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Development of Argufita Equipment (Arm Guard and Finger Tab) for Athletes in the Paralon Division of The Sport of Archery

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Abstract
This research was motivated by the need for paralon archery athletes for training equipment that is comfortable, safe, and capable of supporting their performance when performing archery techniques. This research aims to develop a product that...ARGUFITA (Arm Guard and Finger Tab)as supporting equipment for archery athletes in the paralon division and to determine the level of feasibility of the product being developed. The research used the method of Research and Development (R&D). The Borg & Gall model was modified into seven steps: identifying potential problems, data collection, product design, design validation, design revision, product trials, and final product revision. The research subjects included archery subject matter experts, coaching media experts, and archery athletes in the small and large group trial stages. The results of the subject matter expert validation showed thatArm Guardobtained a score of 89.5% in stage I and increased to 98.33% in stage II, whileFinger Tabobtained a value of 86.85% at stage I and increased to 97.96% at stage II. The results of validation by training media experts showed a value of 84.8% forArm Guardand 80% for Finger Tab. In both validation stages, the results were categorized as good or adequate. The small group trial yielded a value of 79.35% forArm Guardand 84.61% for Finger Tab. Meanwhile, the large group trial obtained a score of 92.5% for Arm Guard and 93.38% for Finger Tab. Based on the research results, the product ARGUFITA was declared suitable for use as training equipment and performance support for archery athletes in the paralon division.

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1. INTRODUCTION

Archery is a sport that requires a gentle spirit, patience, perseverance, high concentration, and strong mental fortitude, as anxiety levels are quite high. Furthermore, archery is a social sport that provides a relaxing effect on the body and has the potential to lead to achievements. Therefore, mastery of basic techniques, proper body movements, physical fitness, and mental strength are essential for every archer, both beginners and professionals. (Bramantha & Setiawan, 2022)

According to Susanto (2023), currently, archery is being developed in various provinces in Indonesia. Its popularity continues to increase in society, as seen from the growth of various archery clubs, extracurricular programs, and the establishment of the Student Education and Training Center (PPLP). There are 4 factors for athletes to achieve success, namely (1) physical, (2), technique, (3) tactics, and (4) mental (Marcelino &

Wijaya, 2023). However, in archery, there is also an important factor in supporting maximum performance, namely the condition of the equipment used by athletes. So, good equipment is also very important, because it will determine good performance. One of the common problems faced by novice athletes is the high price of equipment or bows.

Quality equipment significantly impacts a satisfying performance. Therefore, it's important to have a good understanding when choosing a bow and arrow. Equipment used in archery includes: bows*(bow)*, arrows *(arrow)*, finger protector *(finger tab)*, arm protector *(arm guard)*, aiming device*(visir/sighter/bow sight)*, vibration damper*(stabilizer),* and arrow pouch *(side quiver).* In addition, there is also supporting equipment such as targets consisting of target pads. *(buttress),* bearing support*(standard)*, target paper *(target face)* and the field (Ummah, 2019).

One of the most important tools for an archer is *Finger Tab* and *Arm Guard,* where the tool functions to protect the archer's fingers (especially the index finger, middle finger, and ring finger) from the bowstring so that they don't get sore and sore when performing the technique (*drawing and anchoring*) and as an arm protector from being hit by the string when releasing an arrow. This arm protector is worn on the left arm when holding the bow (Ummah, 2019)

In this study, researchers found that athletes in the paralon division had relatively complete archery equipment, including a paralon bow and three arrows. The arrows used were made from bamboo. Despite having complete equipment, protective gear such as a sling was lacking. *Arm guard* And *Finger tab:* Not all athletes in the paralon division wear it, even though this protective equipment is important for an archer.

Based on the problems described above, the researcher wants to conduct research and development on the development of tools of *ARGUFITA* (*arm guard and finger tab)* made from locally available materials with simpler, more economical designs. Safety and comfort remain the primary considerations in their use, using synthetic leather and plastic as the basic materials. Based on initial field needs, the following data was obtained regarding protective equipment for athletes in the paralon division of the archery sport:

Table 1. Problem Solutions

Problems in the Field	Need	Solutions Through Development *ARGUFITA*
Athletes do not use *arm guard* and *finger tab*	Basic protective equipment that must be used in archery training	Tool development *ARGUFITA* (*Arm Guard + Finger Tab)* to meet this need
The cost of archery equipment is relatively expensive.	Affordable, inexpensive protective gear for beginning athletes	Design *ARGUFITA* using economical local materials without reducing function
Traumatic injury to the left arm due to whiplash *string,* thus affecting technique and performance	Effective and comfortable arm protector	Function *arm guard deep ARGUFITA* provides optimal protection to the athlete's arms
Fingers hurt when pulling strings because of not using a *finger tab*	Comfortable finger protector that fits the athlete's hand size	Function *finger tab* deep *ARGUFITA* adjusted to the size of the athlete's fingers

