Perspectives of a new sport-specific Para Shooting classification system for athletes with vision impairment

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Abstract

The International Paralympic Committee (IPC) and individual sports federations have established the need to develop evidence-based systems of classification for athletes with vision impairment (VI) that may differ depending on the visual demands of each sport. As a consequence, research has been conducted that led to a new classification system for athletes competing in VI shooting. The purpose of this study was to canvas the experiences of key stakeholders (athletes, coaches and classifiers) when the new system of classification was implemented. Twenty-eight participants (17 athletes, 7 coaches and 4 classifiers) completed a questionnaire to rate their experiences of the previous and new classification systems and were interviewed to gain richer insights into their opinions. It was apparent that the changes to the classification system were not adequately communicated to the athletes in particular, and that the classifiers may require a better understanding of the principles of evidence-based classification. The new system was perceived to be more sport specific and intentional misrepresentation was observed to be less likely than when using the old system. This research provides valuable insights into both the positive and negative experiences of key stakeholders experiencing change in a classification system.

Keywords: shooting, classification, para-sport, participant experiences

Introduction

Para-sports can change attitudes toward disability and improve the social integration and well-being of those with an impairment (Blauwet and Willick, 2012; McVeigh, Hitzig and Craven, 2009). Initially, para-sports were a form of treatment for paraplegic patients (MacAloon, 1981) but have since developed to create opportunities in competitive sport for those with a variety of different impairment types, including vision impairment (VI). Accordingly, an increasing number of athletes with VI participate at both the grassroots and elite levels of competition (Gold and Gold, 2007).

A vital aim of para-sports is to ensure that medals are awarded to the best athletes, and not simply those with the least impairment (Tweedy and Vanlandewijck, 2011). To minimize the impact of the impairment on the competition outcome and create an equitable competitive environment, athletes are evaluated to classify the severity of their impairment (Tweedy, Beckman and Connick, 2014). *Classification* is a system by which individuals are placed into different "classes" depending on the type and severity of the impairment and its functional effects on sport performance (Tweedy and Vanlandewijck, 2011). Because this classification process can have a significant impact on which athletes are likely to win, the system should be robust, valid, and reliable (Tweedy and Vanlandewijck, 2011).

The International Paralympic Committee (IPC) mandates the development and implementation of *evidence-based* systems of classification. An evidence-based system of classification will necessarily be sport-specific, because the impact of impairment is likely to differ depending on the demands of a particular sport. Within an evidence-based system of classification, evidence is required to demonstrate: (1) the minimum level of impairment necessary to impact performance and therefore render an athlete eligible for inclusion in competition (the *minimum impairment criteria*); and (2) whether the eligible athletes should compete together in one class or be separated into different classes, and if the latter, what the borders between those classes should be.

Sport-specific classification to cater for athletes with physical and intellectual impairments has progressed more than that for athletes with VI (Tweedy, Beckman and Connick, 2014). VI athletes are typically allocated to one of three classes (B3, B2 or B1, from the lowest to highest level of impairment) based on their visual acuity (VA) or visual fields (VF; Myint, Latham, Mann, Gomersall, Wikins and Allen, 2016). The cut-off criteria between those classes were designed on the basis of the definitions of low vision and blindness outlined by the World Health Organisation (World Health Organization, 2004). There is, however, no evidence to show that those within each class have a relatively equitable level of activity limitation in sport, or conversely whether sport performance differs between those three classes. In some cases sports allow athletes from all three classes to compete against each other within the same competition class, for example, judo, presumably under the assumption that the impact of impairment on performance does not differ between the classes (Krabben, Ravensbergen, Nakamoto and Mann, 2019).

One particularly attractive para-sport for those with VI is air-rifle shooting. Shooting's popularity within the VI community can be explained by the sport's accessibility, regardless of the level of an athlete's impairment, because shooting in the adapted form of the sport is assisted by an audio signal to identify the direction of the rifle barrel. This modification has been enabled by an acoustic mechanism being mounted to the rifle. The pitch of the signal (accessed via headphones) varies, with the pitch of the sound increasing as the rifle is aimed

closer towards the centre of the target. The score of each shot is measured opto-electronically, with a screen display allowing the athlete or their assistant to see the outcome of each shot. Although popular, VI air-rifle shooting is not yet included on the program for the Paralympic games, at least in part because the sport had not yet implemented an evidence-based system of classification for competition. It is for this reason that research has recently been completed to design a new evidence-based system of classification system in accordance with the IPC Athlete Classification Code (International Paralympic Committee, 2017). This research concluded that visual acuity *and* contrast sensitivity are important predictors of performace in shooting and therefore should be evaluated during classification (Allen, Latham, Mann, Ravensbergen and Myint, 2016; Allen, Ravensbergen, Latham, Rose, Myint and Mann, 2018; Allen, Latham, Ravensbergen, Myint and Mann, 2019). See Figure 1 for a summary of the new World Para Shooting classification system for athletes with a vision impairment. The new classification system includes a new measure of contrast sensitivity (using a MARS number contrast sensitivity test), retains the measure of VA (using a logMAR tumbling E chart), and excludes any measure of VF. Eligibility or minimum impairment criteria can be achieved if an athlete has a VA poorer than or equal to 1.1 logMAR or a VA between 0.6 and 1.0 (inclusive) combined with a contrast sensitivity poorer than or equal to 1.4 logCS. Both tests should be conducted under standardised lighting conditions while using the best possible visual correction. Once eligible, athletes all complete in one class i.e. there is no further subdivision into different classes based on level of vision impairment. The newly revised system has since been approved for implementation by the IPC Governing Board. An infographic explaining the new system is included as Appendix 1.

[Insert Figure 1 around here]

Change is often met with resistance, and following the approval of the new classification system it is imperative for the success of the system that key stakeholders including, athletes, coaches, and classifiers have faith in the new system and consider it better than the previous version. Research that investigates the experiences and opinions of key stakeholders is vital to understand and mitigate concerns, and to better implement future systems of classification. Moreover, it is crucial that the classification system should provide a true representation of an individual's vision impairment and its impact on sports performance. One of the greatest concerns during the assessment procedure is that a small minority of athletes may purposefully exaggerate the level of their vision impairment. Termed *intentional misinterpretation*, this occurs when an athlete deliberately misleads or deceives the classifiers in an effort to misrepresent their true level of impairment. This may include consciously presenting in a way that is inconsistent to how they would present for the competition. An example may be, not wearing contact lenses for classification but wearing them when competing, or intentionally underperforming on some tests. The classification process should wherever possible minimize misrepresentation. Previous research investigating the perspectives of classification of VI athletes found in some cases 'a lack of faith in classification' whereby 'intentional misrepresentation was prevalent' (Powis and Macbeth, 2019). This is particularly likely to be the case when test procedures rely on the subjective resposes of athletes. Clearly objective tests of vision are desirable wherever possible.

