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Project-Based Learning as a Strategy in Physical Education Teacher Training: Creating A Cultural Route Promoting Active Commuting

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Abstract: This study analyzes the narrated reflection of the students in relation to their learning, based on the perceptions that emerge from their experience in the development of the project. Participants were 53 fourth year Pedagogy in Physical Education students, with an average age of 24.3, who were divided into 13 groups. A qualitative study that used the narrated reflection of the students in relation to learning, based on a driving question. In order to help guide the students' work, and to collect the perceptions they experienced during their participation, the following four components were integrated into the development of the project and included in the final product: a) historical and heritage sites, b) technology used to measure energy expenditure, c) type of active commuting, d) reflection on what was learned. The students designed 13 routes of active commuting through the city, which included different cultural, heritage and historical landmarks. The students analyzed the learning experience, highlighting the importance of knowing and caring for the heritage of the different cities around which they traveled. PBL can be a didactic alternative in initial Physical Education teacher training to achieve learning by linking subject content with the motivations and interests of the students.

Keywords: *Active learning, higher education, student project.*

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Introduction

Active commuting is defined as any walking or cycling; while passive commuting refers to the use of motorized vehicles as a mode of commuting, such as by car, bus, metro, train, or motorcycle, among others (Chillón et al., 2014). Active commuting is a behavior susceptible to modification that can produce various health benefits (Chillón et al., 2017; Villa-González et al., 2016), such as increasing cardiovascular fitness (Shephard, 2008); improving cardiorespiratory capacity (Chillón et al., 2012) and physical condition (Alexander et al., 2005); and decreasing obesity (Garrido-Méndez et al., 2017). It is a low-cost physical activity that can be integrated into people's routines, since most children and adolescents have to travel to and from school twice a day, while students and adults commute to universities and jobs. Different forms of active commuting, such as cycling or walking, have been recognized as possible behaviors to increase daily physical activity, supplementing the more traditional domains of physical activity, such as playing, sports and exercise (Chillón et al., 2011; Heath et al., 2012; Reynolds et al., 2014; Sahlqvist et al., 2012). In particular, active commuting to school has been proposed as a way to increase physical activity in children and young people (Alexander et al., 2005; Chillón et al., 2010; Roth et al., 2012; Tudor-Locke et al., 2001; Villa-González et al., 2016, 2018), with the additional benefit of reducing pollution and noise (Alfie Cohen & Salinas Castillo, 2017; Chapman, 2007; Woodcock et al., 2009).

From the social perspective, active commuting increases interaction between schoolchildren, university students and workers on their respective commutes, thus favoring social relations (Villa-González & Pérez-López, 2014). From the cultural perspective, many cities offer individual and group active mobility routes, which allow people to carry out physical activity while simultaneously visiting places of tourist, heritage, historical, artistic and cultural interest in general (Navalón García, 2014).

Despite these benefits, longitudinal studies conducted in recent decades in the United States (McDonald, 2007), Australia (Van der Ploeg et al., 2008), Canada (Buliung et al., 2009), and Spain (Chillón et al., 2013) have shown a decrease in active

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commuting rates mainly due to barriers such as the distance between home and school, lack of safety, or family decisions (Buliung et al., 2009; Chillón et al., 2013; McDonald, 2007; Van der Ploeg et al., 2008).