Beginner athletes do not yet understand the importance of protective equipment in the sport of archery.	Introduction to protective equipment in the sport of archery	Introducing the use of protective equipment *ARGUFITA* from basic archery training

2. RESEARCH METHODS

This study uses the Research and Development (R&D) method by adapting the Borg and Gall development model modified into seven steps. This model was chosen because it is suitable for producing and testing the feasibility of a product that can be used in sports activities, especially protective equipment for archery athletes. The research stages include: (1) identification of potential and problems, (2) information collection and needs analysis, (3) initial product design ARGUFITA consisting of Arm Guard and Finger Tab, (4) design validation by archery material experts and coaching media experts, (5) product revision based on expert suggestions and input, (6) small group trials and product revisions, and (7) large group trials until a final product is obtained that is suitable for use (Waruwu, 2024).

The research subjects consisted of archery material experts, coaching media experts, and paralon division archery athletes involved in the product trial. The research instrument used an assessment questionnaire compiled based on product feasibility indicators, including components, size, and usage aspects. The assessment used a five-level Likert scale, namely score 1 (very poor), score 2 (poor), score 3 (sufficient), score 4 (good), and score 5 (very good). Data collection techniques were carried out through observation, documentation, interviews, and questionnaire distribution. Data obtained from the results of expert validation questionnaires and user trials were analyzed using quantitative descriptive analysis techniques in the form of percentages.

The feasibility percentage is calculated by comparing the total score obtained to the maximum score and then multiplying it by 100%. Data obtained from expert input is analyzed using qualitative descriptive analysis techniques used as a basis for determining the level of product feasibility and conducting revisions at each stage of development until the ARGUFITA product meets the criteria for being suitable for use by athletes in the paralon division of the archery sport (Sugiyono, 2016).

3. RESULTS AND DISCUSSION

In the first stage, the assessment showed that the product components, material selection, and size of the *Arm Guard* have met the criteria required in archery. However, there was still some input from the validator regarding design refinements to better suit the needs of athletes during archery movements. After revisions were made according to the validator's suggestions, the results of the second phase of validation showed an increase in product quality in almost all assessment aspects. This improvement indicates that the improvements made were able to improve suitability. *Arm Guard meets* the function and user needs. The product components are considered optimal in protecting against bowstring impact on the inner arm.

Table 2: Assessment Results: *Arm Guard* by Archery Material Experts Level I and II

Evaluation Aspects	**Rating Scale**	
	Level I	**Level II**

Component Aspects *Arm Guard*	85	100
Material Selection Aspects *Arm Guard*	96	100
Size Aspect *Arm Guard*	87.5	95
Average percentage (%)	89.5	98.33
Category	Good/Decent	Good/Decent

The very high validation results in the second stage indicate that the product *Arm Guard* has met the functional, ergonomic, and safety aspects required in archery. Therefore, the developed product is deemed suitable for use as training and competition equipment because it provides effective protection while supporting athlete performance during archery. The results of the validation of the product by archery material experts, *Finger Tab.* This indicates that the product has been categorized as good or suitable since the first stage of development. Initial assessments show that the product's dimensions meet the needs of use in archery techniques, but there are still several component aspects that need to be refined to ensure optimal product function.

Based on validator input, several revisions were made to the component section of *Finger Tab.* The revisions aim to improve athlete comfort when drawing and releasing the bowstring, reduce finger friction, and increase product durability during repeated use. Following the improvements, the second phase of validation showed significant improvements across all assessment aspects, particularly in components and material selection.

Table 3: Assessment Results *Finger Tab* by Archery Material Experts Level I and II

Evaluation Aspects	**Rating Scale**	
	Level I	**Level II**
Component Aspects *Finger Tab*	81.67	98.33
Material Selection Aspects *Finger Tab*	78.89	95.56
Size Aspect *Finger Tab*	100	100
Average percentage (%)	86.85	97.96
Category	Good/Decent	Good/Decent

The highly positive results of the second phase assessment indicate that the Finger Tab product meets the technical requirements of archery. The product was deemed capable of optimally performing its protective function, providing user comfort, and supporting more effective archery techniques. Therefore, the developed Finger Tab was deemed suitable for use by archery athletes as supporting equipment for training and competitions.

The results of the validation of coaching media experts for the *Arm Guard product* obtained in stage I were 84.8% in stage II, with the category Good/Feasible. This indicates that the quality of the developed media has met the eligibility criteria for use in archery training activities. The developed product has met user needs and requires only minor and significant revisions in terms of training media aspects.

