

Modification of Water Rescue Tool for Saving the Drowned People at the Swimming Pool



Yanuar Rachman Sadewa¹, Sigit Nugroho², Abiyyu Amajida³, FransFile Manihuruk⁴

^{1,2,3,4}Sport Science Study Program, Postgraduate Program, Yogyakarta State University, Road Colombo No. 1, Karangmalang, Yogyakarta 55281, Indonesia

ABSTRACT: This research aims to determine the feasibility of a modified a water rescue tool. This research was conducted in a swimming pool. The number of respondents are for about 35 people (5 lifeguards and 3 pool attendants, 12 trainers in the swimming pool, 10 students, and 5 swimming pool visitors). The results of this study are expected to be one of the contributions of researchers to realize a modification tool for water rescue that is simple, safe, and feasible to use.

The stages in this research were using the ADDIE research model in which there were 5 stages: analysis, design, development, implementation, and evaluation. The research method used the quantitative and qualitative approach with the type of research of development research. The data collection technique used the observation, interviews, questionnaires, and documentation. The data analysis was conducted through the recapitulation of expert and respondent validation data in the form of percentage scores.

The results of the assessment of 35 respondents from the buoyancy aspect obtain a score of 95% (in the "Very decent" category), the target accuracy aspect gains a score of 95% (in the very feasible category), the aspect of the use of the tool gains a score of 96% (in the "Very decent" category), the effectiveness aspect obtains a score of 95% (in the "Very decent" category), the durability aspect obtains a score of 92% (in the "Very decent" category). the physical aspect gains a score of 90% (in the "Very decent" category), and the design aspect gains a score of 96% (in the "Very decent" category), while the average total score of the five aspects is at 96.% (in the "Very decent" category). The conclusion is that the feasibility of the Water rescue modification tool is included in the "Very decent" category.

KEYWORDS: Drowned, water rescue, modification

I. INTRODUCTION

Swimming is a sport carried out in water, therefore it takes the ability to glide, float, adjust your breath in order to be able to perform some skills in activities in water (Narlan et al., 2023). Swimming is a sport that is carried out in water (Kristiaputra & Sugiarto, 2023). Swimming has many benefits and can be said to be a favorite sport for people of all ages and from all walks of life (Kabonga et al., 2023; Sanjaya & Rediani, 2022). In doing swimming sports of all ages can have many benefits for health and to understand and adapt to the environment (Widiastuti & Hamamah, 2017).

Events that often occur in swimming pools are drowning cases. Drowning is an injury due to submersion/immersion that can result in death in less than 24 hours (Simamora & Alwi, 2020). Drowning is an accidental death and due to negligence in swimming (Girasek & Hargarten, 2022). In the last ten years, more than 50,000 people in the world have died from drowning and occurring in swimming pools worldwide (Bierens & Hoogenboezem, 2022; Simamora & Alwi, 2020; Vignac et al., 2022).

In the case of drowning or drowning, it does not always occur due to the entry of fluid into the entire respiratory tract or lungs but can occur due to the closure of the nostrils or mouth by fluid so that this does not only occur in deep waters such as the sea but can also occur in swimming pools (Romadhoni, 2021; Yunus et al., 2023). The occurrence of drowning accidents in swimming pools is of special concern, where the incidence can be minimized (Vignac et al., 2015). From the results of a survey in the swimming pool of the Faculty of Sports and Health Sciences Yogyakarta State University through interviews with lifeguard officers, cases that often occur drowning accidents in teenagers. From 2020 there were 21 cases of drowning victims. Where almost all victims who will drown are adults. The incidence of drowning has a major impact on adults and this incidence continues to increase, so that drowning cases are part of the top ten causes of death worldwide (Nurjanah & Suparti, 2022). Of the many drowning cases that occur, socialization and tools are needed for rescue (Suhairi et al., 2021).