Lee et al. (2012) declare that physical inactivity is one of the most significant risk factors in the development of chronic non-communicable diseases and associated mortality. Therefore, the World Health Organization (WHO) recommends that children and youth engage in at least 60 minutes of moderate-to-vigorous physical activity per day (Bull et al., 2020). In this regard, Chilean authorities have sought to provide opportunities in the subject of Physical Education and Health for students to develop knowledge, skills, and attitudes that allow them to maintain an active and healthy lifestyle (Chilean Ministry of Education, 2021). Along the same lines, actively commuting is a means of transport that can be adopted by the vast majority of the population and that does not require a large investment in terms of infrastructure, compared to driving a vehicle. However, 36% of women and 32% of men do not commute actively in Chile (Celis-Morales et al., 2016), and the weighted average prevalence of active transportation to and from school was 15% (10% for children and 20% for adolescents) according to data from different cities and regions, which show low rates of active commuting at the national level (Aguilar-Farías et al., 2018). In fact, the Chilean Ministry of Education (2021) proposes incentivizing the regular practice of physical activity, using public spaces for the development of motor performance, in order to promote an active and healthy lifestyle in students and their classmates, families, and communities. In short, future Physical Education teachers are facing an enormous challenge, for which reason their training itinerary must include enriching training activities that allow them to develop innovative proposals that increase the physical activity levels in the community and facilitate the access to active commuting from a social and cultural perspective at school. Along the same lines, this study focuses its efforts on analyzing the implementation of project-based learning (PBL) for promoting active commuting, due to the positive benefits it has on schoolchildren's physical, social, and emotional health. While there is literature mentioning the application of PBL in school-based Physical Education classes (Treadwell, 2018), there is scant research in initial Physical Education teacher education. One study explored the impact of PBL on learning experiences in Physical Education and demonstrated the limited research on this topic (Simonton et al., 2020). To the best of the authors' knowledge, there are no studies that apply PBL in the initial training of Physical Education teachers associated with active travel and cultural recognition in cities.

For which the research question was posed: What learning was generated by the creation and implementation of an active commuting route using the project-based learning methodology? Therefore, the study had two objectives: (a) to describe the process of design and implementation of a circuit of cultural routes that use active commuting through project-based learning in students of pedagogy in physical education, and (b) to analyze the students' narrated reflection in relation to their learning based on the perceptions that emerge from their experience in the development of the project.

Innovation and Active Methodologies in University Teaching

Education today is immersed in a process of constant change and evolution motivated by the new training demands of a global society, where technological advances reformulate traditional teaching methodologies and innovation acquires a key place (Said-Hung et al., 2017). In this sense, pedagogical training processes must consider active and innovative methodological strategies, since schools need innovative teachers and social constructors (Armour & Harris, 2013; Vargas-D'Uniam et al., 2016).

Any attempt to innovate in the initial training process for Physical Education teachers must also challenge the status quo of the subject in schools to better meet the needs of schoolchildren (Oliver et al., 2015), such as the development of an active and healthy lifestyle that improves their physical capacity and quality of life (Martínez-Baena et al., 2016). In the face of the new challenges, it is necessary to introduce innovation and active methodologies such as PBL, in order for the student to take responsibility for their teaching process, adopting a leading role and having to seek realistic solutions through research, decision making, and application of previously acquired knowledge (De Miguel, 2009). In this sense, the plans and programs that the Ministry of Education of Chile proposes today, indicate that Physical Education is oriented toward making the habits of an active and healthy lifestyle a central part of children's and young people's lives, inside and outside school (Chilean Ministry of Education, 2018). In addition to what is mentioned in the curriculum, there is a need for a different version of Physical Education that is meaningful and relevant for students, and responds to their needs (Ní Chróinín et al., 2018), thus enabling progress towards the recognition of education for health as a social responsibility, where it is recognized that sociocultural and economic contexts provide various opportunities to be healthy and learn to live a healthy lifestyle (Quennerstedt, 2019). Here the training of the Physical Education teacher plays a fundamental role, because it offers a context for students to learn about the promotion of active lifestyles in schools through their interactions and experiences during the teacher training process (Harris, 2014). Therefore, future professionals should encourage schoolchildren to use various public spaces, so that they become promoters of an active and healthy lifestyle among their classmates, their family, their community and their educational establishment (Erwin et al., 2013). Coincidentally, evidence highlights the importance of stimulating active commuting in schoolchildren to promote active and healthy lifestyles (Cooper et al., 2003). A fundamental part of these learnings refers to recognizing and managing self-care and safety measures to practice physical activity (Chilean Ministry of Education, 2018). That is why teacher training faculties must generate innovative proposals that allow them to encounter educational experiences

favoring the future application in schools of projects to promote active commuting and knowledge of the city in schoolchildren.

