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Standard-based inspection and teacher assessment of climbing facilities and equipment in pre-school and primary centers in the province of Pontevedra (Galicia)

Inspección en base a norma y valoración docente de instalaciones y equipamiento de escalada en centros de Educación Infantil y Primaria de la provincia de Pontevedra (Galicia)

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Abstract. The purpose was to identify the risks of climbing facilities in primary schools in the province of Pontevedra (Galicia) in comparison with the regulatory standard, as well as the teachers' assessment of their use, maintenance and safety. The study was carried out in 18 schools by means of an inspection check-list and a questionnaire. Bearing in mind that it is not common for climbing walls to be used for non-educational activities and by people other than the pupils themselves, the most frequent risks were the lack of signage and warnings, and it was found that all the facilities present some risk, of a trivial or tolerable level, which coincides with similar studies. It is important to provide the teaching staff with tools so that they can carry out periodic checks, although they confirmed that the climbing walls studied were totally safe for the activities carried out.
Keywords: Risks, accidents, walls, climbing, review, teachers, school.

Resumen. Se pretendió identificar los riesgos de las instalaciones de escalada en centros de Educación Primaria de la provincia de Pontevedra (Galicia) en comparación con el estándar normativo, así como la valoración que hacen los docentes sobre su uso, mantenimiento y seguridad. Accedieron al estudio 18 centros escolares, mediante un check-list de inspección y un cuestionario. Teniendo en cuenta que no es habitual que los rocódromos se dediquen a otras actividades no educativas y por otras personas que no sean los propios alumnos, los riesgos más frecuentes fueron la falta de señalización y advertencia, constatándose que todas las instalaciones presentan algún riesgo, de nivel trivial o tolerable, lo que coincide con estudios similares. Es importante poner a disposición del profesorado de herramientas para que pueda realizar revisiones periódicas, pero pesar de que ello se confirmó que los rocódromos estudiados eran totalmente seguros para las actividades realizadas.
Palabras clave. Riesgos, accidentes, paredes, escalada, revisión, profesorado, escuela.

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Introduction

In recent decades, artificial climbing has been increasing in popularity and the number of sports facilities, with artificial climbing surfaces being one of the most popular options due to their versatility and simplicity, being relatively affordable and easy to install. This type of facility must meet a series of requirements in terms of the materials to be used, assembly and installation, maintenance, conservation and conditions of use to avoid or, at least, minimise the risks associated with the sport for which they are intended (CBJ, 2022).

Accidents in sport facilities intended for the practice of physical activity, both during school hours and outside of it, have several causes, which include human factors, such as competence, skill in practice, knowledge about the activity to be carried out, dexterity, etc. etc. and environmental factors, including the condition, design, assembly and maintenance of the sports facilities used. Physical practice is the main cause of school accidents (Abernethy et al., 2003), to a greater extent in school sports activities than extracurricular activities (Zagel et al., 2019), mainly at recess and in Physical Education classes. 80% of children, mostly in primary education, who suffer a school accident are usually due to falls or unintentional blows, with mild or moderate consequences (Al-Hajj et al., 2020). Among the causes are that young people, especially boys, who underestimate the possibility of certain risks (Latorre et al., 2015; Gabari & Sáenz, 2018). For this reason, muscle strength work (hand grip) is indicated as necessary and VO_2 max benefits the perceived risk index (González-Gálvez et al., 2023).

In the study by Ruiz et al. (2010), on child accidents carried out on 421 students in the 5th and 6th year of Primary Education, as the age of boys increased, accidents occurred to a greater extent than in girls and especially on the street. In addition, the school was presented as the safest environment. The observed child accident rate had many coincidences with the occupational accident rate (falls, cuts and blows), justifying the importance of reinforcing preventive behaviors at an early age so that it can be transferred in adulthood to a reduction in risks. Both on the street and in the school the most frequent types of accidents were the same, while on the street 83% were due to falls (37.7%), blows (25.6%) and cuts (19.5%); In schools, 95% of accidents were caused by falls (43.4%), blows (39.3%) and cuts (12%). However, several studies have identified the facilities used as risk components. Specifically, Maciá et al. (2020), found numerous risks in the school sports equipment evaluated, and in this case, also among those dedicated to climbing. Along these lines Nabavizadeh et al. (2021), examined the US National Electronic Injury Surveillance System database for playground-related injuries sustained in children ≤17 years between 2010 and 2019, and concluded that more than 55% of unintentional