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Water rescue is one of the rescue techniques carried out in water or a rescue action effectively and efficiently. Water rescue is rescue by preparing treatment and rescue before medical action in the aquatic environment (Esler et al., 2019). Safety is the most important factor in managing a swimming pool, which will have an impact on comfort and tranquility for visitors. The existence of rescue workers who have been used as a way to prevent drowning, little is known about the basic knowledge mastered by professional rescuers (Moran et al., 2017). The capacity to carry out effective and efficient rescue measures is critical (Petross & Blitvich, 2018). The ability of helpers who are full of calculation and consideration in choosing and determining the abilities and skills possessed, as well as the methods that must be done.

Good and correct rescue techniques not only make it easier for helpers to make rescues but also can guarantee the safety of the helper himself. Based on rescue priority, rescue measures that require the rescuer to be in the water come last. Therefore, put the safety of the helper first and then save others (victims). Techniques in general can be divided into two, namely rescue techniques from land and direct rescue techniques (taking victims in water) (Suhairi et al., 2021). It has been recognized worldwide that a lifeguard will do the fastest, safest, both for himself and the victim, if using equipment in a rescue (Barcala-Furelos et al., 2016). How to help victims without having to be in the water by mastering rescue techniques such as, grabbing, throwing and approaching victims with equipment (Szpilman et al., 2014).

Efforts to prevent drowning victims are by applying safety equipment. Some existing water rescue equipment can provide security for rescuers and be more effective for rescue victims (Barcala-Furelos et al., 2016). One of the safety equipment in the swimming pool is a ring buoy. Ring-buoys are specifically designed to help victims (Szpilman et al., 2014). Able to withstand a load of 150 kg. Survey at the Swimming Pool of the Faculty of Sports and Health Sciences Yogyakarta State University with the size of the main pool with a width of 25 meters which has water rescue equipment including ringbuoys, sticks and buoys. There is one Water rescue tool by utilizing used jerry cans from car engine oil. The tool that is often used has a drawback when used, which is that it still looks simple, only jerry cans are tied with rope. But it has a drawback, which is at risk of injury if it is hit by victims who will drown. So that when thrown it must exceed the direction of the victim so as not to injure if it is not appropriate in catching. Less effective in time to save. A tool is needed that makes it easier for rescuers to help victims who are about to drown. A tool that can reach victims right at a distance of 12.5 meters (half the width of the pool), easy to reach by victims, victims are easy to evacuate, minimal injury and can withstand loads of up to 150 kg.

Modified buoyancy aids such as empty plastic bottles/containers, bodyboards, surfboards, driftwood, ice crates, etc. can be used as alternatives as water rescue tools. This modified tool is expected to float when held by an adult, easy to use because the thighs are lightweight, and have accuracy in reaching the target of victims who are about to drown. Using jerry cans measuring 5 liters. Rope to pull the victim that has previously been tied to jerry cans. The nylon mine rope measures 8 mm in diameter with a length of 13 meters, and is coated with Styrofoam as a cushion to withstand impact and reduce the risk of injury. It is hoped that this example of modifying a water rescue device to help victims who are about to drown can be used as a water rescue tool. which has the advantage of reducing the risk of injury when thrown, on target, effective, and able to withstand loads up to 150 kg.

II. METHOD

The type of research used in this research is research and development. It is called research-based development. In this research and development is focused on producing modified products for Water rescue equipment to help victims who will drown. The model used is the development of the ADDIE model. The ADDIE development model is one of the development models that aims to develop a new product, or perfect an existing product and can be accounted for the results (Fitri et al., 2021).

