

Impact of Traditional Versus Interactive Point-Of-View Video-Based Training Methods on Situational Confidence Levels in Intramural College Basketball Officials

Author Information:

Kevin Feller, Kyle Mechelin, Geoffre Sherman, Brian Krohn, David Pierce¹

*¹Sports Innovation Institute, Indiana University – Purdue University
Indianapolis, Indianapolis, IN USA*

Corresponding Author Information:

*David Pierce
Email: dpierce3@iupui.edu*

Article Type: Original Research

ABSTRACT

Purpose: The purpose of this research was to examine the confidence level of college level intramural basketball officials and how different training methods, traditional and interactive point-of-view (POV) video-based, affect their perception on their confidence to perform their job accurately and in stressful environments. **Methods:** There were 13 control participants who trained with the college intramural programs referee training protocols and there were 21 participants who trained with interactive POV video-based technology. Both groups answered 12 questions pre- and post-test on their perceived officiating confidence levels. The data was analyzed using an independent sample T-Test to determine if there are any differences between the means of two groups on each question. **Results:** Three questions showed significant results with the POV video-based group proving greater positive changes in confidence levels from the pre to post-test than the control group: "ability to possess the most extensive knowledge of the rules compared to anyone else present at the game," "the participants confidence in their ability to determine if a foul or violation had been committed," and the participants being "confident in their ability to make consistent calls." **Conclusion:** Interactive POV video-based training can increase confidence levels of collegiate intramural basketball officials.

Keywords: (sports officiating; sports technology; sports innovation)

1. INTRODUCTION

There is a nationwide shortage of sports officials negatively affecting youth sports across the United States. The declining pool of sports officials has manifested through games being rescheduled or canceled (Neddenriep, 2021), games having smaller officiating crews (Demsky, 2021), and with referees working multiple games in a day to cover the shortage (Mills, 2020). States like Florida and Michigan have both seen their populations of active sports officials drop by roughly 25% between 2009 and 2019 (Barnhouse, 2019; Lacy, 2019). Other states have seen sharper declines in shorter periods, with Nevada losing 37% of their officials between 2015 and 2016, and Oregon with a drop of 12% over a three-year period (Ohio University, 2018).

A major factor contributing to this decline is that new officials do not stay in the role for very long. According to the National Federation of High Schools, 80% of new officials leave the profession in the first two years (Leighton, 2017). That is a high percentage, compared to the annual attrition rate of all sports officials, which is right around 20% (Livingston, 2017). As a result of this high churn rate for new officials, the average age continues to increase as there are not enough younger officials available to replace the retiring officials. The most common official is in their mid-50's and coming to the point of retirement (Officially Human, 2019). These constraints are causing sport governing bodies to rely on their population of aging referees heavily, which puts them at risk of burnout or injury, and a population of underprepared referees that is rapidly churning. The present solutions to the problem lead to poor quality officiating and worse matches for the athletes (Szulik & Gieson, 2019). Without action, access to sports at all levels will continue to be diminished.

Officially Human (2019) found the primary driver for people to become a sports official was one's love of sports. In fact, 70% of the 19,000 sports officials surveyed in the study selected "love of sports" as one of their top two reasons for officiating. The vast majority of sports officials officiate as a hobby, avocation, or to earn supplemental income (NASO, 2002). An avocation can be defined as a secondary occupation an individual chooses to participate in, in addition to their primary occupation (Eitzen, 1989). From this definition, those people who get involved in officiating and other positions in sports primarily have careers outside of officiating. This means that the avocation that these individuals choose is important to them because it takes up more of their time in addition to the time that their primary career consumes. This is an important piece of the puzzle when trying to understand why officials get started, train, and eventually depart from their position.

Most sports officials conduct their job with the utmost seriousness and want to find ways to improve upon their craft. However, officials are limited in the types of training available. Pierce et al. (2021) and Officially Human (2019) found that reading the rule book was by far the most utilized method of learning how to officiate. Another widely popular approach to training a group of officials is the preseason clinic. McKennitt et al. (1990) found that 100% of their respondents implemented this approach, but that officials in the study perceived these camps to be of little value compared to practical experience, observation, evaluations, and audio-visual aids. Recently, video-based training has become more popular and has been shown to improve decision-making skills in young officials (Larking et al., 2017). However, video-based training still is not utilized in every league, and the extent to which it is used varies. Officially Human (2019) reported that 63% of officials believe that their fellow colleagues at their same level needed more and better forms of training. Pierce et al. (2021) found that rookie officials, which are those who are within their first two years of officiating, wanted more experience before they began to officiate in front of demanding crowds. These findings align with Warner et al. (2013) who found that after their primary training, officials receive minimal or no training after games, apart from a few association meetings, most officials are left stranded and poorly prepared to succeed on the field once their initial training has been completed. The current referee training model does not deliver training at scale or efficiently.