The aim of this study was to canvas the experiences of key stakeholders when a new system of classification was implemented in VI shooting. We conducted a mixed-methods study incorporating questionnaires and interviews to better understand the viewpoint of key

stakeholders at the international level. To provide a holistic view of stakeholder experiences, we sought to address a series of four key research questions:

1. How well had the *rationale* for the new system been communicated and understood?
2. How clearly had the *procedural* information about the new system been communicated in advance of arriving at competition?
3. How suitable is the new classification system compared to the previous system in terms of relative fairness for athletes?
4. How did the assessment process during the new classification procedure compare with previous assessments in terms of the duration, stressfullness, and complexity?

Materials and methods

Study design

To fully explore stakeholders' experiences of the new classification system, a cross-sectional mixed-methods study design was selected to compare perceptions across three different cohorts. A mixed-methods design was used to allow an in-depth exploration (Fossy, Harvey, McDermott and Davidson, 2002) of the classification process, experiences, and views of the participants. A triangulation approach was incorporated involving both quantitative and qualitative aspects during data collection, data analysis, and interpretation. Ethical approval was granted by the Vision and Hearing Sciences Departmental Research Ethics Panel at Anglia Ruskin University in Cambridge, UK. The study adhered to the tenets of the Declaration of Helsinki.

Study location

The first competition using the new classification system took place in Hannover, Germany in May 2019. We used this opportunity to capture the initial experiences of the new system. The data collection occurred at the event venue immediately adjacent to where classification was conducted. Classification occurred within a large indoor shooting range. Panels were temporarily erected so that there were two booths available for classification.

Sampling and recruitment

Purposeful sampling was used to recruit participants from three groups: i) the VI athletes competing during competition; ii) their coaches; and iii) the classifiers attending the event. Including different stakeholder groups provided the opportunity to obtain a wider range of viewpoints regarding the classification experience. The tenets of the Declaration of Helsinki were observed, and ethical approval for the study was received from the Anglia Ruskin University Faculty Research Ethics Panel. Recruitment took place at the assessment venue. During registration, and when checking in for classification, the participants were made aware of the study. The study was explained verbally and written participant information sheets (PIS) were available. Those who wanted to participate provided written informed consent. Potential participants had the option of consenting to do either or both the questionnaire and/or interview. All written information was provided in large print to aid accessibility of the information for those with vision impairment.

The eligibility criteria included:

- Adults aged 16 years and over
- Being either a VI athlete competing in the event, a coach of a VI athlete, or a classifier
- All VI athletes were eligible, regardless of the nature of their vision impairment
- All athletes being classified were eligible, regardless of the outcome of the assessment, i.e., even if they were deemed ineligible to compete
- Participants from all countries were eligible

Sample size

There were 17 athletes with vision impairment, 7 coaches and 4 classifiers attending classification at the event. Ten European countries were represented. The aim was to obtain the views from as many of the individuals involved as possible to get a representative sample. Therefore, all individuals involved were approached. A prior sample size estimation (Abt et al. 2020) using G*Power software (Faul et al., 2007, 2009) indicated that this number of 28 participants was sufficient to achieve an 80% probability to detect differences on one-tailed paired *t*-tests and 20 participants (if not all contributed) would result in a 70% probability to detect differences.

Procedure

Concurrent data collection involving participants from all three groups took place as follows:

Written questionnaire

Because no standardized measure was available, different custom-made questionnaires were designed for athletes, coaches, and classifiers. The questionnaires were available in paper format in large print if necessary. Participants had the option of completing the questionnaires independently or by having help if they preferred that the questions be read to them by someone else. The questionnaires aimed to quantify pre-defined aspects of the classification process. The questionnaires included demographic questions regarding age, gender, years shooting/coaching/classifying, and the number of previous classifications attended. There were 22 questions in total. A five-point Likert scale was used to grade each question where appropriate. There were six questions eliciting information about the new and previous classification systems (12 in total); four questions regarding experiences during the new and previous classification assessments (8 in total); one question regarding communication about the new system and one regarding understanding why the system was developed.

Semi-structured oral interviews

Semi-structured interviews were conducted following completion of the questionnaire. The interviews aimed to explore participants' views and experiences of the classification system and process. The use of a translator, when available, or Google Translate, facilitated interviews with participants who were not fluent in English. Participants in most cases were accompanied by their coaches, significant other, or an assistant, and were therefore not alone during the interview. A broad interview guide was prepared that consisted of open-

ended questions to elicit elaborative information. The interviews were recorded and notes were taken by the interviewer. The average duration of each interview was ~15 minutes.

Interviewer

To maintain consistency, one interviewer interviewed all participants. A process of reflexivity was applied to identify the ideal characteristics for the interviewer. This process indicated that it would be inappropriate for those researchers originally involved in developing the recommendations for the new classification system to conduct the interviews because they may bring personal biases if involved in the interviews. Furthermore, the interviewer should have no prior involvement in shooting or sport classification. Their main research field should also be outside the sports domain to minimize bias and conflicts of interest. An independent research assistant was therefore recruited who had experience of qualitative data collection and analysis but no strong views on the research topic at hand. The interviewer was not informed of the outcomes of classification or any other personal information about participants unless the participants volunteered this information themselves.

Data Analysis

The Statistical Package for Social Sciences (IMB SPSS for Windows V.24.0) was used for statistical analyses (IMP Corp, 2016). Each participant was allocated a deidentification code to anonymize all data. Equal priority was given to qualitative and quantitative aspects during data analysis and integration. Descriptive statistics including years competing and number of previous classifications were used to describe the sample characteristics for each group. Continuous variables were summarized with means and standard deviations. Categorical variables were described using frequencies and percentages. Where ordinal data (the individual Likert scale questions) were present, the median was reported. When the scores from questions were combined (total scores) the mean scores were reported.

A Chi-squared test was used to analyse categorical data. The Kruskal-Wallis *H* non-parametric test was used for ordinal data with more than two levels and the Freidman test to analyze ordinal data with just one factor. For all analyses, a one-tailed significance level (confidence interval of 90%) of 0.05 was considered statistically significant. Statistical analyses to assess group differences using ANOVAs was not recommended because of the small sample size and resulting low power. Qualitative data coding was performed using NVivo 12 software (QSR International Ltd, 2018). Various steps were involved in the analysis process. Initially, the verbal data were transcribed into the written form. Transcriptions were actively read and re-read in search of initial ideas, meaning, and patterns. Themes or patterns were then identified, and the data coded. The responses that related to the same category were grouped together. The codes were derived using a deductive approach from the themes on the questionnaire. Responses were further categorized as being positive or identifying limitations regarding the new system for each category for ease of identifying opportunities for improvement. Misunderstandings of the new classification system were also identified.

Results

Participants

All but one athlete (*n* = 17/18), all coaches (*n* = 7/7) and all classifiers (*n* = 4/4) participated (Table 1).

