IMPROVING TEACHERS' PROFESSIONAL VISION THROUGH A VIDEO-BASED REFLECTION PROGRAM: A CASE STUDY IN MEXICAN PRIMARY SCHOOLS

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ABSTRACT

Teachers' professional vision (TPV) is an essential contributor to enhancing the quality of teaching-learning processes thanks to its potential effect on teachers' self-reflective skills. This is of particular importance in Physical Education (PE), due to the fact that this subject presents different challenges and more dynamic situations compared to others. One of the latest approaches for enhancing TPV is video-based reflection, allowing teachers to observe and analyze recorded lessons. This research aimed to test the effect of a video-based reflection program on TPV in PE. Two teachers participated in a 3-step video-analysis program consisting of self-reflection, peer reflection, and expert feedback. Notable changes were found in TPV at the end of the 6-month intervention, both in terms of teachers' selective attention to classroom events and their knowledge-based reasoning. Our findings suggest that video-based reflection interventions could represent an important component of any teacher training program aiming to increase PE teachers' ability to evaluate and respond to a variety of in-class situations.

KEYWORDS

Knowledge-based reasoning, professional training, reflection, selective attention, video technology

HOW TO CITE

Cocca M., Cocca A. (2024) 'Improving Teachers' Professional Vision Through a Video-based Reflection Program: A Case Study in Mexican Primary Schools', *Journal on Efficiency and Responsibility in Education and Science*, vol. 17, no. 2, pp. 140-150. http://dx.doi.org/10.7160/eriesj.2024.170204

Article history
Received
June 29, 2023
Received in revised form
May 13, 2024
Accepted
May 17, 2024
Available on-line
June 30, 2024

Highlights

- *An innovative intervention using technological tools for improving teachers' self-reflection skills.*
- *Research in the field of video-based reflection in Physical Education is lacking to date.*
- *Both selective attention and knowledge-based reasoning improved after the intervention period.*
- *Video-based reflection may be useful as an integrative component of pre-service and in-service teacher training programs.*

INTRODUCTION

Professional Vision in Education

Running a smooth, organized, and structured school class may sometimes be very challenging at any level of education. In this sense, teachers' professional vision (TPV) is argued to be one of the skills that allow teachers to feel and be more efficient in the classroom (Meschede et al., 2017; van Es & Sherin, 2010). The concept of professional vision was first introduced by Goodwin (1994), who investigated how professionals learn to look at phenomena in their expertise, how these skills change over time, and the extent to which they differ when compared to lay persons. Sherin (2001) adapted it and included it in teacher education. Since then, teachers' professional vision has been used as a key frame for designing and developing effective professional development programs worldwide (Lefstein & Snell, 2011). According to Sherin and van Es (2005), TPV is defined as teachers' cognitive ability to notice, evaluate, and interpret key teaching-learning moments via two interrelated skills: selective attention (SA), i.e., the ability to detect and respond to key events over others; and knowledge-based reasoning (KBR), i.e., the ability to reason about and interpret selected events using professional competences and knowledge. The extent to which a teacher is able to operate is believed to be dependent on one's amount of professional-related experience. Beginning and pre-service teachers often struggle more with the former than their experienced colleagues, with more attention paid to the teacher's actions

rather than to students and their learning (Meschede et al., 2017; van Es & Sherin, 2010). Moreover, these initial constraints are said to hinder observing classroom situations from a more professional perspective (Meschede et al., 2017; Wolff et al., 2015). Choosing and interpreting only those key processes that either foster or impede students' learning, as well as carrying out corresponding actions to support their growth, is thus key to teachers' professional competence and to constantly improving teaching (Sherin, 2007). Authors suggest that improved TPV may not only have a positive impact on teachers' quality of instruction (van Es & Sherin, 2010; Sun & van Es, 2015) but also on their students' achievements (Roth et al., 2011). Enhancing TPV may also be an effective strategy for pre-service and novice teachers due to its potentially positive effect on pedagogical knowledge (Kersting et al., 2010; Meschede et al., 2017) and classroom management (König & Kramer, 2016).

Professional Vision in the Physical Education Setting

Although there is no doubt about the impact of TPV on all actors in the teaching-learning processes across different areas, only a few studies were conducted on physical education (PE) and PE teachers. This might be due to the distinct characteristics it implies, PE being a movement-based subject, where active, physical engagement is required. Common features of any classroom environment, such as multidimensionality, simultaneity, immediacy, and unpredictability (Doyle, 1986), are even more apparent in PE since space and equipment are used more dynamically than in the traditional classroom, leading to a higher ratio of unexpected events compared to any other school subject (Barker & Annerstedt, 2016). Hence, PE teachers need to attend more classroom motion-based situations, as well as additionally observe and address students' heterogeneity and individual skill levels and developmental aspects of their movement skills. Another factor might be the use of spaces for the classes. Unlike other subjects, PE classes may occur in an open space or even in out-of-school sport-related facilities such as swimming pools or athletic rings. The choice of the classroom space may also be affected by seasons, environmental features, such as the presence of mountains, beaches, parks, etc., and a country's curricular plan. For that reason, the development of TPV may be more challenging due to the inner complexity of the PE subject.