Table 4: Assessment Results: *Arm Guard* by Media Expert Training Level I and II

No	**Rated aspect**	**Percentage (%) Phase I**	**Percentage (%) Phase II**

1	Aspects of Tool Quality Requirements *Arm Guard*	84.8	84.8
	Average Score	84.8	84.8
	Category	Good/Decent	Good/Decent

Based on the results of the assessment by coaching media experts, *t*he product developed is considered capable of carrying out its main function as a protective device for the archer's arm from friction from the bowstring during the arrow release process. The appropriate category obtained indicates that the design, function, and ease of use of the product are in accordance with the needs of archery training so that it can support the comfort and safety of athletes during training. The results of the validation of the product by the coaching media expert, *Finger Tab,* show that in stages I and II the category is Good/Suitable. This value indicates that *Finger Tab, t*he product developed, has met the eligibility standards as a supporting medium for archery training. The absence of a change in scores in phase II indicates that the product has been deemed sufficiently good since the initial validation stage and does not require fundamental improvements.

Table 5: Assessment Results *Finger Tab* by Media Expert Training Level I and II

No	Rated aspect	Percentage (%) Phase I	Percentage (%) Phase II
1	Aspects of Tool Quality Requirements *Finger Tab*	80	80
	Average Score	80	80
	Category	Good/Decent	Good/Decent

*Finger Tab*It functions as a finger protector when drawing and releasing the bowstring, thereby improving athlete comfort during training and competitions. A "suitable" rating indicates that the product has a design that meets user needs, is easy to use, and supports effective archery training. Therefore, the *Finger Tab* product developed can be used as *supporting* equipment in the sport of archery. The results of small and large group trials show that the product *ARGUFITA,* consisting of *Arm Guard* and *Finger Tab,* demonstrates a good level of suitability for use by archery athletes in the paralon division. The data is presented in the following table:

Table 6: Tool Quality *Arm Guard* in Small Group Trials

Evaluation Aspects	Score obtained	Maximum Score	Percentage (%)	Category
Component Aspects *Arm Guard*	336	420	80	Good/Decent
Size Aspect *Arm Guard*	324	420	77.14	Good/Decent
Usage Aspects *Arm Guard*	673	840	80.12	Good/Decent
Shoes Total	1333	1680	79.35	Good/Decent

In small group trials, the *Arm Guard* product received a total score of 79.35%, categorized as good or adequate. The assessment percentages were based on components, size, and usability. These results indicate that the product effectively protects the arm from bowstring friction, although some feedback was received regarding comfort and product fit for the user.

Furthermore, after improvements were made based on the evaluation results of the small group trials, there was an improvement in the large group trials. *Arm Guard obtained*

a good or adequate category. Improvements occurred in all aspects of the assessment, namely the component aspect, the size aspect, and the usage aspect. These results indicate that *Arm Guard is* increasingly suited to the needs of archery athletes in the paralon division, providing more optimal protection, being comfortable to use, and not disturbing when shooting.

Table 7: Tool Quality of *Arm Guard* in Large Group Trials

Evaluation Aspects	Score obtained	Maximum Score	Percentage (%)	Category
Component Aspects *Arm Guard*	383	420	91.19	Good/Decent
Size Aspect *Arm Guard*	385	420	91.67	Good/Decent
Usage Aspects *Arm Guard*	786	840	93.57	Good/Decent
Shoes Total	1554	1680	92.5	Good/Decent

On the product *Finger Tab, t*he results of the small group trial showed a good or adequate category. The assessment was based on the components, size, and usability aspects. The data is presented in the following table:

Table 8: Tool Quality *Finger Tab* in Small Group Trials

Evaluation Aspects	Score obtained	Maximum Score	Percentage (%)	Category
Component Aspects *Finger Tab*	516	630	81.90	Good/Decent
Size Aspect *Finger Tab*	363	420	86.43	Good/Decent
Usage Aspects *Finger Tab*	809	945	85.61	Good/Decent
Shoes Total	1688	1995	84.61	Good/Decent

Furthermore, the results of the large group trial were categorized as good or adequate. Improvements occurred in all aspects, namely components, size, and usability. After improvements were made, there was an increase in *Finger Tab*. This way, the product can provide better protection for athletes' fingers while helping maintain comfort during archery. The data is presented in the following table:

Table 9: Tool Quality *Finger Tab* in Large Group Trials

Evaluation Aspects	Score obtained	Maximum Score	Percentage (%)	Category
Component Aspects *Finger Tab*	580	630	92.06	Good/Decent
Size Aspect *Finger Tab*	390	420	92.86	Good/Decent
Usage Aspects *Finger Tab*	893	945	94.50	Good/Decent
Shoes Total	1863	1995	93.38	Good/Decent

Final Product Results

Final product results of arm protection equipment, *Arm Guard,* which has gone through a repair process



Figure 1: Protective equipment *Arm Guard*

Product after revision, addition of a shell bearing layer (*Arm Guard* so that it is thicker. Wider and longer sizes to fit the athlete's arms, using neutral colors, and the straps are recommended to be more elastic, wide, and the length can be adjusted.