Table 1. Participant characteristics

Group	Athletes (n = 17)	Coaches (n = 7)	Classifiers (n = 4)
Age: mean (SD) in years	43.8 (12.3), range 17-67 yrs	Not assessed	Not assessed
Gender	29% Female, 71% male	100% male	25% female, 75% male
Cause of vision impairment*	Choroiditis Diabetic retinopathy Macular degeneration (*n*=4) Ocular cancer Papilloedema Retinal detachment Retinopathy of prematurity Retinitis pigmentosa (*n*=2) Stargardt's disease Syndromic Trauma (*n*=3)	N/A	N/A
Duration of vision impairment: mean (SD) in years	26.6 (11.6) yrs	N/A	N/A
Previous number of classifications: mean (SD)	2.3 (2.1)	1.1 (1.9)	11.3 (13.2)
Years competing in (athletes) or coaching in VI shooting: mean (SD) in years	11.8 (8.3) yrs	10.5 (8.0) yrs	
Years as a VI classifier: mean (SD) in years			4.5 (4.0) yrs

Acronyms: SD = standard deviation

* *n*=1 unless stated otherwise

Comparison of the new and previous system of classification

Each group was asked six questions about both the new and previous classification systems. Figure 2 shows the median overall rating for each question asked. When averaging across all six questions, results showed that stakeholders preferred the new system of classification though there was no significant difference between the two scores [new vs previous = 3.6 vs. 3.1; t (19) = -1.70, p = 0.11].

[Insert Figure 2 around here]

Preferences regarding the new vs old classification system provided by each stakeholder group (athletes, coaches, and classifiers) were compared (Figure 3). There were no significant differences between the ratings for the new vs old classification system for any stakeholder group (athletes, X^2 = 87.8; p = 0.10; coaches X^2 = 6; p = 0.20; classifiers X^2= 8; p = 0.24). Stakeholder group differences were present when rating the previous system (Figure 3) as athletes and coaches preferred the new system whereas classifiers rated both classification systems lower than the coaches and athletes.

[Insert Figure 3 around here]

Issues related to intentional misrepresentation, exclusion of visual field testing, and the system being sport-specific, inclusive and fair were explored during the interview process. Comments regarding both the positive aspects and limitations along with misunderstandings that became apparent during the interviews of the new system are summarized in Table 2.

315 **Table 2: Participant views of the new classification system**

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Themes	Positive remarks regarding the new classification system	Remarks regarding limitations of the new system	Comments that indicated misunderstandings regarding the new classification system
Satisfaction with the new classification system	*The testing was complete. There was nothing I didn't like about it (Athlete).* *The new system is easier. I am more satisfied with it (Athlete).*	*We need a more objective system. Some athletes are not honest (Athlete).* *The tests need to be more comprehensive (Athlete).*	*The rules have failed if a person with an actual visual impairment is not able to compete (Classifier possibly not understanding how the cut off values have been established)*
Views regarding the new system being fair and unbiased	*It is good when they use the machine tests. These are important, as you cannot cheat (Athlete).* *I liked the machine tests as they are more objective and you can't cheat (Athlete).*	*There can be cheating for the visual acuity and contrast sensitivity testing. It is still not fair (Athlete).* *It was easy to guess the numbers on the sheet as there was little variation in the sheets used (Athletes).* *They need to continue to work at making the classification fairer (Coach).*	*We need more research to compare the VA cut-offs (Classifier possibly not realizing the research conducted to establish the values).*

		The athletes are able to predict the next character. We need the tests on a tablet or laptop to randomize the test. If we use a staircase approach, they can't make predictions which will make it fairer for everyone (Classifier).	
Views about the new system being specific to vision impaired shooting	*Visual field testing is not needed for our sport (Athlete).*	*I still think it can be more specific for vision impaired shooting (coach).* *We need more research to compare the visual acuity cut-offs (Athlete).*	*The minimum impairment values that are used now are too strict (Athlete not understanding that the values are based on evidence-based research).*
Views as to whether vision impairments are treated equally when using the new system	*For shooting the only question is if someone is visually impaired or not. The classification is sufficient as it doesn't need to look at more finer aspects of vision (Athlete).*	*As some people with more vision can cheat it does not treat everyone equally. I want it to be fair even when people have different problems (Athlete).* *Certain tests are better for certain conditions. Visual acuity is, for instance, better for someone with macular degeneration (Athlete).*	*The new system is not entirely fair as not everyone has a problem with field of vision (Athlete not understanding that field of vision testing has been removed)*
Views regarding whether intentional misinterpretation is possible with the new system	*Some of the tests were objective and you couldn't cheat (Athlete).*	*It is easy to cheat as you can guess the numbers such as the zeros in the visual acuity test as they have clear shapes (Athlete)*	*I only did VA, and you can cheat on this test. It feels like the other test should be included and take more aspects of vision into account (Athlete*

		You can still cheat as you can use your memory and can remember the letters. They should change the letters randomly. They should take away the cognition process from the testing. Memory should not be used (Athlete). *Intentional misrepresentation is present, we need to make it harder to cheat (Classifier).*	*possibly not realizing which tests are all included).*
Views regarding whether visual field testing should be excluded in the new system	*The visual field test is depressing, so I am happy it is not included. It is tedious and I cannot see the spots. The other tests are not so boring (Athlete).* *I like that we don't need to repeat the visual field test as that is on the report from the doctor (Athlete).* *I understand that visual field testing is not important for finding the target (Athlete).*	*The new system is not right. An athlete was classified as not eligible based on his contrast sensitivity (Classifier).*	*When there are discrepancies, or we have a borderline case, visual field testing should still be done (Classifier not understanding the reasons visual field testing has been removed).*

Experiences and views regarding the previous and new assessment process

Each stakeholder group was asked to rate their experiences with the previous and new assessment processes during classification in terms of assessment length, the associated stress, and how complex the assessment was. There were no significant differences between the experiences during the new and previous assessment process when averaging each across the four questions in this section ($p = 0.40$; Figure 4).

[Insert Figure 4 around here]

Preferences regarding the new vs previous assessment process provided by each stakeholder group (athletes, coaches, and classifiers) were compared (Figure 5). There were no significant differences for these rating between the new and old assessment process for any stakeholder group (althletes, $X^2 = 59.04$; $p = 0.37$; coaches $X^2 = 6$; $p = 0.20$; classifiers $X^2 = 4$; $p = 0.26$). Stakeholder group differences were present when rating the new vs previous assessment system (Figure) 5 as athletes and coaches showed a preference for the new processes whereas classifiers preferred the old processes.

[Insert Figure 5 around here]

Table 3 elaborates on some of the positive and negative experiences of the stakeholders regarding the new classification process. Overall participants reported that the stress, complexity, and duration of the classification on the day was acceptable (but that the duration could be shorter). They also mentioned that more could be done to reduce the associated stress and complexity thereof. During the interviews it became clear that some issues not initially considered by the research team were of particular concern to the participants. These included the suitability of the rooms where classification assessments were conducted and the complexity of the medical forms required to be submitted before attending the classification assessment.