genital injuries occurred on playgrounds, including climbing apparatus. In this sense, Estapé (2003), already pointed out as passive safety the need for materials to have an adequate design, aspect that is regulated by Royal Decree 1801/2003 (Gobierno de España, 2003), which establishes the rules to guarantee that the products placed on the market are safe, and be correctly located in the sports space, linking active safety to the perception of the educator, who must be able to review and inventory the state of conservation, both of the material and of the space to be used. And to do this, you need to have the right training and tools.

With regard to occupational risk prevention, article 4 of Royal Decree 1537/2003 (Ministerio de Educación, Cultura y Deporte, 2003), which establishes the minimum requirements for centres that provide general school education, states that educational centres must meet the safety conditions set out in current legislation. Likewise, Royal Decree 486/1997 (Ministerio de Trabajo y Asuntos Sociales, 1997), which establishes the minimum health and safety conditions in workplaces, includes the minimum health and safety provisions in workplaces. Article 3 establishes the general obligation of the employer to adopt the necessary measures to ensure that the use of workplaces does not give rise to risks to the health and safety of workers.

On the other hand, article 21 of Law 31/1995 (GE, 1995), on the prevention of occupational hazards establishes that in the event of a serious and imminent risk, the employer is obliged to inform all workers of the existence of said risk and to adopt the necessary measures in terms of prevention, and if this cannot be avoided, to stop the activity. Likewise, it establishes that the worker, in the event of appreciating that the activity entails a serious and imminent risk, will have the right to interrupt the activity. Article 29 sets out the obligations of workers in terms of risk prevention, including the obligation to ensure, according to their possibilities, their own safety and that of other persons who may be affected by their professional activity.

All these regulations reinforce the general idea that installations and equipment must not only comply with the basic regulations on manufacture, installation and scheduled periodic inspections, but must at all times meet the conditions of use that guarantee safety, and if this is not the case, the relevant protective measures must be taken. Similarly, Law 1/1991 (GE, 1991), the Modification of the Civil and Criminal Codes on the Civil Liability of Teachers, came to modify articles 22 of the Criminal Code and 1903 of the Civil Code, in order to grant greater protection to teachers and reverse the so-called "culpa in vigilando", and establishing that those responsible for damages caused by their students are the owners of the centres, although Article 1904 opens up the possibility that non-university education centres may demand the amounts paid to the teacher if there is malice or gross negligence in the exercise of their functions.

It is also necessary to take into account Royal Decree 393/2007 (Ministerio del Interior, 2007), which approves the Basic Self-Protection Regulations for centres, establishments and facilities engaged in activities that may give rise to emergency situations, which is considered a minimum standard and establishes that the self-protection plan must identify and assess risks in order to plan preventive activity and establish the actions to be taken in the event of an emergency. As well as Law 39/2022 (GE, 2022), on Sport, which establishes that the administrations must promote physical activity in safe conditions, without causing harm or risk, and urges the Autonomous Communities and Local Entities to update the technical regulations for sports facilities and their equipment within the scope of their competences, paying special attention to the safety requirements of these, and in its article 124 establishes that the necessary public policies will be developed to guarantee the safety of sports facilities.

