

The Position of the Warm-Up In School Physical Education Lessons

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ABSTRACT

The essence of the presented research is to analyze the length, position, content and the process of the warm-up part within physical education (PE) lessons at lower secondary schools. The research study has a descriptive character and combines quantitatively and qualitatively oriented aspects of the analysis. The research method used was video-based observation. The research participants were selected from lower secondary schools in the Zlín Region – Czech Republic. Through 15 PE teachers, 35 video recordings were captured. For the analysis of video recordings, the deductive approach (system of categories) was used.

Based on the data analysis, the following information was discovered. The actual length of a PE lesson was on average 36 minutes and 30 seconds. The warm-up recorded to be on average 6 minutes and 22 seconds of the entire PE lesson. A total of 15 lessons were led by teachers and 14 lessons were led by the learning students. Mobilization (dynamic) exercises and static stretching were the most common focuses of the warm-up. The teacher's main priority was to point out mistakes that students made during lessons. The teachers also had to give the students verbal instructions (except for the residual category "other"). The most common form of organization of warm-ups was the so-called "free in space".

From the research, it is determined that the warm-up has an important impact on the PE lessons. This research could be appropriate for PE teachers' education as well as for individual teachers when preparing the PE lessons and/or reflecting on them.

Keywords: parts of Physical Education lesson; Physical Education; video study, warm-up

INTRODUCTION

„What seems so hard now will someday be your warm-up”

– unknown

There are various reasons why warm-up activities are essential in education. As the quotation used as the motto of this paper suggests, in the early stages of learning, the warm-up is critical for improving skills, knowledge, and understanding. However, the crucial role of warm-up activities within education is often overlooked or underestimated.

In Physical Education lessons, warm-up exercises are an integral part of the introductory phase. Their importance lies in preparing the cardiovascular and musculoskeletal systems for increased physical stress (Martens, 2004), thereby reducing the risk of injuries (citation needed). By increasing heart rate and blood flow to the muscles, warm-up exercises enhance overall body temperature and improve joint and muscle flexibility (citation needed). They also contribute to enhancing coordination, balance, and psychological readiness for physical exertion. This means that the goal of the warm-up is to prepare the body for the activities that will follow (cf. Tilinger 2009, Jebavý 2014, Dvořáková & Engelthale 2017). For example, in a gymnastics lesson, the warm-up should include toning exercises aimed at adjusting the muscle tone of the most stressed muscle groups of the body. In a sports game, it is advisable to focus the warm-up on a dynamic warm-up that matches the nature of the sports game. If the main part of the lesson focuses on the development of joint mobility, it is desirable to emphasize it during the warm-up. There is no exact recommendation regarding the duration of warm-ups – it depends on the specific situation and the professional judgment of the PE teacher or coach.

Within the PE lesson, the warm-up is an essential part. Therefore, it is necessary to consider its position and its relation to other parts of the lesson. The lesson's structure is discussed in Czech professional literature dealing with general didactics (Najvar, Najvarová & Janík, 2009) and the didactics of PE, where the warm-up is regarded as an important part of PE lessons. However, a detailed analysis of the position of the warm-up within the PE lesson is lacking or presented briefly (Dobry 1997, Jebavý, Hojka & Kaplan 2014, Rychtecký & Fialová 1998, Sliacky 2015).

Regarding the actors involved in warming-up activities, the teacher is predominantly responsible for leading the exercises in traditional PE lessons. However, in non-traditional, student-centred PE lessons, the warm-ups are often assigned to the students (for the Czech context, see Sliacky 2015).

To sum up, it is important to analyse not only the function of warm-ups within PE lessons and their content but also the connection between the warm-up and the main part of the lesson and the specific activities that teachers and students engage in during warm-ups. This is the focus of our study. We believe that this information could be relevant for PE teacher education as well as for individual teachers when preparing PE lessons and reflecting on them.

RESEARCH AIMS AND METHODS

The presented research study is a part of the wider research project, which aims are divided into three levels:

- The aim on the theoretical level is to analyse and subsequently synthesize existing Czech and foreign knowledge on the issue of the warm-up in PE lessons.
- On the research level, the aim is to use video study to analyse the length, position, content and process of the warm-up part within PE lessons at the lower secondary schools (in the Zlín region – Czech Republic).
- The aim on the practical level is to clarify the function of warm-up activities and their connections with other parts of the PE lessons. Also, how the individual teachers are preparing and reflecting the PE lessons.