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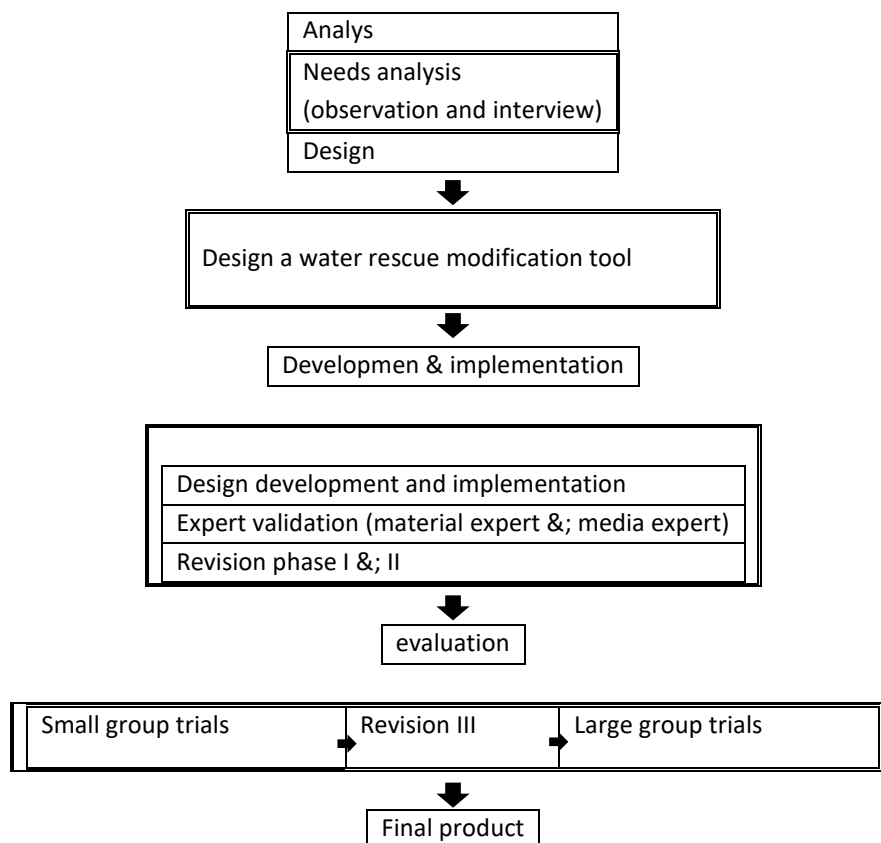


Figure 1. Flow Diagram Development of Water rescue tool modifications according to theory ADDIE

Source: Instructional Media Design (Lee & Owens)

This research will be carried out at the swimming pool of the Faculty of Sports and Health Sciences, Yogyakarta State University which is located at Jalan Kuningan no.9 Caturtunggal, Depok, Sleman, Yogyakarta. The study was conducted in July 2022. The subjects of this study were 2 (two) material experts consisting of 2 material expert lecturers, 2 (two) media experts consisting of 2 media expert lecturers, 3 trial people, and 35 respondents consisting of 8 swimming pool officers of the Faculty of Sports and Health Sciences, Yogyakarta State University and 12 Swimming Club Coaches at the swimming pool of the Faculty of Sports and Health Sciences, Yogyakarta State University. 10 students of the Faculty of Sports and Health Sciences, Yogyakarta State University and 5 general visitors. The data collection used in this study used observation, interviews, dokumentation and questionnaires that have been validated by expert validators and have a reabelitivity value of 0.853 which can be declared reliability. There are two types of data that.

III. DISCUSSION

Development of modified water rescue tools to help victims who are about to drown, the technique carried out in this study uses the ADDIE development model. The development model includes 4 stages, namely: Analysis, Design, Development and Implementation, Evaluation. At the design stage of the modification form of the water rescue tool the design for the modification of the water rescue tool is as follows:

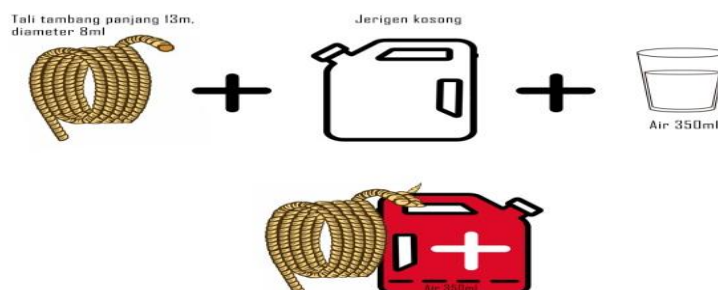


Figure 2. Water rescue equipment installation design

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At the development and application stage, water rescue equipment modifications are developed by applying the product frame design that has been made at the beginning. After the initial product is completed, the next product is validated by experts. The following are the stages of development and implementation carried out and require tools such as scissors, aibon glue, markers, cutter knives, tape and G glue.