349 **Table 3: Participant views and experiences regarding the classification process**

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Themes	Positive remarks regarding the classification process	Limitations of the classification process
Views on the classification process	*The assessment was more straightforward today. I am more satisfied with it (Athlete).*	Incidental finding: *The worst was preparing the medical report. The doctors could not understand it. I had to travel 200km to a doctor and had to have all the forms translated. The doctor could not write in English. It was very complicated (Athlete).* *There are too few venues for classification. It is very hard to get to many of them (Coaches, Athletes).*
Views on the complexity of the classification assessment procedure	*It was all easy and simple to perform today but comprehensive (Athlete).*	*They asked a lot of complicated things and there were a lot of language barriers (Athlete).* *All the technical terms used were complicated. Some form of translation is needed. I tried to help the athlete but I didn't know how to describe the technical terms they were talking about. They should have had some prerecorded explanations or written instructions available in different languages (Coach).*
Views on the stress experienced during classification	*There was less stress as doing the visual acuity and contrast sensitivity tests are not stressful. I was familiar with all the tests (Athlete).*	*I didn't understand them which was stressful. They used many technical terms I did not understand. They made no allowance if you did not understand English. This caused a lot of stress. It should be accounted for (Athlete).* *It was my first time. I was very stressed and nervous. I didn't know what to expect. I didn't know what would happen. There was a lot of misunderstanding. I didn't know what was happening. I didn't know what to do (Athlete).*

Views on the duration of the classification procedure	*It was quick and easy to do. Not many tests to do but they asked lots of questions today. The tests themselves took only 5 minutes (Athlete).* *I liked the tests because they took less time (Athlete).*	*The tests were rushed as they were done rapidly. There was no rest for my eyes (Athlete).*
Comments made regarding the classification conditions	None	*Standardization of the process will be appreciated. This includes the lighting, how the tests are conducted, how we are treated and having access to more information beforehand (Athlete).* *The equipment used needs improving. The charts looked unprofessional and came across as a bit improvised (Athlete).* *The testing facilities were too noisy. Due to not being able to see, the noise caused me to become nervous and stressed (Athlete).* *There was too much brightness from the lights which made it difficult (Athlete).* *The contrast test needs optimal light. The lighting was very poor (Athlete).* *The test facilities need to be stable so that it is fair no matter where you are classified. It would be better in a medical center (Athlete).* *The two rooms were so different. The lighting, the arrangement. The table and chair were together in one room and separate in the other. This was not fair (Athlete).*

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Communication and understanding of the new classification system

Each group was asked to rate how clearly information regarding the new classification system was communicated to them before attending the assessment event. They were also asked to rate how well they understood the reasons for implementing a new classification system. Figure 6 shows the median ratings for each of the two questions. It is clear that stakeholders possessed a good understanding why there was a new classification system, but that they were unsatisfied with the level of information they received about the new system in advance of arriving at competition.

[Insert Figure 6 around here]

The ratings provided by each group (athletes, coaches, and classifiers) with relation to how clearly information about the new system was communicated and the understanding of why the new system was implemented are provided in Figure 7. The athletes were least satisfied by the level of communication provided to them and indicated the least understanding for why there is a new system in comparison with the other groups. These differences were, however, not significant [χ^2 (2) = 4.50, p = 0.11 and χ^2 (2) = 5.96, p = 0.051 respectively].

[Insert Figure 7 around here]

During the interviews, it was clear that all groups felt that the communication of the new system could be improved (see specific comments in Table 4). All groups indicated that they would like a more direct line of communication from the International Federation to improve transparency rather than through their national sporting federation. Many participants explained that the information from the IPC often does not reach the athletes and coaches. It was pointed out that communication about a new classification system was particularly important for athletes and coaches because it would help them to determine whether they would be eligible to compete or not. Some indicated that they may have decided not to attend classification if they realized the rules had changed and they may no longer be eligible to compete.

386 **Table 4. Comments regarding the communication and understanding of the new system**

Responses from each group	Athletes	Coaches	Classifiers
Communication about the new classification system before attending the assessment	*There are many communication gaps, we don't get any information. This caused a lot of misunderstandings and a lot of stress. We need to get information directly from the IPC to the sportsman, not just to the federations. It would be simpler and more transparent for everyone.*	*It should have been clear in advance what tests would be done. We expected visual field testing to be done and it was not.* *We should have had information beforehand. We can then decide not to come if the criteria would not be reached. This will help stop a lot of the frustration, stress, and expense we have if the criteria are not reached.* Incidental finding: *There was a lot of confusion about which forms to fill in. The forms had also changed. They randomly had a new form. This form was good but was not well communicated. Emailing us the new form before-hand would have been good.*	*Yes, I read the report about the new system. It was developed over 4-5 years.* *I was just told about the new rules when I arrived.*
Understanding why there was a new classification system i.e. change in the assessment process	*Only a few tests were done today. Nobody explained why there were not more tests done today.* *I don't understand why some test are not included anymore.*	*I had no idea that anything had changed. I don't understand why some tests are no longer included.* *You have to be proactive and ask questions if you want to get any information.*	*We were given the research report that was done, but it was not explained to us so I don't fully understand the changes.*

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Classifier training

The four classifiers rated how adequately they were trained to perform the assessments using the new classification system. There was a range of ratings between 1-5 with a median of 3.5 (individual scores of 1, 3, 4 and 5). During the interview, it was clear that some classifiers were more familiar with the procedures and that others were not. This was clear in comments such as:

No training was given regarding the rules. We were just informed by the chief classifier who explained that it was the first time using these rules.

Discussion

The aim of this study was to establish the opinions of key stakeholders when exposed to a new sport-specific evidence-based classification system for VI para-shooting. Athletes, coaches, and classifiers who attended the first classification event using the new system rated different aspects of the process and were interviewed to obtain a more in-depth understanding of their experiences. This discussion focuses on the findings regarding the (i) comparison of the previous and new classification systems, (ii) experiences during the assessment process using the previous and new systems, (iii) communication and the understanding of the new system, and (iv) the training of the classifiers. The results uncover some of the uncertainties experienced by para-athletes and other key stakeholders when exposed to a new system of classification, and provide advice and guidelines for improving the implementation of new classification systems in the future.

An important aspect of this study was to establish the views of stakeholders regarding the previous and new classification systems. Participants rated the previous and new classification systems in terms of whether they were unbiased, treated people with different types of vision impairment equally, lowered the chances of intentional misrepresentation, and how specific they were to VI shooting. The responses for the overall ratings for the new classification system were better than those for the previous system, although there was not a statistically significant difference in the ratings. Participants indicated that intentional misrepresentation was less likely in the new classification system when compared to the previous system. Concerns did though remain, particularly among classifiers, largely because of how the testing was conducted, in particular that the number of different test charts is limited (there are usually several different versions of charts to prevent people from learning the symbols on the chart), and that classification continues to use non-electronic test formats, as explained "*The equipment used needs improving. The charts looked unprofessional and came across as a bit improvised" and "It would be fairer to use more objective machines where people can't cheat."* If stakeholders believe intentional misinterpretation is easy, it gives them less faith in the classification system and assessment process. This was highlighted by Powis and Macbeth (2019), who found that VI athletes did not have confidence in the current classification system for the sport of cricket, or the process itself, largely based on speculation regarding intentional misrepresentation. Thus, further work to ensure the classification process is robust and minimizes intentional representation is important. Standardizing the assessment by including computer or tablet-based testing where

the letters can be randomized and using staircase techniques used can assist as outlined "*We need the tests on a tablet or laptop to randomize the test. If we use the staircase approach they can't make predictions which will make it fairer for everyone (Classifier).”* It is worth noting that an advantage of logMAR charts is that they present 5 letters per line for all levels of VA, however, with computer or tablet-based VA tests this is generally not possible due to the limitation of screen size.

