

## Assessing rule understanding and consistency among WUKF karate coaches, instructors, and referees in kata competitions

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### Abstract:

**Problem statement:** Assessing *kata* performance in karate competitions, especially in the World Union of Karate-Do Federations (WUKF), is influenced by the subjective interpretation of criteria such as "strength," "speed," "rhythm," and "kime." This subjectivity can lead to scoring inconsistencies and disputes among referees, coaches, and athletes. **Approach:** To address this issue, a qualitative study was performed involving 40 WUKF karate coaches, instructors, and referees. The study used questionnaires to gather insights into their perspectives on the current judging criteria, their understanding and application of these criteria, and potential areas for improvement. **Purpose:** The purpose of this study is to evaluate the consistency of referee perceptions regarding *kata* evaluation criteria and to explore ways to enhance objectivity and reduce subjectivity in *kata* competitions. **Results:** The findings indicate a lack of standardized interpretation of WUKF judging criteria, particularly for concepts such as "control of energy," "understanding the movement of *kata*," and "spirit." While most respondents expressed satisfaction with the current scoring system, a considerable number also advocated for refinements to improve objectivity. The study also revealed diverse opinions on the potential implementation of video review in *kata* competitions and the feasibility of ranking *katas* based on their difficulty. **Conclusions:** The study concludes that although the current WUKF judging system is generally well-received, there is a clear need in the karate community for greater clarity and objectivity in *kata* evaluation. The findings suggest several potential areas for improvement, including the development of more precise criteria definitions, the incorporation of objective measures where feasible, and the strategic use of technology to assist referees in their evaluations. This research adds to the ongoing discussion on refining judging practices in karate *kata* competitions, aiming to balance tradition with the pursuit of fairness and objectivity.

**Keywords:** criteria, evaluation, objectivity, standardization, judging

### Introduction

Karate, a martial art with a rich history and tradition, has evolved into a globally recognized sport with various competitive aspects (Iorga et al., 2024). Recent studies have demonstrated the positive impact of karate training on the physical and psychological development of children (Rutkowski et al., 2019; Stamenkovic et al., 2022; Potoczny et al., 2022) and on the physical fitness of young adults. An important element of karate competitions is the *kata*<sup>1</sup>, a structured sequence of techniques, stances, and movements that incorporate strength, body contraction and expansion, varying execution speeds, and the concept of "Enbusen," which refers to the line of movement and the starting point of the *kata* (Dăncescu, 2021, p. 86). Recently, there has been increasing interest in reducing subjectivity in sports arbitration, such as incorporating video evidence for real-time point verification. This trend is evident across various sports, including fencing (Federation Internationale d'Escrime, 2021, pp. 18-20), taekwondo (World Taekwondo [WT], 2018, pp. 49-51), and the karate organization (Carlsson et al., 2020; World Karate Federation [WKF], 2018, Appendix 11), which represented karate at the Tokyo 2020 Olympics (Baginska et al., 2022; Souza, 2019).

In sports such as taekwondo, video replay has been effectively implemented to review and potentially overturn scoring decisions (World Taekwondo, 2018, p. 49). While the use of video analysis in karate *kata* competitions is still being explored, its potential to enhance judging objectivity is a promising area for future research (Emad et al., 2020; Lygouras & Tsinakos, 2024).

However, in *kata*-style competitions, the benefit of video analysis in reducing subjectivity is not immediately clear. The sequence of moves is already known to the referees, and unlike a point scored in a fighting competition, which may be missed owing to angle or timing, there is no element of surprise in a *kata* performance that would require video review.

<sup>1</sup> A Japanese term frequently used in martial arts. *Kata* refers to a detailed, choreographed sequence of movements. *Kata* are used to teach and practice techniques, preserve the art's history, and demonstrate skill and understanding of these techniques. They can be performed in competitive settings, where the emphasis is primarily on the athletic ability demonstrated during the execution of the *kata*.

