en la fluidez general y la sincronización. Sin embargo, no se observaron diferencias significativas entre ambos grupos en cuanto a posición corporal, posición de la cabeza, respiración y patada.
Conclusión: El entrenamiento en piscinas poco profundas parece facilitar la adquisición de habilidades de natación en comparación con las piscinas profundas en adultos sin experiencia previa en este deporte. Además, las piscinas poco profundas requieren una menor inversión económica, especialmente en países en desarrollo, donde el analfabetismo acuático es frecuente.

Palabras clave

Agua profunda; brazada; deslizamiento; flotabilidad; patada; Profundidad reducida de la piscina.

Introduction

Swimming as a physical activity has numerous benefits for both physical and mental health (Jackson et al., 2022; Powis & Hazzard, 1984; Tanaka, 2009; Tang et al., 2022). In addition, swimming has been considered a life-saving skill that could prevent drowning (Sinclair & Roscoe, 2023), one of the leading causes of death in many countries (WHO, 2026).

Swimming illiteracy, or the inability to swim without assistance, is dominant in low-income and water-scarce countries (Borgonovi et al., 2022). The Hashemite Kingdom of Jordan (HKJ), the country where this study was held, is one of the top 10 water scarce in the world, with a high rate of swimming illiteracy among its population aged 15-70 years old, reaching over 80% of swimming illiteracy (Borgonovi et al., 2022). Nevertheless, Jordanian colleges of Physical Education (PE) and Sports Science included a compulsory swimming course as a graduation requirement for the undergraduate PE program (Kanaan et al., 2023).

Several factors affect swimming skills acquisition, such as teaching technique, class size, and the general environment of the swimming pool (Langendorfer, 2010; Oh et al., 2011; Van Duijn et al., 2021). The basic swimming skills and aquatic adaptations are generally acquired in shallow waters, ranging between 0.65-1 meter deep. However, the advanced learning stages can be taught and practiced in deeper water levels (Costa et al., 2012).

A considerable body of literature showed significant differences in skills acquisition between adults and children, such as cognitive abilities (Jongbloed-Pereboom et al., 2019; Adi-Japha et al., 2019; Van Duijn et al., 2021; Van Roy et al, 2024; Beck et al, 2024), motor skills level (Voelcker-Rehage, 2008; Komar et al., 2021), aquaphobia (Coelho et al., 2025; Graham & Gaffan, 1997), physical abilities (Kjendlie et al., 2004), and social effects (Wilson et al., 2023). Furthermore, it has been medically ensured that children swiftly adapt and learn skills, including swimming, due to their pre-mature stage and γ-aminobutyric acid (GABA) regulation compared to adults (Frank et al., 2022).

However, studies addressing water depth and its effect on learning swimming are limited to preschool kids and children (Costa et al., 2012; Fahmiruwhanti et al., 2022; Rocha et al., 2018). Furthermore, those studies explored learning the basic swimming skills like floating, gliding, and basic leg kicks (not front crawl stroke or back stroke).

Therefore, the purpose of this study is to compare swimming skills acquisition between generally deep-water swimming pool (DSP) and generally shallow-water swimming pool (SSP) amongst swimming illiterate college students.

Method

Participants

A total of 288 male students were the sample of this study. Students were categorized into two groups. The DSP group consisted of 186 students who registered for swimming courses from October 2021 to January 2023 at Yarmouk University (YU). The SSP group consisted of 102 students registered for swimming courses at Al-Albayt University (AABU) from the period February 2023 to December 2024.

Inclusion criteria

Participants aged (18-25) years, registered at swimming courses with no previous swimming experience were selected for the study, as well as those who completed the course with 85% attendance rate of the full course (2 days/week classes, one hour 15 minutes per class for 12 weeks).

Procedures

Pool design

DSP and SSP were semi-Olympic swimming pool size (25m x12.5m). The SSP ranged from 0.9m to 2m depth, whereas the DSP ranged between 1.5m - 4.5m. DSP and SSP are illustrated in figure (1) and (2).

Figure 1. Shallow swimming pool (SSP) side view dimensions.

