

RESEARCH ARTICLE

Culturally Responsive E-Learning for Indigenous Educators in Chile: Insights From an ICT Training Initiative

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ABSTRACT

Traditional educators in Chile are crucial in teaching indigenous languages and cultures within the formal school system. Decree no. 301 of the Ministry of Education, which regulates their teaching role, states that there is no compulsory formal teacher training for them, but that the State must offer them relevant training opportunities. To support this need, a virtual training program for traditional educators has been developed, which is delivered on the virtual platform “Kimeltun” and allows them to participate in classes independently. In this article, we present the results of this initiative, highlighting the experiences of 20 active traditional educators who participated in the program. The findings indicate that participants significantly improved their knowledge of the subjects covered, particularly, regarding educational theories and pedagogical methods pertinent to their indigenous heritage. The educators positively assessed the content and structure of the classes. Nevertheless, the study also revealed that the knowledge of certain topics, such as the complex specifics of Mapuche educational methods, was deepened. Additionally, the results emphasize the necessity of enhancing digital competencies among educators, especially those with limited experience in digital tools. This study underscores the potential of virtual training platforms such as Kimeltun for bridging educational gaps and enhancing the pedagogical skills of traditional educators, thereby fostering the preservation and transmission of indigenous knowledge within the formal education system.

1 | Introduction

Teachers are central to ensuring the quality of educational systems and driving school improvement efforts (Coppe et al. 2024; OECD 2005; Reid and Kleinhenz 2015). However, this quality-related role is multi-faceted, demanding adaptability from educators on two levels. First, educational needs are evolving rapidly, demanding unprecedented adaptability from teachers to respond to the challenges of an ever-changing society (Colognesi et al. 2019; Gaikhorst et al. 2015; Mansfield and Gu 2019). Second, the growing shortage of qualified teachers

in classrooms, amplified by factors such as an aging teaching population, demographic changes, and the need for teachers in specific subjects, requires rapid solutions to train and retain teachers that ensure the quality of the education system (Coppe et al. 2021; Kohli 2019; Wieser 2024).

Our study focuses on a specific case that illustrates the challenges and affordances of training teachers through online education. In Chile, as in other Latin American countries, bilingual intercultural education policies are being implemented to revitalize the languages and cultures of indigenous peoples,

in line with international agreements calling for the preservation and inclusion of these native peoples in Latin American societies. An essential step in revitalizing language and culture was implementing a new subject in the Chilean primary school curriculum in 2009. This subject, currently entitled “Language and Culture of Ancestral Aboriginal Peoples,” is compulsory for all schools with at least 20% Aboriginal students (approximately 1300). Teachers of this subject are traditional educators from various indigenous peoples. They are chosen by their communities and then accredited by assessments carried out by indigenous cultural and linguistic organizations or associations. The Chilean Ministry of Education recruits these traditional educators. Although they qualify as teachers under Ministry of Education of Chile (2018), they do not enjoy the same working conditions as regular teachers in the Chilean school system (Sotomayor et al. 2015). There are currently around 1000 traditional educators nationwide, 800 of whom are Mapuche educators. Many of these teachers work in isolated rural areas.

In this context, online education integration has emerged as a potential lever to address these systemic challenges. Digital learning platforms offer scalable solutions to train teachers efficiently while maintaining flexibility to meet diverse learning needs (Acosta et al. 2021; Burns 2023; Jiang and Jiang 2022). Moreover, e-learning is increasingly used in teacher training programs (Archambault et al. 2014; Burns 2023). In addition, the global COVID-19 pandemic precipitated the need to adopt new approaches, notably distance learning, and raise everyone’s awareness to speed with its technology-related elements (Bao 2020; Carrillo and Flores 2020; Ferdig et al. 2020). As a result, information and communication technologies (ICTs) have become an integral part of everyday life, including education (Colognesi and Hanin 2024).

This integration has led to a paradigm shift, with a more comprehensive approach toward classroom experiences and their migration to virtuality. The proliferation of digital educational content and the meteoric rise of virtual platforms for teaching and learning have undoubtedly broadened and diversified the educational landscape (Lugo and Delgado 2020; Soletic and Kelly 2022). However, this digital deluge has also exacerbated existing inequities, widening the digital divide for those without access to digital technologies (Liu and Fan 2022), particularly, in rural areas and Indigenous communities even though these groups are aware of this situation and maintain their need to participate in and use digital resources (Calderón, Fuenzalida, et al. 2022). As a result, studies exploring online teaching and learning experiences are increasingly necessary (Pokhrel and Chhetri 2021).

This context of digital expansion and inequity shapes Indigenous educators’ specific challenges. These educators’ knowledge base primarily stems from family socialization and biographical experiences (Calderón et al. 2017). However, they often lack pedagogical and didactic training to effectively transmit their knowledge, which involves adapting traditional content to formal teaching methodologies and student needs (Dolz et al. 2009). Existing training programs for these educators are sporadic and lack evaluation or continuity (Ibanez-Salgado 2015; Sotomayor et al. 2015).

Additionally, digital literacy presents both opportunities and challenges. A study by Calderón, Abarca, et al. (2022) found that while many educators are proficient in basic ICT tools such as email (61.3%) and social networking (56.9%), fewer are familiar with more specialized software like image editors (38.7%) and Microsoft Office programs (28.4%). These disparities highlight the need for accessible and inclusive digital training programs tailored to their needs. Addressing this dual challenge—combining traditional knowledge preservation with effective teaching methodologies—requires innovative solutions. To address these issues, the Kimeltun platform was developed to provide online training tailored to the needs of traditional educators. This platform represents an innovative attempt to support Indigenous educators by combining technological accessibility with culturally relevant pedagogy. This platform is developed from the open-source Moodle system, incorporating three components: self-assessment, which offers a questionnaire for traditional educators to identify their teaching skills; teaching resources, offering a repository of teaching materials for their teaching practice; and courses, the component reported in this article. At the time of the intervention, the platform was at Technology Readiness Level (TRL) 5, meaning that it had only been tested by a group of end users in a controlled or laboratory setting (Olechowski et al. 2020). For this reason, a native Moodle interface was used, which would later be modified based on user feedback. Finally, the technical requirements for using the platform are to have a device (computer or smartphone) with Internet access. Except in remote rural areas, these conditions are available in much of the country (Roberts and Weidenslauffer 2021).