Professional Vision and Self-Reflection

Self-reflection strategies are known to be among the most effective and used tools for developing and/or improving TPV. Using self-reflective tools may help teachers identify the kinds of changes that are necessary to better serve the individual learning needs of their students. With the advancement and accessibility to affordable technologies, video-based reflection (VBR), i.e., reflecting on one own's or other teachers' in-class performance by means of previously recorded videos of their lessons, has become a prevalently used strategy in teachers' development (Rich & Hannafin, 2009). Due to its benefits, in the last decade, many scholars in the area of educational psychology have studied the effect of video-based reflection on changes in TPV in both pre- and in-service contexts (Kleinknecht & Schneider, 2013; Luna & Sherin, 2017). This framework has been predominantly used in projects and studies within mathematics and science teachers' education using video-club contexts to enhance TPV in classroom settings (Seidel et al., 2011; Sherin & van Es, 2009); applying multifarious intervention programs such as designing self-reflective frameworks (Sherin & van Es, 2009); using facilitator-led discussions (Borko et al., 2008); or observing and reflecting on different video material (Kleinknecht & Schneider, 2013; van Es, 2012; Zhang et al., 2011). In order to enhance TPV development, research has focused on identifying the most effective nature of classroom videos in both pre-and in-service teaching contexts by comparing three common types of sources: videos of unknown experts, peers' classroom videos, and one's own recorded practices (Kleinknecht & Groeschner, 2016; Kleinknecht & Schneider, 2013; Santagata & Guarino, 2011). Reflecting on videos with peers has been suggested as a great way through which teachers engage more in comparative and critical thinking, as they found their colleagues facing similar teaching issues (Leblanc & Sève, 2012). Consequently, Borko et al. (2008) add that teachers become more comprehensive about the experiences they share, which in turn allows for faster changes in their classroom practices (Kleinknecht & Groeschner, 2016). However, as Zhang et al. (2011) pointed out, teachers are often reluctant to critically comment on their peers' actions. Thus, guiding a non-judgmental yet constructive discussion is critical to successfully benefit from this type of collaboration (Zhang et al., 2011). It is also essential to reflect on one's own practice since this is suggested to improve teachers' activation and motivation more than when they view videos of others (Seidel et al., 2011). Additionally, this strengthens their observational and interpretative abilities and aptness to adjust classroom practices (Coffey, 2014; Sherin & van Es, 2009). Nevertheless, this approach also has its pitfalls, as some teachers might feel uncomfortable being video-taped and/or viewed by others. As a consequence, some may even refuse to participate in such activities (Borko et al., 2008). Therefore, researchers must create safe, supportive environments that foster learning opportunities (Borko et al., 2008).

Self-reflection Practices in Physical Education

From the studies that were carried out in the PE context, Reuker (2017a) investigated how four groups with varying levels of expertise (coaches, PE teachers, pre-service PE teachers, and PE teachers-coaches) differ in reflection regarding their knowledge-based reasoning skills. As the results indicate, knowledge-based reasoning was found to be profession-related, i.e., PE teachers using more pedagogical-based knowledge and coaches providing more sport-specific expertise. Similar results were found in another study conducted by Reuker (2017b), investigating the relationship between professionalization and the depth of noticing. Firstly, the findings revealed that unlike in studies focused on different subject areas, the participants focused their attention predominantly on students' behavior rather than the teacher. This could also be explained by the nature of the context, where observing students' behavior is an inevitable part of any performance. Secondly, when executing expertise-related group comparisons, teachers and experts noticed significantly more in terms of methodological

and didactic approaches. Another interesting result is that novice teachers noticed fewer cues related to motoric behavior. Although both her works did not study the development of TPV but rather focused on the state of arts related to the level of professionalism, the results generally indicate that involving professionals from the area of sports sciences (PE teachers, athletes, or coaches) may result in an enriching environment, as each participant can profound his/her knowledge from different areas. This might be particularly useful in settings where PE curriculum is more sports- and competition-oriented rather than focused on games and basic motor development. Lonsdale et al. (2016) presented a more advanced experimental multi-level intervention using teachers' VBR followed by individualized feedback with the project facilitator. Two of the variables studied were the effect of changes in teachers' lesson planning and content delivery, to increase students' physical activity engagement and autonomous motivation towards PE. During the intervention, teachers were also provided with strategies and free material designed to support students' psychological needs. In summary, due to the need for a simultaneous development of all three domains (cognitive, affective, motor), more research is needed in PE to understand the current state and changes in TPV using more advanced techniques, such as VBR. Therefore, based on the structure of similar programs presented above and as an extension of a previously presented work (Cocca et al., 2019), this study aims to test the effect of a multi-step VBR approach consisting of 1) written self-reflection of own classroom video; 2) peer reflection with a facilitator-led discussion club including experts from the area of PE and sports psychology; and 3) experts' written feedback, on TPV of PE teachers from the primary school level.

METHODOLOGY AND METHODS

To evaluate the effect of the VBR program on the dependent variables, we employed a mixed qualitative-quantitative approach based on content analysis and a case study design.

Participants

The study sample constituted of two PE teachers: one of them (PET1) has been teaching PE in both pre-K and primary school for nine years and has obtained his bachelor's degree in the area of Sports Sciences; the other (PET2) has taught PE at the elementary school level for the last six years and is a graduate bachelor in the area of Sports Technology. At the moment of the research, they were teaching 155 children from the fourth and fifth grades of a primary school from General Escobedo, Monterrey (MEX). Due to time constraints and accessibility to school districts, our sampling technique was based on convenience. Detailed sample distribution is provided in Table 1.

