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Online physically active academic lessons in COVID-19 times: A pilot study

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HIGHLIGHTS

- A positive perception of online physically active academic lessons was observed among participants.
- The main benefits of combining physical activity and curricular content were noted by the participants.
- During lessons, students did more physical activity, learned, and enjoyed the experience.
- Some parents also did more physical activity, together with their children.
- The barriers observed in this study will not prevent participants from taking part once again.

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ABSTRACT

Schools play an important role in promoting physical activity among students. This paper studies the perception of educators, students, and parents about the use of online physically active academic lessons during COVID-19 in the north of Chile. Starting the first week of November 2020, and for a period of five weeks, 323 students, alongside 11 educators, practiced a geometry-based dance routine online. The qualitative analysis results reveal a positive perception of the experience and an increase in physical activity without reducing the amount of time spent on academic activities. There were also improvements in learning, social relationships, and enjoyment.

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1. Introduction

The spread of COVID-19 led to the closure of schools across the world (Chitourou et al., 2020; Rundle, Park, Herbstman, Kinsey, & Wang, 2020; UNESCO, 2020). Students stayed at home, without walking to and from school, without going in and out of the classroom, without Physical Education, without recess (Dunton, Do, & Wang, 2020; Roe, Blikstad-Balas, & Dalland, 2021) and without any after-school sports programs (Roe et al., 2021; Schmidt et al., 2020). For thousands of students, it was not only their learning that was interrupted; they also lost the opportunity to do physical activity (Kovacs et al., 2021; Roe et al., 2021). Physical activity is defined as any bodily movement produced by skeletal muscles that requires energy expenditure (US Department of Health and Human Services, 2018; World Health Organization, 2010). In this sense, a decrease in physical activity among children and adolescents was reported in the US (Dunton et al., 2020; Jakobsson, Malm, Furberg, Ekelund, & Svendson, 2020), Canada (Guerrero et al., 2020; Moore et al., 2020), Croatia (Schmidt et al., 2020; Znic et al., 2020), France (Ginoux et al., 2021), Brazil and Spain (López-Gil, Tremblay, & Brazo-Sayavera, 2021), Italy (Pietrobelli et al., 2020), Norway (Roe et al., 2021), and China (Xiang, Zhang, & Kuwahara, 2020).

This situation exacerbated the current problems in public
healthcare stemming from low levels of physical activity and high levels of sedentarism among young people (King, Burke, Halson, & Hawley, 2020; Rundle et al., 2020). Taking action to combat the negative impact of physical inactivity during the pandemic is therefore essential (Chtourou et al., 2020). This undoubtedly includes promoting physical activity while respecting wider COVID-19 measures. One way of promoting physical activity during the pandemic is to use physically active academic lessons during online classes (Dunton et al., 2020). This is a way of mitigating the effects of inactivity and sedentarism among children, which, according to Hall, Laddu, Phillips, Lavie, and Arena (2021), can be both serious and long-lasting.

The aim of this study is to explore the acceptability and feasibility of using online physically active academic lessons, considering the perspective of the parents, teachers, and students. We are particularly interested in these three parties as school closures have significantly changed what it means to be a teacher, student, and even parent (Roe et al., 2021).

The research questions guiding this study therefore are:

- What were the teachers', students', and parents' perceptions of the use of online physically active academic lessons during the pandemic?
- What difficulties or barriers were identified by teachers, students, and parents throughout the use of online physically active academic lessons during the pandemic?

2. Background

2.1. The importance of staying physically active during the pandemic

Physical activity can combat the negative impact that fear of COVID-19 has on mental health and wellbeing among adolescents (Wright, Williams, & Veldhuijzen van Zanten, 2021). Lesser and Nienhuis (2020) suggested that adults who did more physical activity during lockdown reported lower levels of anxiety than those who were less active. Even before COVID-19, there was already ample evidence showing that physical activity among young people has multiple benefits. This includes improved cognitive function (Biddle, Cacciotti, Thomas, & Vergeer, 2019), better physical health (Janssen & Leblanc, 2010; US Department of Health and Human Services, 2018), better mental health (Lubans et al., 2016; Álvarez-Bueno et al., 2017), a more positive self-image and improved self-esteem (Dishman et al., 2006; McPhie & Rawana, 2012). In addition to this, other more specific benefits include reduced levels of aggressiveness (Basch, 2011; Bond et al., 2007), depression (Bailey, Hetrick, Rosenbaum, Purcell, & Parker, 2018; Rosenbaum, Tierdeman, Sherrington, Curtis, & Ward, 2014) and anxiety (Strohle, 2009).

In fact, the importance of physical activity was acknowledged by a number of countries during the pandemic as it was one of the few exceptions for people to leave their homes (Wright et al., 2021). Nevertheless, Jakobsson et al. (2020) suggest there is need for resources and solutions to allow young people to continue doing physical activity at home, despite restrictions. Measures must be taken and alternatives found in order to allow for physical activity and to combat the negative effects associated with COVID-19 restrictions (Amatriain-Fernández, Murillo-Rodríguez, Gronwald, Machado, & Budde, 2020; Chtourou et al., 2020). In this sense, Roe et al. (2021) suggest that teachers should support such initiatives by assigning tasks that require students to routinely participate in physical activity, even when at home.

2.2. Opportunities for doing physical activity in educational establishments

Physical activity is present in schools in a number of ways (World Health Organization, 2010), both structured and unstructured (Calvert, Mahar, Flay, & Turner, 2018). Typically, this often includes recess and Physical Education classes (Vazou et al., 2020). Recess, which is usually unstructured, gives students time to play freely and develop their social skills. Physical Education, on the other hand, is structured and based on a series of learning objectives and curriculum standards (MINEUDEC, 2018, 2020e). These look to ensure that students are taught the cognitive or mental skills they need to understand movement, as well as the affective skills needed for developing feelings or attitudes (SHAPE America, 2014). Finally, Physical Education is also a space for psychomotor learning, where students are taught physical skills related to movement (SHAPE America, 2014).