The main objectives of this study were to explore the training needs of traditional educators, evaluate the impact of an online training program on their pedagogical and digital skills, and assess their satisfaction with the program. This study contributes to the literature on e-learning and intercultural education by providing insights into the design and implementation of online training tailored for Indigenous educators.

2 | Conceptual Framework

The conceptual framework of this study draws on two major bodies of knowledge that underpin the design, implementation, and outcomes of the Kimeltun program: (1) theories of e-learning and distance education; and (2) intercultural pedagogical approaches. These frameworks offer complementary insights into the pedagogical and cultural dimensions of the training program for Mapuche educators.

2.1 | E-Learning and Distance Education

Distance education, historically understood as formal instruction provided to learners separated geographically from their instructors (Schlosser and Simonson 2009), has long relied on technologies such as print-based materials and postal systems to deliver content and exchange assignments—a tradition exemplified by institutions like UNISA in South Africa (Moore and Kearsley 2011). With technological advances, particularly, the rise of the Internet, distance education has increasingly

incorporated online learning or e-learning as a dominant mode of delivery (Hoxby 2017). E-learning refers specifically to instruction mediated through digital platforms and internet technologies, offering opportunities for interaction, flexibility, and scalability. These platforms are, particularly, relevant for addressing the challenges of educating underserved populations, such as rural and Indigenous communities.

In their second-order meta-analysis, Martin et al. (2020) demonstrated that well-designed online learning programs could achieve learning outcomes equivalent to or superior to face-to-face instruction, particularly when emphasizing learner autonomy and active engagement. The flexibility and accessibility of e-learning platforms address systemic challenges rural and Indigenous communities face, such as limited access to professional development opportunities (Pokhrel and Chhetri 2021). However, significant barriers remain, including limited infrastructure, digital literacy gaps, and language accessibility (Liu and Fan 2022). These barriers highlight the importance of designing platforms that are not only technologically accessible but also meaningful and culturally tailored for their intended users.

Effective e-learning programs rely on fostering strong learner engagement. Kizilcec et al. (2017) emphasize the importance of supporting self-regulated learning, which enables participants to plan, monitor, and reflect on their progress independently. Wang et al. (2013) similarly highlight the need for learners to develop confidence in managing their learning processes.

Finally, perceived ease of use and the utility of e-learning tools are critical in influencing learner satisfaction and persistence. Studies by Joo et al. (2011) and Lakhal et al. (2021) underscore that platforms must be functional and engaging to support long-term learning success.

2.2 | Intercultural Pedagogical Approaches

In the 1970s, under pressure from Indigenous communities, Latin American countries began recognizing the need for bilingual intercultural education for Indigenous peoples (Tubino 2004). By the 1990s, 17 Latin American countries, including Chile, had acknowledged the right of Indigenous peoples to receive education in their native languages (Abram 2004). Since then, the concept of interculturality has been defined in various ways. Tubino (2004) describes the Anglo-Saxon countries' approach to interculturality as functional (or neoliberal), focusing on affirmative action and compensatory education for minorities without addressing the structural causes of discrimination. In contrast, he advocates for critical interculturality, especially in postcolonial contexts. He notes, "While neoliberal interculturalism seeks to promote dialogue without addressing the causes of cultural asymmetry, critical interculturalism aims to eliminate them." This perspective moves beyond compensatory education, viewing cultural differences as assets. Consequently, Indigenous languages and cultures are considered valuable for everyone, including the dominant sectors of society (Tubino 2004). The concept of interculturality for all was reaffirmed in 2010 during the IX Latin American Congress on Bilingual Intercultural Education (Lopez and Sapón 2011).

Walsh (2005) operationalized its application in education, particularly, in rural contexts, building on critical interculturality. From an educational standpoint, interculturality is an exchange between culturally distinct knowledge and practices under respect, mutual legitimacy, symmetry, and equality. Walsh outlines criteria for fostering interculturality in education: self-esteem and recognition of one's culture, local knowledge and skills, acknowledgment, and appreciation of others' differences, including their knowledge and skills, and addressing cultural conflicts and racism, among others. These criteria translate into teaching competencies and content.

Similarly, the same principles apply to teacher training: "For both students and teachers, it is essential to develop self-esteem and recognize their forms of cultural identity, to understand culture as dynamic and constantly evolving, and to value the social, cultural, and scientific significance of local knowledge, skills, and practices. Equally, providing a better understanding of otherness, its negative manifestations at both social and personal levels, the need to confront and change this reality, and strategies to do so are critical for all teachers in multicultural societies" (Walsh 2005, 62).

This emphasis on strengthening the appreciation of one's cultural heritage was prominently addressed in Bolivia's 2010 educational reform. Bolivia stands out among Latin American countries due to its high percentage of population identifying with Indigenous communities (66%, according to Machaca 2013). The 2010 Siñani Perez Law, aimed at decolonizing Bolivian education, introduced the concept of intraculturality (Catalán 2017) to counter what has been termed mental colonization. Intraculturality refers to the "strengthening of knowledge, wisdom, and the native languages of Indigenous peasant nations and peoples, intercultural communities, and Afro-Bolivians, promoting interaction and coexistence with equal opportunities for all through mutual respect and appreciation between cultures" (263). As a reconstruction of Indigenous cultures, intraculturality is necessary for establishing equitable intercultural dialog.

For Mapuche traditional educators, given the relatively small percentage of the Chilean population identifying with an Indigenous community (4.6%, according to Machaca 2013), an intracultural approach that reinforces and revitalizes Indigenous cultural practices is indispensable. This includes adopting tools from the dominant culture to navigate conventional educational systems effectively.

Intercultural pedagogy also contextualizes learning materials to reflect local realities and community needs (Dolz et al. 2009). For Mapuche educators, this means adapting teaching methods to their students' cultural backgrounds and linguistic contexts.

Aligned with the intra- and intercultural approaches discussed, the Kimeltun program integrates Western educational theories with Mapuche knowledge systems, including narratives, values, and educational practices, creating a hybrid pedagogical framework consistent with Chile's bilingual and intercultural education policies. This approach enhances the cultural relevance of the training and empowers educators to act as agents of cultural preservation and transformation within their communities.