These aims were reflected in the construction of the presented research study. It focuses on the research level of the whole project. Our ambition here is not to generalize the results obtained by our research; we will show on our sample of video recordings of PE lessons, how warm-ups look in practice. We hope to use the relevance of our findings for PE teacher education and individual teachers in practice.

Sampling and data collection

The research sample was selected from lower secondary schools in the Zlín Region – Czech Republic. There were 128 fully organized basic schools (including primary and lower secondary level) on September 15, 2019, the sampling procedure started.

Schools were contacted through their principals. They received an online questionnaire designed by the author of this study. The aim was to capture how many PE teachers work at basic schools in the Zlín Region and how many of them have PE qualifications.

Eighty-seven principals replied to a total of 128 questionnaires – the return rate was 69.2%. One questionnaire was not included in the analysis due to incorrect data. We continued to work with 86 responses from the principals. They showed that a total of 234 PE teachers were working at the lower secondary school at the time of data collection, of which 105 were women and 129 were men.

Based on the obtained data, at the beginning of the 2020/2021¹ school year, teachers were recruited to participate in a video study of PE instruction. The observed teachers were selected based on availability due to the COVID-19 pandemic. The data collection took place from September to 2 October 2020. During the video recording, teachers were asked to keep the lesson as standard as possible. The data was recorded on one camcorder (GoPro Hero 8). The camera in the observed lessons was operated by all the same persons (the main researcher of the project), so there was no need to train more people. The camera was not static, but it moved in space so that the PE teacher was in the picture. The teachers did not have a microphone. The sum of 35 video recordings of PE lessons was acquired (thirty-two 45 minutes long, three 90 minutes long). They serve as the basis for various analyses.

1 Video data collection has been delayed due to the COVID-19 pandemic. The planned number of video recordings was higher, however other teachers were not contacted due to new wave of the pandemic.

The research sample – for the video study – consist of 15 teachers (8 women, 7 men). 11 teachers work in city schools and 4 in village schools. Surprisingly, only 6 teachers (from 15) are PE qualified. The average length of their teaching experience is 12 years. The shortest length of teaching experience is 1 year, which is the case for 3 teachers. The longest teaching experience of 36 years was for 1 teacher (Table 1).

Table 1. Characteristics of the research sample – according to gender, PE qualification, length of practice

Teachers			
Respondent designation	Gender	PE qualification	Length of practice
A_ZL_TV2020	M	no	28 years
B_ZL_TV2020	M	no	29 years
C_ZL_TV2020	W	no	12 years
D_ZL_TV2020	M	yes	16 years
E_ZL_TV2020	W	yes	12 years
F_ZL_TV2020	M	yes	6 years
G_ZL_TV2020	M	yes	1 year
H_ZL_TV2020	W	no	1 year
I_ZL_TV2020	W	no	1 year
J_ZL_TV2020	W	no	2 years
K_ZL_TV2020	W	yes	2 years
L_ZL_TV2020	M	yes	24 years
M_ZL_TV2020	W	no	6 years
N_ZL_TV2020	M	no	36 years
O_ZL_TV2020	W	no	6 years

As this research study focuses on the warm-up, it is necessary to describe the nature of PE lessons within which the warm-up analysis was performed (Table 2, 3).

In Table 2 we present a summary overview of recorded PE lessons, where we add the years (grades) in which the PE lessons were taught. In Table 3 we present the typology of lessons according to the content focus.

Table 2. Lesson typology – general information

Thirty-five physical education lessons	
from it..	
12 girls	
14 boys	
9 coeducational	
22 in the gym	
13 on the outdoor playground	
3x 5 th year	4x 9 th year
7x 6 th year	1x 6 th + 7 th year
12x 7 th year	1x 6 th – 9 th year
7x 8 th year	

Table 3. Typology of lessons according to content focus

Gymnastic	2
Athletic	9
Game	15
Unconventional	1
Fitness	3
Combat sport	0
Mixed	5
TOTAL	35

Tables 2 and 3 show that most of the video recordings were boys' lessons, in the gym and that the most common were game lessons.