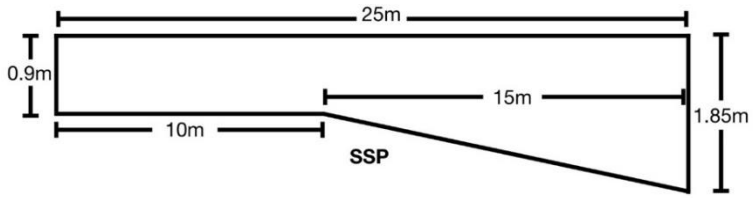
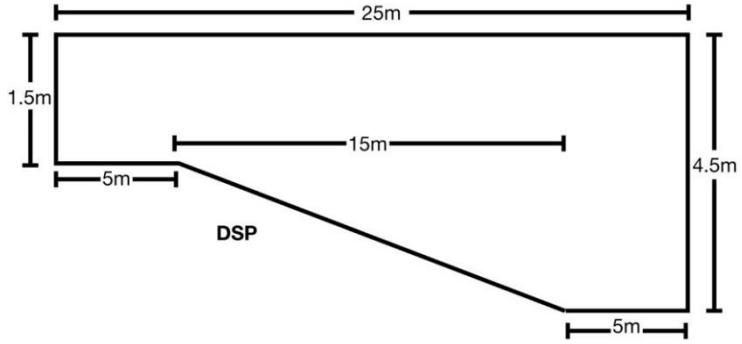


Figure 2. Deep swimming pool (DSP) side view dimension.



Measures

Measuring total swimming time is generally the major factor representing a swimmer's technique, physical condition, and mental abilities. Stroke length and stroke rate are the key parameters defining stroke efficiency in the front crawl (Craig & Pendergast, 1979; Maglischo, 2016). However, when evaluating beginners, other parameters are more relevant and significantly correlate with stroke efficiency and the assessment of technique (Madureira et al., 2012). Therefore, to evaluate front crawl stroke, there are 6 main parameters to cover, which is body position (BP), head position (HP), breathing (Br), leg kicks (LK), arm stroke & recovery (AS&R), and the general fluency & synchronization of the stroke (F&S). Each parameter was granted a percent weight depending on its influence on the stroke, including BP 10%, HP 10%, Br 10%, LK 10%, AS&R 30%, and F&S 30% (Madureira et al. 2012; Maglischo, 2016).

Design and Test procedures

The "Group-instructing" method was implemented along the course with performance feedback during cooperative learning of basic and advanced aquatic skills. Feedback varied between verbal feedback and video playback, recorded at the session through an iPad. The course sequence involved an introduction to the water environment, body position, buoyancy, leg kicks (front and back), breathing, sculling, straight arm and high elbow recovery (front crawl), and ending with a full front crawl stroke.

At the end of each course the final test was conducted. The test consisted of swimming front crawl stroke for 25m (without start jump, and maximum speed was not required). Each student was video recorded via mobile camera from the side of the pool showing full body along the 25m swim. Each video file was renamed with the swimmers' name.

After collecting row videos from both groups, the file name was substituted with a number. The number of the video and the name of the related swimmer was kept away from the evaluators.

Tow swimming lecturers at the undergraduate level and one former National swimming team coach participated in the evaluation process. The evaluators were given the choice to use a paper or electronic sheet for evaluation. Table (1) shows the main part of the evaluation sheet.

Table 1. Shows the upper part of the evaluation sheet used by the evaluators

Video #	Body position (10)	Head position (10)	Breathing (10)	Leg kicks (10)	Arm stroke & recovery (30)	General fluency & synchronization (30)
1						
2						

Each evaluator provided his evaluation individually for each swimmer by watching a playback of the numbered videos, using the evaluation sheet. To avoid observational bias, the evaluators were asked to evaluate the swimming technique without knowing the purpose of the study, or which video belong to which swimming pool (DSP or SSP). Furthermore, the median of each parameter was used in the data analysis.

Data analysis

The evaluated scores were statistically analyzed through IBM SPSS (version 25), using an independent samples *t*-test to compare the difference between the skill acquisition of the SSP and DSP groups. Furthermore, Cohen's *d*-test was used to determine the effect size and significance.

Results

Table 2. demonstrates descriptive statistics for the total performance of both SSP and DSP groups, including the six subdivisions of the total performance. Results showed that SSP group acquired higher level of swimming skills than DSP group in total performance and all subdivisions. The differences were approximately the same in BP, HP, Br, and LK. However, differences were highest within the average of total performance (2.74 points).