Worryingly, even before the pandemic, many schools had already decreased or removed Physical Education classes (Drollette, Shishido, Pontifex, & Hillman, 2012; Hardman, 2011; Institute of Medicine, 2013; Stylianou, Kulina, & Naiman, 2016). This sort of marginalization has only increased during the pandemic (Mercier et al., 2021; Roe et al., 2021). In this sense, Physical Education was not given the same level of priority as other subjects (Cruckshank, Hyndman, Patterson, & Kobele, 2021), with administrators, parents and students all giving more attention to other areas of the curriculum (Kim, Yu, Park, Ha, & Baek, 2021). Physical Education was reduced to simply offering the students the opportunity to do physical activity (Cruckshank, Pill, & Mainbridge, 2021), without taking into consideration the curricular content and objectives of the subject itself. During the pandemic, Physical Education teachers reported a reduction in the number of classes they were required to teach, sometimes having no requirement whatsoever to teach (Cruckshank, Pill, & Mainbridge, 2021; Pavlovic et al., 2021) or assess their students (Kim et al., 2021), despite being a curricular and administrative obligation (Baena-Morales, López-Morales, & García-Taibo, 2020).

However, schools must provide as many opportunities as possible for physical activity, including in the classroom (Sneck et al., 2019; World Health Organization, 2010). In this sense, before COVID-19, there were three main approaches to promoting physical activity in schools (Calella et al., 2020). 1) Physically active academic lessons, which integrate physical activity with curricular content (Dyrstad, Kvalø, Alstveit, & Skage, 2018). Examples include having students jump a certain number of times in order to answer an addition problem or use their bodies to represent geometric shapes and study their properties. 2) Physical activity breaks introduce short bursts of physical activity during class (Turner & Chaloupka, 2017). This might include having students do sit-ups or burpees. 3) Active transitions, which introduce physical activity when moving from one topic (or task) to another (Russ et al., 2017; Vazou et al., 2020), such as having students jump around the classroom before lining up for lunch or changing classrooms.

Physically active academic lessons are a promising way of improving students’ health and learning (Norris, van Steen, Direito, & Stamatakis, 2020), that has been supported by three systematic reviews (Daly-Smith et al., 2018; Martin & Murtagh, 2017b; Norris, Shelton, Dunsuur, Duke-Williams, & Stamatakis, 2015) and two meta-analyses (Norris et al., 2020; Watson, Timperio, Brown, Best, & Hesketh, 2017). Such lessons allow to strike a balance between learning outcomes and time spent in physical activity (Watson et al., 2017), thus counteracting sedentarism among students (McGowan, Ferguson, Gerde, Pfeiffer, & Pontifex, 2020), while managing to align with teachers and school leaders’ needs (Skage, Ertesvåg, Roland, & Dyrstad, 2020).
3. Method

3.1. Participants

This study involved 11 educators, including nine females and two males. This gender distribution is typical within the Chilean school system (see Table 1). Six of these educators were Primary School Teachers (PST), two were Physical Education Teachers (PET), and three were Educational Psychologists (EP). The average age of the educators was 36.6 years, with a standard deviation of 5.6 (Max = 47; Min = 28). On average, they had been working as educators for 11.6 years (SD = 5.9; Min = 3; Max = 18).

During the study, the 11 educators worked at four different educational establishments located in the same district in the north of Chile. Two of the establishments were vouchers schools (S1 and S2), while the other two were state schools (S3 and S4), one of which was a rural school (S4). Although not random, this sample roughly represents the wider distribution of schools within the district. In this sense, 52.3% of schools within the district are voucher schools, while 14.3% are rural (JUNAEB, 2020a). It is worth noting that voucher schools are privately managed establishments that receive public funding via student-based vouchers (Giaconi, Bressoux, & Felmer, 2021).

The School Vulnerability Index (SVI) expresses the level of poverty associated with the students at a given school (MINEDUC, 2019), with 100% representing the maximum level of poverty. The SVI at the schools included in this study ranged between 52.52% and 92.28% (JUNAEB, 2020a). Only School 2 (S2) was below the district-wide average of 85.16% (JUNAEB, 2020a). Similarly, the Multidimensional Vulnerability Index (MVI) represents the most important dimensions of vulnerability that cannot be detected by the students’ academic history, e.g., health, family, protection of human rights, stimulation, and support (JUNAEB, 2020b). In this case, the scores ranged between 34.06 and 41.40 points (JUNAEB, 2020b) with 100 points representing the highest level of vulnerability. Again, School 2 (S2) had the lowest score (34.06 points), while the other schools had scores that were similar to the district-wide average of 41.29 points.

All classes taught by the participating educators were invited to take part in the study. A total of 323 students (135 girls and 188 boys) participated (Table 1). The number of students and gender distribution in each class can be seen in Table 1. It is worth noting that at School 1 (S1), all of the teachers for each class participated in the study (i.e., the Primary School Teacher, the Educational Psychologist, and the Physical Education Teacher). At Schools 2 and 4 (S2 and S4), the Physical Education Teachers chose not to participate in the activity, while the Educational Psychologists were not available (S2 did not have an Educational Psychologist, while at S4 they were on sick leave). Finally, at School 3 (S3), only the Physical Education teacher took part in the study, indicating that her colleagues prioritized curricular content over physical activity. It is worth noting that the negative perception of physically active academic lessons is one of the barriers that is systematically highlighted in the literature (Bedard, St John, Bremer, Graham, & Cairney, 2019; Quarmby, Daly-Smith, & Kime, 2019).

3.2. Procedure

The aim of this study was to evaluate the acceptability and feasibility of using physically active academic lessons during online classes in times of COVID-19.