Teacher	Grade	Age		
		Boys	Girls	Total
PET1	4th	*n* = 8 9.25 ± .46	*n* = 15 9.40 ± .63	*n* = 23 9.35 ± .57
	5th	*n* = 23 10.78 ± .79	*n* = 26 10.69 ± .74	*n* = 49 10.73 ± .76
PET2	4th	*n* = 12 9.25 ± .62	*n* = 14 9.29 ± .47	n = 26 9.27 ± .53
	5th	*n* = 23 10.52 ± .66	*n* = 34 10.88 ± .77	*n* = 57 10.74 ± .74
Total				*n* = 155 10.28 ± .96

Note: PET1 = Physical Education Teacher 1; PET2 = Physical Education Teacher 2

Table 1: Characteristics of the students participating in the study

Instruments

An adaptation of the categorical system proposed by Kleinknecht and Schneider (2013) was used to assess TPV (Sherin & van Es, 2009); in this framework, within the SA domain, teachers' focus is the main aspect to be considered. This can be either on students/teachers, on the learning processes, or on the topics presented. Within the KBR domain, the framework prompts teachers to use a 3-step analysis by which they (1) describe what has been selected from their own lesson's video; (2) explain perceived events based on previous knowledge of teaching and learning; and (3) evaluate and predict, in which the explanation is used to assess the situation and provide possible alternatives.

Procedure

The study was carried out at the facilities of a primary school from a disadvantaged zone in General Escobedo, Nuevo Leon (MEX) during a six-month period within the regular teaching schedule of both PE teachers. The principal allowed both participants to take 90 minutes/month off their regular working hours to take part in monthly meetings with the research team. Also, the principal considered those meetings as a part of their professional development training, which is required by the Secretariat of Public Education. The intervention also required the involvement of four experts (researchers/practitioners with a doctorate in the fields of Pedagogy and PE and at least ten years of experience), who were invited by the research team.

Pre-intervention Phase. Before the start of the second semester of the academic year, the research team organized a one-day workshop with both the participant PE teachers and experts involved in the study to explain the intervention procedure and introduce the framework that they would use to analyze their own lessons. Furthermore, both teachers were asked to send the information to students' parents and/or legal guardians to obtain their written consent regarding students' participation.

At the beginning of the workshop, both teachers were interviewed by the research team about their hopes, beliefs, and worries

about the intervention program. During the practical part of the workshop, participants were provided with a laptop and a memory disk containing framework guidelines. To facilitate the analysis and answer any questions or doubts that might have occurred, teachers and experts were asked to use the provided framework to analyze a short video clip of a PE lesson that we recorded specifically for this purpose. Then the workshop facilitator (the lead of the research team) led a discussion on the moments that both teachers and experts selected and reasoned about them, prompting teachers to exchange ideas and propose new strategies to attend the chosen events. This trial was used to create a friendly environment, make participants understand how the discussion club would work, and familiarize them with the analysis framework.

Furthermore, due to technical requirements, we also recorded a trial PE class of each teacher to make them get acquainted with a wireless microphone and a portable transmitter that they would have to carry during the entire lesson, as well as to set up the best distance to place the cameras to avoid hindering the regular carrying out of the lesson at the same time as every event could be captured properly. This procedure was essential because all PE lessons were carried out outside in an open space.

Intervention Phase. A total of two lessons from both PE teachers were recorded at the beginning of each month. According to the official school curriculum, these lessons last approximately 50 min each. The videos were then downloaded to both teachers' and experts' memory disks for self-analysis. PE teachers were then asked to observe and analyze their videos, write a self-reflection, and send it to the facilitator's email within a week of receiving the recordings. The experts were also asked to write a reflection on both PE teachers' videos and submit it within the same period. After receiving teachers' self-reflection, the experts and the facilitator gathered to create shorter video clips based on the commentaries, each lasting between 15-25 min. Finally, a "video club" was held (a larger meeting with all actors involved: teachers, experts, and facilitator), and the video clips were observed and discussed together. All video club meetings were recorded for further content analysis. All video club discussions generally had the same structure. As there were only two PE teachers, both video clips would be watched. The teachers would briefly introduce the recorded lesson context and content, stating both general and specific objectives, and explaining how these objectives were meant to be reached. The facilitator then led the discussion toward engaging both teachers and experts in a collaborative and critical discussion (Borko et al., 2008; van Es, 2012), allowing for multiple perspectives regarding the selected moments. At the end of the meeting, the teachers were provided with experts' written feedback and suggestions with different strategies regarding both pedagogical and practical aspects. In total, the video club met six times over a six-month period, during which 12 video clips were watched.

Post-intervention Phase. After the last video club meeting, teachers were interviewed to discuss the impact of each step (i.e., self-reflection, peer-reflection, and experts' feedback) on their TPV and pedagogical knowledge, as well as noticed changes in the classroom environment.