Intercultural approaches further stress the importance of creating inclusive and participatory learning environments. By fostering collaboration and dialog among educators, the Kimeltun platform offers opportunities for knowledge exchange and collective problem-solving, reinforcing the communal ethos of Mapuche pedagogy. This aligns with broader calls for decolonizing educational practices and promoting equity in teacher training.

3 | Research Questions (RQs)

Following the above, this study focuses on the training needs of traditional educators participating in an online course. It also aims to explore what they can gain in knowledge and satisfaction from experiencing a pilot online training program. The three RQs are as follows:

RQ1. *What are the reported training needs of traditional educators?*

RQ2. *To what extent did participants' knowledge improve after completing the online training program?*

RQ3. *How satisfied are participants with the online training program?*

The two theoretical strands guiding this study—e-learning and intercultural pedagogy—are directly linked to the RQs. RQ 1, which addresses the training needs of traditional educators, draws from both frameworks: the e-learning perspective highlights digital access, learner autonomy, and platform usability, while the intercultural approach emphasizes the need for culturally situated pedagogies. RQ2, concerning learning outcomes, is informed by e-learning theories examining online instruction's effectiveness and impact on knowledge acquisition. RQ3, which focuses on participant satisfaction, draws on both frameworks to assess the program's perceived cultural relevance and technological usability. This theoretical integration allows for a comprehensive understanding of the pedagogical, cultural, and technological dimensions involved in online training for traditional educators.

4 | Intervention Design

The program featured a comprehensive curriculum that emphasized the development of theoretical and methodological frameworks to support effective teaching practices within a culturally relevant and supportive online learning environment. This curriculum was developed by a specialized working team including five intercultural pedagogy specialists and a Mapuche lonko (a traditional authority figure, usually the head of a community). The Mapuche lonko was in charge of designing and teaching classes on the fundamentals of Mapuche pedagogy and played a pivotal role in shaping the curriculum and ensuring the cultural pertinence of the classes.

To develop the online training program, two sources of information were considered: (1) the trainee needs identified during the first research stage (the qualitative assessment of training

needs) and (2) points of attention highlighted through consultation with eight key informants, specialists in distance education and Indigenous education. These key informants identified four main points of attention: the lack of pedagogical training for traditional educators to work as teachers in the school system; insufficient mastery of the Mapuzugun language in the case of young educators (neo-speakers); their lack of familiarity with technology, particularly among older educators; and problems of Internet accessibility, particularly in remote rural areas.

In this context, courses were designed with one weekly class over 6 months. In a self-instructional and asynchronous format, each student autonomously had to review a series of materials (videos, readings) with live discussions to encourage interaction and peer learning.

From a user experience perspective, the course was structured to allow for intuitive and independent navigation. Participants accessed the platform through a personalized account and followed a linear progression of modules. Each module was accessible from a central dashboard, where clearly labeled icons guided them to the video classroom, reading material, and quiz. They could navigate to Supporting Information whenever they wanted. Instructions were provided in Spanish and Mapuzugun. At this stage, each educator used their device, in their own time and space, but was monitored weekly by the research team. Although the design aimed to minimize cognitive overload, participants could consult the research team for telephone assistance or email.

The training program consisted of eight classes revolving around a general theoretical introduction to culture and learning, focusing on Mapuche culture (hosted on the site: www.educadorestradicionales.cl). The classes were organized around the following topics:

1. Culture and learning
2. Mapuche kuifike zugu (Stories of Mapuche ancestors)
3. Mapuche kimeltuwun (Mapuche educational methods)
4. Personal growth in Mapuche culture
5. Constructivism
6. Freire's liberating education
7. Behaviorism
8. Motivation and learning

Each class was designed to require 2h of work per week. Each class was led by a trained teacher or traditional educator, who was required to record a 10-min video lecture supported by a PowerPoint presentation. The teachers were asked to develop the following materials for their class:

- A PowerPoint that explains the class's objectives, content, and pedagogical gain (maximum of 10 slides with straightforward, concise content).
- A supporting document that synthesizes or elaborates on the class contents (maximum of 10 pages with straightforward, concise content).

- Evaluation in the form of a quiz (maximum five items: multiple-choice, true or false, and open-ended questions), in which the learning of the contents of the class is evaluated.

The recorded class and the written document were translated into Spanish and Mapuzugun, and the project team hired a designer to provide a culturally relevant design and illustration for the resources. The course's pedagogical design and syllabus were validated by a specialist in online course design and a Mapuche academic specializing in Mapuzugun language didactics. Both professionals were provided with the course syllabus, a sample lesson, and a validation guide. The following criteria were considered to evaluate the course syllabus: cultural relevance and relevance of objectives; clarity, relevance, and usefulness of content for the traditional educator; clarity of methodology; and easily understandable evaluation for the educators.

As can be seen, due to the self-instructional design of the courses, the intention is to minimize interaction with a figure such as a tutor. However, user support is incorporated through an e-mail to resolve doubts and researchers' biweekly monitoring of users. No additional materials, such as user guides or tutorials, are integrated.

5 | Method

The following methodology was adopted to evaluate the program's effectiveness in addressing the identified training needs, enhancing participant knowledge, and fostering satisfaction. To achieve this, we adopted a mixed-methods approach, following the recommendations of Schoonenboom and Johnson (2017). Our model is a *three-stage equal-status equal-sequential design*, which can be coded as follows (Johnson et al. 2007; Morse and Niehaus 2009): QUAL—QUAN—QUAL, referring respectively to the collection of qualitative data (focus groups and questionnaires), quantitative data (pre- and posttests), and qualitative data (focus groups and satisfaction surveys). The first stage provided an opportunity to investigate traditional educators' needs (RQ1). The second stage was designed to assess participants' knowledge before and after participating in the pilot training program, using pre- and posttest instruments to measure improvement. More specifically, we wanted to know how participants' knowledge evolved through their participation in the pilot online training program (RQ2). The third stage involved determining participants' thoughts about the training program (RQ3). These three stages are outlined and explained in Figure 1.

5.1 | Participants

Twenty traditional educators from the Metropolitan region of Chile participated in the study. These educators were selected using convenience sampling (Creswell 2007). Table 1 presents their key characteristics, including gender, age, educational level, and pedagogical training. All 20 traditional educators who participated in the initial stage continued throughout the study. This continuity across the three phases (QUAL—QUAN—QUAL) enabled consistent participant experiences, learning outcomes, and satisfaction tracking.

