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# A Holistic Model for Disciplinary Professional Development—Overcoming the Disciplinary Barriers to Implementing ICT in Teaching

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**Abstract:** What helps teachers overcome technological barriers to Information and Communications Technology (ICT) implementation in their subject domains? Can a disciplinary professional development model help reduce these disciplinary barriers? To answer these questions, this mixed-methods case study examines the change in digital ICT implementation and its barriers among secondary school first language teachers after the utilization of a holistic model for disciplinary professional development (language, science, etc.). Ninety-two first language teachers participated in a professional development program that included a unique instructor profile, theoretical and practical training, technical support, and ongoing individual and school-wide didactic and pedagogical support. The teachers' experiences and changes in their personal general experience during their professional development were then assessed via interviews and open-ended questionnaires. The findings indicate that the unique professional development model largely removed the teachers' disciplinary barriers. Specifically, during their professional development, the teachers changed their perceptions of the purposes of ICT in first language teaching in general and teaching writing in particular, indicating that they realized that ICT promotes their discipline and is not merely a tool for lesson diversification or intrigue. Furthermore, they recognized that ICT is not an option but an integral part of teaching in the 21st century.

**Keywords:** professional development; teachers' professional learning; disciplinary barriers in ICT; integrating technology in teaching; first language teaching; teaching writing

## 1. Introduction

### 1.1. Study Context

For over a decade, technological reform has been embedded in Israel's education system. Since 2010, the education system in Israel has applied a national ICT program called "Adapting the Education System to the 21st Century". The goal behind this reform is to promote integration of ICT into teaching, learning, and assessment processes in schools and to develop the knowledge and skills required by students in the 21st century [1,2]. Integrating ICT into teaching has become even more critical following the COVID-19 pandemic, which forced educators to teach online, highlighting the need for digital skills among both teachers and students as well as the need for appropriate professional development for teachers [3–5]. Moreover, in recent years, a dramatic shift in educational challenges with AI developments is being witnessed, forcing educational professionals to rethink, yet again, their ways of teaching [6,7]

In a study of 391 teachers of Hebrew as a mother tongue, Avidov-Ungar and Amir [8] examined attitudes toward the integration of ICT in teaching in general and the purposes of using ICT when teaching a mother tongue in particular. Their findings indicated quite positive attitudes toward ICT tools, but when the teachers were asked about the extent to which ICT is used in practice, the average value of a four-point scale of agreement

(1 = not at all, 4 = to an extent) obtained from the entire sample was 1.60 (with a standard deviation of 0.54). This indicates the participants' very low tendency to use ICT tools. In another qualitative analysis of interviews with some of the same 391 teachers, the researchers found that the teachers perceived the goals of integrating ICT into first language teaching to mainly involve diversity and curiosity. There was no mention of promoting the discipline itself. These findings, both quantitative and qualitative, led the researchers to the conclusion that teachers face a disciplinary barrier to ICT [8,9]. Specifically, they do not see enough of technology's contribution to the advancement of the language learning discipline. Therefore, their technology use is occasional and mainly intended for lesson diversification and to create interest. These findings indicate the need for a deeper understanding among teachers that technological applications can greatly promote first language skills, including writing, and reduce disciplinary barriers. Indeed, ICT tools are not an option but essential for disciplinary advancement.

Research has established that the key to leading change and assimilation is teachers who are willing to spearhead that change [10]. Teachers' professional development is already a mechanism for the introduction and assimilation of new policies in schools, making it ideal for the assimilation of ICT as well. This means that there is a need for professional development that focuses on disciplinary barriers and encourages teachers to use ICT to advance their field of knowledge.

This case study seeks to examine the impact of a professional development model for first language teachers on the teachers' perceptions of the goals of ICT integration in various disciplines and its role in their teaching. The findings contribute to knowledge about the degree of effectiveness of professional development in ICT's integration into language teaching.

### 1.2. Stages of Assimilating Technology into Teaching

Incorporating technology into educational practices entails a significant transformation with two primary phases [11–13]. The initial phase, known as the foundational stage, focuses on the shift from traditional to electronic teaching methods that align with the demands of the 21st century. During this stage, teachers utilize technology as a tool to enhance familiar teaching and learning processes, primarily for activities such as practice, illustration, and enrichment. However, how technology is employed in this phase does not result in the desired pedagogical changes (e.g., [14,15]). It is not until the second phase, referred to as the integration stage, that the seamless integration of ICT tools into the teaching and learning process occurs. In this stage, teachers design their instruction using digital platforms and adapt their teaching methods to the digital environment [16–18].

Studies have indicated that most teachers limit their use of technology in the classroom to basic tasks, such as computer-based practice, surfing the Internet for information retrieval, and simple data processing. According to the SAMR model, there are four hierarchical tasks in implementing ICT processes: Substitution, Augmentation, Modification, and Redefinition. It was found that most teachers remain in the initial and fundamental stages of technological integration, Substitution and Augmentation, and fail to fully integrate ICT into their teaching practices as expected [2,11,12,19].

### 1.3. Incorporation of ICT Tools into Language Instruction

Computer and information literacy (CIL) is defined as an individual's capacity to effectively utilize a computer for research, creation, and communication. It encompasses the technical and pedagogical skills required to navigate computer systems irrespective of subject matter [20], as well as the ability to manage and evaluate information effectively [21]. These skills include information retrieval, integrating information from diverse sources, and proficiency in using generic digital applications [2]. In addition to these generalized skills, there are specific competencies found in CIL that are relevant to various disciplines. Language instruction is one such discipline that places significant importance on the integration of technology [11]). Researchers have defended that teaching and learning in an

electronic environment invite many opportunities for better quality learning of a first and second language. Indeed, numerous studies delve into computer-aided language learning (CALL), especially in the development of second language skills: grammar, vocabulary, reading, writing, listening, and speaking (e.g., [22–24]).

In a study that emphasizes the significant role of ICT in the professional training of language teachers focusing on teaching syntax, it was determined that the use of digital tools and electronic dictionaries has a positive effect on students' mastery of the study material. Furthermore, the correct use of ICT tools in language teaching creates great linguistic richness, authenticity, and motivation among the learners [25].

In language classes, students are specifically taught reading comprehension, where they learn how to find information, merge information, and read digital texts. Therefore, the use of CIL skills in general and word processors in particular (e.g., to highlight sentences, cut and paste content, create tables, etc.) is necessary to promote literacy skills. In recent years, the body of research on the use of technology to increase language learning has grown, with a particular focus on writing skills. Several studies have shown that the use of ICT tools such as blogs, wikis, and online collaborative platforms can lead to improved writing skills among students [26,27]. Moreover, the integration of ICT into language instruction possesses the potential to foster learner autonomy. This is achieved by providing students with increased opportunities for self-directed learning and access to a wide array of online resources. However, according to Akhmedov [28], as previously mentioned, the success of ICT integration heavily relies on the extent to which teachers believe that technology can serve and enhance the field of knowledge. Therefore, it is imperative to prioritize professional development programs that have the power to influence teachers' attitudes and perceptions, thus encouraging a shift in their mindset.

The Integration of ICT Tools into the Teaching of Writing

Writing is a fundamental aspect of the learning process within educational institutions. It is both a means of expression and a learning goal in academic discourse. In language classes, the focus is often on the acquisition of writing skills, commonly referred to as "learning to write" [29].

Technology's rapid advancement highlights its role in the writing process. In particular, in a computer-mediated learning environment [30], a new writing environment emerges as a collaborative space where students and teachers work together to shape their writing [31]. The computer plays a significant role in this process, both in increasing the motivation to write [28] and in offering various functions that promote the development of a new discourse among writers and their peers [32]. These functions include editing and rewriting tools, such as cutting and pasting, spell-checking, formatting options, tracking changes, and receiving feedback from readers. Additionally, the use of computer databases is vital for writing purposes, such as information gathering and fostering connections.

The use of a computer for writing is in line with approaches that see writing as a recursive process of planning, controlling, and rewriting a literate concept, according to which the critical consumption of information and the provision of support by communication colleagues are a basis for promoting literacy in general and writing in particular [33]. In light of this information, language teachers' control of the technological tools that serve writing and their use is not an option, but a necessity that serves their discipline. However, despite technological progress and its impact on all areas of life, most Hebrew teachers in Israel are still reluctant to use digital means to promote writing during the teaching of Hebrew in and out of school [8,34].

### 1.4. Barriers to ICT Integration

Research typically refers to two main types of barriers that hinder teachers from integrating technology into their teaching in an effective and high-quality manner: external barriers and internal barriers, the components of which change according to the development of technology and its establishment in society and educational systems [35–37].