During the second semester of 2020, with schools closed, the 11 participating educators met virtually to plan how to include physically active academic lessons in their online classes. The topic of the lessons was geometry, specifically 2D shapes and their properties. This topic was chosen by the educators as it could be covered at all of the grade levels of primary school in which they taught classes (MINEDUC, 2018) and with different levels of motor skills (Oñate Navarrete, Aranela Castro, Navarrete Cerda, & Sepúlveda Urra, 2021). Also, because of positive evidence regarding the use of physically active academic lessons in mathematics (Mavilidi, Okely, Chandler, Louise Domazet, & Paas, 2018; Snecck et al., 2019), and particularly with geometry (Hraste, de Giorgio, Jelaska, Padulo, & Granić, 2018; Moore & Linder, 2012), and no studies reporting a negative impact of physically active academic lessons on learning in mathematics (Vetter, Orr, O’Dwyer, & O’Connor, 2020).

The planning process began with the Primary School Teachers outlining the content for geometry from 1st to 5th grade. To do so, they used the National Curriculum for Mathematics (MINEDUC, 2018) and official guidelines for prioritizing curricular content issued during the first few months of the pandemic (MINEDUC, 2020f, MINEDUC, 2020g). Following this, the Primary School Teachers and Educational Psychologists worked together to determine the ways in which to use the body to represent said content. The Physical Education Teachers then chose which shapes were easiest for the students to represent, taking into account their level of motor development and the Physical Education objectives to be covered (MINEDUC, 2018, 2020e). They also suggested using a stick so as to make it easier to represent certain shapes (Appendix A, Fig. 4). To promote student interest and participation, the educators then chose to set the activity to music from the popular and recently-released children’s movie, Sponge Bob. Finally, the Physical Education Teachers integrated the representations of the shapes to the music, creating a simple dance routine based on the curricular content for geometry and Physical Education from 1st to

| School | SVI | MVI | Class | Profession/Gender/Age/Teaching Experience | N (M / F) |
|--------|-----|-----|-------|------------------------------------------|----------|
| S1     | 85.56% | 41.25 | 1st   | PST-1/F/39/16 EP-1/F/32/4 PET-1/M/47/17 | 22 (17/5) |
|        |      |      | 2nd   | PST-2/F/40/13 EP-2/F/31/3                | 27 (18/9) |
|        |      |      | 3rd   | PST-3/F/40/18 EP-1/F/32/4                | 27 (20/7) |
|        |      |      | 4th   | PST-4/F/39/17 EP-3/F/28/4                | 25 (18/7) |
| S2     | 52.52% | 34.06 | 3rd   | PST-5/M/37/14                          | 40 (22/18)|
|        |      |      | 3rd   |                                          | 38 (16/22)|
| S3     | 90.69% | 41.40 | 1st   |                                          | 35 (18/17)|
|        |      |      | 1st   |                                          | 33 (17/16)|
|        |      |      | 1st   |                                          | 33 (20/13)|
| S4     | 92.28% | 40.52 | 5th   | PEB-6/F/43/15                          | 43 (22/21)|

SVI = School Vulnerability Index, MVI = Multidimensional Vulnerability Index.
PST = Primary School Teacher, EP = Educational Psychologist, PET = Physical Education Teacher.

a Age and Teaching Experience measured in years.
5th grade.

Once the dance routine had been created it was recorded (https://www.youtube.com/watch?v=hFulkLraaSY). Here, one of the Physical Education Teachers dressed up as different children's characters to attract the attention of the youngest students, which, according to the teachers, was one of the hardest things to do in online teaching, and hiding the teacher's identity, since recognizing the teacher may have had some effect on student engagement. Afterwards, the recordings were arranged in a grid to simulate an online class (Appendix A, Fig. 5). Certain graphical elements were then added to the video to facilitate understanding of the curricular content and improve the overall aesthetics (Appendix A, Fig. 6).

For five weeks, starting the first week of November 2020, each Primary School Teacher and Physical Education Teacher practiced the routine with their students during the periods allocated to them in the school timetable (see Fig. 1). Whenever possible, the schools’ Educational Psychologists would work with both teachers by practicing the dance routine with the students and reinforcing the topics being covered. Each teacher was able to decide the duration and timing of the practice.

During the practice sessions, the teachers used the appropriate terminology, both in Mathematics and Physical Education, to guide the students. As further curricular content and skills were added, the teachers of both subjects taught or reviewed each topic based on the grade level of each class. When necessary, the teachers reinforced the curricular content and skills after the practice.

Additionally, and on request of the school authorities to provide evidence of student participation, the teachers record three of the sessions: at the beginning, middle, and end of the five-week period. Furthermore, during the final week, the students sent a video of themselves dancing the routine outside of school time (individual video).

Once the five weeks were over, the parents, students, and educators were invited to participate in a series of online focus groups (see Assessing the Experience). Finally, the students and parents were also sent a video showing the evolution of the activity at each establishment (Fig. 2). A compilation of the students’ own videos was also shared (Fig. 3).

At each of the schools, the teachers who did not participate taught the same topics and skills as their peers. The primary school teachers taught geometry without using physical activity. For instance, the teachers used the geometry activities included in the school textbooks (MINEDUC, 2020a; 2020b), as to describe 2D shapes with their own words; build 2D shapes using physical materials; and identify vertices, edges, faces and angles in 2D shapes from their surroundings. While the Physical Education teachers developed the students' motor skills and promoted an active, healthy lifestyle, without relating this to geometry. For example, to develop students' basic motor skills such as movement, handling and stability (MINEDUC, 2020c), asking the students to walk in a straight line, jump on one foot and land with two feet together, and balance a ball on their hand as they walked in a straight line. Additionally, all of the teachers looked to strengthen the students' social skills, which are cross-cutting and present throughout the curriculum (MINEDUC, 2018). For example, the teachers encouraged the students to help their classmates whenever possible; to ask for help when needed; to listen and communicate clearly and constructively when faced with a conflict; and to cooperate, among others. Finally, it is worth noting that during other subjects, such as Language Arts and History, all of the teachers (both participating and non-participating) followed the curriculum for each subject (MINEDUC, 2020d) using the school textbooks and activity books.

Table 2 shows that the intervention was mostly carried during mathematics classes and, on average, took up 47 min per week (SD = 24.17). In addition, according to the educators, attendance to their online classes improved during the intervention, even though it remained lower than the number of students enrolled (Table 1).