Therefore, alternative methods are needed to reduce subjectivity, relying primarily on the referees' expertise, with video analysis serving only as a supplementary tool. A key indicator of subjectivity in this context is the persistent lack of agreement among referees. If the criteria were fully objective, one would expect general agreement on scores in most *kata* competitions; however, this is often not the case. This inconsistency is the main reason for using multiple referees. A crucial investigation to help reduce subjectivity involves determining the extent to which referees agree on scoring criteria and their understanding of *kata*. To address this issue, we distributed questionnaires to 40 coaches, instructors, and referees affiliated with the Romanian branch of the World Union of Karate-Do Federations (WUKF). We revisit the essential components of the WUKF rating system (Federația Română de Karate WUKF, 2017)<sup>2</sup>. The arbitration regulations of the Romanian Karate Federation WUKF closely mirror those of the international WUKF organization. These regulations stipulate that in each round of a *kata* competition, performances are not merely classified as good or bad but are assessed based on key elements of judgment according to two criteria: basic execution and advanced execution. Basic execution consists of the following elements (Federația Română de Karate WUKF, 2017, pp. 42-43):

- a) sequence of movements in the *kata*;
- b) control of energy;
- c) control of tension and contraction;
- d) control of speed and rhythm;
- e) direction of movements;
- f) understanding of the *kata* technique;
- g) demonstration of the appropriate understanding of the *kata's bunkai*<sup>3</sup>;
- h) coordination;
- i) stability and balance;
- j) pauses;
- k) *kiai*<sup>4</sup>;
- l) breathing;
- m) concentration;
- n) spirit;
- o) mastery of technique execution;
- p) *budō*<sup>5</sup> attitude.

When evaluating the advanced execution of the *kata*, referees consider specific key aspects, the degree of difficulty, and the risk involved in each performed *kata* (with the term "risk" being open to interpretation; see the "Results" section for clarification based on questionnaire responses).

In terms of penalties for *kata* execution, points will be deducted as follows (Federația Română de Karate WUKF, 2017, p. 43):

- a) a momentary hesitation in the fluid execution of a *kata*, quickly remedied: -0.1 pts;
- b) a momentary but visible stop: -0.2 pts;
- c) a slight momentary imbalance, quickly remedied: -0.1 to -0.2 pts;
- d) for lack of *kiai*: -0.1 pts.

In the *kata* event, competitors are evaluated by five referees based on elements of basic and advanced execution. Depending on the round, scores range from 5.0 to 6.9, 6.0 to 7.9, or 7.0 to 8.9. The highest and lowest scores are discarded, and the final score is calculated as the sum of the remaining three. Typically, *kata* regulations across various Karate federations and organizations do not provide detailed explanations of these criteria, leaving their interpretation and application to the referee's experience and discretion (including an understanding of *kata* technique, rhythm, *bunkai*, spirit, *budō* attitude, etc.). The downside of this approach is that without clear descriptions, these criteria can lead to overly subjective arbitration.

Although our analysis focuses on the WUKF system, our findings are broadly applicable because the evaluation criteria used by the World Karate Federation (WKF), the largest organization of its kind, are similarly vague and lack detailed explanations (World Karate Federation [WKF], 2018). This forces referees to rely on their knowledge and experience gained over years in martial arts to assess elements such as "strength," "speed," "timing," and "kime"<sup>6</sup>. The lack of clarity in these criteria is a disadvantage for objective refereeing because it leads to varying interpretations among the referees in each jury.

<sup>2</sup> The 2017 regulations were referenced in this study, but they have since been superseded by the 2023 version, which is now the current standard. The 2017 version is no longer accessible online. For the purposes of this study, no significant differences have been identified between the 2017 and 2023 regulations. It is important to note that the questionnaires were distributed to referees in 2019.

<sup>3</sup> *Bunkai* refers to analyzing the applications that underlie the movements presented in a *kata*. It is defined as the fighting skills that the *kata* were designed to teach (Clayton, 2004, p. 291). *Bunkai* is an essential aspect of training, ensuring that *kata* practice goes beyond performance to become a meaningful study of practical fighting techniques.

<sup>4</sup> *Kiai* is a short shout performed during an attacking move, representing the culmination and release of energy. It is often used to startle an opponent and express confidence. *Kiai* must be uttered at precise, predefined moments during a *kata*, occurring exactly twice in each *kata* (Yokota, 2013, p. 28).

<sup>5</sup> *Budō* translates to "the way of war" or "martial way" and encompasses the philosophies and practices of traditional Japanese martial arts.