External barriers include terminal equipment and hardware and software resources; technical support; the cultural mindset of the institution; and the technological knowledge and skills required among teachers according to the changing needs of their subjects of study. Some see external barriers as first-order barriers, which is especially concerning when it comes to the lack of end equipment or when existing resources are old and cannot be optimally used. The barriers are extrinsic to the teacher and include lack of resources, time, access, and technical support [36]. According to the International Society for Technology in Education (ISTE), technical support helps teachers "access, create, and use resources and experiences that contribute to rich, meaningful and authentic learning experiences" [38]. Teachers might encounter technical issues while trying to integrate ICT tools into their lessons. These issues can range from setting up equipment to troubleshooting software problems. Adequate technical support ensures that teachers can overcome these barriers effectively. A study by Ertmer [35] emphasizes that providing teachers with technical support positively impacts their willingness and ability to integrate technology. Teachers who are not familiar with the latest technology might feel apprehensive about integrating ICT into their teaching. Technical support provides them with the guidance and training they need to become more confident in using these tools.

The internal barriers of teachers are related to a lack of knowledge, age, and experience. They also include teachers' attitudes toward technology and its added value to learning [35,39]. A lack of computer skills and technical knowledge may cause teachers to experience fear and a lack of confidence, thus preventing them from using ICT in the classroom. They mainly fear looking unprofessional in front of the class [40,41].

Seniority and age can serve as additional internal disciplinary barriers [42]. While novice teachers may lack extensive teaching experience, they often possess greater technical knowledge and exposure to ICT applications [42], whereas experienced teachers tend to possess stronger pedagogical knowledge but may have limited computer skills. Consequently, experienced teachers might perceive themselves as unable to effectively use ICT applications due to their age, leading them to prefer remaining within their comfort zone. Another important internal barrier is related to teachers' perceptions, such as their perception of their ability to make optimal use of ICT tools in their teaching, general pedagogical approaches, and the importance of the comprehensive and in-depth use of technology in their teaching [11,43]. Per Ertmer et al. [44], in the past, external barriers were the most significant in delaying the assimilation of technology into schools [39]. But in recent years, access to high-quality technology resources has increased in schools and, accordingly, so have teachers' and students' degrees of mastery of ICT tools [44]. Against this background, the researcher of the present study focused their efforts on understanding the impact of the internal barrier on teachers' perceptions.

Many studies have shown that teachers' beliefs about their teaching are integral to the assimilation of technology. These beliefs include motivation, perceptions of importance, a sense of ability, a direct connection to the teaching practices they employ, and learning in which they use technology in their teaching [11,13,26,44–46]. Moreover, teachers who believe in the importance of technology in teaching manage to "overcome" and address technical and emotional barriers [37,44]. For example, a study involving elementary school teachers found that teachers who held constructivist pedagogical beliefs about technology use had high self-efficacy beliefs about technology use, positively valued technology use, and had two or more high-level learning practices [11]. In these classes, language skills received the most attention for technology integration.

Despite these findings, a gap emerges from the results of various other studies. On the one hand, teachers have shown a great degree of familiarity with and control of ICT tools, a sense of competence in relation to their ability to use ICT tools in teaching, and positive attitudes toward the use of technology in teaching. On the other hand, these aspects do not influence their use of ICT tools when teaching [8,47]. In most teaching processes, technology is mainly used as an auxiliary tool and not as a qualitatively and meaningfully

designed process through technological spaces [13] Therefore, teachers do not integrate ICT into their teaching in a way that will lead to a significant learning change [2,18].

Avidov-Ungar and Amir [8,9] tried to explain this research gap through the existence of an internal barrier known as the "disciplinary barrier". Disciplinary barriers refer to those in teaching disciplines, such as first language learning, mathematics, and sciences, and express a deep understanding that certain technological tools can explicitly promote a discipline. Teachers' perceptions of the goals of integrating ICT into teaching mainly to promote learning diversity and curiosity mean that they do not always understand this explicit connection. In their view, technology is not inherent to the discipline's learning process and its advancement. This means that if integrating ICT requires a lot of time and resources and managing technical difficulties, teachers will likely choose not to use it.

Thus, to promote the integration of technology in teaching, it is necessary to identify the technological ICT tools that best help teachers improve their teaching and grant them a deep understanding that ICT tools can largely help promote the teaching of their discipline. Professional development may be a solution to this issue and reduce the disciplinary barrier.

### 1.5. Teachers' Professional Development

Professional development, or the constant development of professional knowledge and skills throughout a teacher's career [48], is one of the ways to cultivate quality and professional teacher learning [10,49]. Teachers expect professional development to contribute to teaching the implementation of novel processes and tools to change attitudes on various issues: for example, technology's integration into teaching [11,50] and the formation of the teacher's professional identity [10,47]. By promoting their knowledge and skills, technology integration and the formation of teachers' professional identity enable teachers to assimilate new practices according to the nature of the changes in their discipline.

Despite the substantial importance attributed to professional development, most teachers lack the pedagogical skill to use ICT in the teaching–learning process because they have not received enough opportunities for training, and therefore many teachers are reluctant to use new technology. Hence, professional training is very important [36].

The question arises as to what effective professional development is. Borg [51] pointed out four dimensions in which the effect of professional development can be examined: the input dimension, referring to the inputs that the program invested in teachers (i.e., what was done within the program); the program's distribution (reach, i.e., how many people participated in it and the audience its influence reached); the participation dimension (how many participants were involved in the program's contents); and the output dimension (study and evaluation materials). From studies on online professional learning for teachers, a consensus has developed among education researchers that effective professional development is based on continuous professional learning, active, social, and connected to practice (e.g., [10,52–54]). In the field of integrating ICT in teaching, the topic of training is even more complex because it is important to take into account several elements to ensure the effectiveness of the training, such as the training time and training pedagogy. Training for the use of ICT tools alone was not found to be effective [36].

Teachers' work characteristics and the opportunities to learn and specialize in teaching were addressed by the TALIS 2018 international teaching and learning survey, conducted in 48 countries in 2018 among middle school teachers and administrators. The survey included a variety of questions about several aspects of integrating ICT into teaching. For instance, had the teachers undergone professional development in the field? Did they feel ready and able to teach using digital tools? The report indicated that, in Israel, approximately 70% of teachers discussed participating in professional development activities on "ICT skills for teaching needs". This rate is slightly higher than the rate in OECD countries [55]. Despite this, only about half of the teachers in Israel felt highly competent in their ability to help students learn through digital technology, compared to about two-thirds of teachers in

OECD countries. This illustrates the difficulty teachers experience when integrating ICT into teaching.

It should be noted that most of the described training programs were generic to all teachers and focused on computer applications and ICT skills for teaching purposes. Adequate, up-to-date, and effective use of technology requires teachers to have advanced technological and content pedagogical knowledge [56]. They should know how to combine teaching content with technological tools, based on the unique features and capabilities that characterize those tools. Teachers must also plan their use in accordance with the educational task requirements [57]. This process requires adequate professional development based on pedagogical-technological-content knowledge [58]; exposure to knowledge, teaching practices, or new technologies relevant to the teachers' work [10]; and the adaptation of these aspects to the field of knowledge.

Teachers have a desire to integrate ICT in their teaching but they encounter barriers. These findings have implications for the training of teachers to become permanent users of ICT while focusing on the acquisition of IT skills. Since security, competence, and accessibility have been found to be critical elements for technological integration in institutions, teachers should be provided with ICT resources including effective professional development, sufficient time, appropriate training, and technical support. No one component in itself is sufficient to produce good teaching. However, the presence of all the elements together increases the probability of an excellent integration of ICT in the teaching process [36].

In conclusion, the studies reviewed show that to achieve a significant change process and implement ICT in a broad, high-quality manner in schools, it is imperative to help teachers address and overcome the disciplinary barrier. Teachers' professional development can facilitate educational change by helping them understand the relationship between their field of knowledge and technological advancements. This aspect of training is intended to dispel misconceptions and prove that without the use of technology that promotes knowledge and writing, student learning and skills will be very difficult to advance over time. It should be noted that by achieving a conceptual connection between ICT tools and the teaching of a discipline, there is a chance that the other barriers (external and internal) will lessen. This case study examines a model for first language teachers' professional development, with an emphasis on writing, to deepen their understanding of their experience regarding the disciplinary barrier.

### 1.6. Present Research

The current study was carried out following the COVID-19 pandemic. It lasted about nine months, which constituted the period of professional development. This study is based on a process that Israeli first language teachers underwent in participating in a professional development model specifically for teachers. It examines the extent of the professional development's impact on teachers' attitudes regarding ICT tools in teaching their subject area. The professional development program focused on providing ICT tools that directly promote the field of knowledge—teaching Hebrew as a mother tongue—with an emphasis on writing. The question that formed the basis of professional development was: "How can professional development for teachers contribute to the integration of ICT tools in the teaching of writing?" The goals of the professional development were as follows: (1) to familiarize teachers with ICT tools that explicitly promote their field of knowledge, with an emphasis on writing; (2) to expose teachers to these tools at their level of experience; and (3) to assimilate the tools into the teachers' classrooms. The professional development was developed by teams specializing in first language teaching, ICT teaching, and teachers' professional development.