Many researchers in the neuroscience field suggest that video-based training, such as virtual reality (VR), are deemed as effective because VR draws on a fundamental mechanism in the brain known as embodiment (Riva et al., 2019). Embodiment refers to the integration of a person's incoming sensory signals to their body, which the brain then uses to generate a self-representation (Matamala-Gomez et al., 2019). Studies conducted in the neuroscience field have shown that during simulated practice, which in this case is VR, the individuals can experience a sense of embodiment (Slater et al., 2008). The greater the sense of embodiment an individual achieves through these simulated practices, the more fully the sensorimotor system is engaged, which fully enhances the potential to develop a more desirable behavioral change (Bohil et al., 2011). Kittel et al. (2020) performed a study into the impact of 360-degree VR training and found that VR training did not yield significantly improved results to traditional video training, but that the VR group found the training experience more enjoyable and more alike to a real game. Future research from this study suggested that researchers explore the potential use of other technologies to mimic in-game decision-making practice.

Based on the dire need to curb the decline of sports officials and provide modern, useful training for officials, the purpose of this study is to determine if interactive point-of-view video-based (IPOVVB) training affects confidence in college level intramural basketball officials compared to traditional training methods.

2. METHODS

A new sports technology company, RefReps, developed a beta prototype software that allows for IPOVVB basketball training. This research was conducted in the prototype phase of software development to assess feedback and results from the collegiate intramural market. RefReps is a new, interactive way of training and learning the rules of officiating for multiple sports. This research used the prototype beta version of the product, which used the Xbox Kinect device to track human motion to perform signals and make calls. Each sport includes 25 first-person scenarios and situations where the trainee is presented with a play, and they make the call using motion sensors which are tracked on the Xbox Kinect technology. POV video allows the official to experience game-like conditions.

2.1 Survey Development

The survey questions were developed based on the synthesis of the review of literature. An initial draft of questions was developed and shared with sports officiating experts and feedback was gathered. The questions went through several rounds of revision and the final set of questions was distributed to the intramural coordinators participating in this study. They agreed the questions were appropriate for the study and approved the survey for distribution. Approval for the study was acquired from the Institutional Review Board at the primary author's institution, and consent was acquired by answering the first survey question in the affirmative that the informed consent statement had been read by the participant.

2.2 Research Design

This study focuses on the training methods of referees for college intramural programs. Each intramural program split their sports officials into two different groups, the control and the treatment group. The control group learned how to officiate using the traditional training methods provided by the universities. Each of these training methods is different in their own way, but the focus was on not changing how they are learning to officiate from the previous years. The treatment group used IPOVVB training (RefReps). This group used RefReps to learn throughout the intramural season, rather than only training prior to the season.

2.3 Data Collection

Data was collected via a pre- and post-test survey given to a control (n = 13) and treatment (n = 21) group. The RefReps training was administered throughout the 4-6-week intramural season at each university. The same pre-test survey was given to all the participants after they completed their usual university training, but before they started officiating the intramural college basketball season. The post-test was split into two separate surveys, the first being exclusively for the control group and the second being exclusively for the test group. Both surveys looked at confidence level and how their training can affect their overall confidence in their performance as officials.

2.4 Participants

A total of 34 participants completed the study. The participants were all college students currently enrolled at their university, comprised of 38.2% Freshmen, 26.5% Sophomores, 17.6% Juniors, 14.7% Seniors, and 2.9% Graduate level or higher. Beginner level officials made up 17.6% of participants, 52.9% of participants classified themselves as novice level officials, and 29.4% of participants classified themselves as expert level officials. Participants did not have to have prior training as an official, with 58.8% of officials being in their first season and 41.2% of officials having one or more years of prior work as an official.

2.5 Statistical Analysis

The independent variables in this study are the two different groups (control and treatment). The dependent variables are the difference scores for each question that was asked pre and post-test. The difference scores were calculated by taking the difference in score from the pre-test and the post-test. This difference score that was created is the reason data was analyzed as an independent sample T-Test rather than a repeated measures analysis of variance. The data was analyzed using an independent sample T-Test to determine if there are any differences between the means of two independent groups on a continuous dependent variable. The dependent variables were the questions on the survey regarding the official's confidence level surrounding different areas of officiating. Twelve questions were asked and analyzed to determine if there were any significant differences between the control group and the RefReps group's confidence levels.

