Kjendlie, P.-L., Mendritzki, M. (2012). Movement patterns in free water play after swimming lessons with flotation aids. *International Journal of Aquatic Research and Education, 6*, 149-155.

International Journal of Aquatic Research and Education, 2012, 6, 149-155

Movement Patterns in Free Water Play After Swimming Lessons With Flotation Aids

Per-Ludvik Kjendlie and Marcel Mendritzki

The aim of this study was to investigate the movement patterns of children during free play in a swimming school setting. It was hypothesized that children being taught using flotation vests would be less likely to surface dive, jump, and dive during free play. In this study, 24 participants were observed using a video camera during a 10-minute free play period at the end of a learn-to-swim session. Each subject had undergone 10 lessons either using a flotation vest (n = 11) or without (n = 13). The results showed that the flotation aid group (FLOAT) had significantly fewer surface dives (p = 0.006, using a two sample t-test) compared to the control group (CON) and that FLOAT asked for flotation toys significantly more often than CON (p = 0.03) during free play. No statistically significant differences between groups were observed for breathing, diving, and water entry skills, and the distance moved on land and in water due to low statistical power, but FLOAT participants seemed to be less likely to do vertically-oriented movements. We concluded that children learning to swim using flotation aids had a tendency to move more horizontally during free play and to not choose vertical axis movements (jumping and surface diving) compared to children being taught without the flotation vest.

Keywords: swimming, learn-to-swim, diving, underwater swimming, teaching techniques.

"Learn to swim" programs could be one of the significant actions to reduce drowning in children. Although other prevention strategies also are important, learning a variety of aquatic skills seems likely to reduce the risks associated with drowning (Junge, 1983).

The use of various types of flotation aids in learn–to-swim programs is a widespread practice. In almost every pool, there are flotation aids present in the form of kick boards, pull buoys, bubbles, inflatable armbands, Styrofoam "noodles," and larger floating toys. Lately, the use of flotation suits has become popular in some swimming schools. The scientific basis for using flotation aids within instructional settings seems limited to only a few studies (Kaye, 1965; Kjendlie, 2009a, 2009b; McCatty, 1968; Scurati, Roione, Michielon, & Invernizzi, 2006; Smith, 2008). One

The authors are with the Norwegian School of Sports Sciences, Department of Physical Performance, in Oslo, Norway.

goal of all swimming teaching and aquatic readiness preparation is to establish the free-floating ability (FFA) of swimmers. FFA is defined as the ability to sustain oneself at the surface without support of external buoyancy aids or the instructor.

The advantages of using flotation aids in a learn-to-swim program for beginners seem to relate to their effectiveness, although such claims are unsupported by evidence. For instance, The Drie Essen Swim School in The Netherlands (www.drie-essen.nl) claims that children are more confident wearing a flotation vest and thus are more willing to try more challenging learning exercises. Secondly, a flotation vest is claimed to give children a jump-start, making it possible to start earlier with instruction of propulsive movements, regardless of their FFA. Furthermore, the vest makes safety a lesser challenge in deep water, which means that beginner swimmers can do more exercises independent of the instructor or other support.

On the other hand, it can be argued that using flotation aids in a learn-to-swim setting slows the development of FFA. Furthermore, several swimming school progressions have FFA as their basis for the learn-to-swim process and only after FFA has been achieved does their process focus on generating propulsive movements (e.g., Madsen & Irgens, 2005; Wilke, 2007). When using a FFA-first approach, the need for using flotation aids in the beginning phase is not so apparent.

A literature review on the issues related to FFA-first vs. using flotation aids provides contradictory results on the effect of using flotation aids in learn to swim programs. On one hand, some research has shown that adult males using buoyancy aids (n = 15) in their swimming classes (beginning level of teaching) were found to swim 32% further than the control group (n = 15) after 26 lessons (Kaye, 1965). In contrast, others have not found any difference in swimming performance after beginning swimming with flotation aids compared to not using them. In another example, no differences were found for adult males in swimming distance or "watermanship" skills between a group using flotation aids compared to a control group (McCatty, 1968). Similarly, others concluded that teaching with or without floating devices was equally effective for children (Parker, Blanksby, & Quek, 1999; Scurati et al., 2006). Overall, all these studies have measured the effect of flotation aids in learning to swim using a specific swimming measure or test (e.g., distance or skill). No research so far seems to shed light on the beginner swimmer's freely-chosen movements. Because people tend to choose to do what they have mastered and feel confident in doing (Bandura, 1977), examining freely-chosen movements may tell us something about the specific swimming skills children have learned to a more advanced level. Therefore, the aim of this study was to investigate differences in self-chosen aquatic movements during free play between two groups of children who both have participated in beginner swimming, one group with and the other group without the use of flotation vests.

