CONVERGENCE OF DIGITAL TECHNOLOGY AND JUDO COMPETITIVE PRACTICE

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Summary. Analysis of existing digital technologies used in judo refereeing has revealed a set of programs that provide assistance in conducting competitions. The use of digital technologies provides an opportunity to improve the quality of refereeing at various ranks of the competition. The percentage of using video views and the percentage without video views at the European Championship and the Ukrainian Championship is almost the same. This speaks to the quality of judging at these events. This is because the judging of the final block allows more qualified judges who did not make mistakes during the judging or these mistakes were minimal.

Introduction. In recent years, the tendency for the rapid development of digital technologies has been spreading all over the world, associated with the widespread introduction of computer technology and the Internet, modern multimedia and automation tools [1-3].

The sport of judo has also undergone a number of changes associated with the development of digital technology. Due to the declaration of a pandemic and the introduction of quarantine measures (COVID-19), a large number of fans of this sport can watch the competition online with the help of video hosting You Tube. Today, the
well-known You Tube channels of judo broadcasting are the young domestic channel "Judo Federation of Ukraine", which was created in November 2020; the international channel "Judo", created in October 2005 and the international channel "European judo", created in September 2010. The purpose of the channels is to make this sport more spectacular and understandable not only to professionals but also to any average person [4].

Sport is an open system that exchanges technologies, information, and materials with the external environment [5].

Using literature sources, Internet resources, observations of review commissions, inspectors and commissioners using videos of skirmishes on video hosting (You Tube), for the first time an analysis of the impact of digital technologies on improving the quality of judging was conducted to correctly determine the winner of judo competitions.

**Purpose.** Analyze the impact of the use of digital technology in judging to correctly identify the winner of a judo competition.

**Research methods.** The following methods were used during the research: theoretical analysis and generalization of literature sources and Internet data, analysis of video recordings of the European Championship and the Ukrainian Judo Championship among juniors, methods of mathematical statistics.

**Results.** Analysis of existing digital technologies used in judo judging revealed existing programs. Yes, there is a special set of programs "Judo Shiai", presented in Figure 1, is one of the technical means that assists in the competition [6].

![Fig. 1. General view of the complex of the program "Judo Shiai"](image)

The use of the Judo Shiai software package has a number of clear advantages:
- at registration of the participant all data are stored in a database and the program informs on existence of insurance against accidents;
- independently carries out a draw, gives the chance to update protocols in the on-line mode after each round of fights;
the ability to conduct "quick weighing" using a barcode, which will allow you to quickly weigh a large number of participants;
- electronic "Judogi sokuteiki", which will allow after the measurements of judo to display on a computer board admitted athletes to the fight.

The computer scoreboard allowed the panel of judges to correctly assess the course of the fight. As a way to display the results of the fight for spectators, athletes and judges, an information board is used (Valeev, 2014), which has undergone a certain evolution from manual to computer control. To use a computer board you need modern equipment: a monitor with the function of connecting to a computer and the Internet, a program that displays ratings:
- "Waza-ari", "Ippon";
- remarks: in growth from "Shido" to "Hansoku-make";
- counting down the time of the fight from the beginning of "Hajime" to the end of "sore-made");
- countdown of retention time from "Osaekomi" to "Toketa" with automatic display of the score on the scoreboard;
- additional time of the fight "Golden-score";
- accompaniment of the end of the fight with a sound signal and the appearance of the name of the athlete who won.

Changes have recently been made to the rules of the competition, in which two judges sit behind monitors on which, with the help of cameras installed on different sides of the tatami, a real-time video of the fight is played with a delay of 3-5 seconds and the match is judged together with the referee with the help of headphones and a walkie-talkie.

Figure 2 shows the «Judo CARE» program, which includes a video analytics system used in judo arbitration according to the "majority of three" rule [7].

Fig. 2. General appearance and use of equipment when working with the program "Judo CARE"
With the «Judo CARE» program, which allows you to watch a fight with a video delay, slow down the video replays of the fight and step-by-step reproduction of controversial moments that arose during the fight, judges can minimize errors in assessing the technical actions of athletes. The «Judo CARE» program, as a video arbitration tool, helps to make sure that the right athlete has won.