No.	Material	Information
1	PE mine rope 	<p>This type of PE rope is made from synthetic fibers named Polyethylene fibers. This type of rope has the characteristics of more flexible (Not Rigid), low breaking load value, resistant to chemicals, resistant to sunlight and lighter because it is smaller in size.</p> <p>(https://seoasmarines.com/)</p> <p>Light and not easily sinking into the water so that it can make it easier for victims to reach the tool, if you can't immediately reach the jerry can, you can also grab the rope</p> <p>The length of the rope of 13 meters aims to reach to the middle of the width of the swimming pool. Where the width of the international standard swimming pool size according to the Federation Internationale de Nation (FINA) is 25 meters.</p> <p>The diameter of the rope measuring 8 millimeters aims not to be too big and not too small. Too large makes the rope heavier and sinks easily into the water. And if it is too small, the rope becomes difficult to roll.</p> <p>Mine rope roll pattern with circular roll pattern so that it does not wrap around when thrown. So that the evacuation process can be effective and efficient in terms of time.</p> <p>Easy to get at building stores, plastic stores, home furnishings stores and others at a fairly cheap price of Rp. 2.500,-/ meter or Rp. 32.500 for a length of 13 meters.</p>
2.	5-liter jerry cans 	<p>Raw Material for making jerry cans is a polymer where the polymer has a very strong strength structure</p> <p>It measures 33 cm high, 12 cm thick, and 17 cm wide</p> <p>Easy to get at building stores, plastic stores, home furnishings stores and others at a price of Rp. 8.500,-</p>
3.	Water 350 cc 	<p>Water is used as ballast which is inserted into empty jerry cans.</p> <p>Water uses clean water, can use well water, pond water, and others.</p> <p>The size of the volume of water is 350 milliliters, aiming that when put into the jerry can, it can make the jerry cans remain stable when thrown and make it easier to reach the right target.</p> <p>When filled with more than 350 ml, the jerry cans become heavier and more difficult when thrown, and vice versa when less than 350 ml, the jerry cans become too light and easy to float so that the accuracy of hitting the target is reduced.</p>
4.	Styrofoam PE	<p>Styrofoam is a material from polytrene packaging which is generally white used to safety non-food items such as electronic goods to withstand light impacts</p> <p>Can be used as a cushion to reduce the risk of injury to victims</p> <p>Painted using acrylic paint, special paint for Styrofoam and also</p>

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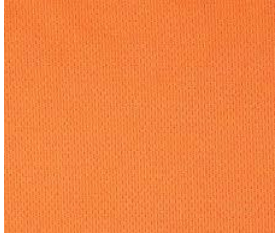
		resistant to water. The paint color is orange for easy viewing.
5.	Polyster fabric 	Polyester under the trade name Dacron is made from terephthalic acid and ethylene glycol, while Terylene is made from dimethyl terephthalate and ethylene glycol. Water resistant Strong but light. Easy to dry. Not broken quickly.

Figure 3. Materials for making water rescue modification tools



Figure 4. Installation of water rescue modification tools

Instructions for use are intended to be how to use the water rescue modification tool. The contents of the instructions are as follows:

1. Handle the rope reel with the left hand.
2. A thumb finger clamped the end of the mine rope.
3. Right hand holds jerry cans on the upper handle on jerry cans
4. Aim at the target and throw it with an arm swing from below
5. Pull the victim to the edge.