In addition to the general safety regulations, we will take into account the NIDE regulations on sports and leisure facilities of Higher Sports Council of Spain (CSD, 2021) and the safety standards for sports facilities (CSD, 2010) which aim to define the regulatory and design conditions to be considered in the construction of sports facilities. These regulations are used in a sports venue to define the regulatory and design conditions in the construction. However, it is only compulsory for projects that are totally or partially funded by the CSD, or those that are built for official competitions. In its preparation, the current regulations of the corresponding Sports Federations have been taken into account, as well as the technical regulations for sports facilities (UNE-EN) (CSD, 2021) on sports equipment, which establish the minimum criteria that must be applied for it to be safe in relation to stability, risk of entrapment, protection against impacts and resistance. The only specific norm, Autonomus Decree 38/2009 of the Community of Navarra, on Safety Measures in Sports Facilities and Equipment (Comunidad Foral de Navarra, 2009), also indicates that the requirements established in the previous regulations will be taken into account, both for fixed and mobile sports equipment.

More specifically, the reference regulations for artificial climbing structures are (AENOR, 2017): UNE-EN 12572-1:2007 (Artificial climbing structures. Part 1. Safety Requirements and Test Methods for SAE with Protection Points); UNE-EN 12572-2:2007 (Artificial climbing structures. Part 2. Safety requirements and test methods. climbing walls); and UNE-EN 12572-3:2007 (Artificial climbing structures. Part 3. Safety Requirements and Test Methods for Climbing Dams).

With regard to the legal obligation to comply with UNE standards if they are not included in a law or mandatory regulation, the following is an interesting reflection on the conviction for an accident in a climbing wall referred to below: "although the UNE standards would not be mandatory in

principle, they do constitute a framework of good practice in each sector of activity, developing standards recognised by all, so that compliance or non-compliance with the UNE by a facility, in this case a sports facility, can be a reflection of the correctness and technical adequacy of the same" (López, 2021, p. 1).

The objective was to identify and assess the risks of artificial climbing systems installed in primary schools in the province of Pontevedra, as well as to know the perception of safety and the use given to this type of facilities by teachers who have access to them.

Method and materials

Participants

The population consisted of 161 randomly selected primary schools in the province of Pontevedra who were contacted by telephone to determine whether or not they had artificial climbing facilities. The sample were composed by 26 centers of them had this type of facilities (26,15%), and finally 18 schools and teachers participed, one form each school.

Instrument

Instruments for facility assessment: a checklist for risk existence and assessment was used (Annex I). The list was defined by 22 risk items and two controls were carried out consisting of the identification of risk on a dichotomous scale of existence of risk or absence of risk, and in the case of positive identification of risk, a scale of risk estimation from 1 to 5, which will determine the possibility or not of using the installation (Figure 1). For this purpose, the criteria for determining risk contained in Technical Prevention Note 330: Simplified accident risk assessment system of the National Institute for Safety and Health at Work (Instituto Nacional de Seguridad y Salud en el Trabajo, 1994) and the check-list drawn up by (Herrador & Latorre, 2005) for the analysis and assessment of the safety of school sports facilities and equipment have been taken into account. The study was conducted by the authors, who acted as observers and recorded the data. Both have knowledge and specialization in Sports Regulations and Safety. An initial pilot test was carried out with two centers, which helped with prior training and error filtering.

Table 1.
Risk assessment (INSST, 2022)

	Risk	Assessment
1	TRIVIA	No specific action required
2	TOLERABLE	No corrective action is necessary, although improvements can be envisaged and the effectiveness of control measures should be monitored regularly
3	MODERATE	Efforts should be made to reduce risk by determining the right investments. Where moderate risk is associated with extremely harmful consequences, further action will be required to more accurately establish the likelihood of harm.
4	IMPORTANT	The installation should not be used until the risk has been reduced. Considerable resources may be required to control risk
5	NOT TOLERABLE	The installation should not be used until the risk is reduced. If it is not possible to reduce the risk, the use of the installation should be prohibited

To carry out the risk assessment, the potential severity of the damage has been taken into account, depending on two factors, the part of the body that may be affected and the severity of the damage that could be caused, and as a second factor, the probability that the risk will materialize is assessed.