Most of the participants (75%) were women. Regarding age range, most educators were in the 41–60 age group (60%), and 12 of the 13 participants in this age group were women. Most (45%) had between 6 and 10 years of experience in mother-tongue teaching, and 40% had recent experience. On the other hand, 40% of participants had attended higher education, and just over a third (35%) had vocational training. It is also worth

TABLE 1 | Characterization of study participants ($N=20$).

ITEM	N	%
Gender		
Female	15	75
Male	5	25
Age groups (years)		
30 or less	3	15
31–40	5	25
41–50	8	40
51–60	4	20
61 or more	0	0
Educational level		
Completed high school	8	40
Higher technical	4	20
Incomplete higher education	1	5
Completed higher education	7	35
Do you have a degree in pedagogy?		
Yes	8	40
No	12	60

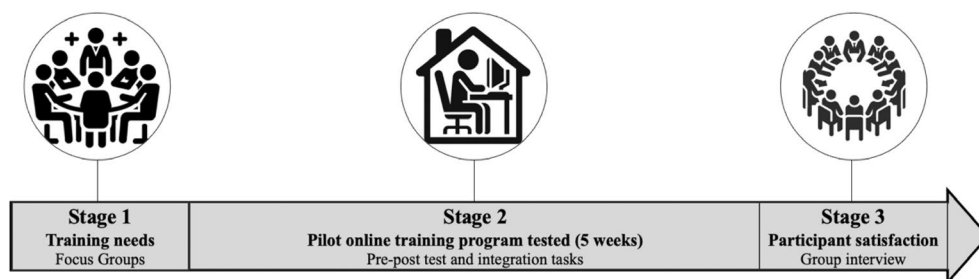


FIGURE 1 | Methodological design visualization.

TABLE 2 | Codebook.

A. Categories derived from e-learning and distance education theories	Learner autonomy and self-regulation	How learners manage their learning despite constraints (e.g., time, tools).
	Technological accessibility	Technical constraints, connectivity, and technical support.
	Engagement and user-friendly design	Platform navigation, perceived utility of tools, and user satisfaction.
B. Categories derived from intercultural pedagogical approaches	Cultural relevance of content	Integration of traditional knowledge and respect for cultural specificities.
	Collaboration and community-based learning	Interactions between learners and trainers, the importance of dialog spaces.
C. Transversal category	Assessment and feedback	Structuring feedback and assessing learning, importance of gradual feedback.

noting that around half of the educators had engaged in pedagogical studies (with or without a degree). In addition to their formal studies, they all worked in the school system. This suggests they had some prior exposure to the topics presented in the virtual course. These sociological variables were independent of each other. Descriptive statistics and chi-square tests of independence were used to explore associations between participants' sociodemographic characteristics. The only two related variables were attending higher education and studying pedagogy in higher education ($\chi^2 = 7.56$; $p < 0.01$). The relationship is apparent, given that teacher training mainly occurs in higher education.

5.2 | Procedure

5.2.1 | Stage 1—Training Needs (RQ1—QUAL)

This stage addressed the first RQ by investigating the pedagogical training needs of traditional educators.

During this stage, implemented face-to-face and in the same physical space, the 20 educators were provided with materials prepared by the research team to validate and examine the pertinence of the pedagogical resources used in the online training program. These four classes, two related to Mapuche culture (Classes 2 and 3) and two related to pedagogy (classes 5 and 6), could be used in the online training program. The researchers/trainers presented the material. Then, the participants watched and listened to a video with each class. Subsequently, they reviewed the class support material, a text of approximately 10 pages. Once this was done, the educators completed an online questionnaire, answering questions about the usability of the Kimeltun platform.

Second, participants were divided into two randomly selected groups to discuss their experience, ease of platform use, the materials presented, and their training needs. These two groups functioned as focus groups (Vaughn et al. 1996), chosen to capture ideas that would have been more difficult to perceive in individual interviews. Interaction was considered the ideal way to encourage participants to express their points of view and needs

(Kitzinger 1994; Stewart et al. 2007) and to quickly identify consensus and disagreement (Baribeau and Germain 2010).

Each focus group discussion lasted approximately 60 min and was audio recorded; then transcribed, resulting in 43 pages of conversations (21,938 words). The research team applied a content analysis to the data collected (Miles and Huberman 1994). In this stage, the training needs of traditional educators were analyzed using a deductive content analysis approach. The analysis was guided by predefined categories derived from the theoretical frameworks of e-learning and intercultural pedagogy. The data was systematically coded according to categories from the theoretical framework, the code book provided in Table 2. These categories were refined and finalized through iterative discussions to ensure reliability and the coding (Strauss and Corbin 1990). Focus group data were transcribed verbatim and analyzed using a deductive content analysis approach. Coding was guided by a codebook based on theoretical constructs from the e-learning and intercultural pedagogy frameworks. Coding reliability was ensured through collaborative discussions among researchers.

5.2.2 | Stage 2—Intervention Phase (RQ2—QUAN)

As part of this study, 20 traditional educators were invited to test four classes from the online training program, two related to Mapuche culture (Classes 2 and 3) and two to pedagogy (Classes 5 and 6). All these activities were carried out virtually on the Kimeltun platform.

Once the classes were completed, we used two evaluation tools, including a quiz and integration tasks. The quiz provided quantitative data, and the integration tasks generated open-ended responses that were scored on a 0–3 scale for quantitative analysis.

The aim was to measure their theoretical knowledge and the ability to apply it in real teaching contexts. To measure the learning impact of the course, before starting the first class, participants were asked to answer 12 closed-ended questions about the content of the four planned classes. There were eight questions for the Mapuche pedagogy classes (Classes 2 and 3). Four

questions addressed the knowledge of basic concepts (Küpan, Tuwün, Fütal Mapu, Poyenkechi), and four questions focused on more advanced concepts (Kuyfike zugu, Piam, Anülmapun, Kimeltuwin). Four questions were selected for the general pedagogy classes (Classes 5 and 6): two on Paulo Freire's pedagogy, one on a constructivist approach to teaching Mapuzungun, and one on cognitive conflict. Each class had an equal number of multiple-choice questions and true/false questions. At the end of the last class, participants were again asked to answer the same questions. This procedure aimed to check whether their answers had changed after attending the course and carrying out the required activities (watching the class video with the PowerPoint presentation, reading the supporting document, and evaluating the class using a quiz or short questionnaire).