The highest number of recordings (12) was conducted in the lessons of 7th-grade students. In 2 cases, it was a combination of several grades, due to the low number of students. In one city school, girls from the 6th and 7th grades were combined, and in one village school, all girls from the 2nd grade (6th – 9th grade).

The research data was obtained with the support of an internal project of the Faculty of Sports Studies of Masaryk University with registration number MUNI / 51/06/2020. As this was a video study, all steps had to be taken in accordance with ethical principles and the GDPR. The school principal has always agreed to the participation of a third party. Teachers had signed the informed consent of the research participant. All research data was handled with confidence.

Data analysis

The research study has a descriptive character, it combines quantitatively and qualitatively oriented aspects of the analysis. Following the video study approach, the research method was observation mediated by video recordings of classroom instruction.

For the video analysis of the warm-up, it was necessary to create a categorical system. We used a categorical system for our design, which was inspired by Janík and Miková (2006) and other authors focused on PE didactics (Dobrý, 1997; Rychtecký & Fialová, 1998; Sliacky, 2019).

In the categorical systems (Table 4), the following aspects (categories) were covered and defined: (1) lesson structure (dividing the lesson in parts), (2) Acting warmups, (3) content of warm-up (traditional), (4) Content of warm-up (non-traditional), (5) teacher activities during warm-up. They were processed in a way that subcategories for the main category were defined, and the description (definition) was provided to clarify. The given subcategory code is what the researcher should use. In case, the observed phenomenon cannot be included in any given subcategory, it should be included in the subcategory "other".

The advantage of using the categorical system within video analysis lies in the possibility to observe one phenomenon multiple times and from multiple perspectives.

Table 4. Categorical system for analysing warm-up in PE lessons

Category	Subcategory	Content definition
Structure of the PE lesson (into parts)	Introduction	Organization (typically a gathering) to present information about the lesson, checking attendance, motivation (acquainting with the aim of the lesson).
	Pulse-raising activities	Pulse-raising aerobic activities to prepare the cardiovascular system and warm the muscles of the body.
	Warm-up	Mobility exercises to prepare the joints and stretches to prepare the muscles and their associated ligaments and connective tissue.
	Main part	Main activity of the lesson.
	Cool- down	Activities assist the body in returning to its normal resting state.
	Organization	For example, preparing tools, time between the parts etc.
Actors of warm-up	Other	It refers to sequences that cannot be classified into any of the above subcategories.
	Teacher – direct instruction	The teacher demonstrates the exercises.
	Teacher – indirect instruction	Pictures, sketches, photos, and videos.
	Student	One student demonstrates the exercises.
	Students – pair, threesome	Two or more students demonstrates the exercise.
	Students	Each student in the group demonstrates one exercise.
Content of warm-up (traditional)	Other	It refers to sequences that cannot be classified into any of the above subcategories.
	Mobilization	Activities which prepare the joints for main activity.
	Dynamic stretching	Stretching exercises that are performed with movement.
	Static stretching	Stretching exercises that are performed without movement - the stretch position and holding the stretch for a specific amount of time.
	Work out	Strengthening exercises, e.g., muscles with a tendency to weaken.
	Specific warm-up	Warm-up that connects with the main activity.
	Missing warm-up	Warm-up is skipped.
	Other	It refers to sequences that cannot be classified into any of the above subcategories.
Content of warm-up (non-traditional)	Warm-up with the music	Warm-up is done to the music.
	Warm-up games	For example, imitating animals, using non-traditional tools...
	Other	It refers to sequences that cannot be classified into any of the above subcategories.

Category	Subcategory	Content definition
Teacher activities during warm-up	Practice (demonstrate exercise)	Teacher demonstrates exercise and gives verbal instructions.
	Verbal instructions	Teacher gives verbal instructions, counts repetitions of exercises etc.
	Observation	Teacher does not demonstrate exercise neither gives verbal instruction, teacher just observe students during warm-up.
	Refer to mistakes	Teacher refers to mistakes without correction of exercise.
	Correction	Teacher refers to mistakes and demonstrate or describe correct execution.
	Evaluation	Teacher evaluates the students.
	Motivation	Teacher motivates the students.
	Other	It refers to sequences that cannot be classified into any of the above subcategories.