It is worth noting that at School 1 (S1), the students from 1st and 3rd grade practiced with the Educational Psychologist on a voluntary basis outside of school time for 30 min per session, twice a week for three weeks. In 1st and 2nd grade, the students practiced the routine both at the start of each class as well as at the end. According to the teachers, this was viewed by the students as being a reward. Furthermore, during the final week, the students in 1st grade extended their practice sessions to 30 min, while in 2nd and 3rd grade they went from practicing three days a week to five, with some of these sessions lasting for 30 min. At School 2 (S2), the sessions were also extended to 45 min during the final week. According to the teacher, the students requested this in order to ensure that their final presentation of the routine was as good as possible. Furthermore, they also practiced with the Physical Education Teacher during that same week, even though the teacher had not participated previously.

The participating teachers were recruited by sending an email invite to the 36 individuals who participated in a previous study on how to plan a physically active academic lesson conducted by Beserra, Nussbaum, Navarrete, and Alves (2021) a few months before the start of the pandemic. Five teachers showed an interest and shared the invite with their colleagues, accepting 6 teachers who had not participated in the previous activity (Beserra et al., 2021). It is worth noting that, thanks to the collaboration and knowledge of the five previous participants, all of the teachers in

![Fig. 1. Example of a practice session during an online class.](image-url)
the present study had the confidence (Quarmby et al., 2019) and knowledge (Daly-Smith et al., 2020) to introduce physically active academic lessons into their practice, both of which are key factors for successful implementation. Finally, it is also important to consider that COVID-19 restrictions and school closures were in place for the entire 2020 school year for the district in which this study took place. However, restrictions were relaxed during the final week, allowing people to leave their homes without higher restrictions. This allowed the students to be more active as they were outdoors (Kovacs et al., 2021).

3.3. Assessing the experience

The parents, students, and educators were invited to participate in a series of online focus groups after the experience. The aim was to understand the participants’ perception about the use of physically active academic lessons in online learning during the pandemic, as well as the obstacles they faced.

Seven of the ten participating classes took part in the focus groups, with two focus groups held for each class (one with parents and the other with students). Only the teacher at School 3 (S3) was unable to participate with her three 1st grade classes due to personal reasons. Furthermore, an additional focus group was held with all of the educators, giving a total of 15 focus groups.

The student focus groups were conducted with three students to ensure the participation of each of them. According to the participating educators, three was the ideal number for carrying out reflection and evaluation activities remotely during the pandemic. It is also worth noting that the students participated voluntarily, answering the call for representatives from each class.

Seven people participated in each of the parent focus groups. Participation was also voluntary, with parents signing up when providing their informed consent. In this sense, informed consent was provided before the first practice session, during the (online) parent-teacher meeting of the term. Although the recommended number of participants for a focus group is up to 12 (Turney & Pocknee, 2005), we took into consideration the recommendations made by Lobe, Morgan, and Hoffman (2020) and Menary et al. (2021) for online meetings and reduced this number to seven. Finally, a special focus group was held with the 11 educators, maintaining the same structure as the meetings that were held during the planning process (see Procedure).

The focus groups with the students and parents lasted for between 45 and 70 min, while the focus group with the educators lasted for 90 min. All of the groups were led by the same psychologist so as to ensure consistency (Quarmby et al., 2019), and by one of the researchers. At the start of each focus group, the participants were told that the questions were related to the use of online physically active academic lessons during the pandemic, that there were no right or wrong answers, that any additional information would be welcome, and that the aim was the analysis of the

| Table 2 | Specific characteristics of the intervention for each participating class. |
|---------|---------------------------------------------------------------|
| School  | Class | Participant | Practices/N# of weekly classes | Duration (min.) |
|         |       |             | Math | Physical Education | Math | Physical Education |
| S1      | 1st   | 17          | 4/5  | 1/1               | 15   | 30               |
|         | 2nd   | 16          | 3/5  |                   | 15   |                  |
|         | 3rd   | 23          | 3/5  |                   | 10   |                  |
|         | 4th   | 21          | 1/5  |                   | 10   |                  |
| S2      | 3rd   | 39          | 2/5  | 0/2               | 20   | 0                |
|         | 3rd   | 39          |       |                   |       |                  |
| S3      | 1st   | 28          | 0/4  | 1/1               | 0    | 20               |
|         | 1st   | 19          |       |                   |       |                  |
|         | 1st   | 28          |       |                   |       |                  |
| S4      | 5th   | 32          | 1/3  | 0/1               | 45   | 0                |
proposal so criticism would be well received as it would help improve the process. Finally, the participants were also asked if the focus group could be recorded for subsequent analysis as part of the research.

Regarding the questions asked to each type of participant (i.e., parents, students, and educators), these were ordered according to the two research questions (Appendix B); participants were always asked to justify their responses and the best moment was chosen to ask each question based on the flow of the conversation. For the first research question, the parents and students were asked whether they would like the initiative to repeated again in the future, while the educators were asked if they would repeat it with their students. The students and educators were also asked whether they would recommend the initiative to a peer. Finally, all participants were asked about the highlights of the proposal.

For the second research question, all of the participants were asked to name any difficulties or barriers that they faced when doing online physically active academic lessons.

3.4. Data analysis

The qualitative data from the focus groups was analyzed in order to understand the participants’ perception of the use of online physically active academic lessons during the pandemic, and identify the difficulties and barriers faced during the activity. To do so, the psychologist and accompanying researcher shared their detailed notes at the end of each focus group so as to reduce any interpretation bias (Elliott, Fischer, & Rennie, 1999). Following this, the recording from each focus group was transcribed word for word, together with the notes from the psychologist and accompanying researcher. The transcripts were read several times by two of the researchers so as to have a general understanding of the data. Following this, they were then independently (Elliott et al., 1999) and thematically (Braun & Clarke, 2006) analyzed by the two researchers. Once any patterns had been identified, the results were organized by theme based on the research questions. After this, the researchers then met to share and discuss their analysis so as to consolidate their work. Any disagreement was resolved by discussing and reaching a consensus. Furthermore, in order to ensure that the themes were strongly linked to the data, the researchers also searched for any contrary evidence in the collected data but failed to find any.