A new system of classification was developed for VI para-shooting to ensure that the sytem was *sport-specific*. Para-shooting actually represents the first VI sport to have adopted a sport-specific system of classification, meaning that we have taken the opportunity to canvas the experiences of the first VI athletes to experience the implementation of a new sport-specific system. Participants indicated that the new system was more specific to VI shooting. They were pleased with the research that has gone into the new system as indicated by comments such as *“I am happy they are working towards making the classification more specific for vision loss (Athlete*)". Because sport-specificity is a requirement for any new classification system (IPC, 2017), it is noteworthy that stakeholders can identify that this has been achieved. All groups of participants (athletes, coaches, classifiers), however, felt that improvements could still be made, with comments such as "*They need to continue to work at making the classification fairer and more specific for VI shooting.”* Overall, the athletes and coaches agreed that VF testing should not be included in classification. The classifiers were, however, not in agreement, and felt that VF testing should be included, particularly when there were discrepancies in the results of the VA and/or CS tests. These differences in views were reflected in the overall rating of the new classification system, with the classifiers' ratings being lower than both those of the athletes and the coaches. These perceptions may be partly related to not all the classifiers receiving training regarding the new classification system and thus not understanding the rationale and evidence-based research from which it was derived (from e.g. Allen, Latham, Ravensbergen, Myint and Mann, 2019). Ensuring sufficient training before future classification events is central for evoking the buy-in of all stakeholders and this should be mandatory when implementing a new system.

The exclusion of VF testing from classification was expected to result in an assessment procedure that would be shorter and viewed as less stressful and complex. Overall ratings regarding satisfaction with the new classification procedure in terms of speed, associated stress and complexity were improved for the new system when compared to the previous system, although these differences were not significant. Satisfaction was associated with the ease of testing, as indicated by comments such as *“I like the new system because it took less time. It was easy and not stressful*" and *“The tests were faster than previously.”* It was reported that although the testing was shorter, the questioning during the classification lengthened the overall process, as indicated with comments such as *“…but they asked lots of questions today.”* Although overall the testing itself was not perceived as stressful, there were other contributing factors that made the overall process itself stressful. This included high ambient noise levels, communication barriers, and uncertainty regarding the assessment. Communication barriers were one of the most frequently recurring themes indicated by comments such as *“I didn't understand them which was stressful. They used many technical terms I did not understand. They made no allowance if you did not understand English. This caused a lot of stress (Athlete).”* The athletes and coaches felt more could be done to address this by either having a translator, using a translation smartphone app, or by using pre-recorded instructions during classification to bridge communication barriers.

When comparing the group ratings, the athletes and coaches rated previous classification experiences lower than the classifiers did. Although questioning focused on the classification process, it was clear that many participants found that the classification conditions were not ideal. When these ratings were investigated further during the interviews, it was identified that the assessment environment at this specific event was not satisfactory. Those with VI are reliant on certain levels of uniform lighting and may find it easier to perform the tests when there is not a lot of noise. In terms of the lighting and noise, there was a lot of variation, as shown by comments such as: "*Standardization is needed in the facilities. The two rooms had different layouts and different lighting conditions. This was not fair."* Standardizing the assessment to reduce variation between classifiers and venues requires significant attention. The level of lighting used is of particular importance, reflected by comments such as *"The contrast test needs optimal light and the lighting was very poor".* Discrepancies, especially in the uniformity of lighting both within and between testing locations were viewed as unfair. This could affect people with various ocular conditions differently, e.g., athletes with ocular albinism would be disadvantaged if the lighting was too bright, whereas, people with retinitis pigmentosa would be disadvantaged in dimmer illumination. Factors such as the unstandardized lighting, rather than the classification system itself, may have contributed to participants' perceptions that the new system was not treating different eye conditions equally, as indicated by comments such as "*The lighting was very poor. For some this may be okay, but it made it very difficult for me (Athlete).* It is vital to ensure that the entire classification process, including the classification conditions, are as consistent as possible (Mann and Ravensbergen, 2018).

Some misconceptions were evident about the new system. This may be partly attributed to the failure of relevant communication about the new classification system in reaching the athletes. Very few athletes indicated any prior knowledge about the changes to the classification procedure, with comments including *"There was no clear information, nothing was communicated."* A lot of confusion was evident surrounding the cut-off values for the minimum impairment criteria, as these were interpreted as being too strict with comments such as *"We need more research to compare the cut off values (Classifier)."* This was particularly surprising because the cut-off for VA was more inclusive (not less inclusive) in the new classification system. Ways of streamlining communication to ensure that timely and accurate information reaches all groups (athletes, coaches, and classifiers) should be prioritized. This may be via dedicated, easy to locate information on the website of World Para Shooting.

This research has provided insight into the perspectives of a new sport-specific Para Shooting classification system for athletes with a vision impairment. The study had some limitations that should be considered when interpreting the findings. When completing the questionnaire and interviews, most athletes were accompanied by a significant other or their coach. It is possible that not being alone may have altered their responses. Moreover, these data were only collected from one classification venue and are not representative of all instances of classification. The small sample size did also not allow sufficient power to draw definitive conclusions. This research was undertaken during the first time the new classification system was used. In time, experiences with the new system may vary. Future work will be able to, with time, evaluate the fairness of the new system, in particular to determine whether competition remains legitimate with the inclusion of the newly eligible athletes (with VA 0.6-1.0logMAR and CS < 1.4logCS) or rather whether they might possess an advantage over their competitors. Significant language barriers were present and many oral interviews and questionnaires were completed using translation. These language barriers certainly prohibited

the flow of conversation-making and thus in-depth exploration of the participants' views was challenging. These findings have, however, identified that further work is required to improve the entire process to assist VI athletes. This is important given that new systems of classification are on the horizon for other sports including VI swimming, alpine skiing, judo, and Nordic skiing. Efforts to ensure everyone involved receives clear communication regarding the classification process should be prioritized.

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The authors declare that there is no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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References

Abt G, Boreham C, Davison G, Jackson R, Nevill A, Wallace E, Williams M (2002) Power, precision, and sample size estimation in sport and exercise science research. *Journal of Sports Sciences* 38(17): 1933-1935. DOI:10.1080/02640414.2020.1776002.

Allen PM, Latham K, Mann DL, Ravensbergen RH and Myint J (2016) The level of vision necessary for competitive performance in rifle shooting: setting the standards for paralympic shooting with vision impairment. *Frontiers in Psychology* 7: 1731. DOI:10.3389/fpsyg.2016.01731.