Instruments for teachers perception of risk: a monitoring and assessment questionnaire (Wood & Smith, 2018) consisting of 12 questions was used to identify the context of the installation, use of this type of structure and teachers' assessment (Annex II). In this case, the questions would be framed in three blocks: 1) Installation: This is about determining determining aspects of the installation such as age, maintenance and accidents (5 items); 2) Use: This is about determining the context of use of the installation (5 items); and Teacher's assessment: To know the teacher's opinion about this type of facility.

Procedure

The study was conducted between November 2022 and May 2023. An application for participation in the study consisting of a short description of the object of the study, the need for a visit to carry out a visual inspection and interview to be covered by a teacher with access to the facility, as well as an informed consent form were sent to each centre telematically. Once the approval for participation in the study was obtained by the center and the teacher, visits were arranged during which the informed consent was delivered and signed (Annex III), and a visual inspection of the facilities was carried out, in accordance with the indicators of the safety check-list, taking photographs of them. Coinciding with the visit, questionnaires were carried out to the teachers who used these facilities. In this research, a security analysis of the facilities was carried out using quantitative methodology, with a descriptive caracter (Thomas & Nelson, 2007). We used the data to calculate de medium ranges and percentages.

Results

Security Analysis

In the safety data shown in figure 1, we find that in all the facilities some risk was identified, with the average number of risk items identified being 9 of the 22 assessed and the extreme values of 3 in the facilities in which the fewest risk items

were identified and 16 in those in which the most were identified. The risk items most detected were those related to signposting, finding that in 94.4% of the facilities the difficulty of the route is not indicated, and in 88.88% of the facilities there are no warning signs or indications for the correct use of the facility. Factors 1, 2, 3, 9, 10, 21 and 22 (red point) have the highest risk frequency (>51%); factors 4, 5, 6, 7, 13, 15, 16, 17 and 20 (yellow point) have a medium risk frequency (<51%); and factors 9, 11, 12, 14, 18, 19 (green point) have the lowest risk frequency (<11%).

The risk associated with the delimitation of the facility indicates that 77.78% of the facilities do not have a perimeter fence, 72.22% do not have a delimited fall zone and 66.67% do not have a delimited climbing wall area. Likewise, none of the facilities has an overhang and only one, 5.5%, has holds or handholds at a height of more than two metres, this being the most highly valued risk found.

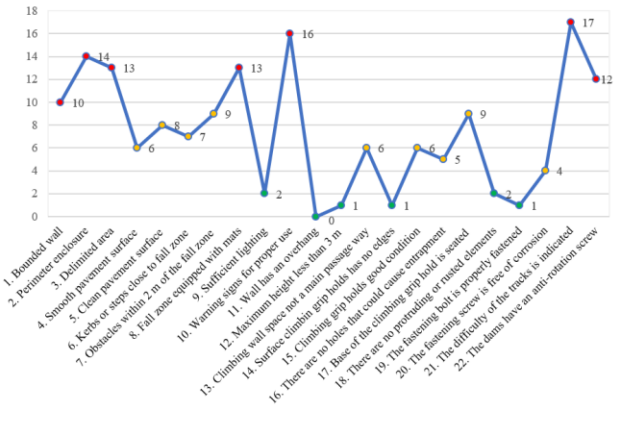

Figure 1. Presence of risk

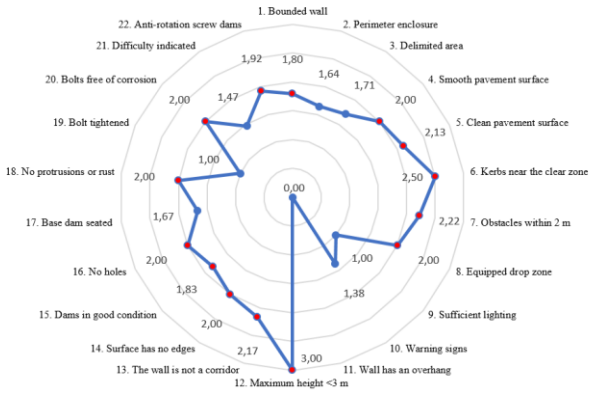

Figure 2. Risk level (1-5)

Regarding the risk assessment shown in figure 2, the average risk detected is 1.72 (x=1,72; SD=0,59), between trivial and tolerable, with the highest risk assessment found being 3, moderate risk, associated with a height greater than three meters found in a single facility, followed by 2.5, between tolerable and moderate, associated with the existence of nearby curbs or steps. less than 2 meters from the climbing wall area. 14 items are above the mid-range (red point), representing 64% of points analysed.