The reliability of the analysis is supported by the peer-review process and the constant dialogue between the researchers (Quarmby et al., 2019); as well as by the use of extracts from the data to show how the information has been interpreted (Braun & Clarke, 2006). This serves to reinforce the reliability and transparency of the study (Tracy, 2010). Finally, it is worth noting that, following analysis of the data, the extracts were then translated from Spanish to English.

3.5. Ethical considerations

The procedures followed during this study adhere to the guidelines set out by the Declaration of Helsinki and were approved by University of Tarapacá Ethics Board.

4. Results and discussion

The results are organized around the two research questions. With regards to the first research question ‘What were the teachers’, students’, and parents’ perceptions of the use of online physically active academic lessons during the pandemic’?), five themes emerged from the representative comments collected during the focus groups (for further comments see Appendix C). These themes were the following: Mathematics Learning Outcomes, Student Satisfaction, Increased Physical Activity, Student Participation and Collaborative Work. A description of each theme is provided below, interweaving the comments from the focus groups with references from the literature.

4.1. Mathematics Learning Outcomes

The activity managed to develop the expected knowledge of mathematics, i.e., the ability to identify geometric shapes in their environment and describe them using mathematical terminology. One of the parents shared the following: “My daughter was going around looking at everything. She’d see the dining table and say ‘it’s oval’, see a window and say ‘it’s a rectangle’, see the door and so on”. Similar experiences were also described by the students. One of them said that “The end of the day was the most fun part … when we made the squares and rectangles, but had to jump and then crouch down quickly”. This is consistent with the work of An et al. (2017), who described how dance routines can be used to develop mathematical concepts using different representations and communication strategies. Furthermore, linking mathematical knowledge with sensorimotor metaphors based on the human body and its movements can help transform such knowledge into something more tangible and accessible for the students (Mavilidi et al., 2018).

Similarly, the teachers also described how the students developed the expected knowledge of mathematics. One of them claimed that “We had no idea of the potential of this activity. It met the revised objectives of the new prioritized curriculum and also promoted increased student participation in physical activity”. Indeed, learning gains of this kind are a common outcome when incorporating physically active academic lessons into the regular (face-to-face) school routine (see the systematic reviews by Daly-Smith et al., 2018; Martin & Murtagh, 2017b; and the meta-analysis by Norris et al., 2020). This is especially true in the case of mathematics (Sneck et al., 2019; Vetter et al., 2020).

4.2. Student satisfaction

The positive feelings experienced during the activity were predominant. One parent suggested that “He laughed so much, he really enjoyed it! The laughter, the giggling, that’s what got my attention the most, unlike in other classes, he had a good time”, while another claimed that “I could see my son and the other kids were really motivated. Like they’d be eager for it to be that class”. Similarly, the teachers suggested that the students were much happier, more interested and more motivated than usual. One teacher said “I think everything we did was really positive. The students were more motivated during the classes; for them, it was gratifying”. Accordingly, the students also described how satisfying it was to participate in the activity. One of them said “It was really fun using our bodies and making [geometric] shapes with them. Also, learning about new, fun shapes”.

From these comments, we can see that the parents and teachers were surprised at the level of satisfaction among the students (for more comments, see Appendix C). This finding is consistent with previous studies, where teachers mention that the use of physically active academic lessons increase students’ motivation for learning (Mavilidi et al., 2018; Romar et al., 2020).

4.3. Increased physical activity

The participants suggested that there had been an increase in the amount of physical activity done by the students during class, thus reducing sedentarism during the pandemic. One parent shared “We’ve been so sedentary this year, they [the students] have
been able to exercise quite a bit during the sessions. They jumped, danced around, and weren't just sat in front of the computer the whole time”. The students also appreciated the increased level of physical activity. One of them said “I really liked it because it helped us learn about the topic and also do a bit more exercise”.

In line with the above, the teachers acknowledged an increase in the opportunities given to the students to do physical activity which is one of the curricular objectives of Physical Education (MINEDUC, 2020e). Indeed, the increase in levels of physical activity is a direct and frequently documented consequence of integrating physically active academic lessons into the school routine (Daly-Smith et al., 2018; Martin & Murtagh, 2017b; Norris et al., 2020) This is particularly important if we consider that, for many families, it was difficult to motivate their children to stay physically active during lockdown (Roe et al., 2021).

The teachers also showed an interest in conducting similar interventions since they indicated the importance to promote both learning and physical activity, especially during the pandemic. One of them said “Articulating these two subjects allowed us to increase the time dedicated to physical activity and learning math. We’ll have to do it again and with other subjects”. The benefits to students of using physically active academic lessons, as perceived by their teachers, is one of the reasons that led teachers to continue to use them (Skage et al., 2020). This is consistent with Mercier et al. (2021) who suggest that while online classes continue, we need to find ways to meet the objectives of the Physical Education curriculum.  

4.4. Student participation

Student participation changed over the course of study. One of the teachers suggested that “The activity helped the students change their attitude towards online classes. As the activity went on, [the students] started to turn their cameras on and participate more in the class”. Students are more likely to participate in activities that are interesting, fun and enjoyable (Zhou et al., 2021). Such characteristics are particularly important during a pandemic (Yates, Starkey, Egerton, & Flueggen, 2021), and in this study, students found the intrinsic motivation necessary to drive their participation in online physically active academic lessons.

Another teacher highlighted that “We practiced at the start of every math class, and I could see how the classes were much more productive. The children were much more interested in learning. The students really did have a different attitude towards participating in class”. Starting classes with physically active academic lessons helps achieve the expected learning outcomes as it fosters student participation, motivation and interest (Skage et al., 2020).  