For data analysis deductive approach was used. It's principle is that (sub)categories (codes) were used for capturing phenomena observation in video recordings then are used in a form of the categorical system. For coding and data analysis, the Videograph software (Rimmele 2002, see Figure 1) was used. Microsoft Excel was utilised for statistics.

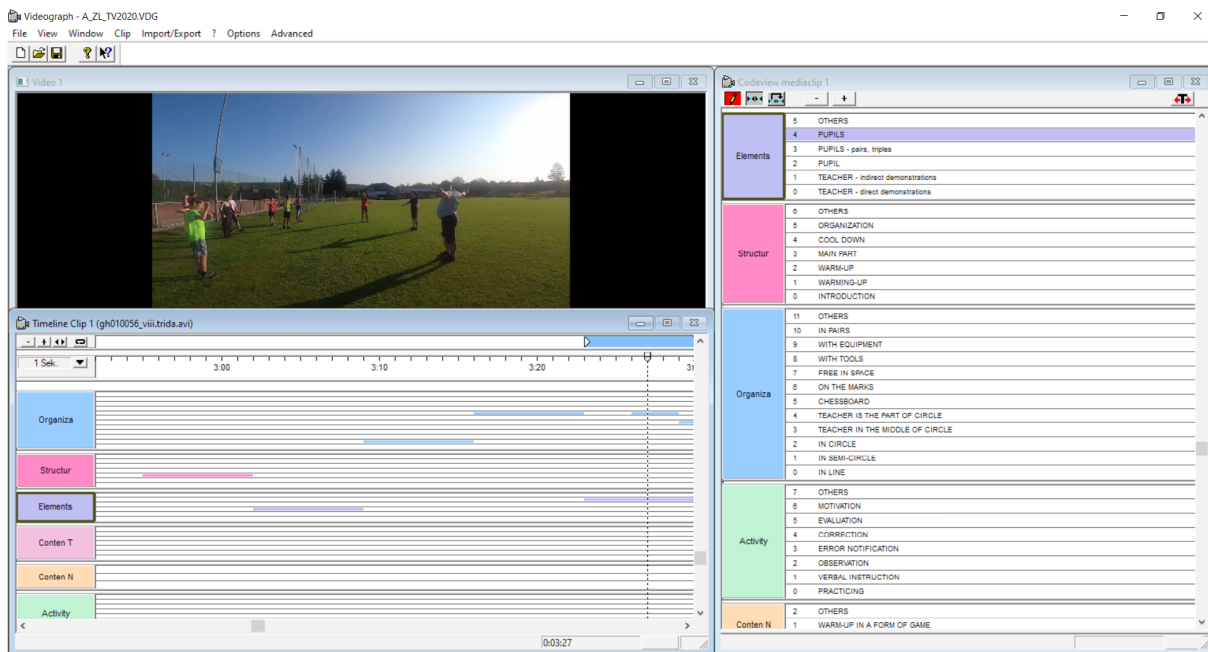


Figure 1. Videograph

The criteria for determining the length of the whole lesson were the following:

- The lesson length was measured from the time the teacher made it clear that the lesson was beginning (in most cases associated with the start of the students) until the teacher verbally finished the lesson (typically with the words “split up”, “let’s get change your clothes” etc.).

The criteria for determining the length of the warm-up were the following:

- The signal for measuring the start of the warm-up part was that the teacher verbally encouraged the students to do one of the activities related to the warm-up, using, e.g. the words “let’s warm-up”, “let’s stretch”, and “find a place”. The signal for the end of the warm-up part was again a verbal instruction from the teacher, for example: “let’s move on”, “so we stretched”, etc.

RESULTS

The research sample includes 32 lessons of PE with 45 minutes and three lessons of PE with 90 minutes. To sum up, 21 hours, 17 minutes and 16 seconds of PE lessons were observed. The warm-up lasted 3 hours, 42 minutes and 56 seconds for all analysed lessons. The average duration of a PE lesson was 36 minutes and 30 seconds. The average length of the warm-up time was 6 minutes and 22 seconds (the standard deviation was 2 minutes and 37 seconds, and the median was 5 minutes and 33 seconds).