Data Analysis

Data analysis consisted of several steps and was conducted using ATLAS.ti version 8. Firstly, all meetings were transcribed so that in-depth content analysis could be carried out. Successively, all meetings and written reflections were segmented into idea units (Jacobs & Morita, 2002). To reveal changes in TPV in teachers' written and oral comments, we applied the above-mentioned adapted version of the categorical system proposed by Kleinknecht & Schneider (2013), which is based on the original work of Sherin and van Es (2009). An open-coding approach (Emerson, Fretz, & Shaw, 1995) was also used to identify and address other potential key issues. These issues were sorted into topic categories, as shown in Table 2.

Dimension	Codes
Motor engagement	• Task involvement, engagement time, dead time, resting time, intensity, performance issue, skill development
Motivational climate	• Motivation, emotions, boredom, lack of effort, autonomy, competition-based tasks
Behavior management	• **Social aspect** (e.g., social integration, respect) • **Psychological aspect** (e.g., attention, students' behavioral characteristics, disruptive behavior, student misbehavior)
Classroom management	• **Time management** (e.g., class organization, task involvement, timing, time constraints) • **Space and facilities management** (e.g., space issues, quality of facilities) • **Equipment management** (e.g., alternative equipment, equipment constraints) • **Group organization** (e.g., pair work, individual, teamwork, peer teaching) • **Other** (e.g., unexpected events, teacher position)
Context	• Culture, hygiene, student-teacher ratio, safety issue, lack of class time, lack of experience
Planning	• Backup activities, self-development, task variety, Objectives, transition between activities, monotonous tasks
Pedagogy	• **General** (e.g., teaching strategies, autonomy orientation, fostering previous knowledge, scaffolding, gender differentiation, task adjustment/individualization, student integration, brainstorming • **Instructional strategies** (e.g., reinforcement activities, task variance, clear instructions, adjusted task selection, self-evaluation) • **Teaching style** (e.g., critical thinking, creativity, free-exploration style, innovative instructional models, cooperation, collaborative learning)
Communication	• Feedback, T-S communication

Table 2: Content analysis of teachers' comments: Description of categories found through open coding

Finally, the relative frequencies of all TPV categories were calculated. This was followed by the creation of semantic models based on the identified categories, aiming to increase the understanding of the contents (Villanueva et al., 2016). All data was coded by two independent researchers. Coding reliability was assessed by calculating the inter-observer agreement, which was found to be 91% across data sources. Additionally, taxonomical representations (or semantic networks; Sowa, 1991) were created to determine how both positive and negative codes related to each other. Disagreements were resolved through consensus.

RESULTS

Results regarding the TPV dimension of teachers' SA are presented as relative frequencies of codes in three categories (table 3): 1) Focus on Actors; 2) Focus on Learning Processes; and 3) Focus on Topic. Regarding PET1, 57.1% of his comments focused on students' activities, with the remaining events being associated with his actions. On the other hand, most of the moments selected by PET2 focused on himself, whereas only a few events involved his students. Additionally, a total of 28.6% of the comments did not refer to any involved person. Post-intervention, both teachers' attention moved toward students' behavior (PET1 = 63.2%; PET2 = 65.0%). Regarding the second category of the SA domain (focus on learning processes), more than 50% of the events selected by both teachers were not concerned with any learning processes. Table 3 shows that at the end of the intervention, this focus changed, and more than 60% of the comments were directed to students' learning processes. In the last category of SA on focus on topics, there was a change in the number of events implying negative issues selected by both teachers: in fact, at the start of the intervention both teachers highlighted a lower number of positive events (PET1 = 24.8%; PET2 = 30.3%) compared to the last reflections (PET1 = 65.2%; PET2 = 68.5%). Topics addressing issues about *Motor Engagement* (PET1 = 33.2%; PET2 = 36.9%) and *Classroom Management* (PET1 = 25.2%; PET2 = 27.6%) initially represented the highest concerns, but both matters showed lower frequency at the end of the program.

Dimension	Categories Pre-test		PET1		PET2	
			Post-test	Pre-test	Post-test	
Actor-focus	No focus		0%	10.5%	28.6%	15.0%
	Focus on teacher's behavior		42.9%	26.3%	28.6%	20.0%
	Focus on student's behavior		57.1%	63.2%	42.8%	65.0%
Process-focus	Focus on learning processes		28.6%	63.2%	42.9%	70.0%
	No focus on learning processes		71.4%	36.8%	57.1%	30.0%
Topic-focus	Positive	Classroom management	21.4%	19.7%	12.1%	15.6%
		Behavior management	12.8%	8.0%	12.0%	5.9%
		Motivational climate	23.5%	10.8%	28.9%	20.4%
		Motor engagement	27.5%	22.6%	11.2%	22.2%
		Context	0%	2.3%	3.1%	0%
		Planning	13.4%	16.3%	5.4%	18.5%
		Pedagogy	1.4%	14.8%	18.7%	15.3%
		Communication	0%	5.5%	8.6%	2.1%
		Total positive	**24.8%**	**65.2%**	**30.3%**	**68.5%**
	Negative	Classroom management	25.2%	19.3%	27.6%	23.5%
		Behavior management	13.4%	11.2%	18.1%	13.3%
		Motivational climate	3.4%	8.5%	5.8%	6.4%
		Motor engagement	33.2%	25.8%	36.9%	23.6%
		Context	2.3%	7.6%	4.5%	5.1%
		Planning	6.4%	9.4%	3.1%	12.5%
		Pedagogy	11.9%	11.8%	2.7%	12.6%
		Communication	4.2%	6.4%	1.3%	3.0%
		Total negative	**75.2%**	**34.8%**	**69.7%**	**31.5%**