Research Questions

RQ1. What were the experiences that teachers had during their professional development, and how do these experiences express their barriers in integrating ICT into first language teaching?

RQ2. What is the degree of effectiveness of the holistic model for professional development that combines ICT in language teaching with an emphasis on writing teaching, and are there differences between the participants due to seniority in teaching?

RQ3. How do the teachers who participated in the professional development explain the effectiveness of the model? We tested this question with a question regarding the participants' suggestions for professional development to ensure effective implementation of ICT tools in first language teaching, especially in writing.

## 2. Method

### 2.1. Conceptual Framework and Description of the Professional Development Model

2.1.1. Professional Development Model

The holistic model for disciplinary professional development analyzed in this study included a 30 h hybrid course guided by an instructor with two specializations. Professional support included the following components: A WhatsApp group in which all participants engaged, and didactic and technical support provided by instructors from the Israeli Ministry of Education, as described in Figure 1. The professional development model provided instruction, guidance, and support to teachers in both the subject domain (first language teaching) and the digital field.
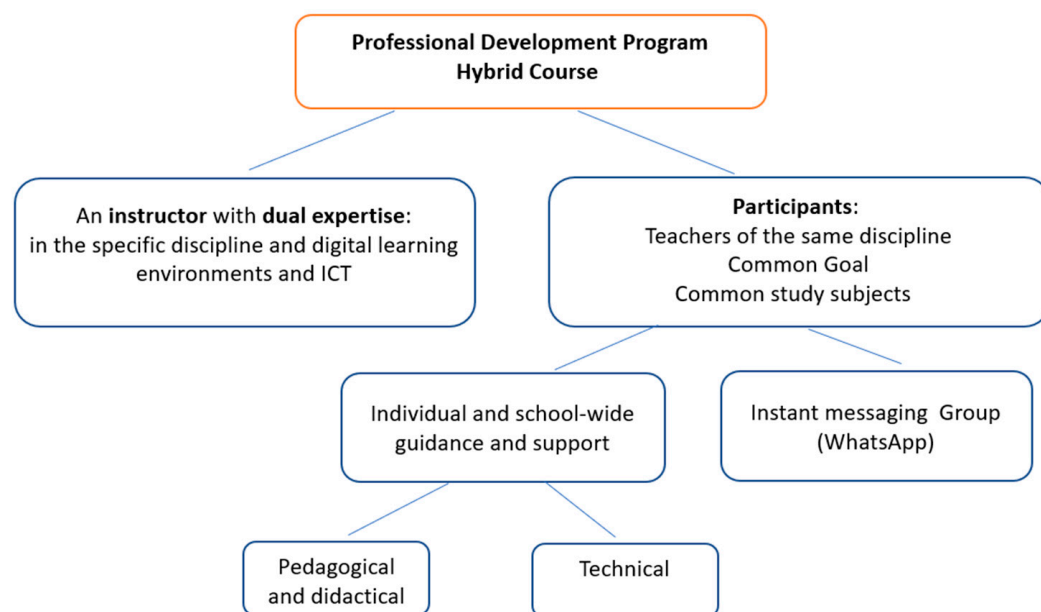


**Figure 1.** Professional development model for disciplinary information and communications technology (ICT) assimilation.

(A) The course instructor

The course instructor had a critical role in the model. An important principle was that the course instructor must have two specializations, one in the field of teaching (i.e., teaching a first language) and the other in ICT and digital learning environments. Expertise in the field of knowledge ensured that the facilitators were familiar with the content and principles of the field, as well as effective pedagogical strategies, curricula, and student assessment. Simultaneously, expertise in ICT allowed them to effectively integrate technological tools and resources into the learning process. Practical teaching experience in

digital environments was also essential, as it provided valuable insights, ideas, strategies, and best practices for integrating ICT effectively while addressing potential obstacles.

The combination of expertise in the discipline, ICT knowledge, and practical experience created professional instructors who could effectively support the teachers in integrating technology into their classrooms. This improved the effectiveness of the professional development and helped teachers reduce or overcome barriers in the field of knowledge. However, the course alone could not provide a holistic answer for teachers. Therefore, beyond the course, there was also a support and communication framework featuring a WhatsApp group and school guidance.

(B) Participants

The learning group, defined as the target audience, was intended to be Israeli teachers of first languages in secondary schools, with a focus on the integration of ICT into their teaching. This meant that the selected content, whether digital or disciplinary, was suitable for teaching a first language. The professional development was offered to teachers who teach a first language and were interested in being part of a learning group of teachers. The group was not defined as a community, as it does not adhere to the characteristics of a learning professional community [49].

(C) Instant messaging group

The WhatsApp group, established by the course instructor, was used as a dedicated communication platform for all the participants in the teacher community as part of the full support system provided to the participants. The WhatsApp group was not limited in hours and did not have a single moderator who responded to the group members. Some of the questions were addressed to the course instructor, and others were intended for consultation and sharing among colleagues. Participants could ask each other questions and participate in discussions. Sometimes the course instructor brought to the course issues that arose in the group.

(D) Individual and school-wide guidance and support

Each participant had the option to receive technological, pedagogical, and didactic support through personalized and/or school-based guidance. This support included telephone assistance, remote guidance, and even on-site visits to schools. All of these measures ensured effective communication and support throughout the professional development process.

This model highlights the comprehensive response, guidance, and full support provided to each participant who chose to take part in the professional development.

### 2.1.2. Structure of the Course

The in-service professional development program focused on exposure to ICT tools that directly promote the field of knowledge (i.e., first language teaching). It had a circular structure, as depicted in Figure 2.

The circular structure included (1) group meetings in which the teachers were introduced to ICT tools that explicitly promoted the field of knowledge, with an emphasis on writing; (2) experimentation with ICT tools during the course itself; (3) those tools' implementation in classrooms; and (4) discussion and reflection regarding the use of technology in the first part of each meeting. This allowed the teachers to recognize the value and applicability of using specific technologies in their discipline.

The plenary sessions were in workshop format and had a fixed structure: participating, studying, practicing, and planning the application in class. In the plenary sessions, the teachers were exposed to ICT tools that specifically promoted the field of knowledge, with an emphasis on writing. They experimented with these tools during the meeting, practiced, and were asked to apply them in class. The next plenary meeting opened with a reflection and discussion about the teachers' experiences. Each meeting began with a question: What ICT tools did you use in the period between the previous meeting and the current meeting, and what were your experiences and those of the students? The answers to the questions varied, sometimes through an online questionnaire, an online collaborative board, or a

quick verbal round of the participants. This structure allowed for a type of follow-up that helped in assimilation. The teachers were actively engaged in the course due to its workshop-oriented nature and structural design. The course syllabus was flexible and often referred to as the "listening syllabus". The teachers and the instructor developed the course content collaboratively.
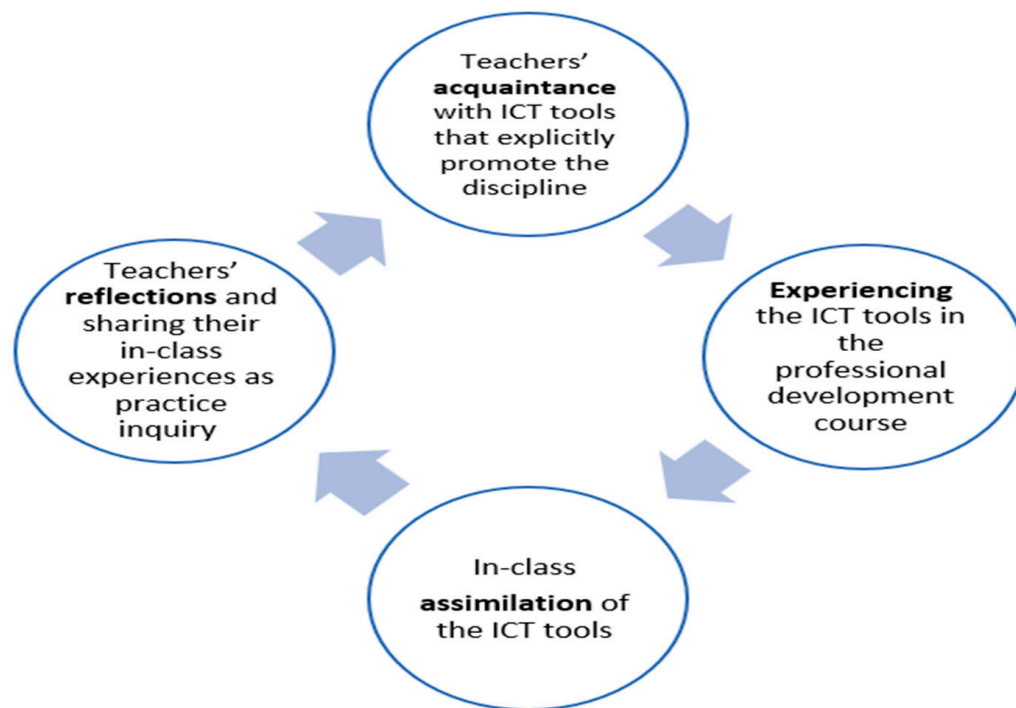


**Figure 2.** The circular structure of the professional development course.

The teachers' participation in the classroom experience was carried out within the framework of practice research. Practice research aims to examine and improve teaching and learning methods by studying teaching actions and developing tools and skills based on those actions. The research in this study was based on the assumption that the knowledge derived from teachers' experiences is fundamentally different from the academic knowledge created in formal studies. It was personal, applied, and authentic, closely linked to the teachers' everyday contexts [59].The discussions and reflections then facilitated deeper and more critical thinking regarding the integration of technology in the field of knowledge.