<sup>6</sup> *Kime* is a term used in Japanese martial arts to describe the concept of focus or decisiveness in executing a technique. It involves a

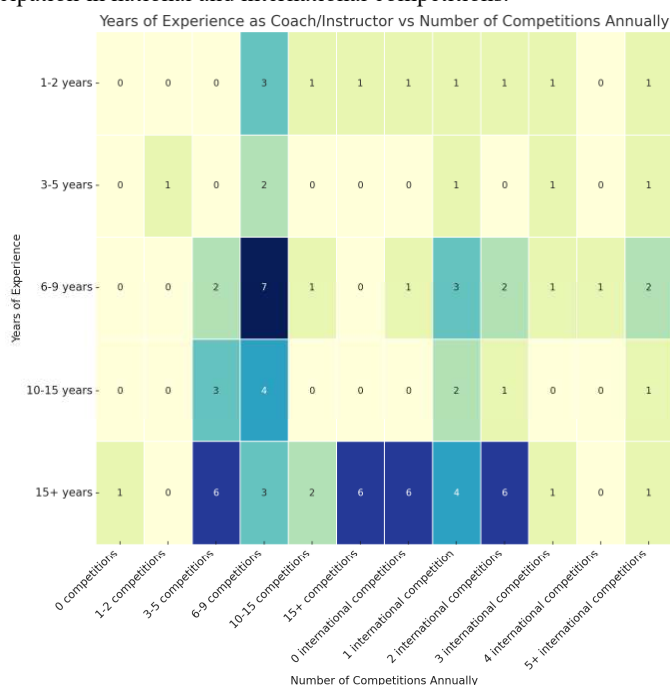
**Materials and methods**

We distributed questionnaires to 40 coaches and instructors, most of whom also serve as referees in the WUKF, to evaluate which aspects of a *kata* presentation referees focus on and to identify potential solutions for improving arbitration in Karate, particularly regarding the integration of video analysis in *kata* competitions. A key objective in developing this questionnaire was to gather insights from referees, coaches, and Shotokan karate instructors in the Romanian Karate Federation WUKF regarding the evaluation criteria for *kata*. The current arbitration rules list these criteria without providing explanations or indicating their relative weight in the overall evaluation of an athlete. By analyzing the responses, we aim to define and establish connections between these criteria, which could inform proposed amendments to the *kata* arbitration regulations. Additionally, we collected general demographic data from referees, such as age and karate skill level, to better understand their backgrounds.

**Results**

**Background of coaches, instructors, and referees.** The questionnaires, which were administered in Romanian (with the questions provided in English below), included several questions about the background of coaches, instructors, and referees, as well as their formal training in sports science. The results are summarized in the table below. It is important to note that respondents may have multiple qualifications for the "qualifications" category. Thus, the total number in that category does not need to add up to 40, as detailed in

Table I. Additionally, the heatmap in Figure 1 illustrates the correlation between experience as a coach or instructor and participation in national and international competitions.



**Figure 1 – Heatmap showing the years of experience of coaches and instructors in national and international competitions**

**Table I – Background of coaches, instructors, and referees**

Categories	# results (adds up to 40, excluding qualifications)
Gender – Male	32
Gender – Female	8
Age (18–24 years)	3
Age (25–34 years)	13
Age (35–50 years)	17
Age (>50 years)	7
Qualifications – refereeing course	23
Qualifications – instructors course	26
Qualifications – formal education	38
Qualifications – other	11
Karate practice time (1–2 years)	5

combination of physical power, mental focus, precision, and control. *Kime* transcends mere physical movement, incorporating the mental and spiritual dimensions of martial arts training.

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Karate practice time (3–5 years)	3
Karate practice time (6–9 years)	10
Karate practice time (10–15 years)	4
Karate practice time (>15 years)	18
Title – assistant coach	11
Title – coach	9
Title – senior coach	5
Title – master coach	2
Title – not applicable	11
# of yearly national competitions coached – none	1
# of yearly national competitions coached – 1–2	1
# of yearly national competitions coached – 3–5	11
# of yearly national competitions coached – 6–9	19
# of yearly national competitions coached – 10–15	4
# of yearly national competitions coached – >15	5
# of yearly international competitions coached – 1	11
# of yearly international competitions coached – 2	10
# of yearly international competitions coached – 3	4
# of yearly international competitions coached – 4	1
# of yearly international competitions coached >4	6

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**Referee agreement.** To ensure a *kata* is evaluated as objectively as possible, it is essential that referees have a consistent understanding of the technical evaluation criteria. Below, we present a series of questions that allow for open-ended responses and interpret the answers received. This study achieved a 100% participation rate for a considerable number of questions, with most questions receiving responses from at least 75% of participants. The average response rate across all questions was 87.5%. These results indicate a strong interest in the topic and a general willingness to contribute to the research.