Note: PET1 = Physical Education Teacher 1; PET2 = Physical Education Teacher 2

Table 3: Content analysis of teachers' comments: Relative frequencies of codes regarding selective attention

Regarding the domain of KBR, the full 3-step (describe, explain, evaluate) analysis was used to reason about selected moments from the beginning of the intervention period (PET1 = 47.0%; PET2 = 35.2%). Nonetheless, about one-third of the teachers' comments were limited to the first step, i.e., describing (PET1 = 29.4%; PET2 = 31.3%), whereas less than half of the reasoning was conducted using the full 3-step analysis. On the contrary, at the end of the intervention, the full 3-step analysis reached 69.6% and 75.0% for PET1 and PET2, respectively. Furthermore, in dealing with negative events, both PET1 and PET2 were more focused on the simple perception of such events (PET1 = 53.2%, PET2 = 31.6%) rather than being engaged in a deeper analysis. At the end of the intervention, these frequencies shifted, with

comments on potential strategies and alternatives to negative situations being the most prominent category (PET1 = 61.6%; PET2 = 45.4%). Analyzing the category dealing with positive events, there are differences between the two teachers regarding the number of comments on no positive events (50.0% and 20.0%, respectively) and their evaluation (13.4% and 50.0%, respectively). At post-test, PET1 was more focused on discussing alternatives (36.2%), whereas PET2 tended to reflect slightly more on their consequences (24.4%). Table 4 provides detailed results on code frequencies regarding KBR.

Dimension	Categories	PET1		PET2	
		Pre-test	Post-test	Pre-test	Post-test
Reasoning process	Describe	29.4%	8.7%	31.3%	7.1%
	Evaluate	11.8%	8.7%	20.2%	10.7%
	Explain	11.8%	13.0%	13.3%	7.1%
	3-step analysis	47.0%	69.6%	35.2%	75.0%
Dealing with negative events	No negative events	10.0%	15.3%	10.5%	28.7%
	Perceive	53.2%	0.0%	31.6%	4.1%
	Evaluate	26.7%	7.7%	21.0%	7.7%
	Reflect on consequences	13.4%	15.4%	21.0%	14.1%
	Propose and reflect on alternatives	6.7%	61.6%	15.8%	45.4%
Dealing with positive events	No positive events	50.0%	16.7%	20.0%	21.1%
	Perceive	0.0%	0.0%	20.0%	10.5%
	Evaluate	13.4%	15.8%	50.0%	22.2%
	Reflect on consequences	23.5%	16.4%	10.0%	24.4%
	Propose and reflect on alternatives	13.1%	36.2%	0.0%	21.8%

Note: PET1 = Physical Education Teacher 1; PET2 = Physical Education Teacher 2

Table 4: Content analysis of teachers' comments: Relative frequencies of codes regarding knowledge-based reasoning

Concerning the semantic relationships between teachers' comments (code linkages), figure 1 shows the taxonomical representation of negative issues derived from the first reflection cycle and the open codes. Each category is represented by a rectangle labeled to others with arcs. Due to the complexity of the linkage network, the figure summarizes it by presenting the most recurrent codes, which belong to the categories of Classroom Management, Student Engagement, and Behavioral Management. All of the mentioned issues were further identified as being a cause of inappropriate Planning.

Teachers recognized students' engagement as composed of motor and affective aspects, the former affected by elements such as inappropriate intensity or the amount of unused (excluding planned breaks) time during sessions; the latter associated with amotivation and boredom. Other issues underlined in teachers' comments referred to their role, in particular their ability to provide proper feedback and their position during the activities concerning their ability to keep behavior under control. Teachers tended to focus on themselves rather than their students, pointing out topics such as group control fail, monitoring fail, or unclear instructions (Figure 1).

Figure 2 represents linkages between positive codes derived from the last reflection cycle and the open codes. The figure shows the most recurrent categories and their linkages. Several positive outcomes within the main categories (e.g., *Management, Engagement*) were either "associated with" or "cause of" improved *Planning*, which in turn is associated with students' engagement or enjoyment, amongst others.

Teachers' reflections showed more articulated connections between elements of the teaching-learning environment; in particular, the cognitive sphere was added as an extra component of students' engagement compared to the first reflection cycle, where only the motor and affective ones were emphasized. The focus switched to more autonomous, student-centered matters, such as self-evaluation and brainstorming and their relationship with cognitive development; collaboration and teamwork as components linked to affective development; or peer assessment, attention to individual needs, and focus on student, categories that were linked with improved fluency of activities and their transition, hence affecting the overall classroom management (Figure 2).