The professional development was organized by teams specializing in teaching the field of knowledge, ICT teaching, and teacher professional development. To enable the teachers to apply what they learned in the course, relevant learning topics related to the discipline were also selected. This ensured that the content of the course would significantly integrate into the teachers' daily lives at school [60].

### 2.1.3. Research Tool

To address the three research questions, a combined quantitative and qualitative method was employed. Accordingly, two main research tools were utilized: (1) semi-structured interviews conducted with the teachers of writing at the end of their participation in the professional development (10 interviews) and (2) an open- and closed-ended questionnaire (N = 89).

(A) Semi-structured interviews

To answer the first research question regarding the participants' experiences with professional development, we conducted 10 interviews. Each interview consisted of 9 questions focusing on the description of the course (see Appendix A); significant experiences

during the professional development; changes and contributions to teaching methods and student learning processes in the field of knowledge resulting from the professional development; attitudes toward the integration of ICT in the field of knowledge; and changes in attitudes following participation in the course. In this article, the term experience refers to how events, situations, and phenomena are perceived and interpreted by individuals, encompassing their thoughts, feelings, and behavior within the context of a specific action.

The interviews were analyzed using Atlas software (Atlas.ti 7.0) based on a phenomenological perspective guided by the principles of grounded theory. Grounded theory allows for entering the research without a preconceived theory and instead developing one based on the study of how participants experience and present the phenomenon under investigation. The underlying premise is that knowledge resides in the meaning individuals attribute to their experiences. The primary objective of this research was thus to capture the human experience as perceived and experienced by each participant.

The data processing entailed several stages. The first was initial coding, which involved the identification and definition of initial categories and marked the beginning of the theoretical sampling stage. The second stage was category development, entailing the definition of criteria for categories while continuously refining and advancing theoretical sampling. The third was the refinement of codes and finalization of the category system, allowing for revisiting and redesigning categories and codes at any time. The fourth stage was the creation of hierarchies and identification of core categories, which involved establishing connections between categories and exploring different relationships among them, as well as identifying central categories that form the core of the analysis. The final stage was the construction of a theoretical framework based on the preceding steps, integrating categories, research literature, and theories to address the research questions. Atlas software again facilitated the creation of a semantic map with graphical representations that illustrated the interrelationships between codes, the formation of super-categories and sub-categories, and enabled a conceptual analysis of the subject under study. It also provided a means to manage the vast amount of qualitative data in the research while maintaining methodological rigor.

(B) Open- and closed-ended questionnaire

To explore the second research question, which pertains to teachers' perceptions of the goals of integrating ICT into teaching their field of knowledge, an open-ended question was posed to the teachers at the beginning and end of the course: "Why do you integrate ICT into your field of knowledge?" The analysis of the findings involved a process of categorizing, organizing, and understanding the data based on prominent, important, and recurring categories.

To answer the third research question about the effectiveness of the course, the participants were also given a combined questionnaire (open- and closed-ended) at the end of the professional development (see Appendix B). For example: "To what extent is the course guided by ICT professionals who are proficient in the field of knowledge more effective than a course guided by ICT professionals only?".

The open-ended questions were analyzed by extracting dominant categories and sub-categories, sorting the teachers' answers per these categories, quantifying the number of responses in each category, and assessing the relative value of each category among all the responses. The number of responses was greater than the number of participants who answered the questionnaire, as it was possible to extract multiple answers from a response that addressed more than one category.

The use of various research tools enabled the triangulation of the findings, the establishment and strengthening of confidence in the conclusions reached regarding the studied phenomenon, and the creation of an outline for a model describing how the use of ICT tools promotes the essence of the involved teachers' field of knowledge.

2.1.4. Participants

This study involved 92 Israeli first language teachers who teach grades 7–9. In total, the gender distribution of 83% women is similar to that of the general population of teachers in Israel, in which 82% are women according Central Bureau of Statistics in Israel. Of all teachers, 58% held a bachelor's degree (B.Ed.), and 42% held a master's degree (M.Ed.). The teachers' experience ranged from 1 to 45 years; on average, the teachers had 13.74 years of experience. Further analysis of the participants' experience revealed that 44% had up to 10 years of experience, 37% had 11–20 years of experience, and the remaining 19% were senior teachers with more than 20 years of experience, as detailed in Table 1.

**Table 1.** Sample characteristics.

|  |  | N | % |
|---|---|---|---|
| Gender | male | 77 | 83.7 |
|  | female | 15 | 16.3 |
| Education level | BA | 54 | 58.7 |
|  | MA | 38 | 41.3 |
| Tenure |  | $M = 13.75$ [1–45], *S.D.* = 9.40 | |
| Total |  | 92 | 100.0 |

For the analysis of the first research question, which was based on the semi-structured interviews, a sample of 10 first language teachers from the 92 participants was included. In the analysis of the second and third research questions, all 92 first language teachers were included (of which 89 answered the questionnaires).

2.1.5. Research Procedure

The Ministry of Education offered first language teachers the opportunity to participate in this comprehensive program for professional development accompanied by research. The proposal was published in the ministry's "Community of Hebrew Teachers Online", which consists of 3546 Hebrew teachers who teach in middle and high schools and aims to provide teachers with a platform to discuss issues related to the teaching of Hebrew, engage in professional peer discussions, and share information about professional development opportunities. The number of participants was limited to 90 teachers from three different regions of the country (North, Center, and South). The decision to limit the number of participants was driven by the goal of testing the effectiveness of the model with a smaller group before scaling it up. Additionally, as the course had a workshop nature, it was important to ensure that each instructor had no more than 30 participants, allowing for experimentation and more personalized attention. There was a high level of interest, with 149 teachers expressing interest within 3 days of the call's publication. Of them, 41 teachers were interested in professional development in the northern region, 60 in the central region, and 48 in the southern region. The registration for professional development was closed after registering 92 teachers. The program was conducted online and included 10 sessions, each lasting 3 academic hours (145 min). Each session consisted of two parts: a plenary session focusing on writing-related topics and tools, followed by workshop sessions held in three Zoom rooms, each facilitated by one instructor. The total duration of the program was 30 h.

An open-ended question ("Why integrate ICT into your field of knowledge?") was posed in the first and last meetings. Additional questions were added to the end-of-course questionnaire (in Hebrew), which included feedback on the professional development model and the course itself. Furthermore, at the end of the course, 10 female participants were interviewed in Hebrew by the research assistant. The interviewees provided their consent and were given a general explanation of the study's topic to prevent bias during the interviews, which were recorded and transcribed.

## 3. Findings

This study reports the findings of a professional development course taken by Israeli first language teachers regarding the integration of ICT into their teaching. The findings are presented in three subsections, in accordance with the research questions: (a) The experiences the teachers had during professional development and how these experiences express their barriers to integrating ICT into first language teaching; (b) The effectiveness of the model, including reference to seniority in teaching; (c) The explanations for the effectiveness of the model through suggestions of teachers for an effective model.

### *3.1. First Research Question*

The first research question examined the experiences that the teachers had during their professional development and how these experiences reflect their barriers to integrating ICT into first language teaching. The interview analysis reflected the experiences of the teachers who participated in the professional development, as well as the process of change the teachers underwent as part of the professional development in reference to the reduction and removal of external and internal barriers as a precursor to effective professional development.