The program provides innovative opportunities for training judges, namely the use of videos of fights can be used to improve the quality of refereeing, which leads to increased productivity of judges during tournaments [8].

42 clashes of the final block of the European Championship (EC) and 42 clashes of the Ukrainian Championship (UC) in U21 Judo were reviewed (Table 1).

According to the materials of the recording of video broadcasts of the European Championship and the U21 Judo Championship on video hosting (You Tube), the final block was analyzed and the impact of video replays on the referee's decision to correctly identify the winner in the competition.

**Table 1**

| Judges’ decisions when assessing a fight without / with video reviews | Championship of Ukraine number of fights | European Championship number of fights |
|--------------------------------------------------------------------|------------------------------------------|----------------------------------------|
| Decision-making by judges without video preview                   | 24                                       | 22                                     |
| Decision-making by judges with video preview                      | 18                                       | 20                                     |
| The total number of fights                                        | 42                                       | 42                                     |

After watching 42 fights of the final block of video broadcasts of the European Championship with judo U21 on video hosting (You Tube), an analysis of the impact of video replays on the referee's decision was made to correctly identify the winner in the competition (https://youtube.com/c/europeanjudo).

In 22 fights out of 42 referees made decisions that did not require revision or change. In the other 20 fights, video replays were used, 8 of which changed the decision to perform a technical action by the athlete.

After watching 42 fights of the final block of video broadcasts of the Championship of Ukraine with judo U21 on video hosting (You Tube), the analysis of the impact of video replays on the referee's decision was made to correctly identify the winner of the competition [9].

In 24 fights out of 42 referees made decisions that did not require revision or change. Video replays were used in the other 18 skirmishes.

Comparison of the average rates of contractions in which digital replays were used with the help of digital technologies or did not apply showed statistically significant differences in the indicators between the European Championships and the U21 Judo Championships (<0.05) (Table 2) [10].

Since \( t (0.051) < t_{fr} (1.98) \), the analysis of the refereeing of the European Championship and the U21 Judo Championship is considered statistically significant.

As you can see, judo judging with the use of digital technologies allows for quality judging in competitions of various levels.
Table 2

| Application of video previews by the panel of judges | Championship Of Europe | Championship Of Ukraine | Student's difference | Statistical reliability |
|-----------------------------------------------------|------------------------|-------------------------|----------------------|------------------------|
| fights without video viewing                       | $x_\text{sp} \pm \delta_x$ | $x_\text{sp} \pm \delta_y$ | 0,051                | $>0,05$                |
| fights with video viewing                           | $0,48\pm4,48$          | $0,43\pm4,52$           | 0,051                | $>0,05$                |

Figure 3 shows that the percentage of video views used and the percentage without video views at the European Championship and the Ukrainian Championship are almost the same. This speaks to the quality of judging at these events. This is because the refereeing of the final block allows more qualified judges who did not make mistakes during the refereeing or these mistakes were minimal. However, at the Championship of Ukraine, judges spent more time watching video replays than judges watching European replays. This is because it takes time for judges to master certain programs. Thus, with a total of 42 skirmishes, of which 20 skirmishes - 47.6% of international judges use video replays and 22 skirmishes - 52.3% of international judges did not use video replays. Analyzing the U21 Judo Championship of Ukraine with a total of 42 fights, of which 18 fights - 42.8% of judges use video replays and 24 fights - 57.1% of judges did not use video replays.

Fig. 3. Percentage of fights with and without video viewing at the European Championship and the Ukrainian Judo Championship U21

Conclusions. Analysis of existing digital technologies used in judo refereeing has revealed a set of programs that provide assistance in conducting competitions. Yes, the complexes store data about the participants; independently carry out draws, give the chance to update protocols in the on-line mode after each round of fights;
the ability to perform "quick weighing" using a barcode, which will allow you to quickly weigh a large number of participants; do video replays of fights, etc.

The use of digital technologies provides an opportunity to improve the quality of refereeing at various ranks of the competition. The percentage of video views used and the percentage without video views at the European Championships and at the European Championships are almost the same. This speaks to the quality of judging at these events. This is because the refereeing of the final block allows more qualified judges who did not make mistakes during the refereeing or these mistakes were minimal. However, the judges spent more time watching the video repetitions than the judges of the European Championships. This is because it takes time for judges to master certain programs.

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