DISCUSSION

Our study aimed to analyze the effect of a video-based reflection program on TPV. A total of 370 units were analyzed during the six months of the intervention. As previous literature suggests, the extent to which teachers are able to use their SA and KBR is related to their experience (van Es & Sherin, 2010). Our findings suggest that both teachers showed positive changes in both domains from pre- to post-test. Initially, teachers focused mostly on learning and students, respectively, and their analysis involved the class as a whole rather than evaluating individualities within it. Indeed, previous research has highlighted that a more individualized focus is developed over time and is more commonly shown by experienced teachers (Jung, 2012). However, the literature is inconsistent in this sense: for instance, Reuker (2017b) found that different groups of experts focused primarily on overall students' behavior, which is in line with our findings. Just as in our work, Reuker's sample was composed of PE teachers. Hence, perhaps, the peculiar characteristics of PE may partially explain the difference with other studies in the field. In fact, one of PE curricula's main objectives is the development of the motor domain (Secretaría de Educación Pública de México [SEP], 2022). Therefore, teachers may be more naturally looking at the overall students' actions and whether the whole class is engaged or not.

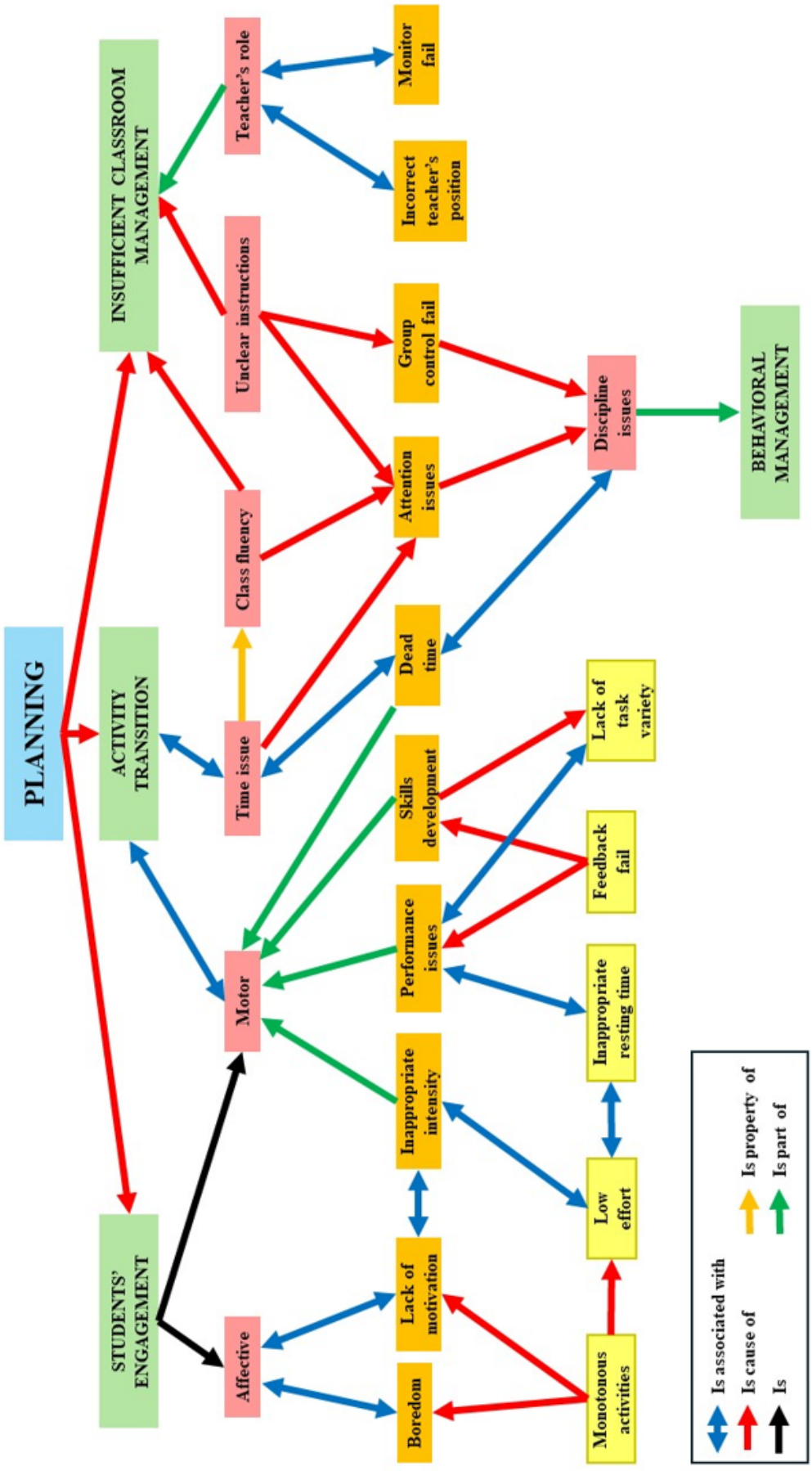

Figure 1: Taxonomical representation of code linkages at baseline

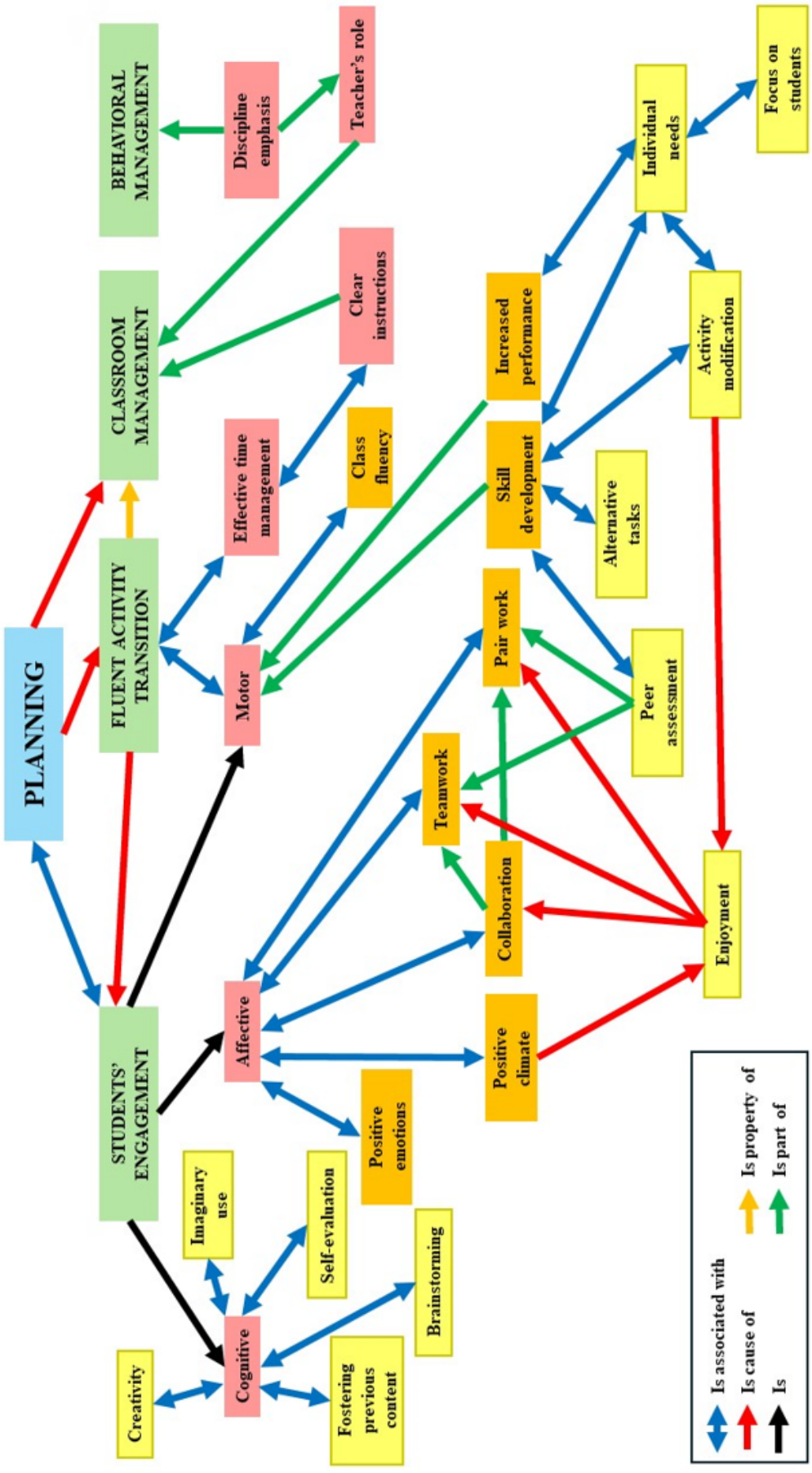

Figure 2: Taxonomical representation of codes linkage post-intervention

Reflecting on the different TPV domains more in detail, our findings show considerable changes in teachers' SA over time, with increased attention towards each student. This may suggest that at the end of the intervention, both teachers were more capable of extrapolating from their analysis matters related to individual learning (hence, attending to individual needs), while still maintaining an overall supervision of the entire class. Our taxonomical analysis may support this idea since