### 3.1.1. External Barriers

The participants expressed, in their own words, how fears of the technological world, knowledge, and skills, as well as experiencing sophisticated tools, gradually dissolved during the professional development course, as can be seen from the following interview excerpts:

*"What helped was that the fear disappeared. I mean the fear of the computer field. I learned how to explain and make it accessible, and I saw that the demon is not so terrible. I saw how XXX [the instructor] acted, how he explained clearly and demonstrated to us [our] study materials."*

*"We were taught tools that we can use in the language classes. I was taught all kinds of tools in the past as well, but this time it was different. In the course, we had an amazing instructor, and when I needed help in the afternoon or the morning, I had someone to turn to. I had instructors at my disposal, and they were in full coordination with the instructor in the course. For example, I composed a test using the side-by-side option—the text on the left and the questions on the right. I got into trouble, but I had someone to turn to. This support beyond the scope of the course is very helpful. I really liked the fact that it doesn't end when the course ends. It made me not be afraid, to dare and try."*

*"Technology and I are not friends, but I realized that the technological challenge is here, whether we want it or not. The direction is going there, and I can't run away from it. I was very afraid of the technical matters. I was afraid that I would get into trouble during the class, that I wouldn't know how to use the technology properly, and that I would lose the students. But to my surprise, I was able to face the technological challenge thanks to everything I received in the course. We experimented with everything, even after the course hours. We had a WhatsApp group I could consult, and I could also invite an instructor to the school to help me deal with the technical problems."*

*"Our school has portable computer carts. I never ordered them because I was afraid that I wouldn't be able to manage. I gained confidence in the professional development. I felt that I could deal with the fear I had. The first three times I asked the instructor to be with me. She guided and helped me. Later, I already activated everything by myself."*

### 3.1.2. Internal Barriers

Internal barriers emphasize disciplinary barriers or those related to the teachers' field of knowledge. In all the interviews, almost without exception, there was some reference to disciplinary barriers. The participants expressed a deep understanding that certain technological tools can explicitly promote their discipline and emphasized their personal

ability to make optimal and intelligent use of ICT tools in their field of knowledge, as in the quotes below:

*"Until I started the course, I thought I needed technology [in class] to diversify the teaching. I used presentations and videos, but here I realized that diversity is not the main thing at all. The tools I received from the instructor, who was also a language teacher himself, directly touched my field. For example, in the field of writing, the wiki that taught me can greatly help me in promoting writing and also in checking the texts that are so difficult for me. So we should get on the train early and not late."*

*"As soon as the instructor was so professional and introduced us to computerized tools that are suitable for my field, it aroused my great interest. I realized that I can also use more recent, relevant, and accurate materials. It also saves me a lot of time in building materials, and most importantly, helps me to promote the students. I took it upon myself to lead the entire team to use the tools we received."*

*"You can see the sparkle in the students' eyes. There is more dynamism in the teaching. You see the interest and curiosity and especially the progress in writing. It does not become an exhausting and tiring 45-min class. Working on the computer made them write during the class, correct and rewrite. They could compare their versions on the wiki. It wasn't in my regular class. What else impressed me was that they continued to talk about it at home. An interest was created, and what happens in the classes is relevant to them."*

*"Honestly, I didn't really understand why I needed ICT in my classes. I'm considered a good teacher even without it, but the instructor in the course managed to convince me that the use of ICT is necessary for my field. He himself teaches language in classes. The examples he gave and the tools he showed made it clear to me that I had to use it in teaching, not occasionally but regularly."*

*"Sometimes I get mad at myself, why did I just now remember, but to be honest, I was in several training courses at school where we were taught in general. This time it was different. The whole focus was on teaching the language and especially writing. We were shown, for example, all kinds of computerized environments that can promote writing, make comments, and also write collaboratively. It made me realize that there is no turning back."*

*"I experienced a course different from what I had known until now. Everything was relevant. We were taught things related to our field: reading and writing. Everything I learned, I could apply in the classrooms. When I encountered difficulty or did not understand something, I had someone to talk to both within the course and outside of the course hours. In the WhatsApp group, we shared ideas for lessons. It was very difficult for me at first, but the course instructor was also available beyond the course hours."*

### 3.2. Second Research Question

The second research question focused on the effectiveness of the model and whether there are differences between participants due to teaching seniority. The effectiveness of the model was measured in several aspects: through the characteristics of professional support (technical support, didactic support, and an instant messaging group (WhatsApp)); through the concept of effectiveness related to the use of instructors with expertise in ICT and in the field of language; and through the perception of effectiveness related to the entire professional development model. Descriptive statistics of professional support, instructor effectiveness, and effectiveness of the entire model are detailed in Table 2.

**Table 2.** Descriptive statistics of professional support, instructor effectiveness, and effectiveness of the entire model.

|  |  | *M* | *S.D.* | N |
|---|---|---|---|---|
| Support | Technical | 2.60 | 0.97 | 85 |
|  | Didactic and pedagogical | 2.64 | 0.95 | 81 |
|  | WhatsApp groups | 3.25 | 1.00 | 65 |
| Effectiveness of the course instructors | Training effectiveness due to language proficient IT professionals | 4.57 | 0.56 | 86 |
| Effectiveness of the entire model |  | 4.47 | 0.67 | 85 |

The Degree of Effectiveness in Each of the Support Components of the Model

Paired *t*-test and correlation analyses results of the characteristics of the professional support received by the participants are detailed in Table 3 below. Support characteristics were measured using a 4-level Likert scale (1 = not at all, 4 = to a large extent). The level of support through the WhatsApp groups (*M* = 3.23) was significantly higher than both the scope of technical support (*M* = 2.53) and the scope of didactic and pedagogical support (*M* = 2.64) received by the participants.

**Table 3.** Professional support descriptive statistics, correlations, and paired *t*-test comparisons.

|  | Descriptive Statistics | | | Pearson Correlations | | | Paired *t*-Test Comparisons | | |
|---|---|---|---|---|---|---|---|---|---|
|  | *M* | *S.D.* | N | Technical Support | Didactic and Pedagogical Support | Whatsapp Groups Support | Technical Support | Didactic and Pedagogical Support | Whatsapp Groups Support |
| Technical support | 2.53 | 0.94 | 81 | -- |  |  | -- |  |  |
| Didactic and pedagogical support | 2.64 | 0.95 | 81 | −0.485 *** | -- |  | 0.614 | -- |  |
| WhatsApp groups support | 3.23 | 1.01 | 62 | −0.116 | 0.234 | -- | 3.072 ** | 4.437 *** | -- |

*** $p < 0.001$, ** $p < 0.01$.

As stated in Table 3, no. difference was found in the level of technical and pedagogical support received by the participants, but there was a negative correlation between them (r = −0.485, $p < 0.001$), so the higher the technical support, the lower the level of didactic and pedagogical support. No correlations were found between the scope of support through WhatsApp groups and the level of technical support or the level of didactic and pedagogical support.

Two additional statements were used to estimate the effectiveness of the model. The first related to the effectiveness associated with the use of instructors with expertise in ICT and in the field of knowledge (*M* = 4.57) and the second related to the general concept of effectiveness of the model (*M* = 4.47). As detailed in Table 4, a significant positive correlation was found between the two dimensions of effectiveness perception (r = 0.393, $p < 0.01$). In addition, a significant positive correlation was found between the level of technical support and the perception of the contribution of instructors' expertise in the field of knowledge (r = 0.219, $p < 0.05$) as well as with the overall model effectiveness (r = 0.287, $p < 0.01$).

**Table 4.** Pearson correlations of professional support, training contribution, and effectiveness.

| | | Support | | | Effectiveness of the Course Instructors | Effectiveness of the Entire Model |
|---|---|---|---|---|---|---|
| | | Technical | Didactic and Pedagogical | Whatsapp Groups | Training Effectiveness Due to Language Proficient IT Professionals | Overall Model Effectiveness |
| Effectiveness of the course instructors | Training effectiveness due to language proficient IT professionals | 0.219 * | −0.098 | −0.249 | -- | |
| Effectiveness of the entire model | Overall model effectiveness | 0.287 ** | 0.153 | −0.009 | 0.393 ** | -- |

** $p < 0.01$, * $p < 0.05$.

No differences were found in the level of professional support relative to the gender of the participants or their level of education; however, it was found that the seniority of the participants played a significant role in the perception of professional support they received. As detailed in Table 5, the perception of technical support increased with seniority ($r = 0.466$, $p < 0.001$), while didactic and pedagogical support decreased with seniority ($r = −0.509$, $p < 0.01$). It was also found that the extent of use of support through WhatsApp groups did not depend on seniority.

**Table 5.** Pearson correlations of professional support, training contribution, and effectiveness with participants' seniority.

| | | Seniority |
|---|---|---|
| Support | Technical | 0.466 ** |
| | Didactic and pedagogical | −0.509 ** |
| | WhatsApp groups | −0.042 |
| Effectiveness of the entire model | Training effectiveness due to language proficient IT professionals | 0.239 * |
| | Overall model effectiveness | 0.147 |

** $p < 0.01$, * $p < 0.05$.

Table 5 also shows that effectiveness associated with the use of instructors with expertise in ICT and in the field of knowledge increased with seniority ($r = 0.239$, $p < 0.05$). However, overall model effectiveness was not significantly related to gender or associated with participants' seniority.