Allen PM, Latham K, Ravensbergen RH, Myint J and Mann DL (2019) Rifle shooting for athletes with vision impairment: does one class fit all? *Frontiers in Psychology* 10: 1727. DOI: 10.3389/fpsyg.2019.01727.

Allen PM, Ravensbergen RH, Latham K, Rose A, Myint J, and Mann DL (2018) Contrast sensitivity is a significant predictor of performance in rifle shooting for athletes with vision impairment. *Frontiers in Psychology* 9: 950. DOI:10.3389/fpsyg.2018.00950.

Blauwet C and Willick SE (2012) The Paralympic Movement: using sports to promote health, disability rights, and social integration for athletes with disabilities. *Physical Medicine and Rehabilitation Journal 4*(11): 851-856.

Braun V and Clarke V (2006) Using Thematic Analysis in Psychology. *Qualitative Research in Psychology 3*(2): 77-101.

Committee IP (2017) *IPC Athlete classification.* Bonn, Germany: IPC. Available at: https://www.paralympic.org/ (accessed 12 September 2019).

Dillman DA, Smyth JD and Christian LM (2014) *Internet, phone, mail, and mixed-mode surveys: the tailored design method.* Hoboken, New Jersey: John Wiley and Sons.

Faul F, Erdfelder E, Buchner A, Lang AG (2009) Statistical power analyses using G* Power 3.1: Tests for correlation and regression analyses. *Behavior Research Methods*. 1;41(4):1149-1160.

Faul F, Erdfelder E, Lang AG, Buchner A (2007) G* Power 3: A flexible statistical power analysis program for the social, behavioral, and biomedical sciences. B*ehavior Research Methods* 1;39(2):175-191.

Fossy EC, Harvey F, McDermott F and Davidson L (2002) Understanding and evaluating Qualitative Research. *Australian and New Zealand Journal of Psychiatry* 36(6): 717-732.

Gold JR and Gold MM (2007) Access for all: the rise of the Paralympic Games. *Journal of the Royal Society for the Promotion of Health* 127(3): 133-141.

IBM Corp. IMP SPSS Statistics for Windows Version 24.0 (2016) Armonk, NY: IMB Corp.

International Paralympic Committee (2017) *IPC Athlete classification code rules, policies and procedures for athlete classification.* Bonn: International Paralympic Committee. Available at http://www.paralympic.org.

Krabben KJ, Ravensbergen RH, Nakamoto H and Mann DL (2019) The development of evidence-based classification of vision impairment in Judo: A delphi study. *Frontiers* 10, 98. DOI:10.3389/fpsyg.2019.00098.

NVivo qualitative data analysis software version 12 (2018) QSR International Pty Ltd.

MacAloon J (1981) *This Great Symbol: Pierre de coubertin and the origins of the modern Olympic Games.* Chicargo: University of Chicago Press.

Mann DL and Ravensbergen HJ (2018) International Paralympic Committee (IPC) and International Blind Sports Federation (IBSA) Joint Position Stand on the Sport-Specific Classification of Athletes with Vision Impairment. *Sports Medicine:* 38(9): 2011. DOI:10.1007/s40279-018-0949-6.

606 Mashkovskiy E, Magomedova A and Achkasov E (2019) Degree of vision impairment
607 influence the fight outcomes in the Paralympic judo: a 10-year retrospective analysis.
608 *The Journal of Sports Medicine and Physical Fitness* 59(3): 376-379.
609 DOI:10.23736/S0022-4707.18.08232-4.
610 McVeigh SA, Hitzig SL and Craven BC (2009) Influence of sport participation on
611 community integration and quality of life: a comparison between sport participants
612 and non-sport participants with spinal cord injury. *Journal of Spinal Cord Medicine*
613 *32*(2): 115-124.
614 Myint J, Latham K, Mann D, Gomersall P and Wikins AJ (2016) The relationship between
615 visual function and performance in rifle shooting for athletes with vision impairment.
616 *BMJ Open Sport and Exercise Medicine, 2*: e000080. DOI:10.1136/bmjsem-2015-
617 000080.
618 Powis B and Macbeth JL (2019) "We know who is a cheat and who is not. But what can you
619 do?" Athletes' perspectives on classification in visually impaired sport. *International*
620 *Review for the Sociology of Sport*. DOI:10.1177/1012690218825209.
621 Ravensbergen RH, Mann DL and Kamper SJ (2016) Expert consensus statement to guide the
622 evidence-based classification of Paralympic athletes with vision impairment: a Delphi
623 study. *British Journal of Sports Medicine* 50: 368-391. DOI:10.1136/bjsports-2015-
624 094534.
625 Tong AP, Sainsbury J and Craig J (2007) Consolidated criteria for reporting qualitative
626 research (COREQ). A 32-item checklist for interviews and focus groups.
627 *International Journal for Quality in Health Care* 53(7): 349-357.
628 Tweedy SM, and Vanlandewijck YC (2011) International Paralympic Committee position
629 stand—background and scientific principles of classification in Paralympic sport.
630 *British Journal of Sports Medicine 45*(4): 259-269.
631 Tweedy SM, Beckman EM and Connick MJ (2014) Paralympic classification: conceptual
632 basis, current methods, and research update. *Physical Medicine and Rehabilitation*
633 *Journal 6*(8): S11-S17. DOI:10.1016/j/pmrj.2014.04.013.
634 World Health Organization (2004) *International Statistical Classification of Diseases and*
635 *Related Health Problems.* Geneva: World Health Organization.
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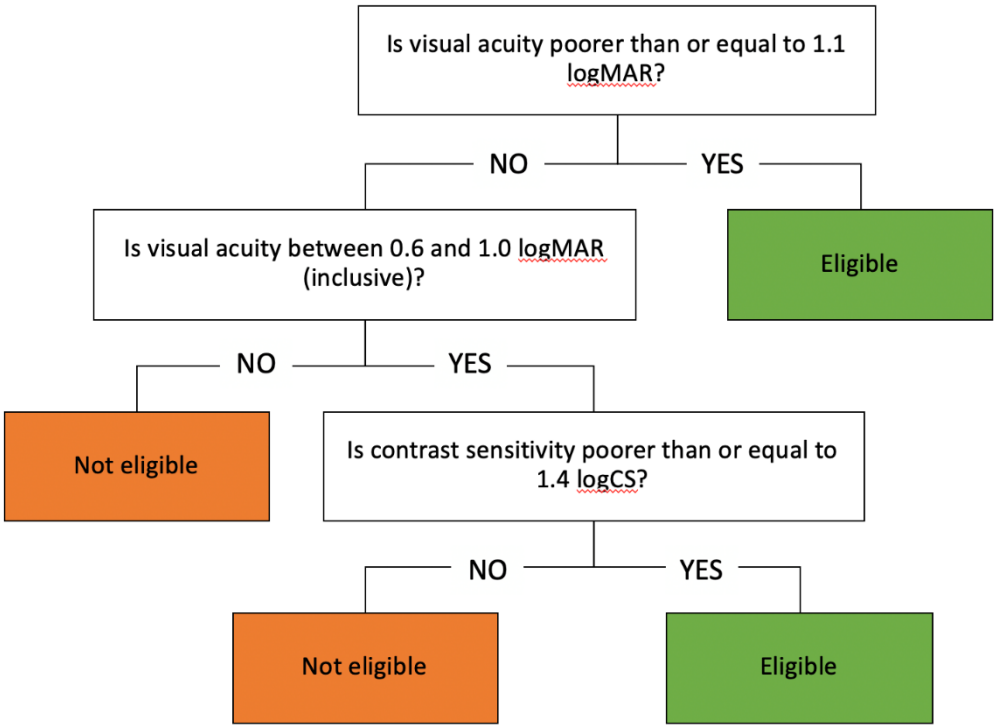
[Insert Appendix 1 around here]