However, some respondents chose not to answer certain questions. This non-participation, particularly noticeable for specific questions, may be attributed to factors such as the perceived difficulty of the questions, the sensitivity of the topics, or fatigue from completing the questionnaire. Despite our efforts to create clear and relevant questions, some respondents might have found certain items too complex or personal, leading them to abstain from answering.

While non-responses are an inherent limitation of questionnaire-based studies, the high response rate for most questions allows us to proceed with data analysis and draw meaningful conclusions.

For the question, "*Do you think that the scores given in kata (5.0–6.9, 6.0–7.9, 7.0–8.9, depending on the round) clearly reflect the athlete's performance?*" the vast majority of respondents—31 out of 40—believe that the scores awarded accurately reflect the athlete's performance. It is important to note that while the WUKF Karate regulations do not specify the exact score ranges for evaluating *kata*, they do outline the conditions under which an athlete should be penalized.

*"Based on the decision criteria (from the FRK<sup>7</sup> WUKF arbitration regulation) for basic kata execution, what do you think "control of energy" refers to?"* Out of thirty-seven surveyed individuals, nine respondents indicated that they either did not understand what "control of energy" refers to or found the term too vague. Eight respondents associated it with the muscular contraction at the end of a technique known in karate as *kime*. Three respondents connected it to *ki*, a Japanese term meaning energy, mind, spirit, or heart. Seventeen respondents provided a range of interpretations, including concentration during the *kata*, the force of the strike, control over vital functions, pacing of effort, and mental balance.

*"According to the decision criteria (from the FRK WUKF arbitration regulation) for basic kata execution, what do you think "understanding the movement of kata" refers to?"* Out of 37 instructors and coaches, 20 referred to the term "*bunkai*," which pertains to the application of *kata* in a real fight (Swanson, 2017, pp. 6, 12). Two respondents indicated that they did not understand what "understanding the movement of *kata*" means. The remaining 15 responses varied, with interpretations including the need for the athlete to understand the movement, the accuracy of the movement, and the challenge of following the criteria during execution, etc.

*"According to the decision criteria (from the FRK WUKF arbitration regulations) for basic kata execution, what do you think "showing the appropriate understanding of the kata's bunkai" refers to?"* In response to this criterion, 37 instructors and coaches provided answers. Fifteen of them indicated that "showing the appropriate understanding of the *kata's bunkai*" means demonstrating the application of techniques in a real fight. Five respondents were unsure about what this criterion meant. Another five suggested that understanding the *bunkai* is related to the rhythm of the *kata's* techniques. Three people believed that this understanding could not be effectively demonstrated in a competitive setting. Additionally, three respondents equated understanding the *bunkai* with understanding the *kata's* movements, as discussed in the previous question. The remaining six

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<sup>7</sup> Abbreviation for *Federația Română de Karate* (in Romanian)

responses varied, addressing aspects such as the performer's mastery, the athlete's imagination, the trajectory of the techniques, and other related factors. Although more than half of the responses to the previous question about "understanding the movement of the kata" referred to *bunkai*, only 8.1% of responses to this question were associated with the criterion "understanding the movement of the kata."

"According to the decision criteria (from the arbitration regulations of the FRK WUKF) for basic kata execution, what do you think "breathing" refers to?" Out of 34 coaches and instructors, 16 believe that breathing should be natural, while 9 think it should be synchronized with the execution of the techniques. The remaining 9 respondents provided varied interpretations, such as quiet breathing or breathing originating from the Hara (the abdomen).

"According to the decision criteria (from the arbitration regulations of the FRK WUKF) for basic kata execution, what do you think "concentration" refers to?" Regarding "concentration" as a decision criterion, out of the 37 responses received, 9 instructors and coaches indicated that it referred to the athlete's attentiveness in executing the *kata* techniques. Seven respondents believed that it pertained to the fighting attitude demonstrated by the athlete during the *kata*. The remaining 21 responses varied, referring to concepts such as *zanshin*<sup>8</sup>, *bunkai*, and breathing, among others.

"According to the decision criteria (from the arbitration regulations of the FRK WUKF) for basic kata execution, what do you think "spirit" refers to?" Out of 32 responses, 15 respondents interpreted "spirit" as relating to the fighter's attitude displayed by the athlete during the performance of the *kata*. Six individuals indicated that they did not know what the criterion "spirit" referred to. The remaining 11 responses varied, with some referring to concepts such as *bunkai*, *zanshin*, and the notion that the "spirit" criterion is subject to judgment by the referees.