### 3.3. Third Research Question

In the third research question, we sought to examine the effectiveness of the model through the participants' explanations of the effectiveness of the model. However, unlike the second research question in which we specified the components of the model, in this question we asked an indirect question concerning the participants' suggestions for professional development to ensure the effective application of ICT tools in the teaching of the first language, especially in writing. Based on their course experience, the participants were asked what suggestions they would make to ensure the effective implementation of ICT tools in teaching Hebrew, particularly writing. From the findings, three key aspects emerged in relation to professional development: (A) the course instructor, (B) the learning group, and (C) the comprehensive model.

**(A) The course instructor**

According to the participants, it is essential to select an instructor with combined expertise in both the subject matter and ICT. The instructor should also use technological tools that align with the specific needs of the field of knowledge. For example, one participant stated, "*Combining pedagogical content with relevant technological tools was valuable*". The course leader's teaching practicum, which combines guidance and practical experience, was also highlighted. As one participant mentioned, "*Showing examples from the field of writing and facilitating hands-on learning allowed us to experience the course*".

**(B) The learning group**

With respect to the learning group, the participants mentioned four considerations:

B.1 Active engagement: The participants emphasized the importance of being active learners who apply in their teaching the tools and knowledge acquired while addressing barriers and challenges that arise from using ICT tools to advance disciplinary goals. For instance, the participants expressed the value of practical experiences using the tools from the course and the ability to apply them within their specific field of knowledge. They also described the need for ongoing discussions and reflections on those experiences.

B.2 Relevance: The participants stressed that the course should be relevant to their needs as learners and align with the requirements of their discipline. They also highlighted the significance of activities that can be immediately implemented and the ways in which ICT tools can facilitate teaching.

B.3 Community building: The participants valued the sense of community fostered within the learning group. They described a cohesive group dynamic and highlighted the collaborative nature of their professional development experience. Some gave statements such as "*I felt a sense of belonging to a community of teachers with a shared goal*" and "*We learned as colleagues and established collaborations across different contexts*".

B.4 Accessibility and support: The participants emphasized the importance of maintaining accessibility to the professional development team (supervisors and instructors) and their availability to address any challenges or difficulties encountered while planning lessons or using technological tools. They appreciated the comprehensive support provided through various channels such as the WhatsApp groups, telephone assistance, and direct consultation.

**(C) Preservation of the comprehensive model**

Lastly, the participants emphasized the need to preserve a comprehensive model that offers professional, practical, didactic, and technical support, along with personal and emotional guidance. They expressed satisfaction with the all-encompassing nature of the course and the support received in statements such as "*This is the first time I have experienced such comprehensive support; they have thought of everything*" and "*This approach enables us to implement innovations effectively. The course, technical support, and the professionalism of everyone involved were exceptional. They understood our needs*". The participants also stressed the importance of continuing such professional development opportunities.

**(D) Ongoing and continuous training within schools as part of professional development**

Ongoing training was highlighted by 21% of the participants, who perceived training within the school as crucial. They emphasized the role of the school guide as a central figure for support and guidance during practice and when addressing challenges. The participants also stressed the importance of integrating training within the classroom and maintaining a sequence of training to facilitate assimilation and create lasting change. One teacher suggested, "*To ensure the assimilation of the ICT tools learned, I recommend regular school-based training throughout the year to support our lessons*".

The findings also identified four secondary areas for improvement:

(A) Time: Seventeen percent of the participants expressed a desire for increased course hours to allow for more in-depth learning, practice, and application of the content. They further highlighted the need for sufficient time to practice using the learned tools. As one teacher stated, "*The course is excellent, but I need more time to practice and internalize [what I learned]*".

(B) Learning in small and homogeneous groups based on ICT knowledge: Of the participants, 11% suggested learning in smaller groups that are more homogeneous in terms of ICT knowledge. They believed that smaller groups would enable the instructors to provide tailored guidance based on the specific needs and varying levels of ICT knowledge among the participants.

(C) Dissemination of the acquired knowledge: Additionally, 9% of the participating teachers expressed their role as ambassadors in spreading the knowledge and tools acquired during the course. They emphasized the importance of creating a training sequence and introducing the instructor-guide to schools and classrooms to facilitate assimilation and change at a broader level. Suggestions included involving all literature teachers or designated representatives to convey the course contents and tools to their colleagues. One teacher mentioned, "*I intend to share what I have learned with all my teammates*".

(D) Practice and experience: Another 9% of the teachers emphasized the importance of practice and hands-on experience with the tools taught in the course. They considered practice and application to be integral parts of the assimilation process for the course contents and tools.

Other factors raised by the participants but considered marginal areas for improvement included increased participation of the beneficiaries in the learning process (6%) and ensuring the availability of computer equipment to practice and apply the course content (4%).

## 4. Discussion

The study focused on examining the effectiveness of a holistic model for professional development for integrating ICT in teaching. The aim was to eliminate various barriers faced by first language teachers (as a case study) when assimilating ICT into their teaching, with particular emphasis on overcoming disciplinary barriers.

In this paper, a barrier type that has not received enough attention in the theoretical literature was emphasized: the disciplinary barrier. Regarding ICT, this barrier refers to teachers' lack of in-depth understanding of the significant advantages of digital tools and interactive environments for advancing their field of knowledge. The findings from the interviews (research question 1) consistently revealed references to disciplinary barriers, with the participants demonstrating a deep understanding that certain technological tools can explicitly promote their discipline, particularly in the field of writing. They also expressed confidence in their ability to make optimal and informed use of ICT tools in their field of knowledge.

Also, previous studies have shown that teachers' experiences during professional development can influence their attitudes toward technology use in teaching. For example, Chai et al. [61] and Kaur [36] found that teachers who had positive experiences during technology training were more likely to have positive attitudes toward technology use. Similarly, Ertmer et al. [44] found that teachers who had positive experiences during technology training were more likely to incorporate technology into their teaching practices. In the current study, the results indicated that the teachers had positive experiences during the professional training program, which influenced their disciplinary barriers and perceptions of ICT use in teaching.

The findings may be attributed to the appropriate teacher training that plays an important role in integrating ICT into teaching. The recommendations of the literature on integrating ICT into teaching are that teachers must be provided with effective professional development, sufficient time, appropriate training, and technical support. It was also found that no single component in itself is sufficient to produce good teaching, and the presence of all the elements increases the probability of excellent integration of ICT in the teaching process [36]

Indeed, the holistic professional development model for integrating ICT into teaching, which was examined in the study, was found to be effective (RQ 2–3). The model included a hybrid course guided by an instructor with two specialties, expertise in the subject

(in this case, teaching a first language) and ICT proficiency, as well as broad support including technical and pedagogical support and support through an instant message group (WhatsApp).

The objective behind the development of the model was to create an effective approach that caters to the domain of knowledge. This approach aimed to eliminate as many external and internal obstacles as possible while giving particular attention to disciplinary barriers. One of these disciplinary barriers is the deep-seated notion among teachers that technological applications can explicitly enhance their domain of knowledge. Another challenge lies in becoming familiar with technological applications that can significantly benefit the discipline. This concept is founded on the premise of disciplinary knowledge, wherein a discipline encompasses not only a specific body of knowledge but also possesses its own methods of organizing information, thought patterns, and modes of reading and writing. Disciplinary knowledge also encompasses understanding how to explore a discipline and its knowledge sources [62,63].

The model was crafted based on this approach, and the perspectives of the participating teachers regarding the efficacy of their professional development (research questions 2 and 3) underscored the disciplinary dimension on two fronts. One pertained to the competencies of the training course instructors, while the other related to the fusion of disciplinary content with the utilization of pertinent technological tools in the field.

The distinctiveness of this model primarily resides in the facilitator, who possesses expertise in both the domain of knowledge and ICT. Proficiency in the subject matter and teaching experience guarantee that the instructor possesses comprehensive knowledge of the subject's content and principles, thus enhancing the likelihood of employing pedagogical strategies effectively. Concurrently, competence in ICT equips the instructor to seamlessly integrate technological tools and resources that serve the domain of knowledge, all the while recognizing the challenges and opportunities associated with technology-driven teaching in the realm of education. These dual specializations empower the instructor to gradually dismantle disciplinary barriers. In the present context, educators who grasp that advancing writing skills necessitates the use of technological tools will thrive in integrating ICT, even when confronted with diverse obstacles and challenges. Indeed, the participants attributed the effectiveness of the model to the selection of instructors with dual specializations in ICT and expertise in the field of knowledge (RQ 2).

The comprehensive approach of the model, which included the workshop nature of the course, ongoing technical and disciplinary support beyond the course hours, and the possibility to raise difficulties, requests, and questions in the WhatsApp group, allowed the group of participants to see the model as an effective framework for professional development. The level of support through the WhatsApp groups was significantly higher both in the scope of the technical support the participants received and in the scope of didactic and pedagogical support. Also, the higher the technical support, the lower the level of didactic and pedagogical support. No differences were found in the level of professional support in relation to the gender of the participants or their level of education; however, it was found that the seniority of the participants had a significant role. As seniority increased, the participants needed more technical support and less pedagogical support. However, the support provided through the WhatsApp groups did not depend on seniority.