1. Styrofoam installation



2. Wrapping process



3. Strap mounting

Figure 5. Stages of manufacturing modification tools

Process

After product validation is complete, media experts and material experts get advice from validators. Then refine the modification tools according to the suggestions and inputs of the media expert team and material experts and so that there is a comparison of the initial product and the product after revision. The comparison of initial and post-revision products is as follows:

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Initial product



Products after revision



Figure 6. Comparison of modifications of water rescue equipment

At the evaluation stage, revisions are carried out before small-scale tests are carried out on products developed based on suggestions and student input given during the implementation stage. After the revision of the product is completed, it is carried out by the advice of the respondent. Then improve the product to make it better than the previous revision. The comparison of initial and post-revision products is as follows:



Figure 7. Final Product

Material feasibility assessment is carried out by material expert validators and is assessed based on 5 aspects, namely aspects of buoyancy, target accuracy, effectiveness of use, ease of use and product durability.

Table 1. Data from assessment by 2 material experts

No.	Aspects	Average score	Category
1.	Buoyancy	100%	Very decent
2.	Target accuracy	100%	Very decent
3.	Tool use	87,5%	Very decent
4.	Effectiveness	87,5%	Very decent
5.	Durability	87,5%	Very decent
Average score		92,5%	Very decent

The table above can be seen that the assessment results of two material experts from the buoyancy aspect obtained a score of 100% (with the category "Very decent"), the aspect of target accuracy obtained a score of 100% (with the category Very decent), the aspect of using the tool obtained a score of 87.5% (with the category "Very decent"), the aspect of effectiveness obtained a score of 87.5% (with the category "Very decent"), and the durability aspect obtained a score of 87.5% (with the category "Very decent"). While the average total score of the five aspects is 92.% (with the category "very decent"). The conclusion is that the material in the Water rescue modification tool is included in the category of "Very decent"

Media feasibility assessment is carried out by media expert validators and assessed based on four aspects, namely physical aspects, content, writing, and color.

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Table 2. Assessment data from 2 media experts

No.	Aspects	Average score	Category
1.	Physical	95%	Very decent
2.	Fill	97%	Very decent
3.	Writing	81,5%	Very decent
4.	Color	100%	Very decent
Average score		93,5%	Very decent

The table above can be seen that the assessment results of two media experts from the physical aspect obtained a score of 95% (with the category "very decent"), the content aspect obtained a score of 97% (with the category very decent), the writing aspect obtained a score of 81% (with the category "very decent"), the color aspect obtained a score of 100% (with the category "very feasible"), while the average total score of the four aspects was 93.% (with the category "very decent"). The conclusion is that the media in the water rescue modification tool is included in the category of "very decent".

This small group trial produced response data from 5 respondents. This respondent response questionnaire contains product assessments in terms of buoyancy, target accuracy, ease of use, effectiveness, durability, physical, and design.

Table 3. Small-scale test result data

No.	Aspects	Average score	Category
1.	Buoyancy	95%	Very decent
2.	Target accuracy	95%	Very decent
3.	Tool use	96%	Very decent
4.	Effectiveness	95%	Very decent
5.	Durability	92%	Very decent
6.	Physical	90%	Very decent
7.	Design	96%	Very decent
Rerata skor		94%	Very decent

The table above can be seen that the assessment results of five respondents from the buoyancy aspect obtained a score of 95% (with the category "Very decent"), the aspect of target accuracy obtained a score of 95% (with the category Very decent), the aspect of using the tool obtained a score of 96% (with the category "Very decent"), the aspect of effectiveness obtained a score of 95% (with the category "Very decent"), the durability aspect obtained a score of 92% (with the category "Very decent"). The physical aspect obtained a score of 90% (with the category "very decent"), and the design aspect obtained a score of 96% (with the category "very decent"), while the average total score of the five aspects was 94.% (with the category "very decent"). The conclusion is the feasibility of water rescue modification tools included in the "Very decent" category.

This large group trial produced response data from 35 respondents. This respondent response questionnaire contains product assessments in terms of buoyancy, target accuracy, ease of use, effectiveness, durability, physical, and design.