In addition, two open-ended questions were asked, one for each type of pedagogy (Mapuche and general). These were complex integration tasks. The aim was to see how participants could use what they had learned to complete the assigned task. For the Mapuche pedagogy class, participants had to prepare a Grade 6 class plan as an assignment based on elements of the Mapuche *Kim Mapun* educational method. Participants had to create an activity from a socioconstructivist perspective for the general pedagogy class. For this purpose, specific documents with the content to be considered were provided. Participants could submit their answers in writing or audio up to 1 week after the end of the final class, performing these tasks remotely.

Responses to the 12 closed-ended questions were coded as 0, incorrect answer, or 1, correct answer, and measured before and after the training program. A nonparametric Wilcoxon test on the difference between pretest and posttest was performed. In addition, a Kendall's Tau test was performed to verify the influence of demographic variables. Open-ended responses were read and coded by a Mapuche researcher. They had an average length of 36 words. The coding was as follows: 0, no answer; 1, wrong answer elements; 2, incomplete answers; 3, correct and complete answers. Three dimensions were assessed for each response: content, educational model, and classroom contextualization. Given the small sample size and the ordinal nature of the test scores, we applied the Wilcoxon signed-rank test to evaluate pre- and posttraining differences. To explore possible relationships between knowledge gains and participant characteristics, Kendall's Tau was used for correlation analysis. These nonparametric methods are appropriate for small, nonnormally distributed samples.

Responses were assessed using a 0–3 scale by a trained Mapuche educator for open-ended integration tasks. The rubric evaluated three dimensions: (1) content knowledge, (2) alignment with pedagogical models, and (3) classroom contextualization. This allowed for a qualitative interpretation of learning transfer.

5.2.3 | Stage 3—Participant Satisfaction (RQ3—QUAL)

In this stage, participants' assessment of the online training program was investigated.

A face-to-face meeting was held with 18 out of the 20 participants. Two participants were unable to attend the meeting due

to personal reasons. First, they were invited to complete a 9-item quiz on their appreciation of the course content. A group discussion with the 18 participants followed this. The idea was to enable them to give their point of view on what they had experienced. This discussion, held in Spanish, lasted 60 min and was guided by the project researchers. They were asked about their general opinions about the course, the relevance of the content, and the difficulties or obstacles they had in completing their evaluations.

The entire conversation was recorded and transcribed, producing a corpus of 12,800 words. A thematic analysis was applied to the focus group transcript using open coding. Categories were developed inductively to capture participant perspectives on the clarity, relevance, and delivery of the course content and structure.

Table 3 summarizes the instruments used at each stage of the study, their format, and their specific purpose in addressing the research questions.

6 | Results

This section presents the findings in response to the three RQs that guided the study.

6.1 | RQ1: Participants' Needs

The training needs of traditional educators were categorized into six areas derived from the theoretical frameworks: (1) learner autonomy and self-regulation, (2) technological accessibility, (3) user-friendly platform design, (4) cultural relevance of content, (5) collaboration and community-based learning, and (6) formative and progressive feedback.

Participants emphasized the challenge of managing family, work, and study simultaneously; and requested clearer guidance and flexibility:

■ Balancing work, family, and study is not easy. The course should offer flexibility. (TEF6)

■ We require more tutoring and less autonomy, especially considering the challenges we face. (TEF1)

Participants expressed concerns about access to technology necessary for effective participation in distance learning. They mentioned challenges like limited connectivity in some regions and the need for adequate devices. Consequently, they need continual technical support. Educators sought to feel confident using online tools to maximize their teaching effectiveness.

■ We need access to the internet but also who to ask if we have any questions. (TEF11).

■ It is crucial to have tools that help us connect and deliver our kimun [Mapuche knowledge] through digital platforms. (TEF9)

TABLE 3 | Summary of instruments used in each research stage.

Stage	Research question	Instrument(s) used	Format	Purpose
Stage 1—training needs	RQ1	Focus group protocol; platform usability questionnaire	Semistructured group discussion; Online survey (open and closed items)	Explore pedagogical and digital needs; assess ease of use and relevance of platform content
Stage 2—intervention	RQ2	Pre- and posttest questionnaire; Integration tasks. Pre/post quiz (Wilcoxon test), demographic correlation (Kendall's Tau), integration tasks (rubric-based analysis)	12-item quiz (multiple-choice and true/false); 2 open-ended tasks (written or audio)	Measure knowledge gains and assess ability to apply pedagogical content in practice
Stage 3—satisfaction	RQ3	Satisfaction survey; final focus group. Focus group (thematic analysis)	9-item Likert-type questionnaire; semistructured group discussion	Assess participant satisfaction with content, delivery, and learning experience

Note: All instruments were designed by the research team and validated by experts in online education and intercultural pedagogy to ensure cultural and pedagogical relevance.

The platforms will work offline and upload the information afterwards. (TEM3)

Ease of navigation and the platform's intuitiveness seem crucial for maintaining participant engagement.

Participants stressed the importance of an attractive platform to encourage participation. This, they believe, will also minimize barriers to learning.

If the platform is too complex, it discourages us from continuing. (TEM4).

The design needs to be as simple as possible, because some of us are not familiar with this type of tool. (TEF5)

We need a more visual interface, with clear icons to guide us easily. (TEF8)

If the platform is not intuitive, it can discourage us from continuing the course. (TEF6)

The participants highlighted a need for educational content that is not only relevant and engaging for students but also adaptable to the specific cultural and academic contexts of Mapuche educators. Regarding content, needs ranged from training in general pedagogy, which some people said they needed to gain knowledge of, to cultural understanding from an intracultural perspective.

There are always topics to learn from our own culture, but it is also relevant to know how to teach them. (TEM2)

We need materials that do not just come from external sources but reflect our territorial and cultural specificities. (TEF15)

It is important to avoid a culturalist perspective and instead link language and culture dynamically (TEF6).