teachers' latest reflections delved into how they could adapt certain activities to better fit students' individual characteristics and skill levels. Considering individual needs and each student's starting skill level is essential to PE teachers if they aim to provide benefits to all their students (National Association for Sport and Physical Education [NASPE], 2007): therefore, the changes shown in our participants in this sense should be considered as improvements. The importance of addressing individual needs and characteristics is further stressed by previous literature, suggesting that individualized tasks may provide benefits at both cognitive and physical levels (Kostecka, Bojanowska, & Stoma, 2017).

As per teachers' KBR skills, previous research highlighted the positive impacts of video-based programs and teachers' reflective skills development, particularly in terms of their reflections becoming more meaningful and more mindful of students' learning processes (Borko et al., 2008; Santagata & Guarino, 2011; Walkoe, 2015). In line with these studies, the teachers in our study initially showed more shallow reflections, with a high descriptive and evaluative character and no further reasoning, for instance, on potential solutions and adaptations that could be made to improve the learning process. The initial difficulties were confirmed in the analysis of the group meetings with peers, experts, and the facilitator, in which most ideas proposed by the teachers were disconnected and fragmented. However, by the end of the intervention, both participants had developed more thoughtful reflection strategies, this being stressed by the fact that, differently than in the beginning, they predominantly applied the full 3-step analysis for all the selected in-class events. At the same time, their discourse during the meetings was more logical, with ideas connecting to each other, allowing for not only more complex reasoning but also for more meaningful discussions between each other and with the experts. These outcomes are in line with previous literature on the development of KBR in schoolteachers (Walkoe, 2015).