Physical education classes are typically measured in minutes rather than percentages because time is a more straightforward and universal way of measuring duration. Minutes provide a more tangible way for students and educators to plan and execute a class schedule while percentages can be more abstract and difficult to visualize.

Additionally, minutes allow for a more precise way of measuring physical activity, which is often measured in minutes per day or week to meet recommended levels of exercise. It is also easier to calculate grades, attendance, and overall performance based on minutes spent in physical education class than it would be using percentages.

Overall, although percentages can be useful in some contexts, minutes remain the standard unit of measure for physical education classes.

PE lessons and warm-up: composition and content

Regarding the content of the warm-up, it is essential to consider what will be focus on in the main activity. For this reason, we analysed the role it plays in warm-ups in relation to the main activity. First, we roughly analysed the overall content focus of the examined lessons (see Figure 2). Most lessons were focused on games (15 lessons), followed by athletics (9 lessons). In contrast, we did not find any combat sport-oriented lessons.

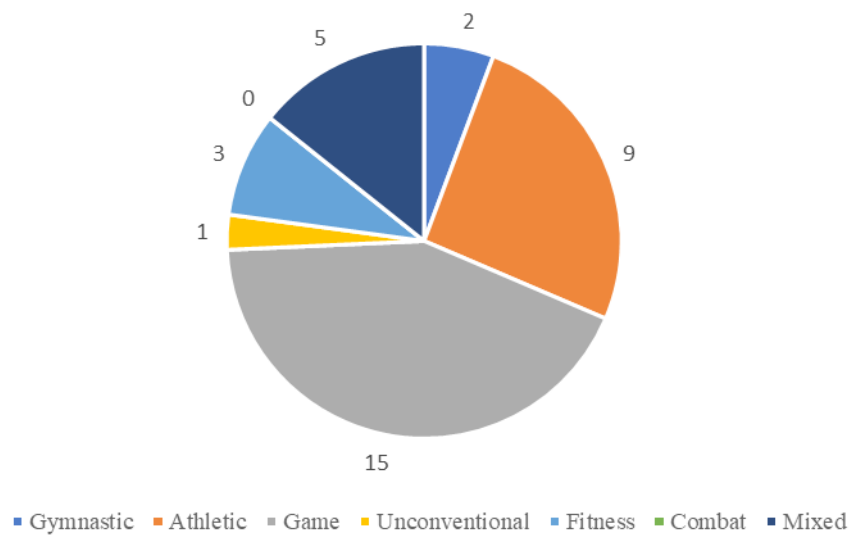


Figure 2. Typology of lessons according to content

Then we performed a detailed analysis of the lessons recorded and found (based on the study of the warm-up exercises and the objectives of the main part) that in most of the PE lessons, there is a connection (correspondence) between the content of the warm-up and the main part of PE lessons.

In athletic lessons, the mobilization (dynamic part) was most often used on the spot in combination with static stretching of the lower limbs. In four lessons, the teachers also included an ABC running drill during the warm-up. Three teachers did not include a comprehensive ABC running drill in the warm-up, but only some of its leg extension and butt-kicking elements. In two warm-ups (led by the student, and the second time by the teacher) the elements of cool-down were included at the beginning of the warm-up after the pulse-raising activities.

In the two observed gymnastics lessons, the mobilization (dynamic) part on the spot and the mobilization of the head were included most frequently. There was employed static stretching or pulse-raising activities of the lower limbs while standing and sitting.

In the fifteen recorded game lessons, the mobilization (dynamic) part, the mobilization of the head and the static stretching of the lower limbs while standing were employed most frequently. Compared to other types of lessons, strength training, such as squats, push-ups, and V-Ups, was included in the warm-up. As in athletic classes, the warm-up was initiated by a cool-down.

During fitness lessons, the warm-up was devoted to the mobilization (dynamic) part, stretching the lower limbs while standing and sitting and stretching the upper limbs while sitting.

In one non-traditional lesson, elements of mobilization, static stretching, and “jumping-jacks” were used in the warm-up.