Method

Participants

We used a randomized control design. The 24 participants were all between 6 to 8 years of age and were randomly divided into an intervention group (FLOAT; n = 11, 5 girls and 6 boys) and a control group (CON; n = 13, 3 girls, 10 boys). These participants were part of a larger study on the effects of using flotation aids in a learn-to-swim program, where they underwent a 10-lesson learn-to-swim program (Kjendlie, 2009a, 2009b). The general swimming performance of these children at the start of the study was assessed as "advanced beginners." As such, participants were those who had undergone a 10-lesson course of water familiarization in a shallow pool that enabled them to demonstrate some beginning competence in surface diving and picking up an object from 1.2 m, jumping into 1.2 m deep water with support and floating with support.

Apparatus

We videotaped the in-water activities using a Panasonic MX-500 camera (Panasonic Inc, Japan), recording at 25 frames per second. The camera was mounted on an elevated tripod and covered a view of approximately 6 × 10 m of the shallow end of the pool. Data reduction included importing the recorded video into the Dartfish 4.5 software on a MS windows XP computer (Dartfish Inc., Fribourg, Switzerland) and then using the Dartfish software to control the videotaped movements of the children. The data were reduced into our coded categories of swimming activities by replaying the digital videos using the Dartfish software system.

Procedure

The procedure for this study consisted of following several steps. After the regional research ethics committee approved the study and the treatment of the participants, swimming instruction was given to the participants of both groups. The FLOAT group was instructed using a personal flotation device, the "Easy Swim" (Nimtech A/S, Skien, Norway; Figure 1). During the lesson, the children wore this vest during instruction; however, at the end of each lesson, some time was devoted to

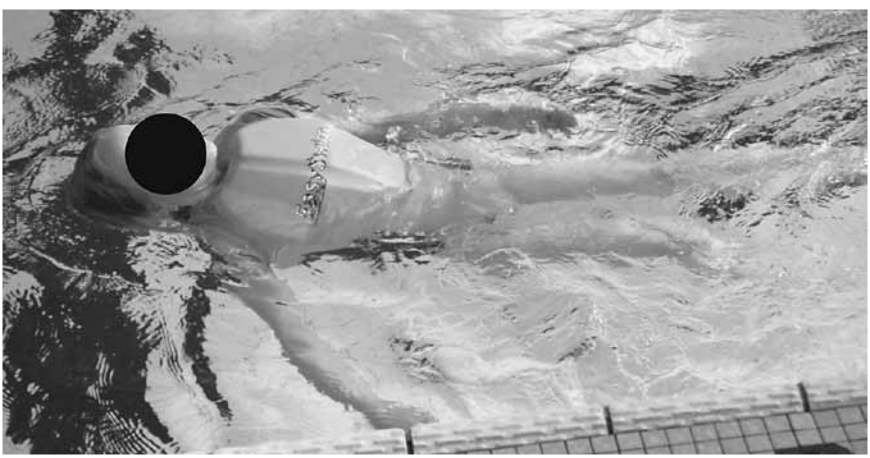

Figure 1— The flotation vest used by the flotation aid group in this study.

exercises without the vest. In the beginning of the course (lessons 1-5), more time was spent wearing the vest (approximately only 12% instruction time without vest) while later in the course (lessons 6-10), the instruction time without vest was increased to approximately 24%). Similarly, the CON group underwent the same instructions, using the same exercises, with the same instructors, at the same pool, but separated so that the two groups could not observe each other's lessons. The CON group was instructed with minimal use of floatation aids, wore no personal flotation device, but for approximately 5% of the time used a kickboard or a Styrofoam noodle for some exercises. All instructions were done at a pool depth of approximately 1.2 m, where the children could *not* stand on the bottom. A steel platform was placed 5 m from the edge of the pool, serving as a mid-pool base to and from which children could move.