Regarding the topics that our teachers tended to address in their reflections and their positive/negative evaluations of them, initially, the participants mostly evaluated the selected events as more negative than positive. Moreover, their evaluation was not followed by any proposed changes or potential alternatives that would help turn the negative events into positive ones. Two previous studies presented similar findings, as the involved teachers were less likely to identify consequences and alternatives when analyzing their own videos compared to those who reflected on peers' teaching performance (Kleinknecht and Schneider, 2013; Seidel et al., 2011). This is also one of the reasons why authors have suggested that in VBR programs, the presence of a facilitator who guides the discussion may be beneficial (Santagata & Guarino, 2011). At the end of the intervention, the PE teachers showed more frequent reasoning on consequences and alternatives for the selected events, and they were able to balance the detection of positive and negative events in their recorded classes. Beyond the positive impact of the presence of a facilitator in the meetings (Santagata & Guarino, 2011), other elements that could have had an impact on this change are the creation of a collaborative environment with peers and experts: for instance, Reuker (2017a) and Sherin and van Es (2009) mention that environments stimulating cooperation and mutual exchange of ideas allow for more profound analyses, since there is a higher chance that the teachers share their own experiences and bring different perspectives. Furthermore, the consistency of our sessions, with the 3-step cycle of self-reflections, teacher club meetings, and expert feedback repeated regularly on a monthly basis for six months, may have also helped by creating a positive reflective routine (Kleinknecht & Schneider, 2013; Zhang et al., 2011). Regarding the most addressed negative events (figure 2), teachers emphasized issues related to *Classroom Management (e.g., unclear instructions, group control fail, etc.), Student Engagement, including both motor and affective domains (e.g., performance issues, task invariability, inappropriate intensity; and lack of motivation, boredom, respectively), and Behavioral Management (e.g., issues with students' discipline and behavior). Most of these issues from the first reflections turned into more positive events at the end of the program (figure 3). This may hint at the fact that, on the one side, the teachers were able to attend to these issues with more efficiency and to use instructional strategies to solve/improve them, and on the other side, they may be more responsive in implementing a variety of strategies to diversify and individualize their teaching approach.*

Another interesting change started occurring from the third session onward. Due to their enhanced reflection skills and ability to critically reflect on both their own and students' actions, teachers' noticing started being mirrored in their on-the-spot actions. As a result of this change, teachers were able to notice an issue (e.g., some students not engaged, negative attitude towards an activity, etc.), evaluate circumstances, and make an immediate alteration to the occurred condition. According to Schön (1983), reflection-in-action is a critical feature of a professional, as it allows practitioners to interpret, analyze, and provide solutions to sudden and unique conflicting situations. Our findings are congruent with those of Jung (2012), who found PE teachers become more aware of issues related to their instructional practices and are able to make modifications during their teaching.

Another important aspect that seems vital to teachers' changes is involving experts in reflective discussions (Brown & Kennedy, 2011). Reuker (2017b) suggests that using multiple professional perspectives might increase teachers' effectiveness when addressing student behavior issues. In a study conducted by Brown and Kennedy (2011), teachers were able to improve their interactional styles with disruptive students as a result of a collaboration with educational psychologists. Similarly, Kleinknecht and Groschner (2016) demonstrated that peer and expert feedback enhanced pre-service teachers' self-reflections. Equivalent patterns could be observed in our study, where experts from the fields of physical education and pedagogy also

viewed PE teachers' videos and attended the discussion sessions. Furthermore, the experts were asked to deliver written feedback on every video, suggesting various strategies that teachers could apply to improve certain aspects of the teaching-learning environment. As a result of these interactions and collaborations, it seems that the teachers felt better prepared to manage their classrooms and students' behavior effectively, also suggesting the implementation of different strategies to avoid side activities that could interrupt contents or reduce learning possibilities (Little & Hudson, 1998).

CONCLUSIONS

Our findings seem to support the hypothesis that video-based intervention programs involving self-reflective tasks, peer reflections, and discussion clubs may largely benefit PE teachers' TPV. Indeed, the reflection cycle presented in this study, with three main steps that progressively involved peers and experts in the video-analysis process, seemed to have contributed to a number of positive changes in our participants, as well as to teachers' increased understanding of their students' individual needs. Especially in a PE setting, an efficient focus on constantly dynamic events may be of particular importance due to the fact that teachers, at times, need to react quickly and efficiently in tasks that prompt students to move around the classroom environment. Although this may be considered one of the first studies of this kind in the field of PE, our outcomes suggest that VBR programs could be added to the traditional pre-service and in-service teacher training so that teachers can learn a tool for autonomous self-evaluation during the course of the school year.

The major limitation of this study is that it is based on the case of two teachers only. However, recruitment is one of the common difficulties in research of this type, especially when using video recording, which requires permissions at more levels than usual. Therefore, our results must be taken as explorative, also considering the fact that the proposed intervention has no precedents in the field of PE. Future research in this line may aim at recruiting larger samples: this would allow for diversification of outcomes, for instance, based on gender, years of experience, or level of education. In addition, the analysis of the effects of VBR programs may also cover other aspects, such as changes in teachers' perceived self-efficacy in the classroom or their students' enjoyment and engagement during PE sessions. Finally, incorporating new technologies, such as eye-tracking devices, may provide additional information that can be contrasted with teachers' self-reflections to examine differences between in-class real-time focus and post-class teachers' SA and KBR parameters.

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