Project Based Learning

PBL can be defined as the development of complex tasks, based on challenging questions or problems, that involve students in design, problem-solving, decision-making or research activities, giving them the opportunity to work relatively autonomously for extended periods of time, and culminating in realistic presentations or products (Thomas, 2000). PBL is a methodology focusing on students as protagonists of their own learning (Núñez & León, 2015), increasing student participation and involvement — in the selection of content and related tasks, in commenting on the process, or in verbalizing learning needs (Núñez & León, 2015). Julián et al. (2017) affirm that in these situations, the teacher becomes a pedagogical mediator between the student and the new knowledge and, Toledo Morales and Sánchez García (2018) mention that the PBL methodology is an effective tool for the acquisition of the knowledge and skills that society is demanding from students, trying to respond to real life problems (Moya-Mata & Peirats Chacón, 2019). PBL is considered an innovation in higher education, which can be used to work on the decisive professional competencies in the profile of the university student (Toledo Morales & Sánchez García, 2018) and represents a change in pedagogical paradigm compared to traditional teaching-learning models (Cascales Martínez & Carrillo García, 2018). Some advantages of this methodology are the development of creativity, critical thinking, problem solving, decision making and, importantly, the construction of one's own identity (Hernández, 2000). This methodology becomes even more valuable in today's society when working with students who present different levels of ability and diverse ethnic and/or cultural characteristics (Moya-Mata & Peirats Chacón, 2019). Therefore, PBL is an active and coordinated process, which has enough flexibility to adapt to the characteristics of the students and the sociocultural context to resolve the situations that arise (Hernández, 2000).

The above serves as a basis for the creation of a proposal to design active commuting routes in the city that consider the interaction of culture, history, and the promotion of physical activity. Along these lines, the project was conceived to sensitize future teachers in the use of active commuting as an activity that can be linked to other learning, on the one hand, and, on the other, to learn content through the PBL methodology.

Methodology

Participants and Design

The study is based on the qualitative paradigm, which allows an approach to the phenomenon through the observation, conceptualization, and interpretation of reality, providing new perspectives on what is known (Vasilachis de Gialdino, 2006), allowing a deep understanding of the reality studied (Briones, 2006).

The project was sponsored by the Teaching Innovation and Development Unit of Andrés Bello University and is also part of the Learning Laboratory. In this version, 53 fourth-year students of Pedagogy in Physical Education at Andrés Bello University participated, organized into thirteen work groups, with an average age of 24.3 years. They participated voluntarily, under informed consent based on the recommendations of the Declaration of Helsinki (World Medical Association, 2013).

Procedures

To develop the PBL, two criteria were previously considered: a) students must perceive the project as something personally significant, as a task that is relevant to their professional training; b) a meaningful project serves an educational purpose, demonstrating that well-designed and implemented project-based learning makes sense for both criteria (Larmer & Mergendoller, 2010).

The PBL was carried out based on 8 fundamental elements (Figure 1).

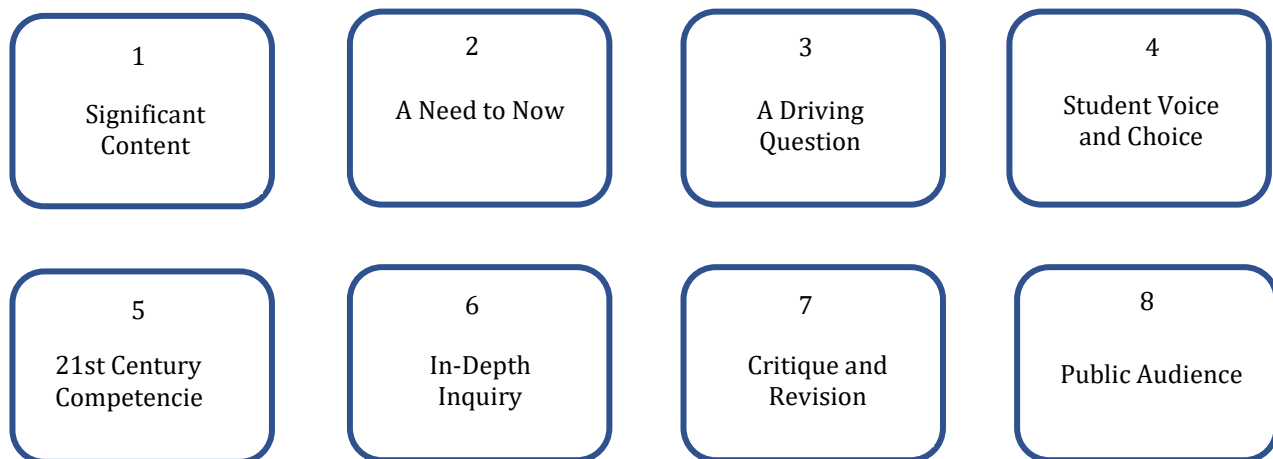


Figure 1. Eight Elements for The Development of Project Based Learning (Adapted from Larmer & Mergendoller, 2010)