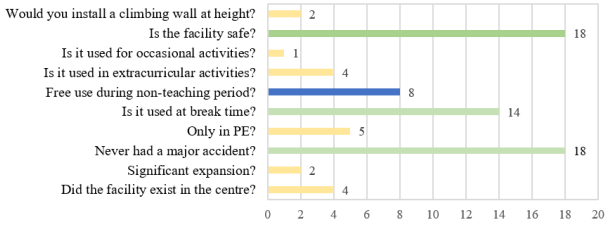

Figure 3. Assessment of facilities

From the answers shown in figure 3, it can be seen that most of the teachers were already in the school when the installation was carried out, and the average age of the facilities is <4 years, they are really news, a fact that partly explains the absence of major renovations of the facilities. We can see in that teachers (100% - green colour) consider the installation to be safe, and confirm that no major accidents have occurred in any of them (100% - green colour). And in terms of use, the centers that have this type of facilities use them mostly in physical education classes (27,78%- Yellow color), although a high percentage of the facilities are also free access during recess and outside the school period (44,4% - Blue colour), not being used in competitive days or activities, which indicates that their main use is as part of physical education and leisure activities. They are not mostly intended for the sport of competitive climbing or as a federated sports activity (5-22% - yellow colour).

Discussion

Implementing content of Activities in the Natural Environment in schools like climbing is complicated (Arufe et al., 2012), among other issues for reasons of school calendar, meteorology or teaching organization. Despite the fact that they are perceived as very positive, outdoor proposals are no longer included in the teaching programmes, which continues to be low (Navarro et al., 2015), justified by the various opinions of the school management, the students or their families; the economic cost; the distance to the facilities; organizational and material difficulties; or the need for teacher training (Guillén & Peñarrubia, 2013).

The risk factor is an important conditioning factor, but at the same time an educational element with great potential, since it allows the student to learn to identify it and improve strategies to manage it (López et al., 2015), and we know that safety in school sport practices is a fundamental aspect that directly influences the well-being and development of students, and in order to achieve a safe environment there are several factors involved such as the planning of the preventive

activity, the continuous evaluation of the same, the training of staff and the awareness of the school community, among other aspects. Waiting for research advances to know the level of safety of the equipment used in the different educational stages (Burillo et al., 2010; Maciá et al., 2020), it is understood that these climbing facilities are not the most common in schools, both due to their price, complexity of construction, maintenance and control, as well as the physical, technical, and mental and emotional maturity of the students who can use them. It is common to see small groups of dams on the walls of school playgrounds, or other intermediate equipment in school gymnasiums such as trellises, which complement the proposals made in Physical Education, although equipped climbing walls are undoubtedly facilities that pose a much greater challenge for teachers, students and educational centers

The need for safe facilities is a fundamental element when developing activities with the highest possible level of safety, and teachers must be able to have elements of judgment to determine whether the facilities at their disposal are safe, but when assessing the safety of these facilities, we find a lack of precision in terms of the regulations to be met and the guidelines are often unspecific and general recommendations, hence the need to develop tools that allow us to perform a specific analysis of safety in the facilities that we will use to identify the risks they present and to seek solutions to them. Despite these demands, we know of interesting low cost educational projects, an example was the construction of a climbing wall in a Nursery and Primary School was proposed, taking advantage of materials provided by local entities and of natural origin (Falo et al., 2020). About that, it is important to have specific training that favors the realization of innovative proposals (Granero et al., 2016), in addition to carrying out a documented project in which technical specialists in design and construction participate.