The need for interaction and community-building was a recurring theme. Participants sought opportunities for dialog and collaboration among peers and trainers:

We need spaces for dialogue, where we can share experiences and support each other. (TEM7)

It cannot be limited to these workshops. We need to stay connected, and now, with the internet, this is possible. (TEF14)

We are stronger when we work together and learn from each other's experiences. (TEF10)

Participants mentioned that it is essential for them to be aware of their progress and also to be able to stay motivated with

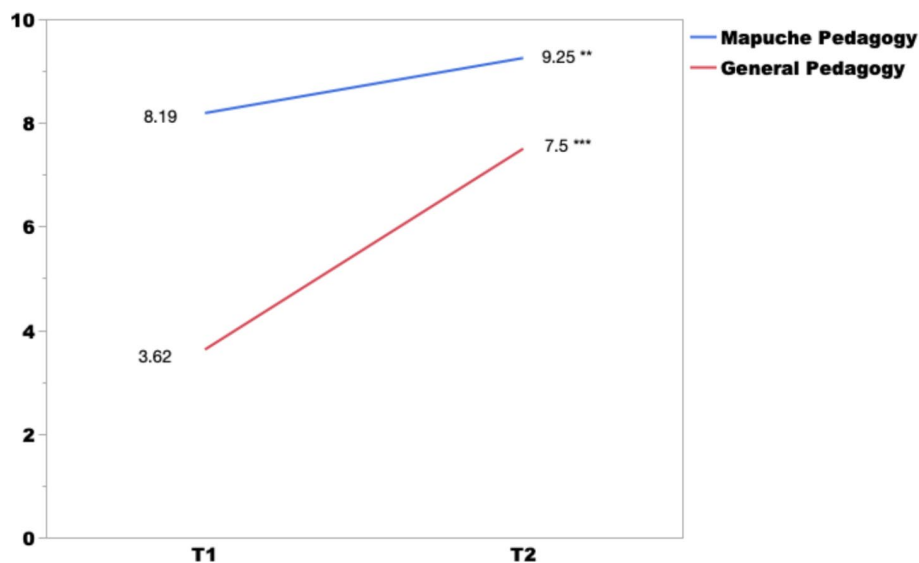


FIGURE 2 | Means of the results for the 12 questions of the pre- and posttest, grouped in two modules, Mapuche (8 questions) and General (4 questions). Wilcoxon nonparametric test on the difference between the pre- and posttest. ** $p < 0.01$, ***: $p < 0.001$.

assignments. They also valued the role of formative assessment in creating a personalized learning experience.

Knowing where I stand and how I can improve is very motivating. (TEM6)

Feedback should help us not only see where we are but also how to improve. (TEF18)

Participants emphasized six key needs: autonomy in learning, reliable access to technology and support, engaging and user-friendly course design, culturally relevant content, community-oriented learning opportunities, and formative assessments. These findings highlight the importance of designing e-learning programs that are culturally responsive and accessible, while providing tools for collaboration, motivation, and personalized learning.

6.2 | RQ2: Knowledge Evolution

Pre- and post-tests were applied before and after four online classes to measure learning outcomes. Figure 2 shows the mean scores across the original 12 items. However, four items assessing basic Mapuche concepts showed a ceiling effect and were excluded (see Section 7.3). Figure 3 presents adjusted results based on the remaining eight items.

Learning gains were, particularly, notable in general pedagogy, indicating low prior exposure to these concepts. Improvements in complex Mapuche concepts also reflect enhanced conceptual depth.

In open-ended integration tasks, 80% of participants successfully contextualized content for classroom use. Definitions of Mapuche concepts varied in depth:

Tuwün: Territorial ancestry of the people who preceded us ... The territory builds us as a person. (TEM3)

For general pedagogy, 60% of participants created plans aligned with socioconstructivist principles. Freirean tasks (e.g., syllabic analysis in Mapuzugun) proved more challenging, likely due to linguistic complexity.

On the questions about non-Mapuche pedagogy or Western educational tradition, most participants (80%) could choose a word related to Mapuche life and context, which suggests that they understood the concept of the generative word in Freire's theory. However, only one-third of the educators (30%) could perform the exercise of syllabic decomposition and create other words from the generative word. This reflects that applying the psychosocial method proposed by Paulo Freire took much work in the Mapuzugun language, possibly because this exercise requires a high level of knowledge of this language, which is typologically polysynthetic and agglutinative, so it is necessary to adequately understand suffixes and other particles that change the meaning of the speech (Salas 2006). Regarding generating an activity using text in Mapuzugun to carry out an activity from a socio-constructivist perspective, 60% of the traditional educators created a plan with Mapuzugun content that adequately used this paradigm. Of these teachers, 25% did so partially, and 15% needed to answer more adequately.

Our results showed that traditional educators adequately incorporated the content taught in this online course. When performing the complex integration tasks requested, most participants were at Levels 2 (incomplete answers) and 3 (correct and complete answers); meaning they could incorporate some of the content covered in the online training program when developing a lesson.

In conclusion, participants showed notable improvements in their knowledge, particularly, in general pedagogy, while Mapuche cultural knowledge was reinforced and contextualized. However, applying new methods, such as Freire's syllabic approach, presented challenges, particularly, in Mapuzugun, because its application requires a more advanced knowledge of this language.

6.3 | RQ3: Participant Satisfaction After 5 Weeks of Online Training

To better understand participants' perceptions of the online course, a satisfaction survey was conducted in Spanish at the end of the program. The results, summarized in Table 4, provide a quantitative overview of participant satisfaction and highlight strengths and improvement areas.

Survey responses and focus group discussions revealed high overall satisfaction with the course, particularly, about video

clarity, content relevance, and general usability of the platform. However, participants also identified four key areas for improvement: course timing and flexibility, technological accessibility, content design, and assessment clarity.