In addition, the project was organized with the following schedule that was implemented in the different lessons of the subject. Schedule of the stages of project development: (a) Selection of the topic and proposal of the driving question, (b) Formation of working groups, (c) Definition of the final product or challenge, (d) Planning, (e) Research, (f) Analysis and synthesis, (g) Elaboration of the product, (h) Presentation of the product, (i) Collective response to the initial question, (j) Evaluation and self-evaluation.

In order to help guide the students' work, and to collect the perceptions they experienced during their participation, the following four components were integrated into the development of the project and included in the final product: a) historical and heritage sites, b) technology used to measure energy expenditure, c) type of active commuting, d) reflection on what was learned. Based on component d, emerging categories that arose from the students' reflection were considered, and have been expressed as codes in the presentation of the results.

The reflective diary (Bardají Fandos, 2008; Berlanga-Fernández et al., 2021), which can be understood as the record of accounts of a subject in some specific activity through descriptions, analysis, opinions and evaluations of a situation about their own experience, was used as an instrument for collecting information.

The reflective diary consisted of three guiding questions that sought to know: a) What aspects of the project had a favorable impact on the contents of the subject; b) What learning was generated by the creation of a cultural route for active displacement; and c) What aspects of teacher training are strengthened by the PBL methodology? ; to grant validity and reliability to the instrument, it was subjected to: a) content validity, understood as the logical judgment on the correspondence that exists between the items and the content domain in the instrument or test (Urrutia Egaña et al., 2014); and b) dependence, which was achieved by specifying the context and care in data collection, there being also clarity of the selection criteria of the participants (Bedregal et al., 2017).

The development of the project had a first axis that led to the proposal of a cultural route with emphasis on active commuting as a means of transport. Therefore, the students had to design a product as evidence of their work, and also familiarize themselves with PBL as a methodological strategy, which offered them a series of systematic procedures for the achievement of an objective. A second axis of the present investigation was to understand students' perceptions stemming from the work with PBL, understanding that this type of strategy had not been previously used by the students. This experience was described through written narratives (Hernández-Sampieri & Mendoza, 2018) in which students related their personal and group experience. Thus, this stage was configured as a data collection process on the study phenomenon, taking the shape — by the nature of the evidence — of a discourse analysis (DA), which "studies the order, disorder and organization of daily social action, apprehending what people say, tell or do and, ultimately, everything as it is produced by the participants in the conversation or narration" (Artiles Gil, 1990; Íñiguez Rueda, 2006). DA was considered as a data analysis technique due to the nature of the evidence collected, which allows a permanent dialogue between the researcher and the search for conformation and meaning in the data, focused on the reflexivity of what has been said, what has been understood and the existing theory and the commitment to answer the questions that have been raised (Antaki et al., 2003).

The DA process was guided by the principles of Grounded Theory (Coffey & Strauss, 2002), which determines different methods to generate categorizations, of which the following were used in this study: a) selective coding, where it is sought to generate a priori categories to integrate and refine the theory; and b) open coding, understood as an analytical process by means of which concepts are identified, and their properties and dimensions are discovered in the data. These two types of coding are positioned from the researcher's point of view (Álvarez González, 2007), with an ethical perspective (recoding of the information that bears the theoretical imprint) and an emic perspective (decoding the data obtained by the researcher that emanate from beliefs and meanings).