The effectivity of the model was examined by an indirect question (RQ 3). In particular, the model created opportunities for the teachers to work collaboratively. The group was relatively homogeneous in terms of discipline and experience in ICT integration, which was found to be more effective as well). The interaction between the teachers in the course itself and the WhatsApp groups contributed to learning and fostered a sense of security and emotional support within the group. A culture of trust and mutual respect developed among the participants [10,64,65], and some of them referred to it as a professional support group.

Based on the results of this study, it seems that a holistic model that includes an optimal combination of disciplinary knowledge content, the utilization of relevant technological

tools by a supervisor with two specialties, and technical and disciplinary support are seen as key factors in effective professional development. A large majority of the participants in the course expressed a willingness to continue professional growth within such a model in the coming years and even recommended it to other teachers.

## 5. Conclusions

Professional development programs provide teachers with the knowledge and skills needed to improve their teaching practices and student performance. However, not all professional development programs are equally effective. In a study conducted on continuing professional development (CPD), Avidov-Ungar [10] and Avidov-Ungar & Amir, [66], found that half of the participating teachers were very satisfied with the provided CPD. The other half believed that the CPD topics were often irrelevant to their needs, hindering their ability to learn effectively for various reasons. In addition to the effectiveness of professional development programs, there are external and internal barriers that prevent many teachers from, for instance, integrating technology into their respective subject domains. The focus of this paper was on disciplinary barriers, which are given less attention in the literature, and presented a model for professional development that aims to reduce and eliminate these barriers, thereby encouraging teachers to integrate ICT into the curriculum within their knowledge domain.

The teachers' experiences during the professional development shed light on the barriers they encounter. The teachers reported that professional development helped them understand the necessity of using ICT, particularly in first language teaching with an emphasis on writing, to advance their field of knowledge. Alongside positive experiences, the support the teachers received was also crucial, as reflected in the model. Zheng et al. [67] found that teacher support, including ongoing feedback and coaching, was more likely to be associated with integrating ICT into teaching. All of these factors instilled confidence in the teachers regarding technology usage and their willingness to employ ICT in their teaching. The participating teachers further recognized the professional need for technological tools to promote their teaching field, beyond the necessity for renewal and updating, to adapt teaching methods and provide adequate responses to the needs of both the knowledge domain and learners [10,68].

This professional development model can serve as a framework for effective training and professional development. The underlying assumption is that by removing the disciplinary barrier and establishing a pedagogical and didactic connection between ICT tools and the discipline, teachers will be motivated to overcome external technical barriers and internal emotional barriers and consider the benefits that ICT brings to their field of knowledge. This outlined approach signifies a shift in the pedagogical concept, moving away from a perspective that creates a separation between ICT and the discipline to one that advocates their combination, with the understanding that technology serves the discipline rather than the other way around. This ensures that 21st century skills become a means to advance the discipline rather than an end in themselves.

To further promote the significant integration of technology into teaching, and not only in terms of diversity or proximity to students' lives, it is recommended to adopt the proposed unique model for disciplinary professional development. This model fosters a deep understanding that ICT tools can greatly facilitate the teaching of a discipline and enable teachers to use technology in a systematic and intelligent manner, allowing them to overcome both external technological and internal emotional barriers.

In conclusion, there is a clear fit between the main factor influencing the effectiveness of the model and the main points for its preservation and improvement, as perceived by the participating teachers. This study highlighted an optimal combination between the teaching of the content or the skills learned in the discipline and the relevant ICT tools suitable for achieving the essence of the field of knowledge and its goals to be an essential and critical element for success. Furthermore, the instructor of this model should be a

significant figure who possesses knowledge of technological tools that respond to the needs of the discipline, thereby creating and integrating an intelligent and optimal combination.

*Limitations and Future Research*

There are two main limitations in this study. The first is that the research was conducted on one field of opinion. Perhaps if it had been conducted in several such fields, the conclusions might have been more applicable and generalizable. The second limitation is that the research focused on teachers who willingly participated in the professional development course. It would be interesting to examine whether the observed change would also occur in settings where teachers are required to participate.

My recommendations for future research are derived from these limitations. Notably, a study that examines the integration of ICT in teaching through a unique disciplinary model in other disciplines can offer results for comparison. Additionally, testing this model in different settings not necessarily chosen by the teachers themselves would provide valuable insights. Another direction for research is to continue monitoring the group of teachers after the course's completion to assess the extent to which the principles of integrating ICT form an ongoing integral part of their discipline.

It is well known that typical professional development may be well received at the end of the experience and not have a long-term effect on a teacher's practice.

The professional development was completed in 2022. In a planned follow-up study, the degree of long-term assimilation among the participants of the present study will be examined.

**Appendix A. Questions for the Interviewees**

1.  Describe to me the professional development in which you participate. What does it include? What are its components? What are its highlights?
2.  What is the most significant thing you have experienced in the professional development? Tell me about a significant experience from the course you are participating in.
3.  What areas of knowledge and language teaching did this course promote in particular?
4.  Has the course changed your way of teaching the first language subject? If so, how?
5.  Does the course contribute to the teaching of a first language, and if so, in which areas of the field of knowledge?
6.  If you had to describe two things that distinguish the professional development in which you participate, what would you mention?
7.  Can the tools you are exposed to advance students in the field of knowledge? Where? How? Explain and give an example.
8.  Have you previously participated in a course dealing with ICT? If so, how is this course different from the ICT course you participated in before?
9.  What are your views on ICT integration in the first language teaching field of knowledge?
10. Has your attitude toward ICT in your discipline changed as a result of your participation in the professional development? Please provide an explanation.

**Appendix B. Mixed Online Questionnaire (Closed- and Open-Ended Questions)**

(a) "To what extent is the course guided by ICT professionals who are proficient in the field of knowledge more effective than a course guided by ICT professionals only?" (answered on a scale ranging from 1 (not at all) to 6 (to a very large extent);

(b) "And why?" (open question);

(c) "To what extent did the course contribute to your ability to use ICT tools in teaching writing in the classroom?" (answered on a scale ranging from 1 (not at all) to 6 (to a very large extent));

(d) "What changes would you make in order to integrate an ICT tool into the teaching of Hebrew?" (open question);

(e) "What would you improve in order to integrate ICT tools into Hebrew teaching?" (open question);

(f) "Would you like to specialize in a continuation course next year?" (yes/no); (g) "Would you recommend this course to other Hebrew teachers in this format?" (yes/no).

## References

1. Ghalib, B. Integration of Information and Communication Technologies in the Teaching-Learning Process of Biology within Middle School Education from Israel. 2021. Available online: https://ust.upsc.md/wp-content/uploads/2021/10/BG_Rezumat_eng.pdf (accessed on 23 October 2023).
2. Magen-Nagar, N.; Rotem, A.; Inbal-Shamir, T.; Dayan, R. The effect of the national ICT plan on the changing classroom performance of teachers. In Proceedings of the 9th Chais Conference for the Study of Innovation and Learning Technologies, Raanana, Israel, 11–12 February 2014.
3. Dhawan, S. Online learning: A panacea in the time of COVID-19 crisis. *J. Educ. Technol. Syst.* **2020**, *49*, 5–22. [CrossRef]
4. Paños-Castro, J.; Arruti, A.; Korres, O. COVID and ICT in primary education: Challenges faced by teachers in the Basque country. *Sustainability* **2022**, *14*, 10452. [CrossRef]
5. Simamora, R.M. The challenges of online learning during the COVID-19 pandemic: An essay analysis of performing arts education students. *Stud. Learn. Teach.* **2020**, *1*, 86–103. [CrossRef]
6. Ilic, P. Understanding the Challenges of Leveraging Information and Communications Technology in Education. In *Handbook of Research on Teacher and Student Perspectives on the Digital Turn in Education*; IGI Global: Hershey, PA, USA, 2022; pp. 94–111. [CrossRef]
7. Limna, P.; Jakwatanatham, S.; Siripipattanakul, S.; Kaewpuang, P.; Sriboonruang, P. A review of artificial intelligence (AI) in education during the digital era. *Adv. Knowl. Exec.* **2022**, *1*, 1–9.
8. Avidov-Ungar, O.; Amir, A. Development of a teacher questionnaire on the use of ICT tools to teach first language writing. *Comput. Assist. Lang. Learn.* **2018**, *31*, 675–693. [CrossRef]
9. Avidov-Ungar, O.; Amir, A. Use of digital tools by high school teachers teaching writing participating in an intervention program to reduce the "discipline block". In Proceedings of the Society for Information Technology Teacher Education International Conference, Las Vegas, NV, USA, 18–22 March 2019; Association for the Advancement of Computing in Education: Chesapeake, VI, USA; pp. 1489–1493.
10. Avidov-Ungar, O. The professional learning expectations of teachers in different professional development periods. *Prof. Dev. Educ.* **2023**, *49*, 123–134. [CrossRef]
11. Hsu, P.S. Examining current beliefs, practices and barriers about technology integration: A case study. *TechTrends* **2016**, *60*, 30–40. [CrossRef]
12. Luterbach, K.J.; Brown, C. Education for the 21st century. *Int. J. Appl. Educ. Stud.* **2011**, *10*, 14–32.
13. Tondeur, J.; van Braak, J.; Ertmer, P.A.; Ottenbreit-Leftwich, A. Understanding the relationship between teachers' pedagogical beliefs and technology use in education: A systematic review of qualitative evidence. *Educ. Technol. Res. Dev.* **2017**, *65*, 555–575. [CrossRef]
14. Hong, H.Y.; Scardamalia, M.; Zhang, J. Knowledge society network: Toward a dynamic, sustained network for building knowledge. *Can. J. Learn. Technol.* **2010**, *36*, 1–29. [CrossRef]
15. Voogt, J.; Roblin, N.P. A comparative analysis of international frameworks for 21st-century competences: Implications for national curriculum policies. *J. Curric. Stud.* **2012**, *44*, 299–321. [CrossRef]
16. Bonk, C.J. For openers: How technology is changing school. *Educ. Leadersh.* **2010**, *67*, 60–65.
17. Pellegrino, J.W.; Hilton, M.L. (Eds.) Education for life and work: Developing transferable knowledge and skills in the 21st century. In *Committee 011 Defining Deeper Learning and 21st Century Skills*; National Research Council of the National Academies: Washington, DC, USA, 2012.
18. Sandholtz, J.H.; Ringstaff, C.; Dwyer, D.C. Ensinando com tecnologia: Criando salas de aulas centradas nos alunos. In *Teaching with Technology: Creating Student-Centered Classrooms*; Artes Médicas: Sao Paulo, Brazil, 1997.
19. Aldosemani, T. Inservice Teachers' Perceptions of a Professional Development Plan Based on SAMR Model: A Case Study. *Turk. Online J. Educ. Technol.—TOJET* **2019**, *18*, 46–53.
20. Wilkinson, K. Students' computer literacy: Perception versus reality. *Delta Pi Epsil. J.* **2006**, *48*, 108–120.