6.3.1 | Time and Flexibility

Many participants found it difficult to balance study with family and professional responsibilities. They recommended more flexible timelines and suggested that summer would be a more

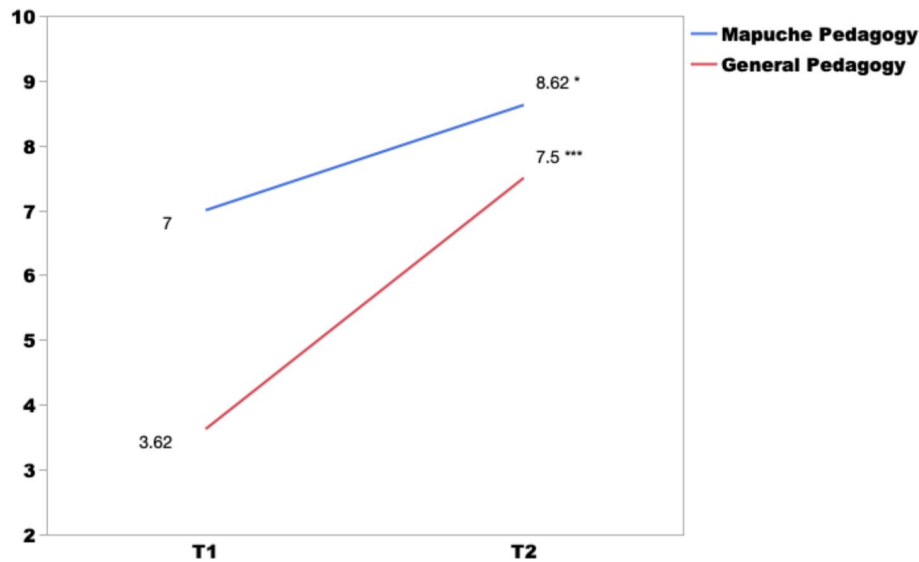


FIGURE 3 | Means of the results to the eight questions of the pre- and post-test, and grouped in two modules, Mapuche (4 questions) and General (4 questions), following identification of the ceiling effect. Wilcoxon nonparametric test on the difference between the pre- and posttest. ** $p < 0.01$, ***: $p < 0.001$.

TABLE 4 | Course satisfaction survey results ($N = 18$).

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1. I enjoyed taking an online course.	11 (61.1%)	4 (22.2%)	2 (11.1%)	1 (5.6%)	0
2. The way the information is presented helps me navigate the course.	9 (50%)	6 (33.3%)	2 (11.1%)	0	1 (5.6%)
3. This course is useful for my learning	13 (72.2%)	3 (16.7%)	0	1 (5.6%)	1 (5.6%)
4. The time required for each class is sufficient.	9 (50%)	7 (38.9%)	2 (11.1%)	0	0
5. The form of assessment in each class is appropriate.	8 (44.4%)	9 (50%)	1 (5.6%)	0	0
6. The supporting material is understandable	16 (88.9%)	2 (11.1%)	0	0	0
7. The video is clear and helps me understand the content.	14 (77.8%)	4 (22.2%)	0	0	0
8. The PowerPoint helps me understand the course content.	12 (66.7%)	6 (33.3%)	0	0	0
9. I'd like to take more classes this way.	11 (61.1%)	5 (27.8%)	1 (5.6%)	1 (5.6%)	0

suitable period for Indigenous educators to participate in virtual training:

Balancing the family, work, and the course requirements was the most difficult part. I wish there were more flexible deadlines. (TEM7)

May and June are challenging months; summer would be better for us. (TEF7)

6.3.2 | Access and Digital Barriers

Poor internet connectivity and limited familiarity with digital platforms were recurrent concerns. Participants valued the offline functionality of the platform and recommended minimizing heavy visuals to reduce data consumption:

We need platforms that work offline and synchronize later, as connectivity is often unreliable in our regions. (TEM3)

Designs should use fewer heavy visuals and more plain text to reduce data consumption. (TEM4)

6.3.3 | Material Quality and Accessibility

Although the video classes were well received, participants described the accompanying documents as redundant and overly dense, particularly for older educators. Suggestions included integrating diagrams, audio alternatives, and simplified language.

The material is good, the video is clear ... but the document is the same as the video. It is also written in a language that, for the older ones, is complex to understand. (TEF10)

6.3.4 | Cultural and Thematic Coherence

Participants appreciated the inclusion of Western and Mapuche educational content but highlighted a perceived lack of cohesion across topics. They recommended adopting a storytelling approach and increasing the presence of Mapuzugun in instructional materials:

We need more stories that connect the themes; otherwise, it feels disconnected. (TEF5)

If it is the pedagogy of the Mapuche people, it should be all in Mapuzugun. It would be positive for them and encourage those of us still learning. (TEM2)

6.3.5 | Interactivity and Collaboration

A strong desire for continued dialog among participants emerged. Many advocated for the integration of forums or chat rooms to foster peer exchange and community building:

We need to be connected, and now, with the Internet, this is possible. This needs to be included in the course. (TEF14)

Forums or chat rooms could allow us to exchange ideas and maintain the feeling of being connected. (TEM6)

6.3.6 | Assessment and Feedback

Participants called for more precise and more progressively structured evaluations. Several noted confusion about the wording of some questions in both Spanish and Mapuzugun, and proposed the use of visual aids and concrete examples:

Some of the questions were not clear; it would help if they included examples or visual guides. (TEF5)

Evaluations should have a gradual structure, helping us improve step by step. (TEM7)

In summary, while participants strongly appreciated the course, they also contributed constructive suggestions to enhance its flexibility, accessibility, cultural coherence, and interactivity—critical factors in developing effective and inclusive online training for Indigenous educators.

Table 5 Summarizes the results for the three research questions.

7 | Discussion

We investigated the potential of online training for a specific population: traditional educators in Chile, who focus on reviving indigenous languages and cultures at school. The urgency of their training needs and geographically dispersed locations highlight the importance of online tools that facilitate pertinent, self-paced learning. This approach aligns with the growing interest among educators in incorporating technological solutions in professional development (Acosta et al. 2021; Burns 2023; Jiang and Jiang 2022). Furthermore, online training can foster the development of technology use habits within this educator group. In the work carried out, a mixed-methods approach (Johnson et al. 2007; Morse and Niehaus 2009) was chosen to assess training needs, the effectiveness of an online pilot training program, and participant satisfaction.

7.1 | Discussion of Findings

7.1.1 | Training Needs (RQ1)

The identified needs highlighted six key priorities for creating e-learning environments supporting pedagogical and cultural development for traditional educators: learner autonomy and self-regulation, technological accessibility, engagement through user-friendly design, culturally relevant content, collaboration opportunities, and formative assessments with progressive feedback. These needs reflect both structural barriers and

TABLE 5 | Summaries of the results.