Data Analysis

The final products of the 13 groups were analyzed. For components a, b and c, a descriptive analysis was performed. Data from component d were analyzed with the ATLAS.ti 9 software, organizing and systematizing the information in a way that allowed greater reflection and dialogue with the data, positioning the researcher in an inductive and naturalistic perspective to achieve the greatest openness and sensitivity, revealing patterns, trends, characteristics and other dimensions of interest for the research (Hinojosa Torres et al., 2020). The results in qualitative research are a response to a theoretical methodological process that the researcher develops with a large amount of data of different nature (Flick, 2007; Gibbs, 2012; Valles, 2007) and collects through an orderly and flexible process to understand the phenomenon in question (Álvarez-Gayou Jurgenson, 2003; Coffey & Atkinson, 2003). In the AD process, codes emerge as a response to the recurrence of concepts and meanings provided by quotations, a process that was safeguarded by the researcher's epistemological vigilance over the theoretical field of the object of study (Bourdieu et al., 2002). In this way, the codes present validity in virtue of the fact that the interpretation given by the researcher does not depart from the need to respond to the study developed (Lincoln & Guba, 1985). The codes meet the criterion of transferability since a detailed description of the research context was considered, allowing the codes to represent other realities in contexts with similar characteristics (Morse, 1991). The reliability of the codes was achieved by considering more than one source of information for the analysis, ensuring a breadth of perspective on the study in question (Patton, 2002).

Results

The students designed 13 routes of active commuting through the city that acknowledged different cultural, patrimonial and historical landmarks. *Component a*: All routes included heritage sites in natural settings. Nine routes combine heritage buildings and natural environments. *Component b*: Six groups used accelerometry to quantify the physical activity carried out, the rest used smartphones, watches, and related applications. *Component c*: Nine routes proposed walking, three using the bicycle, and one suggested alternatives such as skating or skateboarding. *Component d*: The qualitative results are presented in association with "groups of codes", "codes" and "quotes" (Penalva Verdú et al., 2015; Sabariego-Puig et al., 2014), which facilitates the interpretation process under a balanced and reflective attitude (Yuni & Urbano, 2005), achieving a holistic, comprehensive and complex understanding that describes the qualities and properties that characterize the object of study (Marradi et al., 2018).

Three groups of codes were found in the investigation: Health, Learning and Cultural Route.

The "*Health*" group of codes is understood as the state of physical, mental and social well-being. It is made up of three codes that refer to the meanings attributed to the concept of health from the perspective of human well-being, as represented in the following codes and quotes.

The "*Physical Activity*" code is related to planned, systematic and structured physical activity with the aim of positively impacting physical condition, which can be reflected in the following quotes:

"As for physical exercise, this can be for all audiences, since it does not present a greater effort, allowing up to two straight hours of travel without noticing the passage of time" (G12:02-03)

"Regular walking and cycling are a means to aerobic exercise, which effectively combats high cholesterol, obesity, diabetes, heart disease and depression" (G11:01-02)

The "*Active Commuting*" code refers to any walking or cycling; while passive commuting refers to the use of motorized vehicles as a mode of commuting, such as by car, bus, metro, train, or motorcycle, among others (Chillón et al., 2014), as is expressed in the following quotes:

"Walking is an exercise susceptible to adaptation by the individual, where each one chooses their own pace, and establishes the distance and time to travel" (G7:01-02)

"This route was made thinking about how to visit the most iconic places in the 'garden city' [Viña del Mar], exercising through various means of active transport" (G3:02-03)

The "*Recreation*" code refers to creating or having fun in a search for distraction in the midst of daily obligations, which can be seen in the following quotes:

"Doing physical activity in a group and with friends is highly motivating, since it's a very pleasant moment where the factor of doing physical activity was secondary, and the fact of sharing and enjoying that moment of distraction that these instances generate is primary" (G2:01-02)

The "*Learning*" group of codes is understood as the process through which abilities, skills, knowledge, behaviors and values are modified and acquired, as a result of experience, study, reasoning, and observation. It is made up of two codes oriented towards aspects that contribute to the lessons gleaned from the proposed experience.