The general instructional method used was based on the Norwegian Swimming Federation and Norwegian School of Sport Science teaching systems (Madsen & Irgens, 2005; Stallman, Junge, & Blixt, 2008). In this method, front crawl and back crawl are the two first strokes instructed, and the skill progression follows an ordered pattern of water familiarization, submerging and diving, floating, gliding, flutter kicks, and arm stroke exercises. The didactic setting emphasizes play and enjoyable exercises with specific learning goals, both in a group and individual settings, more than direct programmed instruction.

The data collection was conducted at lesson 10, during the last 10 minutes of the 40-min lesson. This time was devoted to free play for the children when they were released from instruction to play and move in and around the pool at their own initiative under lifeguard supervision. No group wore any flotation aids, and all regular flotation aids and equipment (e.g., kickboards, noodles, floating mats) were removed from the pool deck during the data collection period. During the free play time, the video camera recorded the movements of the children. The participants wore different colored caps to distinguish the members of the two groups from each other. Each child's movements were tracked for the whole 10 minutes of play and quantified according to a modified Aquatic Readiness Assessment (ARA) (Langendorfer & Bruya, 1995). The participants' performance was scored from 1-10 in each one of the following movement groups: water entry, breathing/surface diving, and propulsive actions. This is a modification of the original ARA test, where the scale was 1-5. No intra- or interrater reliability were calculated for the tests done in the free play setting; however, we tested the interrater reliability for a ARA test used in the larger study on the children in a specific test session. The interobserver reliability for combined swimming abilities was 86% exact agreement, and a Cronbach's Alpha coefficient for reliability using 4 skills (i.e., combined swimming, leg kicking, arm recovery, and arm propulsion) was 0.87 (Kjendlie, 2009a).

Movement distance was recorded both for land movements and swimming/moving at the water surface. This was approximated by having a reference grid marked along the pool deck sides, and the number of grid cells (in x and y coordinates) the child could cover was used to approximate the swimming distance. Data analysis was done using the statistical functions in MS Excel, and presented as means ± SD. Group comparisons were made using a two-sample Students t-test.

Results

The FLOAT participants who used the flotation suit in their learning curriculum were found to choose significantly fewer surface dives compared to the control group (p = 0.006) during free (and unaided) playtime. Additionally, the FLOAT group showed a statistically significant greater interest in using flotation toys during free play (p = 0.03) shown by their requests for them to the instructor even though they had been removed (i.e., the children were not allowed to use the flotation toys even though they requested them). For the other measurement items, there were no statistically significant differences at alpha < 0.05 (see Table 1).

Discussion

The main finding in this study was that those swimmers who had been instructed using flotation devices chose to perform significantly fewer surface dives compared to the control group.

The dependent measure, "wanting to use flotation toys," tells something of the preference of the children toward using flotation toys. It was only a fraction of FLOAT children who asked the instructor to get a flotation toy during free play, although these toys had been removed. Interestingly, none of the control group children asked for flotation aids. We interpret this observation to mean that the children who were used to and more comfortable having a flotation aid during instruction felt that they needed them during free play as well and that their general aquatic confidence especially in performing flotation skills was less than the control group children. Their requests for floating toys seems to reflect an attitude toward wanting to float on some device with the head up out of the water rather than to surface dive, jump, or swim with the head in the water. Thus, it seemed that the use of flotation aids during the learn-to-swim instructional setting made the children

Table 1 Results of Observation of Movement and Actions During 10 min Free Play

Movement Category	FLOAT	CON	t-test
Distance in water	17.1 ± 5.0m	14.9 ± 7.0m	p = 0.47
Distance land	19.9 ± 12m	14.8 ± 9.1m	p = 0.28
Propulsion (score)	4.1 ± 0.8	4.2 ± 0.9	p = 0.48
Breathing and Surface Diving (score)	4.5 ± 2.1	5.6 ± 1.0	p = 0.25
Number of surface dives	2.4 ±± 1.6	5.8 ± 3.3	p = 0.006
Water Entry Skills	6.1 ± 4.7	6.8 ± 2.4	p = 0.38
Number of jumps	3.0 ± 2.9	4.5 ± 3.2	p = 0.25
Wish for flotation toys	36%	0%	p = 0.03

FLOAT and CON is the intervention (flotation aid) and control groups, respectively.

less confident in FFA and less eager to surface dive and jump from the pool deck. This was despite the fact that all flotation aid participants had some instruction at the end of each lesson without the flotation suit to accustom them to free floating situations. Sociological and psychological theories of motivation, mastery, and skill confidence support these findings. For instance, using Bandura's self-efficacy theory (Bandura, 1977), a generalized explanation is that children prefer to do what they master, if left with free choice of possible actions.