Research question	Key findings
RQ1: Participants' needs	Participants highlighted practical challenges, such as balancing professional and personal responsibilities, limited access to reliable technology, and difficulty navigating online platforms. They also expressed the need for culturally relevant content that aligns with their unique contexts, interactive learning opportunities, and clear feedback mechanisms.
RQ2: Evolution of knowledge	Quantitative improvement: Mean scores increased from 7 to 8.62 for Mapuche pedagogy and from 3.62 to 7.5 for general pedagogy. Qualitative results showed partial to full integration of learned content into pedagogical practices. Older participants showed resistance to new concepts.
RQ3: Participant satisfaction	High satisfaction with platform usability (e.g., video clarity, supporting materials). Key challenges: technological barriers, need for content personalization, clearer activity instructions, and improved feedback mechanisms. Desire for more collaborative and interactive tools.

pedagogical expectations. Participants emphasized that balancing study with work and family responsibilities required greater flexibility and scaffolding, aligning with findings by Kizilcec et al. (2017) on the necessity of structured support in online learning. Digital barriers—connectivity, interface complexity, and device access—also emerged, echoing the principles of universal learning design (CAST 2018).

Participants also emphasized the importance of culturally relevant content that reflects Mapuche values and knowledge systems. This need aligns with the broader call for decolonizing educational practices (Tubino 2004; Walsh 2005), intracultural deepening (Catalán 2017) and adapting pedagogical strategies to Indigenous contexts (Dolz et al. 2009). The need for dialog and peer interaction was likewise pronounced, reinforcing the value of collaborative e-learning environments.

7.1.2 | Knowledge Gains and Integration (RQ2)

Participants showed significant gains in pedagogical knowledge, particularly in general education theory, and demonstrated the ability to integrate traditional and Western approaches in learning tasks. These outcomes align with studies on e-learning effectiveness (Martin et al. 2022) and

emphasize the added value of culturally responsive online training (Burns 2023). Participants' statements confirmed the program's perceived relevance, particularly in contrast to previous experiences of training that lacked contextual or cultural sensitivity (Ibanez-Salgado 2015).

The findings of this study are consistent with existing literature on online professional development for underserved and indigenous communities. For instance, like Martin et al. (2022), well-designed e-learning programs can yield significant knowledge gains, mainly when learner engagement and autonomy are supported. Our results also echo the work of Burns (2023), who emphasizes the need for adaptable, culturally relevant content in digital training environments. Additionally, the importance of scaffolding self-regulated learning, as highlighted by Kizilcec et al. (2017), was reflected in participants' expressed need for more structured guidance. However, this study goes beyond existing work by integrating critical intercultural and intracultural pedagogies in an online format tailored to Mapuche educators—an area that remains underexplored in global research. Doing so bridges a gap between digital innovation and cultural preservation, offering insights that can inform national and international educational strategies.

7.1.3 | Satisfaction and Challenges (RQ3)

Participants expressed high satisfaction, particularly regarding content relevance and clarity of video-based instruction. However, they also noted issues: dense documents, unclear assessment instructions, limited platform interactivity, and rigid timelines. These critiques underline the importance of progressive feedback structures (Wang et al. 2013) and the incorporation of tools that support ongoing dialog among educators.

7.2 | Implications for Theory and Practice

The findings have implications for both educational theory and instructional design. Theoretically, the study supports the integration of e-learning and intercultural pedagogy, demonstrating that digital education can be adapted to Indigenous contexts when designed with cultural responsiveness and learner diversity in mind.

Practically, the results point to actionable recommendations: (1) online courses for Indigenous educators should incorporate flexible pacing and progressive feedback; (2) content should balance cultural specificity with general pedagogical concepts; (3) technology platforms must support offline access and simplified navigation; and (4) collaborative tools like forums should be integrated to foster community-based learning.

These insights may inform training programs for Indigenous educators beyond Chile, offering a framework for digital inclusion that respects cultural identity and pedagogical diversity.

Similar culturally responsive digital training initiatives have been developed in other Indigenous contexts. For example, in Canada, the First Nations Pedagogies Online project (NCCIE 2019) emphasizes the integration of Indigenous knowledge systems into e-learning environments, with a strong focus

on community-based values and intergenerational knowledge transmission. The Stronger Smarter Institute supports Indigenous educators in Australia through blended learning programs that promote culturally affirming content and leadership development (Sarra 2011). These examples demonstrate that, while approaches differ by context, successful initiatives share core principles with the Kimeltun program: cultural relevance, flexibility, and alignment with local pedagogical traditions. As such, Kimeltun offers a promising framework for designing digital training platforms tailored to Indigenous educators in diverse settings.

7.3 | Limitations and Implications

The study has several limitations. First, the geographic concentration of participants in Santiago and the sample scope could affect the results' generalizability. Future research could extend the sample to other regions to better understand the needs and experiences of traditional educators in different contexts. Second, assessment of knowledge through multiple choice or true/false questions relied on a different number of items for each dimension (Mapuche pedagogy and general pedagogy). The small number of items considered is also a limitation.

Nevertheless, the two integration tasks enabled us to flesh out this information. In addition, the study highlighted challenges related to access to technology and the Internet, particularly in rural areas, and barriers related to age and familiarity with technology among educators. These factors underline the importance of considering demographic characteristics and access to technology when designing and implementing e-learning programs.

Although this study is grounded in the specific context of Mapuche traditional educators in Chile, its findings carry broader implications for indigenous education worldwide. The challenges addressed—such as the need for culturally responsive pedagogical training, digital inclusion in remote communities, and integrating traditional knowledge systems with contemporary educational practices—are shared by many indigenous groups globally. This research offers a scalable model for designing online professional development programs that honor cultural specificity while fostering broader educational equity. Educational policymakers and institutions in other countries can adapt the Kimeltun approach to support indigenous educators in their contexts, contributing to the global effort to decolonize education and empower marginalized communities through digital innovation and intercultural pedagogy.

8 | Conclusion

This study contributes to the growing literature on Indigenous education and digital inclusion. It demonstrates the feasibility and value of culturally grounded online training for traditional educators while identifying design principles essential for its effectiveness. The findings support efforts to decolonize professional development and affirm the importance of intercultural and intracultural pedagogies in digital environments.

The Kimeltun platform should be adapted and scaled based on these insights. Institutional support will be key to sustaining this program and expanding its reach within Chile and other contexts where Indigenous knowledge and education are central to community empowerment.

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Ethics Statement

Ethical approval was sought and obtained in November 2020 from the university's Ethics Social Sciences and Humanities Research Ethics Committee.

Consent

It should be noted that the educators signed a contract in which they voluntarily agreed to carry out this work, to be recorded and for the results to be disseminated with a guarantee of anonymity, and to receive symbolic compensation.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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