638 **Figure 1**

639 Summary of the new World Para Shooting classification system for athletes with a vision
640 impairment



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642 **Figure 2**

643 Comparison of the new and previous classification system. Higher scores reflect greater
644 satisfaction.

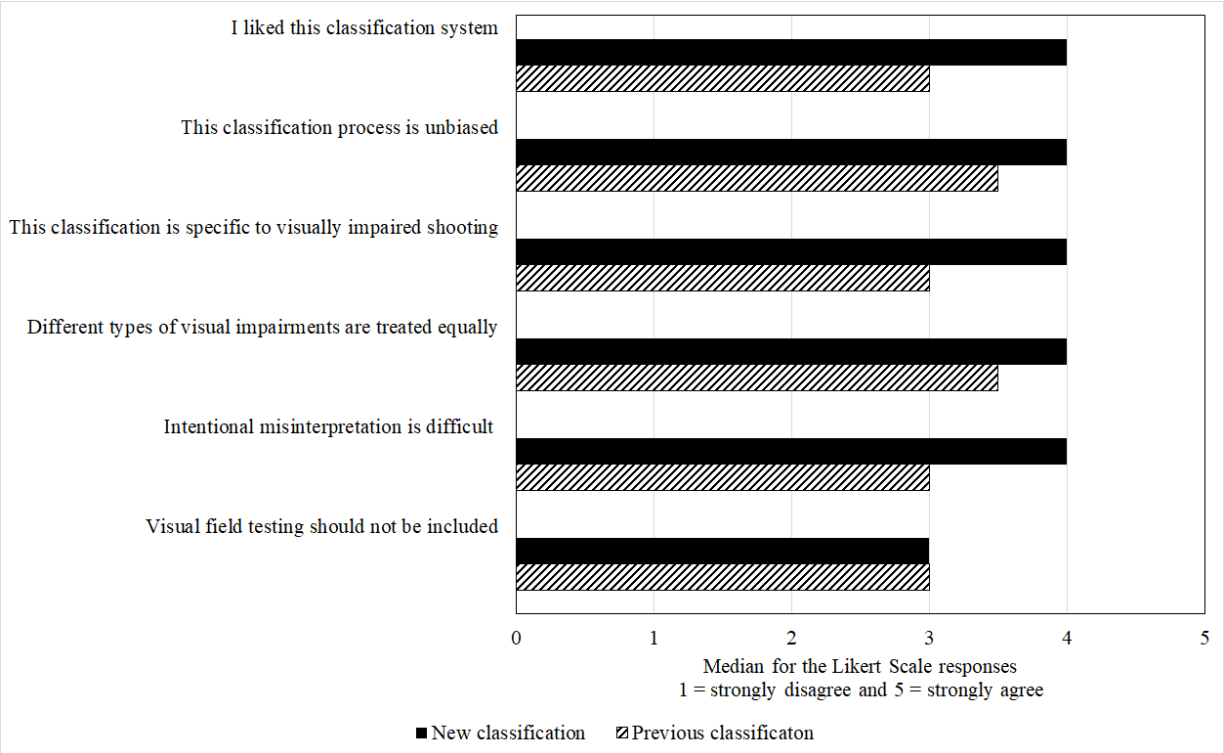

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Figure 3

Comparison of the classification systems for each group. Error bars indicate standard error. Higher scores indicate more satisfaction.

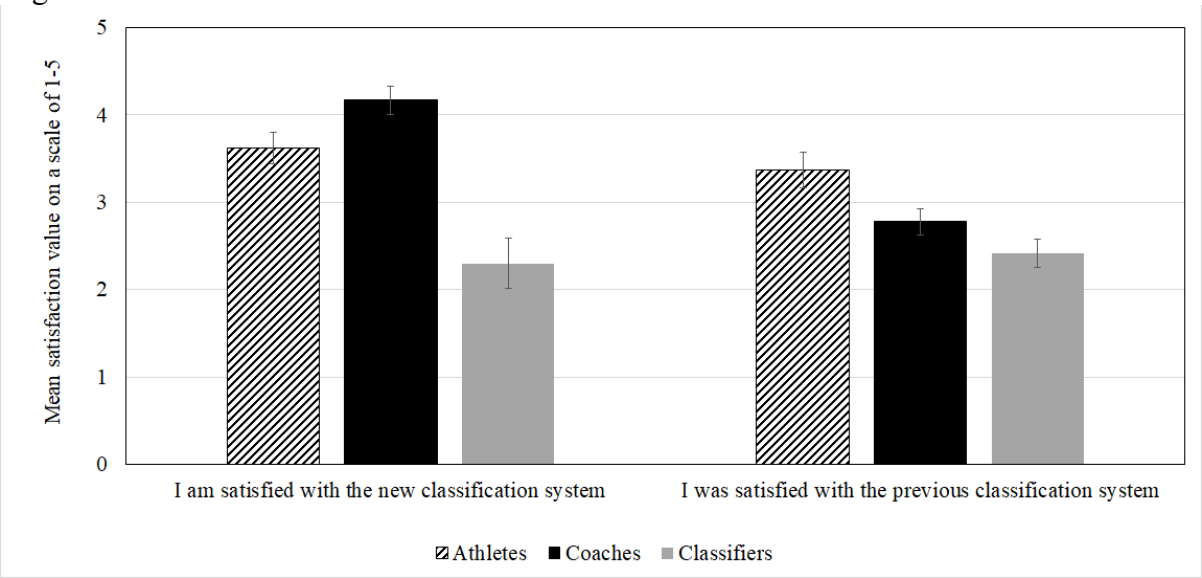

Figure 4

Comparison of the experiences regarding the new and previous classification system. Higher scores indicated more satisfaction.