Although in general any physical activity is inherently associated with a risk component, which can be due to several factors, including the environment in which it is carried out, the nature of the activity or the equipment used, the practice of climbing, especially on artificial surfaces, has an element of risk inherently associated with the facility itself. The conditions of design, assembly, maintenance and use have a great influence on the safety of the activity. At schools, through Physical Education, the body knowledge and physical-motor development of students from the earliest ages is helped. In this subject, teaching-learning experiences are used that are dynamic and motivating, although they are not without risks to the health of students and teachers. In relation to the equipment we studied, it is considered necessary to control aspects such as interaction with the own material, the delimitation of spaces, the age of the student, and the speed of execution of the tasks, since these are aspects that could transcend in a legal claim against the teacher, the school, or the educational administration (Herrador, 2013; in: López, 2015).

The low presence of this type of facility in the schools consulted stands out, with only 16.5% of the schools contacted having this type of facility. The risks with the greatest presence are those related to signposting, not indicating the difficulty of the route, present in 94.44% of the facilities and the non-existence of warning signs for its proper use in 88.89% of the facilities, followed by those related to the delimitation of the facility, finding that 77.78% of the facilities have no perimeter enclosure to separate it from other slopes or facilities and 72.22% do not have a signposting of the fall zone. This is in agreement with Silva (2023), who points out that most of these facilities do not have adequate signage or procedures for use (17%), and that they are used under supervision (42%), or control outside school hours (33%). These risks associated with signage have a low risk rating and are easily solvable with minimal intervention.

Regarding the need to comply with regulatory standards and well-equipped and signposted facilities, the Ombudsman's report (Defensor del Pueblo, 2015) indicates that a public entity in charge of a sports facility should refer to the Technical Safety Standards drawn up by the European Committee for Standardisation and approved by the Spanish Association for Standardisation and Certification (AENOR), which, although not mandatory, are usually included in specifications for the supply of equipment. In any case, the administrations are competent to determine the conditions of the installation and maintenance to guarantee safe activity, whether for adults, young people or children. The state establishes the minimums, the autonomous regions develop or extend them, and the local authorities guarantee them. The fact that there are no compulsory safety regulations for sports facilities indicates that their correct installation and maintenance is not guaranteed, but neither is it enforceable. And in the case that there are regional or local regulations, it will be complicated to observe a chapter on infractions or sanctions.

The risks with the lowest presence are having a height greater than 3 meters, being in a single installation, this risk being due to a decision in the design of the same and the presence of sharp edges or burrs, due to poor installation and maintenance, which are present in only 5.56% of the installations. The next risk found with the highest average severity is the presence of curbs or steps near the climbing wall area, with a rating of 2.5 between tolerable and moderate, and which is due in most cases to insufficient space in the areas intended for sports practice, which must be shared with other areas of the schools.

Although there are studies on the safety of sports facilities in schools (Maciá et al., 2021), which stress the importance of carrying out periodic reviews of the facilities (Gallardo et al., 2022) and which highlight the need to provide teachers with tools to assess the safety of their facilities (Ros-Martín,

2022), there is a significant lack of literature and studies specifically addressing the safety of sports facilities, which highlights the need to provide teachers with tools to assess the safety of their facilities (Ros-Martín, 2022), we find that there is a significant lack of literature and studies that specifically address artificial climbing surfaces, with the particularities that these have, which makes it difficult to make comparisons between the different types of facilities (Ros-Martín et al., 2022), we can affirm that, as with other types of sports facilities in other studies (Soriano, 2014), the presence of risks is generally very high, 100% of the facilities present some type of risk, but when we take into account the assessment of these risks is on average 1.73, between trivial and tolerable, so it is necessary not only to identify the risk, but also to assess the degree of risk, and once this assessment has been carried out, what we observe are facilities that, although they do not meet optimal safety standards, do meet the minimum standards for carrying out the planned activity, trying to solve the risks detected as soon as possible.