Final product results of finger protection device *Finger Tab* after several stages of expert validation tests and trials were carried out.



Figure 2: Finger Protector *Finger Tab*

The product has undergone improvements to components (*Finger Tab)* so that it resembles imported products and provides an attractive neutral color so that athletes are interested in always wearing finger protection equipment in the long term.

4. CONCLUSION

This research aims to develop the *ARGUFITA* consisting of an *Arm Guard* and *Finger Tab as* supporting equipment for athletes in the paralon division of the archery sport (Ummah, 2019). The results of the study showed that the developed product achieved a high level of feasibility based on the assessment of archery material experts, coaching media experts, and the results of user trials. These findings indicate that ARGUFITA has met the functional, safety, comfort, and user needs aspects according to the characteristics of archery. In sports product development research, a product is declared feasible if it can meet user needs through a validation and revision process.

The improvement in the results of the archery material expert validation from stage I to stage II indicates that the product revision process was effective. *Arm Guard*, the feasibility value increased from 89.5% to 98.33%, while for *Finger Tab, it* increased from 86.85% to 97.96%. This increase indicates that the input provided by the validators successfully improved the product's design, size, comfort, and protective function.

According to research and development theory, product revision is a crucial step in producing a product that better suits user needs and the context in which it is used. This finding aligns with research (Prasetyo et al., 2022) on developing archery equipment, where improved product quality after revision resulted in a very high level of validity.

In contrast to the validation results of the material experts, the validation value of the coaching media experts on *Arm Guard* and *Finger Tab tended* to remain constant between stages I and II. This indicates that, from the initial development stage, the product design met the criteria for good training media in terms of form, ease of use, efficiency, and usefulness in training. In other words, the revisions focused more on refining product details and fundamental design changes.

The results of the small group trial showed that *Arm Guard* obtained a percentage of 79.35% and *Finger Tab* of 84.61%. Although both are considered adequate, these results indicate that several aspects still need improvement based on direct user experience. In sports product development research, small-group trials serve to identify product weaknesses before being implemented on a wider population. Therefore, the small-group results in this study can be viewed as an evaluation process to improve product quality. *ARGUFITA.* After product refinement, the results of large group trials showed a very significant increase, namely 92.5% in *Arm Guard* and 93.38% in *Finger Tab.* This increase demonstrates excellent user acceptance of the developed product. The high level of user acceptance indicates that the product is capable of meeting the needs of athletes during training and competitions. This finding aligns with research (Fajri & Prasetyo, 2015) that developed PVC arches as an extracurricular learning medium for elementary school students.

From a functional aspect, the *Arm Guard* was developed to have an important role as a protector for the lower arm from the impact of the bowstring during the process of releasing the arrow (*string slap*). Bowstring injuries are a common problem for archers, especially beginners and those who are adjusting their technique. *Arm Guard: A* comfortable and user-friendly arm guard can increase a sense of security, allowing athletes to focus more on archery techniques. *Finger Tab functions* to protect the fingers from repeated pressure from the bowstring while also helping to produce a more consistent arrow release (Ummah, 2019). In archery biomechanics, the quality of release (*release*) is one of the factors that influences shooting accuracy. Therefore, the use of*Finger Tab*Ergonomic not only contributes to finger protection, but also supports the overall quality of archery technique.

ARGUFITA not only functions as a protective tool, but also as a supporting tool for improving the quality of archery training. Based on the overall results of expert validation, small group trials, and large group trials, it can be concluded that the product *ARGUFITA (Arm Guard and Finger Tab)*It has an excellent level of suitability. This product can meet the safety, comfort, function, and user needs of archery athletes, particularly athletes in the paralon division. The high level of user acceptance demonstrates that ARGUFITA is suitable for use as training and competition support equipment, and has the potential to become a sports equipment innovation that can improve the quality of archery training and performance.

5. ACKNOWLEDGMENTS

Based on the results of expert validation and user trials, the product *ARGUFITA* has the characteristics of being safe, comfortable, functional, and able to provide protection for the athlete's arms and fingers during the archery process. *Arm Guard serves* to protect the arm from the impact of the bowstring, while the *Finger Tab* helps protect fingers and increases comfort when drawing and releasing the bowstring. All assessment results show a category

of adequate to very adequate, so the product *ARGUFITA is* declared suitable for use by athletes in the paralon division of the archery sport in training activities and competitions.

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