Accordingly, the parents also described an increase in levels of attention, and participating in class, which was not common before this experience. One parent said “My son doesn’t really like math, but he seemed excited about this Project and participated during class, asking questions and paying attention to the teacher”. Physically active academic lessons promote and maintain student attention (Routen, Johnston, Glazebrook, & Sherar, 2018), participation (Romer et al., 2020; Routen et al., 2018), and reduce off-task behavior (McGowan et al., 2020).

4.5. Collaborative work

The students and parents agreed on how gratifying it was to be participating in collaborative group activities again. One parent shared “For my son, it was really gratifying being able to practice with his classmates, not in the same place, but at least in the same virtual space, which got him engaged and motivated, so he enjoyed it more and learned”. The physically active academic lessons provided the students with opportunities to talk and cooperate, thus strengthening their collaborative skills (Mavilidi et al., 2018; Skage et al., 2020; Øien & Solheim, 2019). As one of the teachers suggested, “The activity was good for encouraging collaborative work, leaving competition to one side. For me, this is the hardest skill to work on with the children.”

Similarly, the activity encouraged an emotional bond between the participants, improving the classroom environment. One student said “I liked it because we were dancing and learning. And we were also spending time together, dancing as a whole class”. Having opportunities to collaborate is an important aspect of the students learning experience during homeschooling (Yates et al., 2021). Together with the physically active academic lessons, such opportunities helped improve the social climate and group cohesion (Romer et al., 2020).

Finally, it is important to note that, there is a certain belief about how the collaborative work (i.e., having a shared goal, learning, laughing, and having fun with peers and teachers) also fostered student participation and satisfaction. One parent said “I am grateful that the school proposes an activity that allows group participation: it is much more bearable for the children”, while another said “They missed each other, and, finally, seeing each other there, dancing together, was entertaining”.

4.6. Other findings

One finding that would appear to be unique in the literature is that some parents suggested that the level of burden and responsibility with regards to their child’s learning actually decreased during the intervention. One of the parents highlighted how “She (her daughter) was really worried about making her video, about having to practice. She’d close herself in her room because she said she had to learn the steps, that it had to be coordinated, that she had to do it all really well. I didn’t have to tell her anything!”. Accordingly, the parents attributed this change to the improved levels of student satisfaction and participation during the activity. This is particularly relevant given that education at home requires parental support (Pokhrel & Chhetri, 2021). In this sense, one parent commented that “Before, I’d spend all my time helping my son do his work, build models, things like that. But with this activity he did it all by himself. He practiced, attended class, learned what the shapes were like, all by himself”. During the pandemic, parents had to juggle working from home with supporting their children (Guerrero et al., 2020). Reducing this burden may therefore have helped parents overcome this challenge. This reduced burden is reflected in different comments made by the students, including the following “I also did it all by myself, my mum just gave me the broomstick”.

Finally, the parents’ perceptions were in line with the teachers’, who suggested that the students were more punctual and that attendance improved during the activity. One of the teachers said “In my class, attendance improved. There were a few kids who were inconsistent, whose parents would say they have trouble getting out of bed early. But we started practicing and they’d come every day”.

Another relevant finding was the level of parental and family involvement during the intervention. The participants described how family members would practice the dance routine with the children and highlighted how fun and emotionally significant this was. One parents commented how “It was more fun and dynamic than other classes. For my daughter is was just learning while playing. We practiced every day. And, of course, we had get it wrong and laughed. It was a nice experience because we could do it together”. Meanwhile, one of the student’s claimed that “The best part was the dancing because I’d practice with my brother and my mum and when we didn’t get it right we’d laugh”. Facing and overcoming the challenges of online learning during times of COVID-19 can reinforce a sense of community and cohesion among family members (Fegert,
One of the teachers highlighted the fact that “... It was more fun for the families, because they didn’t have to reinvent what we’d studied in class by sitting and talking, or going over notes. Instead they had to move about. That brought the families closer to the school, and closer to each other, too.” Ultimately, physical activity can help families better tolerate the pandemic, both mentally as well as physically (Amatriain-Fernández et al., 2020).

Parental support of student learning during the pandemic has varied in both its scope and degree. This depends on several factors, including the family (Wyse et al., 2020). For example, when there was less family participation than in the cases described above. One student said “My mum helped me; I mean, she'd watch as I danced and reminded me what I had to do”, while another said “My mum helped me cover things to record the individual video”. This is an important factor as physically active academic lessons allow for shared experiences between educators, parents, and students in a collaborative space (Oien & Solheim, 2019).

In summary, we can see that the participants were able to identify the main benefits of integrating physical activity with curricular content, as described in the literature. The success of a physically active academic lesson depends primarily on their actions (Gammon et al., 2019). Furthermore, the parents’ positive perception is also relevant as this has been considered a potential barrier (Beserra et al., 2021; Daly-Smith et al., 2020; Quarmbry et al., 2019; Routen et al., 2018). Future research should look to determine whether or not the parents’ positive perception is related exclusively to the use of online active academic lessons or some other characteristic of the intervention.

With regards to the second research question (What difficulties or barriers were identified by teachers, students, and parents throughout the use of online physically active academic lessons during the pandemic?), barriers (themes) emerged from the comments taken from the focus groups, which are analyzed next.

4.7. Digital divide (internet access)

Problems with connectivity became more evident during the activity. The digital divide in terms of Internet access, is a key barrier when it comes to successfully implementing educational technology strategies (Gil-Flores, Rodríguez-Santero, & Torres-Gordillo, 2017) and was a difficulty that was faced when implementing physically active academic lessons during online teaching. One of the parents suggested that “The only bad thing is that where we live the Internet signal is terrible. I'm lucky to be connected now. That was really frustrating for my son! There were days when he couldn't follow the class”. This is consistent with the poor quality of group video calls experienced by users in Chile during 2020 due to problems with bandwidth (Wyryzkowski, 2021).