Playful activity by itself, especially within a school, is a fundamental element of the physical, intellectual, emotional and social growth of each person from childhood. Although it involves risks, they will be acceptable as part of a motivating and supervised practice context. In addition to requiring that equipment for sports physical education meets the highest safety standards, it is necessary to guarantee a correct installation, and regular inspections and maintenance by qualified professionals, since these facilities have an intense and continuous use that demands it (DP, 2015). Considering the above, our work coincides with the perception of the teachers, since 100% of them consider their climbing facilities safe, and reports that in no case did there occur any outstanding accidents in them.

Therefore, it is not only a question of safety, but also of risk perception. As mentioned above, these facilities are not very widespread, and if we were to take into account the necessary precautions and training, we could talk about safe, dynamic and attractive school source from an early age. And this opinion is what emanates from our data. In any case, it is important to reinforce as much as possible the attention and supervision of teachers, students or the school so that a current of negative opinion is not provoked, since we are in a sensitive and expansive moment. All the new studies that can be carried out, the training and educational proposals, as well as the technological and regulatory advances of the coming years will be important. In fact, the school's outdoor activities, and those carried out indoors, must respond to current demands proactively and critically. However, we must be cautious and not let an uncontrolled increase in these practices negatively affect, paradoxically, the natural environment itself (Funollet & Olivera, 2016), hence the facilities in the schools themselves can help to incorporate the values of respect and skills that students need and complement the natural space.

Conclusions

All the climbing facilities studied presented risks, although these were considered trivial or tolerable, which implies that no corrective actions would be necessary, and vigilance should be maintained on the control measures, especially the use and maintenance of the facility. On the other hand, the absence of signage and the lack of procedures and rules of use were the risk factors with the greatest presence in this type of facility. The majority of the teaching staff considered the facilities safe, advising against the incorporation of more complex surfaces or structures that can be progressed in height due to the difficulty of maintaining them, the necessary training and the need to limit access during the non-teaching period.

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Annexes

I. Safety Checklist

	SAFETY CRITERIA	RISK IDENTIFICATION		RISK ASSESSMENT
		YES	NO	1-5
1	The climbing wall area is delimited			
2	The climbing wall area has a perimeter fence that separates it from other courts, if any.			
3	The drop-free zone is demarcated.			
4	The pavement surface is smooth (no cracks, holes, potholes, holes without a lid).			
5	The pavement surface is clean			
6	There are curbs or steps close to the climbing wall area, less than 2 m away.			
7	There are obstacles within 2 meters of the drop zone.			
8	The drop area has mats.			
9	The lighting is sufficient.			
10	There are warning signs for proper use.			
11	The wall has collapsed.			
12	Maximum height is less than 3m			
13	The climbing wall space is not the main route of passage			
14	The surface of the dams is free of sharp edges and free of burrs.			
15	All dams are in good condition.			
16	There are no gaps or gaps that could cause imprisonment			
17	The base of the dam sits completely on the wall			
18	There are protruding or rusted elements.			
19	The clamping screw is correctly fastened.			
20	The set screw is free of rust or corrosion.			
21	The difficulty of the routes is indicated.			
22	The dams have an anti-rotation screw			
	TOTAL RISK ITEMS DETECTED	0	0	0

II. Teacher Assessment Questionnaire

	Installation		
1	Did the facility exist when you arrived at the center?	Yes	No
2	How old are you?		
3	Have there been any significant expansions?	Yes	No
4	What are the most common installation setbacks?		
5	Have there been any major accidents since it has been operational?	Yes	No
	Use		
6	Is the use limited to PE classes?	Yes	No
7	Is the facility used at recess?	Yes	No
8	Is the facility free to use during the non-teaching period?	Yes	No
9	Is the facility used for extracurricular activities?	Yes	No
10	Is the installation used in specific activities such as training days, sports competitions or courses?	Yes	No
	Assessment		
11	Do you consider the installation safe?	Yes	No
12	In the event that the installation does not require progression instruments, do you consider the installation of a climbing wall for height progression feasible?	Yes	No