"According to the decision criteria (from the arbitration regulations of the FRK WUKF) for basic kata execution, what do you think "mastery of technique execution" refers to?" Out of 37 responses, 6 respondents associated "mastery of technique execution" with *kime*—the muscular contraction at the end of a technique (Amălinei, 2001, p. 10). The remaining 31 responses varied, with interpretations including a high level of technical execution, the speed of repetition, the difficulty of the chosen *kata*, and the artistic aspect, among others.

"According to the decision criteria (from the FRK WUKF arbitration regulations) for basic kata execution, what do you think "budō attitude" refers to?" Out of 33 responses from instructors, 7 respondents referred to the definition of the word *budō*, which means the way of the martial arts (Funakoshi, 1973, p. 247). Five respondents associated *budō* attitude with courtesy, while another five believed it referred to the concentration exhibited by the athlete. Three respondents thought it related to *zanshin*, and three did not know what *budō* attitude meant. The remaining 10 respondents provided varied interpretations, including *bunkai*, self-control, and self-respect.

"According to the decision criteria (from the FRK WUKF arbitration regulations) for basic kata execution, what do you think "degree of difficulty and risk" refers to?" Out of 37 responses, 20 respondents believed that "degree of difficulty and risk" pertained to the difficulty and complexity of the *kata* chosen by the athlete. Five instructors or coaches thought it referred to jumps and stances in the *kata* that required special balance, representing a high degree of difficulty and risk. The remaining 12 responses varied, with references to concepts such as *bunkai*, mastery of technique execution, the complexity factor, and the naturalness of techniques.

"Do you believe that athletes are penalized for execution errors beyond the four specified in the regulations?" Thirty out of the 40 instructors and coaches who responded believed that athletes were indeed penalized for additional mistakes. In contrast, 10 respondents thought that athletes were not penalized for other execution errors during the performance of the *kata*.

If respondents answered "yes" to the previous question, they were asked what additional reasons might lead to athletes being penalized. Those who answered "no" were instructed to proceed to the next question. For those who answered "yes" to the previous question about additional penalties for execution errors, 10 respondents believed that athletes were penalized for incorrect execution of stances and techniques. Six respondents thought that a lack of appropriate attitude during the *kata* led to deductions. Four believed that subjectivity in referees' assessments contributed to penalties, while three thought that insufficient power during execution resulted in deductions. Seven respondents provided various other reasons, such as failing to return to the starting point of the *kata* or missing or changing a technique.

"Rank in order of importance the five most important criteria that referees use when awarding a score." Based on responses from 36 coaches and instructors, we have identified and ranked the most frequently mentioned criteria as follows. The correctness of the stances mentioned by 14 respondents is generally considered the most important criterion. The correctness of the technique, mentioned by 23 respondents, is the second most important criterion. Attitude/concentration, cited by 14 respondents, is also a key factor on average. Speed and power, although mentioned 31 times, are considered the fourth most important criterion. Rhythm,

<sup>8</sup> Refers to the state of alertness (Funakoshi, 1973, pp. 217-218)

mentioned 11 times, is generally regarded as the least important of the five key criteria that referees use when awarding a score.

*"Why do you think additional points are awarded after executing a kata?"* Out of the 36 individuals surveyed, 11 thought that the athlete's appropriate attitude was scored, while 10 coaches/instructors thought that the complexity and difficulty of the chosen *kata* were the reason for additional points. Five respondents noted that points were awarded for performing the techniques with *kime*, and 10 respondents provided various reasons for additional points, such as correct rhythm, proper stances, affiliation, or the athlete's physical preparation.

*"Do you believe that the four criteria for point deduction (momentary hesitation, momentary stop, slight imbalance, and lack of kiai) are sufficient?"* Out of the 40 instructors and coaches who answered this question, 26 thought that these four criteria were insufficient, while 14 believed they were sufficient. According to the regulations (Federația Română de Karate WUKF, 2017, p. 43), there are only four criteria for point deductions. Because most athletes can easily avoid these, it suggests they are unlikely to lose points. However, deductions still occur, indicating that athletes are being penalized for other criteria not specified in the regulations.

### Improving judging criteria

The next question aimed to assess the need for change: *"Do you believe that changing the scoring method would be beneficial?"* Out of 40 coaches and instructors, only 14 thought that a change in the scoring method would be advantageous. This indicates that, despite some positive responses to the previous question, there are still individuals who think a change would be beneficial.