In mixed classes (with boys and girls together), the warm-up ABC running drill was also part of the warm-up due to the fact, that the first part was devoted to athletics (running techniques) and the second to games (“king” and football).

During the warm-up, we noticed some unusual elements in the recorded lessons (due to the exercises that preceded and followed them in the warm-up), which were so-called “completely out of context” to the content of the warm-up, but also the main part:

- Elements of yoga appeared in two warm-ups.
- Jogging was included in two warm-ups.
- Sprints were included in two warm-ups.
- Students crawled once at the end of the warm-up.

Further analysis of the obtained data showed that the two warm-ups were directly related to the content (topic) of the main activity. This is because the teachers used the same tools, which they used during the main part. In one warm-up, there was use of a basketball ball, to help increase the skill when playing the sport in the main part. The second warm-up also included a ball however this time it was a volleyball. The topic of main part of this observed PE lesson was the basics of sports games. In both the warm-up and the main part, the teacher used the same equipment, so he did not waste time returning or exchanging tools, but especially the student perceived natural continuity from the beginning of the PE lesson.

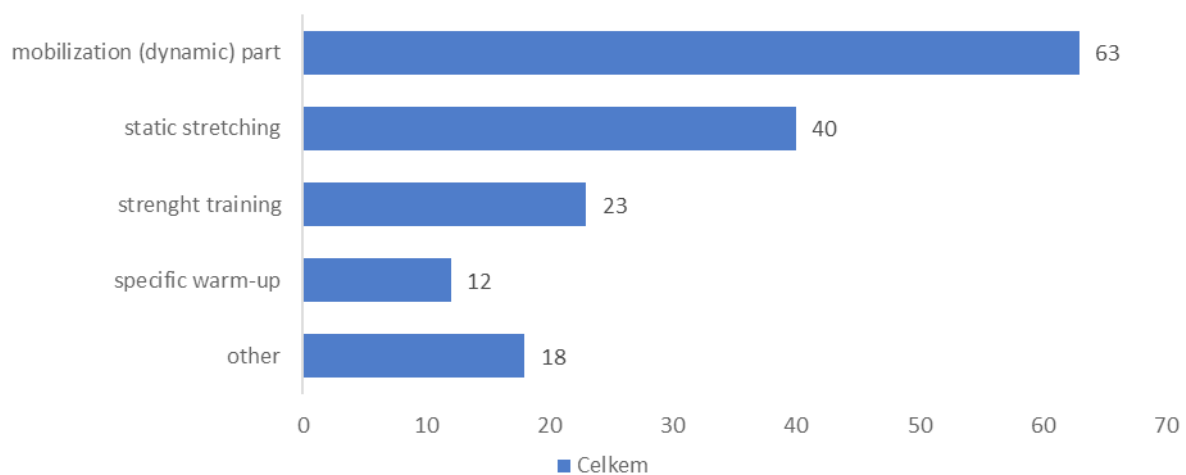


Figure 3. Content of warm-up in PE lessons

In one lesson of physical education, a tool (skipping rope) was used in the warm-up, which was not related to the content of the main part. Specifically, it was an athletic lesson (preparation for the long jump).

In the warm-up (see Figure 3), the mobilization (dynamic) part was the most common (63x) In neither case was it a dynamic part in motion. The second most represented content of the warm-up (40 times in total) was static stretching. It occurred in different forms and other parts of the warm-up. In lessons led by a teacher, a student or two students, static stretching exercises were used, both standing and sitting. A total of 23 strength training sessions appeared during the warm-up, most often squats and push-ups. In two lessons there were V-Ups, sit-ups and plank. The specific warm-up most often presented the ABC running drill or the application of its elements. In specific cases (see category “others”), the warm-up was about exhaling, jogging, sprinting, jumping jacks and crawling.

Teacher activity during warm-up and its' organisation

The teacher is responsible for the content of the warm-up. The teacher should choose activities during the warm-up related to the correct execution of exercises that connect to the following

activities. Therefore, we created a categorical system that covers the teacher's activities during the warm-up (see Figure 4).