Additionally, the participating teachers expressed that, sometimes, the audio, the instructions, or the video were intermittent, or simply could not be heard/seen. One of them shared that “I found that the children would hear the instructions cut off, I had to repeat them and we'd waste a lot of time”. This is consistent with the connectivity issues that were experienced during the pandemic, which were a challenge for teachers and students in Ireland (Scully, Lehane, & Scully, 2021), Spain (Palau, Fuenteás, Mogas, & Cebrián, 2021), Chile (Radovic, 2020), and other countries (Burgess & Sievertsen, 2020).

The teachers also described how, many times, due to unstable internet speeds, it was difficult for the students to be synchronized during the dance routines. “For me, the main difficulty was the Internet. It'd happen a lot that a child's screen would freeze, or ours would. And then we couldn't see what we were doing”. Lack of access to a quality Internet connection and suitable technological equipment are a barrier that has been repeatedly documented in the literature (Cabello, Claro, Rojas, & Trucco, 2021; Palau et al., 2021; Scully et al., 2021). Even though Chile has some of the most affordable access to internet in the region (International Telecommunication Union, 2021), there is still significant inequality when it comes to access (Cabello et al., 2021; León & Meza, 2018). This is especially worrying when considering that educational alternatives without Internet access at home are somewhat limited (Scully et al., 2021).

4.8. Suitable physical space

The lack of enough physical space for doing the activity meant that some students were not able to move freely during the dance, which may have affected their satisfaction. One of the teachers said “I have students who live in apartments, so in order to not bump into anything or anyone, some of the students wouldn't do the dance as enthusiastically as they'd have liked”. Similarly, one of the parents suggested that “My daughter didn't have any more space than her room. She'd start to do the dance and bash into things... to practice and record the video we had to make some space”. The teachers described how the lack of physical space meant that some parts of the students’ bodies could not be seen, while with students in larger spaces it was hard to accurately distinguish their movements. One of them described how “… students with lots of space would go really far back and you couldn't see what they were doing.”

Having a suitable environment for learning at home was not a reality for students of all levels of socioeconomic status (Pokhrel & Chhetri, 2021).

Finally, it is worth noting that the students did not explicitly highlight problems relating to physical space as being a barrier. However, they did describe some situations in which a lack of space may have been an inconvenience. One of them said “My mum helped me do literally everything. She gave me the stick, she helped me move the bed and the bedside table every day”. Having limited physical space reduces the likelihood of students being physically active during quarantine (Amatriain-Fernández et al., 2020).

Unsuitable physical space has also been systematically described in the literature on physically active academic lessons (Gammon et al., 2019; Nathan et al., 2018; Quarmbry et al., 2019) as well as in the literature on Physical Education classes (online: Kim et al., 2021; Pavlovic et al., 2021; Webster et al., 2021; and face-to-face: Lawson, 2019). Given the heterogeneity of students’ homes, it is important to consider alternative spaces to carry out such activities online; as in schools, this consideration might include the corridors, staircases and green spaces for physically active academic lessons (Daly-Smith et al., 2020).

4.9. Developing motor skills

The participants suggested that, initially, some students were not able to follow the dance routine and had to repeat it a number of times in order to get it right. One parent shared that “What was hard for us [at the beginning], I mean, hard for my son, was coordinating his hands, feet and the stick”. Similarly, one student commented that “At the beginning it was a little hard to learn the dance. I found it really difficult, but really it was quite easy once I’d learned”. While a classmate suggested the difficulty “... was coordinating the steps and the hands with the music, but my mom helped me”.

Developing motor skills is one of the curricular objectives during the first years of school (Oñate Navarrete et al., 2021). This was an objective that was prioritized within Physical Education during the pandemic (MINEDUC, 2020e). However, school closures probably affected students’ development of such skills (Chan et al., 2021; Pombo, Luz, de Sá, Rodrigues, & Cordovil, 2021). In this sense, one
of the teachers shared that “We found motor coordination quite difficult, not all of them [the students] are the same, but that was to be expected, given their age and that they’re all ‘trapped’ in their houses”. This is particularly concerning as the development of motor skills during early childhood is an important part of the preventative measures that can be taken to combat sedentarism (Greier & Drenowatz, 2018).

4.10. Digital divide (skills and use)

Some parents mentioned that they did not have the necessary skills for recording or sending the video. They suggested that their children were the ones who had the necessary skills and, therefore, were responsible for said process. One of the parents shared that “My daughter is better with technology than me. She makes TikTok videos, so she had a ring light to record herself. So she did it all”. Similarly, one of the teachers described how “Some parents found it difficult to record or send the video. They didn’t know how to do it, they had a lot of trouble doing it”. This is consistent with the digital divide in Chile, where 24.5% of the adult population are at the lowest level in terms of Internet skills and use (Cortés et al., 2020). It is therefore unsurprising that this should emerge as a barrier. However, the teachers suggested that said difficulties could be seen throughout the whole academic year, not just during this activity.

It is important to note that Internet use varies among countries. While 87% of the population in developed countries were using the Internet in 2019, this figure was just 19% in less developed countries (International Telecommunication Union, 2021). Similarly, almost 3.7 billion people across the world are still not connected (International Telecommunication Union, 2021). Here, it is worth noting that there are several sociodemographic factors that affect Internet use. This includes level of income, education, gender, geographical location (urban vs. rural), and the presence of school-aged children in the home (UNESCO, 2017).