The *"Integrative Learning"* code refers to the learning process mentioned above in which contents from different disciplines and/or topics are connected to each other, as a result of the educational experience. This is expressed in the following quotes:

"We have managed to connect and relate different types of data and actions. On the one hand, information related to physical education (more focused on social health) and, on the other hand, knowledge of heritage closer to our environment" (G6:01-02)

"Participants can take photos and at the same time do moderate physical activity without being aware of it, while learning more about the history of Chile" (G9:03-04)

"The learning achieved is multiple, since in the same action we have collected different types of scientific and cultural knowledge" (G6:03-04)

The *"Instruments"* code is oriented toward the use of equipment used to collect and read data considering its usefulness and manipulation for such purposes, which is expressed in the following quotes:

"...recommending the use of measuring instruments capable of collecting information in all these dimensions" (G1:02-03)

The *"Cultural Route"* group of codes is conceived as the space traversed, understanding it as everything that can be appreciated. Two codes are integrated that interact with the components responding to the conditions that the routes present in the area.

The *"Heritage"* code refers to such natural and architectural monuments, historical places and natural landscapes that have a relevant value from an aesthetic, scientific and/or environmental point of view, which can be observed in the following quotes:

"Through this active route we were able to realize how wonderful the Limache municipality is. In addition to its flora and fauna present in the downtown area, it presents various historical sectors to visit and it's pleasant and safe to commute by bicycle" (G12:01-02)

"The route we created had the goal of getting to know a little more about the city of Valparaíso, its infrastructure, history, and the nooks and crannies of the so-called 'main port' " (G9:01-02)

"There are beautiful spaces in places that we transit daily, but because we are wasting time on technological devices, we do not take the time to see these places, admire them and inform ourselves about this" (G2:02-03)

The *"Environment"* code gives an account of ideas about the care and appreciation of natural environments, which can be observed in the following quotes:

"It provided significant lessons about caring for the environment, the health of one's own body and, from the perspective of physical activity and socialization, about one's relationship with the environment and with people" (G4:01-02)

"It's important to spotlight the natural settings present in our city, which are public and offer us the possibility of generating novel proposals in recreational, sports, health-related areas" (G5:01-02)

"We must connect more with these beautiful places that are nearby to us, and take advantage of the nature that we still have" (G2:03-04)

The qualitative results seek to represent the meanings attributed by the participants through the units of meaning or quotes (Izcara Palacios, 2014), which constitute the evidence that provides answers to the researcher. In this way, and as a way to represent the evidence found, a "semantic network" was constructed (Sabariego-Puig et al., 2014) in order to present the general and specific elements that make up the results through a final representation that also provides the diagram of relationships between quotes, codes and groups of codes, linking everything based on an axis or key concept that defines the epistemological foundation of the research. Figure 2 shows the network for the present research that emerges from the above.