3. RESULTS

There were 13 control participants who trained with the college intramural programs referee training protocols and there were 21 participants who trained with RefReps. An independent t-test was run to determine if there were differences in confidence level between a control and the RefReps group. Nine out of the 12 questions showed no significance when analyzed between the two groups. The three questions that showed the most significant change in confidence level were the participants "ability to possess the most extensive knowledge of the rules compared to anyone else present at the game," "the participants confidence in their ability to determine if a foul or violation had been committed," and the participants being "confident in their ability to make consistent calls."

3.1 Confident in ability to better understand rules

The change in confidence (M) for the treatment group (Change in M = .52, SD = .81) was greater in their ability to "possess the most extensive knowledge of the rules compared to anyone else present at the game" compared to the change in mean of the control group (Change in M = -.08, SD = .64) The treatment group change in mean confidence score was 0.60 (SE = 0.27) higher than the control change in mean confidence level score. There was a statistically significant difference in the change of mean confidence level scores between the control and treatment groups, $t(29.99) = 2.392, p = 0.023$.

3.2 Confident in ability to determine if a foul has been committed

When it came to determine if the participant was confident in their ability to determine if a foul or violation had been committed, the change in confidence (M) for the treatment group (M = 0.33, SD = 0.66) was greater than the change in confidence for the control group (M = 0.00, SD = 0.00) The treatment change in group mean confidence score was 0.33 (SE = 0.14) higher than the control groups change in mean confidence level score. There was a statistically significant difference in the change of mean confidence level scores between the control and treatment groups, $t(20) = 2.320, p = 0.031$.

3.3 Confident in ability to make consistent calls

The change in confidence (M) to make consistent calls for the treatment group (M = 0.38, SD = 0.59) was greater compared to the control group (M = 0.08, SD = 0.28). The treatment group change in group confidence score was 0.30 (SE = 0.15) higher than the control groups change in mean confidence level score. The results here show close significance ($p = .05$) in

mean confidence level scores between the control and treatment groups, $t(30.38) = 2.028, p = 0.51$

3.4 Non-Significant Results

The rest of the 9 independent variables that were assessed returned insignificant results. These variables were: ability to stand in the correct position, ability to know which zone to monitor, ability to move their eyes and body to the right position, ability to apply their knowledge of the rules to make the right call, ability to stay calm in pressure situations, ability to explain a call in question to a coach, ability to make a call with conviction, and ability to control the flow of the game.

Table 1

Question	Levene's equality of variance			Equality of Means				
	Equal Variance	F	Sig.	T	DF	Sig. (2-Tail)	Mean Difference	Std. Error Difference
Stand in correct position	Assumed	.128	.723	-1.669	32	.105	-.172	.103
	Not Assumed	----	----	-1.703	27.188	.100	-.172	.101
Know which zone to be monitoring	Assumed	.554	.462	-.546	32	.589	-.095	.174
	Not Assumed	----	----	-.583	30.536	.564	-.095	.163
Move eyes and body to make correct call	Assumed	3.739	.062	.444	32	.660	.047	.107
	Not Assumed	----	----	.568	20.000	.576	.047	.083
Understand rules better than anyone else*	Assumed	5.648	.024	2.260	32	.031	.600	.265
	Not Assumed	----	----	2.392	29.991	.023	.600	.251
Apply knowledge of rules to make right call	Assumed	10.967	.002	1.135	32	.265	.190	.167
	Not Assumed	----	----	1.451	20.000	.162	.190	.131
Determine if a foul has been committed*	Assumed	20.405	.000	1.815	32	.079	.333	.183
	Not Assumed	----	----	2.320	20.000	.031	.333	.143
Stay calm in pressure situations	Assumed	.008	.927	1.253	32	.219	.201	.160
	Not Assumed	----	----	1.339	30.584	.190	.201	.150
Explain a call to a coach in question of said call	Assumed	18.563	.000	1.219	32	.232	.238	.195
	Not Assumed	----	----	1.558	20.000	.135	.238	.152
Perform well in hostile environments	Assumed	.507	.482	-.255	32	.800	-.047	.186
	Not Assumed	----	----	-.278	31.492	.783	-.047	.171
Make a call with conviction	Assumed	4.904	.034	1.229	32	.228	.267	.217
	Not Assumed	----	----	1.479	27.576	.150	.267	.180
Make consistent calls*	Assumed	15.672	.000	1.737	32	.092	.304	.175
	Not Assumed	----	----	2.028	30.383	.051	.304	.149
Be in control of the flow of the game	Assumed	1.904	.177	.893	32	.378	.142	.159
	Not Assumed	----	----	.928	28.639	.361	.142	.153