Table 4. Large-scale test result data

No.	Aspects	Average score	Category
1.	Buoyancy	96%	Very decent
2.	Target accuracy	95%	Very decent
3.	Tool use	96%	Very decent
4.	Effectiveness	94%	Very decent
5.	Durability	97%	Very decent
6.	Physical	96%	Very decent
7.	Design	97%	Very decent
Rerata skor		96%	Very decent

The table above can be seen that the assessment results of 35 respondents from the buoyancy aspect obtained a score of 95% (with the category "Very decent"), the aspect of target accuracy obtained a score of 95% (with the category Very decent), the aspect of using the tool obtained a score of 96% (with the category "Very decent"), the aspect of effectiveness obtained a score of 95% (with the category "Very decent"), the durability aspect obtained a score of 92% (with the category "Very decent"). the

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physical aspect obtained a score of 90% (with the category "very decent"), and the design aspect obtained a score of 96% (with the category "very decent"), while the average total score of the five aspects was 96.% (with the category "very decent"). The conclusion is the feasibility of water rescue modification tools included in the "Very decent" category.

So far, the water rescue tools in Faculty of Sports and Health Sciences, Yogyakarta State University swimming are ring buoys, sticks, modified tools from used jerry cans of car oil. Researchers try to make a product in the form of water rescue equipment that is effective, efficient, cheap, easy to obtain, and the risk of injury to victims can be minimized. As revealed by Fitri et al., (2021), the initial idea that utilizes materials from used fabrics. Researchers also used used goods and adapted from a water rescue tool, namely a rescue tube, researchers tried to make a tool from a 5-liter jerry can coated with Styrofoam and given a cover and given a rope to pull the victim after holding on to the tool. which aims as a water rescue tool to be thrown at victims accurately, minimal injuries and can still float to be used as a relief tool. such as the purpose of research (Fantiro et al., 2021) to make it easier for students to experience the material. By using such modification tools it is believed to be able to.

In this developed product will be carried out according to the procedure that has been developed by Lee & Owens (2004), namely the ADDIE model. The stages of the model are clearer so that researchers choose to use the model in this development research. The stages of developing this product go through several stages, starting from making the initial design and produced with 5-liter jerry cans filled with 350 ml of water and the jerryen cans tied to the mining rope. Research conducted (Fantiro et al., 2021; Usman et al., 2019; Widowati & Decheline, 2020) on initial product validation. This research also validated the initial product to material and media experts obtained the first revision. In the first revision there was the addition of cushions from Styrofoam and painted. After revising the product, it is assessed by validators and gets the second stage of revision. That is by changing the appearance to remove the original shape of the jerry can, changed so that it is not like a jerryen.

The second product revision was done by adding Styrofoam pads to the jerry cans and shaped to resemble a rescue tube. To make it look neater, the product is wrapped in a cover of polyster fabric. The second phase of product revision has received approval from validators for small-scale testing. At this stage, there is a product revision in the third stage according to the suggestions and input from respondents, namely by adding pads to the cover to make it more precise and the cover does not get water. The revisions that have been carried out in the third stage are then tested on a large scale. The results obtained in the product become more perfect. Research results (Usman et al., 2019; Widowati & Decheline, 2020) suggestions and inputs from large-scale respondents become revisions for the final product. Researchers also revise the fourth stage or final product such as suggestions and input from large-scale test respondents. At this stage researchers made improvements to the cover to make it more precise and without angles, the addition of a handle at the end of the throwing rope and the addition of a rescue logo on the product.

IV. CONCLUSIONS

Based on the results of research from data analysis, it can be concluded that: 1). Development of modified water rescue equipment products to save victims who will drown in a design resembling a rescue tube. From the initial design to the final product which went through the stages of design revision for the modification of this water rescue tool got a score of 97% with the category "very decent", 2). The feasibility of modified water rescue equipment products to save drowning victims after being validated by 4 validators, namely two material experts by 90%, and two media experts by 93% and scores from 35 respondents by 96%, which means that the modification of water rescue equipment is "very decent" to use. 3). The effectiveness of modified water rescue equipment products in helping the safety of victims who will drown with data analysis from two material experts by 87%, and scores from 35 respondents of 95% which means that water rescue equipment modifications are "very effective" to use and have buoyancy that can exceed ringbuoys of 155 kg or two adults.

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