Despite its interesting findings, this study had several limitations. The low number of participants influenced the results due to low statistical power. The statistical power (1-β) for detecting significant differences was low for the number of jumps (0.20), distance swum (0.10), distance on land (0.22), propulsion (0.06), breathing and diving (0.34) and water entry (0.07). For the number of surface dives performed, the power was high, $1-\beta = 0.86$. Enrolling a greater number of participants could have produced more significant differences.

Another potential limitation was objectivity errors associated with assigning children's behavior correctly to categories from the videotape. We did not calculate interrater or intrarater objectivity for the tests done in the free play setting; however, a high inter-rater reliability (86% agreement) was found for combined swimming skills in a specific ARA test session for the participants in a larger study (Kjendlie 2009a).

The topic of this study, the use of flotation aids and its impact on children's confidence and free choice skills, definitely warrants closer research in the future. While the study was carried out quite cleanly, the relatively few numbers of participants along with questions about the validity of the modified instrument and the rater objectivity may have clouded the results. Alternatively, it may simply be that, like many of the previous studies, use of flotation during instruction does not significantly alter the outcomes of many learning to swim skills either positively or negatively except in the case of performing surface dives or desiring to use flotation devices.

Conclusion

A learn-to-swim program using a personal flotation device or a floating vest decreased the incidence of surface diving by children during free play who had used the vest during instruction compared to the amount of surface diving undertaken by children who were taught without flotation. Although more studies with larger numbers are needed, the flotation vest seemed to make children somewhat less skilled in using vertical movements such as those employed in surface diving. Whether stroking skills were improved by the use of the flotation vest was not addressed in this study.

References

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84*(2), 191-215.

Junge, M. (1983). *Svømmedyktighet blant 3. klassinger i Oslo 1981[Swimming skills among 3rd grade children in Oslo].* Oslo, Norway: Master, Norwegian School of Sport Sceince.

Kaye, R.A. (1965). The use of a waist-type flotation device as an adjunct in teaching beginning swimming skills. *Research Quarterly, 36*(3), 277-281.

Kjendlie, P.-L. (2009a). Swimming abilities are not enhanced by using a flotation suit for advanced beginners in deep water swimming teaching. *15th Annual Congress European College of Sport Science, Oslo June 23-27, 2009.*

Kjendlie, P.-L. (2009b). No effect of using flotation suits in gliding and floating abilities of advanced beginners in swimming teaching. *15th Annual Congress European College of Sport Science, Oslo June 23-27, 2009.*

Langendorfer, S.J., & Bruya, L.D. (1995). *Aquatic readiness: Developing water competence in young children*. Champaign, IL: Human Kinetics.

Madsen, Ø., & Irgens, P. (2005). *Slik lærer du å svømme [Learn to Swim]*. Oslo: Norwegian Swimming Federation.

McCatty, C.A.M. (1968). Effects of the use of flotation device in teaching nonswimmers. *Research Quarterly, 39*(3), 621-626.

Parker, H.E., Blanksby, B.A., & Quek, K.L. (1999). Learning to swim using buoyancy aides. *Pediatric Exercise Science, 11*(4), 377-392.

Scurati, R., Roione, G.C., Michielon, G., & Invernizzi, P.L. (2006). Analysis on learning the front crawl stroke by use or non-use of instructional floatation devices. In J.P. Vilas-Boas, F. Alves & A. Marques (Eds.), *Biomechanics and medicine in swimming X* (pp. 259-260). Porto: *Portugese Journal of Sport Sciences*,*6* Suppl.2.

Smith, C. (2008). The importance of optimal floatation in the learn-to-swim process. *Swimming In Australia, 24*(4), 54-55.

Stallman, R.K., Junge, M., & Blixt, T. (2008). The teaching of swimming based on a model derived from the causes of drowning. *International Journal of Aquatic Research & Education, 2*(4), 372-382.

Wilke, K. (2007). *Schwimmen lernen für Kinder und Erwachsene [Learn to swim for children and adults]*. Aachen: Meyer & Meyer.