Table 2. Descriptive statistics of the variables for SSP and DSP groups.

Variable	SSP Group n=102		DSP Group n=186	
	Average	SD	Average	SD
Body Position (BP)	7.98	1.20	7.76	1.32
Head Position (HP)	8.19	0.77	8.05	0.87
Breathing (Br)	7.39	1.01	7.19	1.06
Leg Kicks (LK)	7.38	1.00	7.20	1.05
Arms Strokes & Recovery (AS&R)	21.48	2.99	20.61	2.97
Fluency and Synchronization (F&S)	21.84	3.49	20.69	3.49
Total Performance	74.07	9.99	71.33	10.31

Independent-samples *t*-tests were conducted to examine total and subdivision performance differences between SSP and DSP groups (Table 3). Non-significant differences were observed for BB, HP, Br, and LK, indicating that basic skills in swimming can be equally acquired within different swimming pools depths.

In contrast, a statistically significant difference towards the SSP group was found for AS&R (M = 21.48, SD = 2.99), t(207) = 2.35, p = 0.009, F&S (M = 21.84, SD = 3.94), t(208) = 2.65, p = 0.004, and total performance (M = 74.07, SD = 9.99), t(214) = 2.19, p = 0.014. The effect size of the differences was small, as reflected by Cohen's d values of 0.29, 0.32, and 0.26, respectively.

Table 3. Independent samples *t*-test and Cohen's *d* for the DSP and SSP Groups

Variable	df	*t* stat	*P* value	Cohen's *d*	Effect size
Body Position	225	1.414	0.079		
Head Position	231	1.427	0.077		
Breathing	217	1.558	0.060		
Leg Kicks	217	1.557	0.060		
Arm Strokes & Recovery	207	2.358	0.009**	0.29	Small
Fluency and Synchronization	208	2.656	0.004**	0.32	Small
Total Performance	214	2.199	0.014*	0.26	Small

**Significant at $p<0.01$, *Significant at $p<0.05$

Discussion

This study aimed to explore whether any potential difference exists between teaching swimming to aquatically non-experienced college students in deep vs shallow water swimming pools. The statistical analysis of the data showed a favorable result toward learning to swim in a shallow swimming pool. Although the difference was significant, the effect size was small, which is still meaningful as there are other factors affecting skills acquisition, not only swimming pool depth (Costa et al., 2012). The results also algin with existing research on children (Bitang & Bitang, 2017; Fahmiruwhanti et al., 2022; Rocha et al., 2018; Costa et al., 2012). However, Bitang & Bitang (2017) contradicted the present research where it showed a slight performance advantage towards the deep-water group. This contradiction could be explained by difference in methodological approach, namely sample size (20 children), program duration (4 weeks), and evaluation type (grading system from 1 to 5)

The favorable difference in learning swimming skills at SSP could be attributed to more noticeable confidence of the learners, and more time spent applying skills, as noted by the coach in charge of the teaching program. This could be also indirectly explained by the nonsignificant difference in BP, HP, Br, and LK, as these skills start early in the course, indicating enough time to practice.

Unlike previous studies (Costa et al., 2012; Fahmiruwhanti et al., 2022; Rocha et al., 2018), the present study addressed the issue of teaching swimming skills for adults (not children), with an acceptable number of samples, and an approximate number of students in class. The teaching program was conducted with the same coach for both groups, with the same teaching methods and skills sequence. Moreover, the study tracked swimming skills until reaching a full front crawl stroke performance.

In a related context, SSP consumes minimal water, less pressure on the filtration system, a lower heating budget, and fewer water treatment substances compared to DSP (Berg et al., 2019; Li et al., 2020; Wyczarska-Kokot et al., 2020). Those benefits, alongside with shallow water effect on learning swimming can be taken into consideration for swimming pools construction codes, especially in developing countries.

Conclusions

Proper swimming skills are significant for physical and mental health as well as personal safety. The current study addressed this issue by comparing swimming skills acquisition, including shallow and deep-water depth. However, the research demonstrated that students with no previous swimming experience had more potential benefits of swimming skill acquisition through SSP than DSP. Furthermore, SSP facilitates minimum financial demands compared to DSP due to the low water volume in swimming pools. The study highlighted further research regarding swimming acquisition strategies to reduce challenges for low-income and developing countries.

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