For referees who answered "yes" to this question, we asked for their suggestions on how to improve the scoring system. Half of the 14 coaches and instructors recommended adopting a system similar to that used in Olympic sports such as artistic gymnastics, acrobatic gymnastics, and figure skating, which involves awarding separate scores for difficulty and execution. The other half provided various suggestions, including using a scoring scale from 1 to 10 or 1 to 20, expanding the range of scores, or ranking based on the difficulty of the chosen *kata*.

*"Do you think that having five referees for the kata event is sufficient?"* Of the 39 respondents to this question, 33 thought that the number of referees was adequate, while 6 thought a different number would be preferable.

For referees who answered "no" to the previous question, we asked a follow-up question to determine whether six or seven referees would be more suitable. The six respondents who expressed dissatisfaction were evenly split: three preferred 6 referees, while the other three favored 7 referees.

*"Do you think it would be beneficial to rank katas and incorporate these rankings into the scoring?"* The vast majority—34 out of 40 instructors and coaches—thought that including *kata* rankings in the scoring would improve the evaluation process, while only six found this approach unsuitable. This question is closely related to the "degree of difficulty and risk" criterion in the *kata* regulations (Federația Română de Karate WUKF, 2017, p. 43). Although this criterion is important and part of advanced execution, it is currently listed alongside other criteria without a specific score or detailed description.

*"If video review were introduced in kata, how do you think it would function?"* Out of 30 respondents, 7 thought that video review was inappropriate for *kata* competitions. Six stated that it would be useful in resolving disputes related to athlete disqualification. Five respondents thought that while video review could be beneficial, they did not provide specific implementation methods. Three were unsure how video review could be effectively integrated into *kata*. Nine respondents offered various alternative suggestions, such as using drones for filming, adopting video review systems from other sports, or recording competitions for referees' educational purposes.

### Discussion

The data from the questionnaires distributed to WUKF referees reveal the complexities involved in judging karate *kata* competitions. The referees' extensive experience in karate and formal education enhance the credibility of their responses, while the diversity of their answers highlights the inherent subjectivity in evaluating *kata* performances.

The range of interpretations for key judging criteria—such as "control of energy," "understanding of *kata* movements," "concentration," "breathing," and "spirit"—suggests a lack of standardized understanding. This variability can result in inconsistent scoring and a perception of arbitrariness in the results. While these criteria have considerable cultural and martial importance, their difficulty in being quantified contributes to the subjectivity in scoring.

While most referees think that the current scoring system adequately reflects athletes' performance, a considerable number see the potential for improvement, highlighting a disparity between satisfaction with the existing scoring system and a desire for a more objective and accurate evaluation method. The integration of technology, such as wearable sensors (Saponara, 2017) or motion capture systems (Coppola et al., 2019; Ardelean et al., 2016; Ardelean et al., 2019; Cynarsky et al., 2014), could provide objective metrics for performance parameters such as speed, power, and technique execution. Combining these technological advancements with the referees' expertise may lead to a more comprehensive and objective assessment of *kata* performances.

## Conclusions

The investigation into the subjectivity of karate *kata* judging reveals a fundamental tension between traditional, holistic evaluations of performance and the modern need for quantifiable, objective standards. The data indicate that while the current system is broadly accepted, there is a strong interest in refining the criteria to minimize subjectivity. This refinement could be facilitated using the following approaches.

1. **Clear definitions:** Providing detailed descriptions of each criterion to ensure a consistent understanding among referees.
2. **Objective measures:** Incorporating objective metrics where feasible, such as time stamps for *kiai* or exactness of foot placements.
3. **Technology integration:** Using video analysis to support, rather than replace, the judgments of experienced referees.
4. **Scoring system refinement:** Revising the scoring system to include separate scores for difficulty and execution, similar to the approach used in other judged Olympic sports.
5. **Feedback mechanisms:** Establishing feedback systems for athletes and coaches to understand referees' scoring, thus promoting transparency and learning.

We recommend incorporating these measures into the refereeing manuals to reduce subjectivity. In conclusion, although karate *kata* competition is rooted in tradition, there is a clear path to modernization that respects the art's heritage while aiming for greater fairness and objectivity. The WUKF, along with other Karate organizations, should consider these findings as they work to advance the sport for practitioners and audiences worldwide.

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**Author contributions** All authors contributed equally to the completion of this work.

**Conflicts of interest** The authors declare no conflicts of interest.

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