* $p < .05$

4. DISCUSSION

The purpose of this research was to look at the confidence level of college level intramural basketball officials from colleges around the United States and how different training methods, traditional and IPOVVB, affect their perception on their competency to perform their job accurately and in stressful environments. Students officiating intramural basketball at three universities were asked 12 questions about their confidence level in different areas of officiating. The treatment group showed significant improvement on three of the 12 questions compared to the control group. The first question pertained to the officials' confidence in their ability to possess the greatest knowledge of the rules compared to anyone else that is present at the game. This, in simpler terms, is gauging how much the official thinks they know compared to the fans, coaches, players, and parents at the game. The results showed that the treatment group increased their mean confidence level in their knowledge rules compared to the control group. The treatment group was able to see the calls through interactive video-based content rather than seeing them in a book without any motion. Next, the treatment group increased their mean confidence level in their ability to determine if a foul or violation had been committed compared to the control group. This is another similar situation where the treatment group increased their confidence due to their video-based training compared to the control group that experienced fouls and violations via PowerPoint or readings. Based upon these results, the research shows that in some situations, different training methods can affect the confidence level of an official, with the trend being that RefReps IPOVVB training increases an official's mean confidence level compared to traditional training methods used by these college intramural programs. This moderately confirms support for IPOVVB training with regard to increasing confidence for young officials.

Kittel et al. (2020) outlined that 360-degree VR training scored higher than the control group on the overall retention of knowledge of the rules test. Scoring higher on the retention test would then translate into understanding the rules and being able to apply them more confidently. This study also had a smaller sample size (N = 25) which makes it similar to this study as well. These results in turn showed evidence that virtual reality training was more effective than the basic training provided by the control groups. What is not known is if these intramural programs used match broadcast or similar video training, because Kittel's results show that there is no significant difference between match broadcast training and virtual reality training.

4.1 Limitations

The largest limitation on this specific study was due to the pandemic that occurred during the time of the pre and post-test surveys. When trying to recruit participants, many colleges and universities that were contacted had canceled their intramural programs due to the COVID-19 outbreak. This created a shortage of programs that could be contacted for participation, which then led to the small sample size for this study. The difference in size between groups with such a small sample size increased concerns for equality of variance, which impacted where significant results were indicated.

In addition to small sample size, there were wide variations in the manner of delivery of traditional training at each intramural program. With each college intramural program being different, the difference in control training groups could have been drastically different. This would have caused differences in responses from each college program and their participants. Finally, control participants were not training throughout the season like the RefReps participants were. This could have affected the controls confidence level due to them not refreshing their recollection of the rules throughout the season.

4.2 Future Research

Future research in the space of virtual officiating training is necessary to further understand the impacts it can have on the confidence and longevity of officials. Walker et al. (2018) found that only 17 percent of officials receive training in a video format, which includes virtual training. The bulk of officials learn through officiating live events, which add pressure to the learning experience, and through PowerPoint presentations, which do not provide opportunities for real-life application during training. Exploring the impact of virtual training to equip officials with real experience in a stress-free environment could be a factor that improves referee recruitment and retention in the long-term.

5. CONCLUSIONS

Guided by the growing shortage of officials, this paper sought to understand what role IPOVVB training could play in mitigating the causes of the shortage. Three questions showed significant results, with the RefReps group proving greater positive changes in confidence levels from the pre to post-test than the control group. The results are relevant because it shows that interactive video-based training, such as RefReps, should become more common in training than it already is. Although interactive video-based training can be seen as new and confusing for some officials, especially when all of their prior training in years past was using these traditional methods, this study proves that this new, rarely used training method is more

beneficial on increasing confidence in basketball officials at the college intramural level. Referees from different sports and levels of play are decreasing at an alarming rate, with many leagues not having the capacity to play their games at their scheduled times or canceling their games because of this shortage. The development of better training methods for young officials will increase the number of new officials in the pipeline to serve the every growing youth sports industry.

6. ACKNOWLEDGEMENTS

6.1 Disclosure of Funding Sources

NONE

6.2 Conflict of Interest

One author became an investor in the company after the data had been collected and analyzed. This conflict-of-interest form is recorded and on file with the university.