During the warmup the teacher pointed out mistakes (30 times in total), however, in most cases, it was resolved by simple instructions. The next most common task (also 30x) was activities from the category "other", which included organizational matters. Such as "let's make a place" (12x), questions such as "what we haven't stretched yet", or questions about health status (5x), preparing tools, which means that the teacher did not even observe the warm-up, but was preparing tools for the next part of the lesson (5x), 3x the teacher "moralize" the students, 2x provided the feedback, 2x the teacher exercise together with the students, in one case the teacher asked the students what was done in the last PE lessons, also in one case the teacher check the attendance and once the teacher whistled a change of direction at the exercise.

The next most represented category (23x) was verbal instructions. This means that the teachers no longer performed the exercises but only described them verbally. The teachers used vocabulary that the students knew well.

When the warm-up was led by a student/students, in twenty-one cases, the teacher only watched them and did not interfere in the exercises in any way.

During the demonstration of exercises (16 times), the teacher was the only leader no students were involved. During the demonstration of exercises, the teacher most often accompanied the activity verbally or counted the number of repetitions.

The category of motivation (16x) was more of a brief short phrase. E.g. "hold on", "go, go", "let's still go", "girls, let's go", etc. An example of longer motivation is "whoever can't, can practice at home".

The least represented categories were evaluation (12x) and comparison (11x).

In the evaluation case, it was a brief reaction to conducting a warm-up or performing an exercise – e.g., "excellent", "very nice", "great", "super", etc.

For correction, teachers usually approached the students individually and corrected the exercises manually. Or they told the students that variant B would be better than variant A.