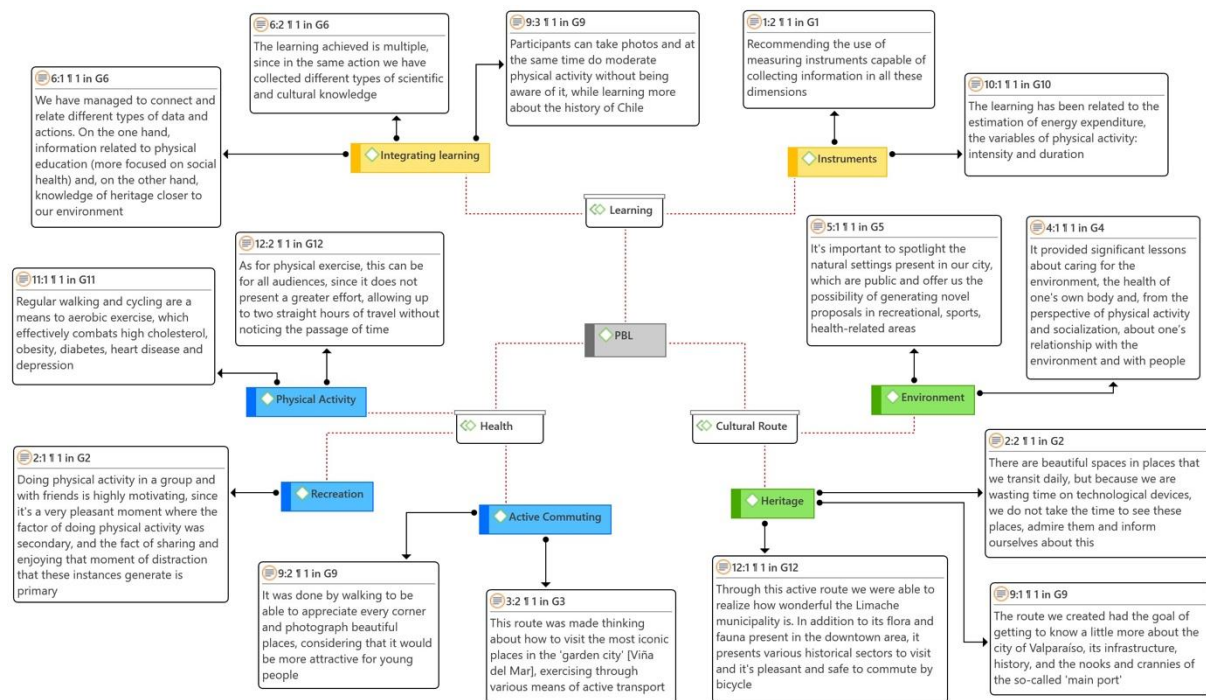


Figure 2. Final Research Network

Discussion

The students sought solutions to real educational problems by posing a driving question. They debated ideas, collected and analyzed data, reflected on their learning processes, communicated their ideas, created products, and shared their learnings with a real audience, just as recommended by the Curriculum and Evaluation Unit (UCE, for its Spanish acronym) of the Chilean Ministry of Education (2019) in the document called *Project-Based Learning Methodology*.

While in this study the main results were improved interdisciplinary and learning, a study conducted in nursing students in Brazil found that PBL associated with the use of new information technologies allows the achievement of learning objectives, increasing motivation and autonomy, favoring meaningful learning (Pascon et al., 2022). Another study conducted in Chile shows that PBL is a good teaching methodology for school children to solve problems in the real world, encouraging a participatory role in the learning process (Borroni et al., 2021). Although PBL is an excellent teaching strategy, it cannot completely replace traditional education and should be used as a complement to educational training in university students according to a study conducted in Israel (Tsybulsky & Muchnik-Rozanov, 2019).

The students who participated in the project developed an active and cultural route through PBL, which favors the application of the objective of sustainable development related to health and well-being. In this context, Spanish students who used PBL acquired greater individual and collective responsibility. (Lozano et al., 2022).

This methodology helped the participants to work on and develop different competencies, as highlighted by Ausín: autonomy, group work, self-confidence and motivation (Ausín et al., 2016). The students highlighted the learning obtained from the relationship between different types of content applied in the project, as stated in the following quotes: "The learning achieved is multiple, since in the same action we have collected different types of scientific and cultural knowledge" (G6:03-04), and "We have managed to connect and relate different types of data and actions. On the one hand, information related to physical education (more focused on social health) and, on the other hand, knowledge of heritage closer to our environment" (G6:01-02). In short, the participants highlight what Ausín et al. (2016) conclude in their research with Spanish pedagogy students: "Leaving behind teaching based on mechanical memorization, and focusing towards work methodologies where the activities are presented as challenges and not as assignments that are decontextualized from the subject's objectives, based on an interdisciplinary approach and encouraging the cooperative work of the students". On the other hand, Guo et al. (2020), emphasizes that PBL is an educational approach that favors learning in higher education, improving theoretical knowledge and professional skills (Guo et al., 2020). Coincidentally, PBL has been used to improve the quality of education in various areas of knowledge, for example, generating positive effects in bioinformatics training (Emery & Morgan, 2017).

The challenge posed is seen as an opportunity, taking advantage of the cities' excellent conditions so that students improve their knowledge about them and appreciate that cities are spaces that can be used for physical activity and at the same time for learning history, art, science, and about heritage, flora, and much more. In this sense, they acknowledged that they know little about the city they inhabit and the opportunities it offers for active commuting routes, as can be gleaned from the following quotes: "Through this active route we were able to realize how wonderful the Limache

municipality is. In addition to its flora and fauna present in the downtown area, it presents various historical sectors to visit and it's pleasant and safe to commute by bicycle" (G12:01-02), "...getting to know a little more about the city of Valparaíso, its infrastructure, history, and the nooks and crannies of the so-called 'main port' " (G9:01-02), "There are beautiful spaces in places that we transit daily, but because we are wasting time on technological devices, we do not take the time to see these places, admire them and inform ourselves about this" (G2:02-03). In the training of future teachers PBL is an educational tool that allows a better application of information technologies and favors meaningful learning of the contents of initial teacher education (Liu et al., 2019).