7. REFERENCES

- Barnhouse, W. (2019, April 19). High school sports struggling with shortage of officials. Global Sports Matter.
<https://globalsportmatters.com/youth/2018/09/20/high-school-sports-struggling-with-shortage-of-officials/>)
- Bohil C. J., Alicea B., & Biocca F. A. (2011). Virtual reality in neuroscience research and therapy. *Nat Rev Neurosci*, 12(12), 752–762.
<https://doi.org/10.1038/nrn3122>
- Demsky, M. (2021, March 20). High school sports facing referee shortage. FOX40. <https://fox40.com/sports/high-school-sports-facing-referee-shortage/>.
- Eitzen, D. S. (1989). The sociology of amateur sport: an overview. *International Sociology of Sport Association*, 24(2), 95-105.
<https://doi.org/10.1177/101269028902400201>
- Kittel, A., Larkin, P., Elsworth, N., Lindsay, R., & Spittle, M. (2020). Effectiveness of 360° virtual reality and match broadcast video to improve decision-making skill. *Science and Medicine in Football*, 4(4), 255–262.
- Lacy, E. (2018, October 14). Why referee shortage may have long-term consequences for high school, youth sports. Lansing State Journal.
<https://www.lansingstatejournal.com/story/news/2018/10/11/sports->

[officials-athletics-referee-shortage-highschool-youth-football-baseball-basketball-mhsaa/1366937002/](https://www.nfhs.org/articles/recruiting-retaining-officials-challenges-state-associations/)

- Leighton, T. (2017, April 5). Recruiting, retaining officials challenges state associations. NFHS. <https://www.nfhs.org/articles/recruiting-retaining-officials-challenges-state-associations/>
- Livingston, L. A. (2017, December). Sport officiating recruitment, development, and retention: A call to action. *Current Issues in Sport Science*, 2, 011. https://doi.org/10.15203/CISS_2017.011
- Matamala-Gomez, M., Donegan, T., Bottiroli, S., Sandrini, G., Sanchez-Vives, M.V., & Tassorelli, C. (2019). Immersive virtual reality and virtual embodiment for pain relief. *Front Hum Neurosci*, 13, 279. <https://doi.org/10.3389/fnhum.2019.00279>.
- Mills, J. (2020, October 23). Muskegon Catholic Central's game starts early, refs needed across town for second game. WZZM13.com. <https://www.wzzm13.com/article/news/referee-shortage-west-michigan-muskegon-county-high-school-football/69-032c7a9a-de58-416f-8808-67dad63ba430>.
- National Association of Sports Officials. (2002). *Special report: Officials under assault*. <https://www.naso.org/portals/0/downloads/reports/SpecReptAssault.pdf>
- Neddenriep, K. (2021, April 28). "We need help": Umpire shortage is causing high school programs to cancel games. Indianapolis Star. <https://eu.indystar.com/story/sports/high-school/2021/04/28/ihsaa-baseball-umpire-shortage-cancelling-games/7341489002/>
- Officially Human. (2019, May). Behind the stripes. Officially Human. <https://officiallyhuman.com/our-data/>
- Ohio University. (2018, October 09). The nationwide decline in sports officials. Ohio University. <https://onlinemasters.ohio.edu/blog/the-nationwide-decline-in-sports-officials/>
- Pierce, D., Sherman, G., & Kryder, B. (2021). Innovate sports officiating with design thinking. *Case Studies in Sport Management*, 10(S1), S18-S23. <https://doi.org/10.1123/cssm.2020-0029>
- Riva, G., Wiederhold, B.K., & Mantovani, F. (2019). Neuroscience of virtual reality: From virtual exposure to embodied medicine. *Cyberpsychol Behav Social Networking*, 22(1), 82–96. <https://doi.org/10.1089/cyber.2017.29099.gri>.
- Slater, M., Pérez-Marcos D., Ehrsson, H. H., & Sanchez-Vives, M. V. (2008). Towards a digital body: the virtual arm illusion. *Front Hum Neurosci*, 2, 6. <https://doi.org/10.3389/neuro.09.006.2008>
- Szulik, B., & Gieson, R. (2019). *Whistleblower: calling fouls on the amateur sports officiating crisis*. Amazon. <https://www.amazon.com/Whistleblower-Calling-Amateur-Sports-Officiating/dp/1691418862>.

Warner, S., Tingle, J. K., & Kellett, P. (2013). Officiating attrition: The experiences of former referees via a sport development lens. *Journal of Sport Management, 27*(4), 316–328.
<https://doi.org/10.1123/jsm.27.4.3>