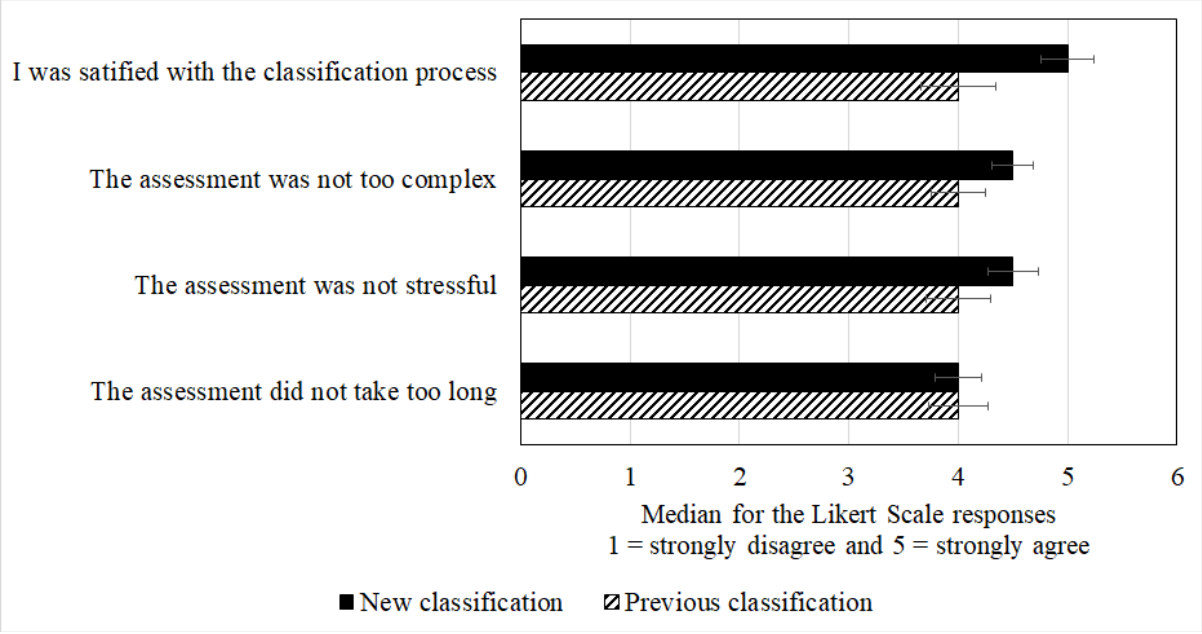

Figure 5

Comparison of the overall experiences during the assessment process using the new and previous classification systems for each group. Error bars indicate standard error. Higher scores indicate more satisfaction.

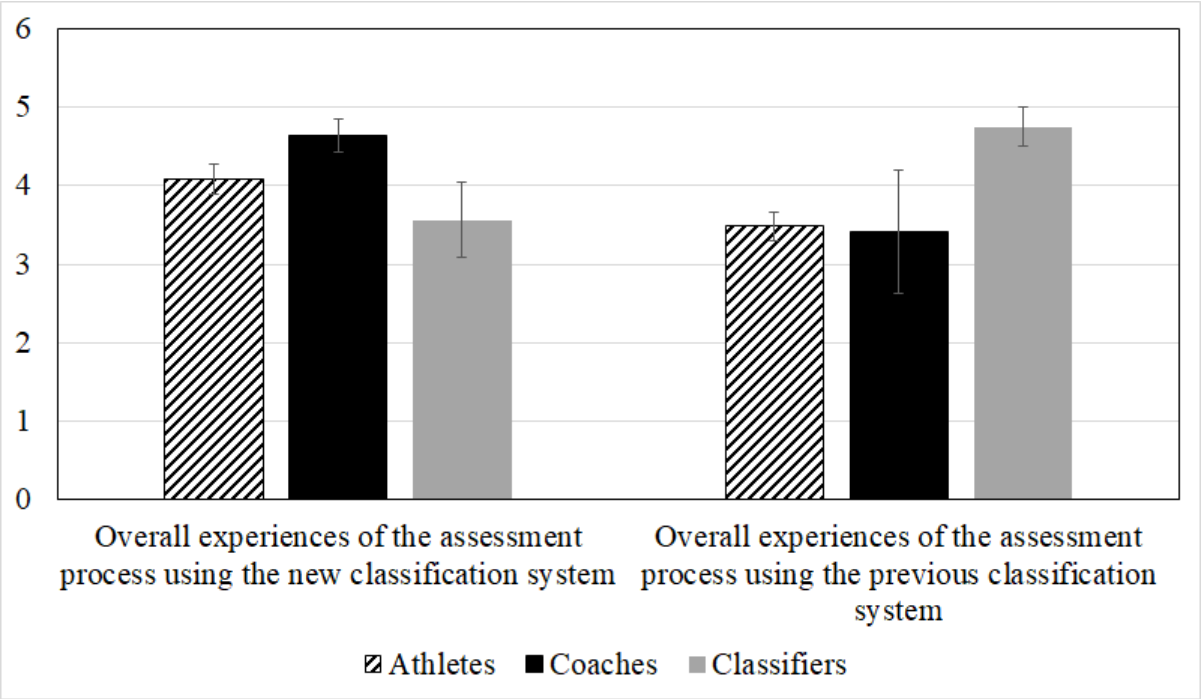

Figure 6

Comparison of the ratings regarding how clearly the information regarding the new classification system was communicated and understood.

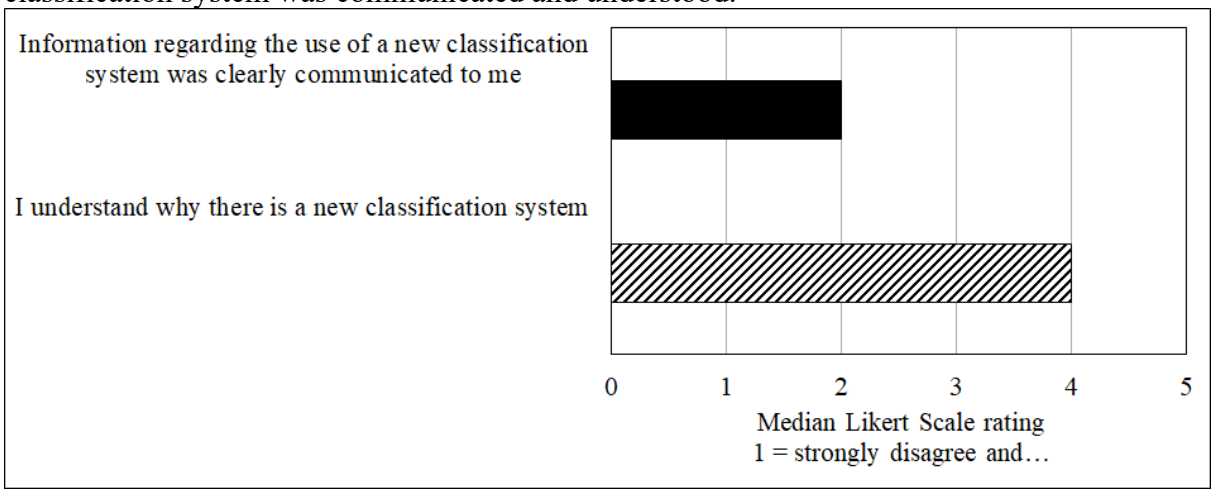

Figure 7

Comparison of the communication and understanding of the new system between the groups. Higher scores represent more satisfaction.