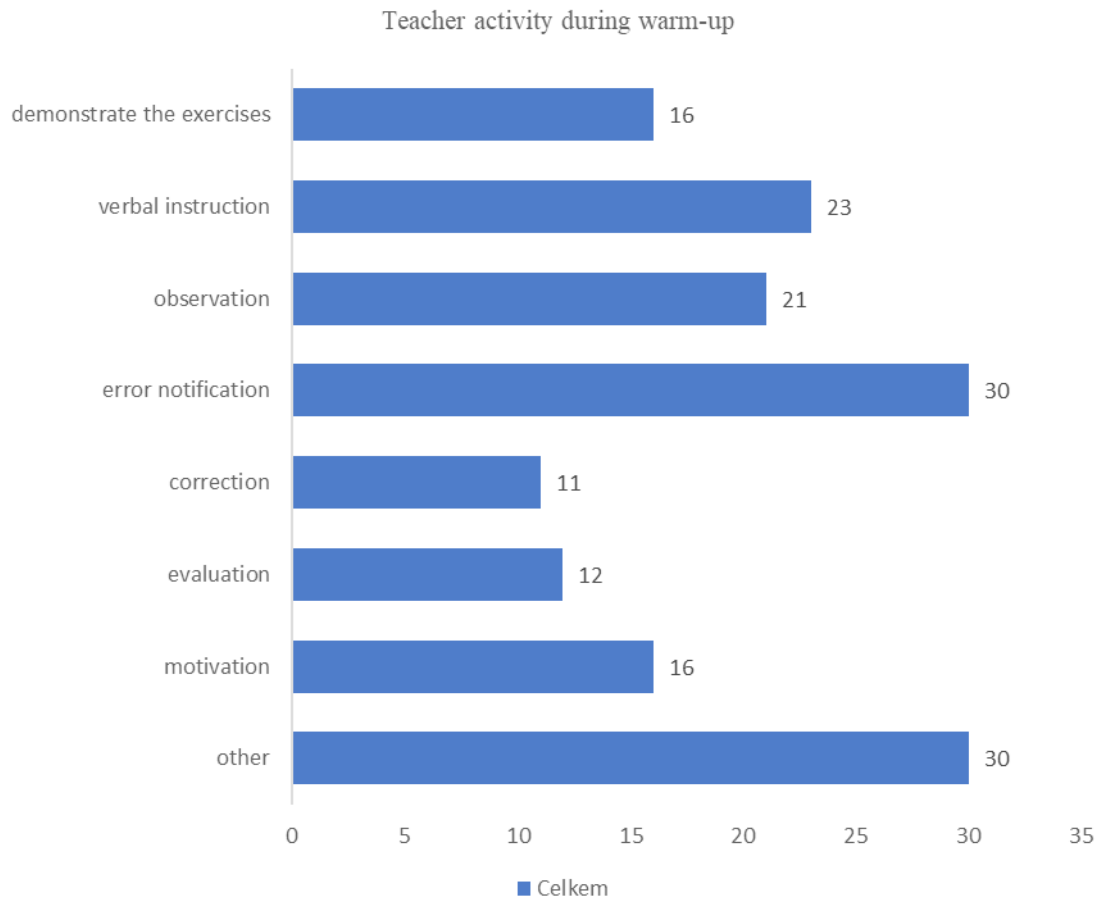


Figure 4. Teacher activity during warm-up

DISCUSSION AND CONCLUSION

When studying the literature, the challenge of defining the “warm-up” in PE lessons occurred. Some authors (Albrechtová, 2006; Buzková, 2006; Ramík, 2010; Stackeová, 2014; Ramsay, 2014) use the word “stretching” instead of “warm-up”. From the content definition and from the context of including stretching in the “movement lesson”, it may seem that it could be a synonym. However, it should be noted that these authors publish mainly in the field of fitness and exercise programs for coaches and the public, so their goal is not to define the “preparatory part”, which is included in the literature of PE didactics.

A positive finding was that warm-up was included in each of the analysed lessons. The average duration of the warm-up was 6 minutes and 8 seconds for the regular 45-minute lessons and 8 minutes and 50 seconds for the 90-minute lessons. This time also corresponds to the time reported in the literature, e.g. Škop (2000) sets the length of the warm-up at six to ten minutes. We also agree with Škop (2000), that he separates the time for warm-up from the time for pulse-raising activities, and, of course, the other parts are clearly defined in time.

In the lessons we studied, the connection between the warm-up and the main part was observed. For example, the warm-up, which closely corresponded to the athletic lesson, was analysed in four PE sessions. Specifically, it was about the inclusion of the ABC running drill in the warm-up.

Three teachers included elements of the ABC running drill in the warm-up. In two PE lessons, the connection of the warm-up with the main part was due to the use of equipment during warm-up. In both cases, it was a ball. One lesson was focused on the basketball game, the other on the basics of sports games. It is important to say that the content of the warm-up (the selection of exercises) should correspond to the given physical activities used in the main part. Jebavý (2014) mentions that the teacher should include general and then special exercises in the warm-up.

A positive finding is that teachers often pointed out errors in the lessons. According to Klimtová (2010), not correcting mistakes is a common shortcoming that teachers make. Sometimes the student does not even notice the poor exercise. The students need to know when they are doing something wrong because then they can improve and know what to work on. Especially if, for example, poor exercise could be fixed, which could harm the body rather than a benefit in the future. Dvořáková (2012) emphasizes that the teacher should explain the importance of the exercise. However, we rarely met with that in the analysed lessons. Another issue is the form in which the student learns that he has made a mistake. In PE, there is often not enough space for long explanations allocated; short commands are frequently used.

The evaluation of the observed warm-ups in relation to their correctness, structure, content, and leadership, as per the recommendations of academic publications, yielded notable results. The warm-ups generally demonstrated a commendable level of accuracy, with a well-structured format and appropriate content that adhered to established guidelines. However, occasional shortcomings were noted in terms of the structure and content, indicating room for improvement. Nonetheless, the leadership exhibited during the warm-ups was effective, demonstrating proficiency in guiding participants through the exercises. Overall, these findings highlight the successful implementation of warm-up strategies that align with best practices in the field, while also suggesting areas for further refinement.

As we mentioned in the Introduction, this research study could serve as inspiration, especially for PE teachers. Based on our findings, suggestions on how to think about warm-ups when preparing PE lessons could be provided – for example: to be aware of the physiological effects of individual exercise, to find correct (safe) space for students, to use correct vocabulary, point to out possible mistakes, to communicate correct performance, etc.

However, it is crucial to keep in mind the limiting factors that influence the choice of warm-up exercises – for example the environment, the age of the students, and the variability of the warm-up.

We see the following research option in the analysis of the cool-down part of PE lessons. During our previous observation and analysis, we noticed, that the cool-down part is also devoted to a minimum of time and its' position is probably not clear within PE lessons. However, the next analysis is needed to highlight this phenomenon.

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