These quotes allow us to project that future Physical Education teachers will encourage (in educational centers, especially in schoolchildren) the use of various public spaces and will encourage their students to become promoters of an active and healthy lifestyle among their classmates, their family, their community and its educational establishment, as mentioned in the Curricular Bases in its training purposes (Chilean Ministry of Education, 2023).

Active commuting is a behavior that we must promote because of its multiple benefits (Chillón et al., 2017). The students reflected on it, as it is clear from the following quotes: *"Walking is an exercise susceptible to adaptation by the individual, where each one chooses their own pace, and establishes the distance and time to travel" (G7:01-02), "This route was made thinking about how to visit the most iconic places in the 'garden city' [Viña del Mar], exercising through various means of active transport" (G3:02-03), "...this can be for all audiences, since it does not present a greater effort, allowing up to two straight hours of travel without noticing the passage of time" (G12:02-03), and "Regular walking and cycling are a means to aerobic exercise, which effectively combats high cholesterol, obesity, diabetes, heart disease and depression" (G11:01-02).*

It is clear from these quotes that the students reflected on the importance of actively commuting, an element highlighted by Molina-García et al. (2016), who recommend that both families and teaching teams encourage this behavior, and discourage – as much as possible – the use of the family car to get to the school and around the city. To this end, those responsible for educational centers and other local entities should promote the existence of healthy urban environments that are more accessible and have better pedestrian walkability. In this sense, PBL turned out to be a methodology that succeeded in developing significant learning in future physical education teachers.

Conclusion

Regarding PBL as a strategy in the training of PE teachers, it is concluded that the project "Creation of a cultural route promoting active commuting" generated spaces for reflection oriented toward the search for alternatives to solve the problems that arise in this didactic learning format. In this way, the students were nourished by experiences that consolidate the competencies necessary for their future work, considering that the current characteristics of the school system require teachers who can resolve emerging difficulties on a daily basis.

The integration of interdisciplinary content for the development of the project led to the articulation of learning experiences in complementary areas of knowledge, which allows teachers in training to respond with much more complete actions in their future employment. In this sense, active commuting was linked to cultural heritage, which – based on the analysis carried out – allowed the participants to value and become acquainted with sites and spaces that coexist in the city, which could lead to a sense of belonging.

As noted above, there is little evidence on the implementation and benefits of PBL in physical education teacher education. In this study the application of PBL methodology had a significant impact on the reflective learning process of future teachers, from which it is possible to conclude that the connection of disciplines under the PBL methodology brings meaning to the work of any subject that uses it as a resource, which – in connection with the positive evaluation from the students – predicts good development in teacher training.

Recommendations

In light of the findings, it is suggested that university curriculum developers should consider the use of PBL in initial teacher education. In this way, future teachers are expected to apply it in their professional practice at school. This type of strategy favours the development of meaningful learning and stimulates teamwork skills. In addition, it is recommended to use all the potentialities that cities offer, taking students out of their traditional classrooms to get to know the place they live in.

It is recommended that future researchers in PBL pay attention to the data collection processes, considering instruments that favor a broader view of the educational experience. It is also suggested to open this line of study for teaching in inclusive educational settings.

Limitations

This study presents a proposal made in a specific university context, so it is not possible to extrapolate the results to all contexts, therefore it is necessary to develop studies integrating other educational institutions in order to identify the effects of this teaching methodology in teacher training.

Disclosure Statement

No potential conflict of interest was reported by the author(s).

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Authorship Contribution Statement

Zavala-Crichton: Conceptualization, design, data collection, editing, reviewing, administration, supervising. Hinojosa-Torres: Data analysis, reviewing, supervising, editing. Yáñez-Sepúlveda: Conceptualization, design, drafting, technical support, editing, reviewing.

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