4.11. Student embarrassment

Some students felt embarrassed. One of the students shared how “Some of my classmates said they didn’t know how to dance, that they didn’t like to dance or that they were embarrassed. But I like it”. Embarrassment has previously affected student motivation during Physical Education classes, as well as their intentions to be physically active (Trigueros, Aguilar-Parra, Cangas, López-Lina, & Alvarez, 2019). Although expected, this did not stop them from participating in the group recording or during the online practice sessions. Instead, it affected the recording of the students’ own videos. One of the parents mentioned that “Getting her to do the individual video was difficult. She was really embarrassed, but it wasn’t like that when she was dancing with the rest of the class [during practice], because when she saw her classmates doing it she was more enthusiastic”. Embarrassment of being in front of a camera has also been previously identified as being a barrier to successful learning in non-face-to-face settings (Estela Urbina et al., 2021; Gherhes et al., 2021; Kozar, 2016). Faced with this challenge, the parents suggested changing this from an individual video to a video in which other members of the family could participate. One parent suggested that “It would have been more spontaneous if I’d have danced with her, and as my sisters (i.e. the student’s aunts) were there too, they could dance as well. We could all have danced with her, maybe it would’ve been easier and less embarrassing for her”. Similarly, another said “I think it would have been better, or more spontaneous, if, for example, I’d have danced with her and left the phone recording on its own. Then she wouldn’t have been so worried about ‘me recording her’, maybe that would have been better”. According to the parents, this would help the students feel less embarrassed. One parents suggested that “When it came to recording him on his own it was difficult, my youngest son wanted to participate and the older brother was embarrassed. We had to record it together and then separately, it was twice the work”.

4.12. Other barriers

One barrier that would appear to be a finding that has not previously been reported in the literature was the students’ devices reflecting the image like a mirror. According to the educators, certain devices showed a mirror image of the students’ video, known in optics as a virtual image (Ting, Tai, Tseng, & Tsai, 2018). This caused confusion among the participants during the practice sessions. Indeed, when a certain group of students moved in one direction, their classmates would see them moving in the opposite direction. One of the teachers described how “We could tell clearly who had a tablet, a computer or a smartphone. The phones and tablets reflected the student’s image, and [so] we’d see all their movements going to the other side”. Although this issue provided an opportunity to talk about symmetry, it may also have impacted negatively on student satisfaction as it interrupted the activity. This is reflected in the following comment by one of the students: “Some of us used our left hand instead of our right… for drawing the circumference with the stick, some turned to the right [clockwise], while others turned to the left [counter-clockwise]; it was really difficult to coordinate everyone”.

Teachers are not free from the influence of their surroundings (Quarmby et al., 2019). One of the teachers suggested that “The exchanging of experiences was fantastic. Those stories saved me more than one problem. They helped keep me motivated, [as] I wasn’t the only one with these difficulties, and how I solved them might help others”. Accordingly, another teacher commented that “We’ve learned to work as a multidisciplinary team, to overcome obstacles as a team, to learn from each other’s difficulties”. For the teachers, this sort of teamwork allowed them to acknowledge different barriers when it comes to teaching physically active academic lessons. By acknowledging such barriers, they were then able overcome the challenges, increasing the probability of success (Beserra et al., 2021). In this sense, we can highlight the following teacher comment “As a group, we were able to anticipate different challenges of introducing this into the classroom. We all saw how we’re able to work collaboratively and that it doesn’t matter whether it’s face-to-face or online, we’ll adapt to the context and overcome any difficulties”.

Surprisingly, some of the barriers described systematically in the literature were not identified by the participants. First, the additional time required for planning (Gammon et al., 2019; Quarmby et al., 2019; Øien & Solheim, 2019); it is important to remember that the activity was planned and carried out by a group of teachers, which probably reduced the amount of time each teacher spent planning individually. Second, student performance on standardized tests (Gammon et al., 2019; Quarmby et al., 2019); no national tests were administered during the pandemic. MINEDUC, 2020h and the amount of curricular content and number of learning objectives were reduced (MINEDUC, 2020f, 2020e). Surprisingly, the parents were also not concerned about their children’s performance. Third, the difficulty of getting students to concentrate at the end of the activity (Gammon et al., 2019; Martin
accomplish proposed objectives during online teaching. This article provides a view of how teachers, students, and parents positively perceived the use of online physically active academic lessons during the pandemic. The results show that the participants were able to identify the main benefits of such lessons that have been previously described in the literature. They were also able to identify a number of barriers. This included certain widely-acknowledged barriers relating to online learning, as well as others linked more directly to doing physical activity at home. The findings in this study reinforce the idea that, regardless of their format (i.e., face-to-face or online), physically active academic lessons are a valid strategy for increasing levels of physical activity without sacrificing time spent on learning. Furthermore, they also reinforce the idea that physically active academic lessons improve learning, relationships, and enjoyment, not just among students, but among teachers, parents, and other family members, too. It is worth noting that this study is the first to describe such results of using physically active academic lessons within the context of online learning.

Finally, despite the promising results reported here, it is worth considering certain limitations of this study. This includes the small sample size, as well as the ethnic and gender distribution of the participants, all of which are key characteristics when it comes to generalizing the results. Another limitation is the lack of a control group, as well as any assessment of student knowledge. Including these would help accurately determine the pedagogical impact of this study. It is worth noting that a control group was not included as the aim was to assess the feasibility of using physically active academic lessons in online teaching. Furthermore, no student assessments were included on the request of the teachers, who did not want to expose the students to any additional stress or anxiety while in lockdown.

Another limitation is the use of a single topic that is not directly related to Physical Education for these physically active academic lessons (i.e., geometry). This may have affected learning outcomes, student satisfaction, increased physical activity, and participants’ perception. Including additional topics (from Mathematics, Physical Education or other sciences), and incorporating them into one or more dance routines, would be one way of overcoming this limitation.

A further limitation was the short duration of the intervention. Extending the duration would probably allow students to identify additional benefits and barriers when it comes to the use of online physically active academic lessons. Similarly, it is important to increase the number of students and parents who are interviewed as this would also allow us to unearth more findings. Furthermore, it is important to consider the inherent limitation of the data that was analyzed. All data was reported by the parents, students, and teachers, with social convenience and/or memory bias possibly impacting the results.

It remains as future work to develop a proposal to determine whether or not there is an exclusive relationship between the results reported here, the collaborative work carried out by the educators, and the conditions in which the study took place (i.e., a global pandemic). To do so would require a large sample, with a more diverse range of teachers and schools, a reliable assessment of student knowledge, control groups and larger focus groups. Finally, future studies should also consider determining the optimum duration and intensity of physically active academic lessons to accomplish proposed objectives during online teaching.

## 5. Conclusions

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