21. Fraillon, J.; Ainley, J. The IEA International Study of Computer and Information Literacy (ICILS). 2010. Available online: http://forms.acer.edu.au/icils/documents/ICILS-Detailed-Project-Description.pdf (accessed on 23 October 2010).

22. Abraham, M.; Arficho, Z.; Habtemariam, T. Effects of training in ICT-assisted English language teaching on secondary school English language teachers' knowledge, skills, and practice of using ICT tools for teaching English. *Educ. Res. Int.* **2022**, *2022*, 6233407. [CrossRef]

23. Martínez-Soto, T.; Prendes-Espinosa, P. A Systematic Review on the Role of ICT and CLIL in Compulsory Education. *Educ. Sci.* **2023**, *13*, 73. [CrossRef]

24. Torsani, S. *CALL Teacher Education: Language Teachers and Technology Integration*; Springer: Berlin/Heidelberg, Germany, 2016. [CrossRef]

25. Vintoniv, M.; Tiutiuma, T. Use of ict tools in teaching syntax of Ukrainian language to philology students. *Sci. J. Pol. Univ.* **2022**, *51*, 187–199. [CrossRef]

26. Liu, H.; Lin, C.H.; Zhang, D.; Zheng, B. Language teachers' perceptions of external and internal factors in their instructional (non-) use of technology. In *Preparing Foreign Language Teachers for Next-Generation Education*; IGI Global: Hershey, PA, USA, 2017; pp. 56–73. [CrossRef]

27. Warschauer, M.; Ware, P. Learning, change, and power: Competing Frames of Technology and Literacy. In *Handbook of Research on New Literacies*; Lawrence Erlbaum Associates: New York, NY, USA, 2014; pp. 215–240.

28. Akhmedov, B.A. Use of Information Technologies in The Development of Writing and Speech Skills. *Uzb. Sch. J.* **2022**, *9*, 153–159.

29. Bartlett, E.J. *Learning to Write: Some Cognitive and Linguistic Components*; Center for Applied Linguistics: Washington, DC, USA, 2007.

30. Yadav, M.S.; Pavlou, P.A. Marketing in computer-mediated environments: Research synthesis and new directions. *J. Mark.* **2014**, *78*, 20–40. [CrossRef]

31. Sharples, M.; van der Geest, T. (Eds.) *The New Writing Environment: Writers at Work in a World of Technology*; Springer: Berlin/Heidelberg, Germany, 1996. [CrossRef]

32. Moran, C. Computers and the writing classroom: A look to the future. In *Re-Imagining Computers and Composition*; Hawisher, G.E., LeBlanc, P., Eds.; Heinemann: Portsmouth, NH, USA, 1992; pp. 7–23.

33. Hawisher, G.E. Electronic meetings of the minds: Research, electronic conferences, and composition studies. In *Re-Imagining Computers and Composition*; Hawisher, G.E., LeBlanc, P., Eds.; Heinemann: Portsmouth, NH, USA, 1992; pp. 81–101.

34. Amir, A.; Avidov-Ungar, O. What's blocking the integration of technology in teaching? The disciplinary barrier. In Proceedings of the 12th Annual Education and Development Conference, Bangkok, Thailand, 1–10 February 2017.

35. Ertmer, P.A. Addressing first- and second-order barriers to change: Strategies for technology integration. *Educ. Technol. Res. Dev.* **1999**, *47*, 47–61. [CrossRef]

36. Kaur, K. Teaching and Learning with ICT Tools: Issues and Challenges. *Int. J. Cybern. Inform.* **2023**, *12*, 15–22. [CrossRef]

37. Kim, C.; Kim, M.K.; Lee, C.; Spector, J.M.; DeMeester, L. Teacher beliefs and technology integration. *Teach. Teach. Educ.* **2012**, *29*, 76–85. [CrossRef]

38. Crompton, H. *ISTE Standards for Educators: A Guide for Teachers and Other Professionals*; International Society for Technology in Education: Washington, DC, USA, 2017.

39. Hew, K.F.; Brush, T. Integrating technology into K-12 teaching and learning: Current knowledge gaps and recommendations for future research. *Educ. Technol. Res. Dev.* **2007**, *55*, 223–252. [CrossRef]

40. Newhouse, C.P.; Clarkson, B.D. Using learning environment attributes to evaluate the impact of ICT on learning in schools. *Res. Pract. Technol. Enhanc. Learn.* **2008**, *3*, 139–158. [CrossRef]

41. McGrail, E. Teachers, technology, and change: English teachers' perspectives. *J. Technol. Teach. Educ.* **2005**, *13*, 5–24.

42. Yermekkyzy, A. Experiences and Challenges of Novice and Experienced English Teachers in Using ICT Applications. Master's Thesis, Faculty of Education and Humanities, Suleyman Demirel University, Isparta, Türkiye, 2022.

43. Nikolopoulou, K.; Gialamas, V. Barriers to ICT use in high schools: Greek teachers' perceptions. *J. Comput. Educ.* **2016**, *3*, 59–75. [CrossRef]

44. Ertmer, P.A.; Ottenbreit-Leftwich, A.T.; Sadik, O.; Sendurur, E.; Sendurur, P. Teacher beliefs and technology integration practices: A critical relationship. *Comput. Educ.* **2012**, *59*, 423–435. [CrossRef]

45. Greer, R.; Koran, J.; White, L. A beginning model to understand teacher epistemic beliefs in the integration of educational technology. In Proceedings of the Society for Information Technology Teacher Education International Conference, Savannah, GA, USA, 21 March 2016; Association for the Advancement of Computing in Education: Chesapeake, VI, USA; pp. 2050–2056.

46. Barak, M.; Dori, Y.J. Enhancing undergraduate students' chemistry understanding through project-based learning in an IT environment. *Sci. Educ.* **2005**, *89*, 117–139. [CrossRef]

47. Avidov-Ungar, O. A model of professional development: Teachers' perceptions of their professional development. *Teach. Teach.* **2016**, *22*, 653–669. [CrossRef]

48. Bolam, R. Professional learning communities and teachers' professional development. In *Teaching: Professionalization, Development and Leadership: Festschrift for Professor Eric Hoyle*; Springer: Dordrecht, The Netherlands, 2008; pp. 159–179.

49. Olsson, D. *Improving Teaching and Learning Together: A literature Review of Professional Learning Communities*; Karlstad University Studies: Karlstad, Sweden, 2019; pp. 4–41.

50. Bai, H.; Ertmer, P.A. Teacher educators' beliefs and technology uses as predictors of preservice teachers' beliefs and technology attitudes. *J. Technol. Teach. Educ.* **2008**, *16*, 93.

51. Borg, S. Evaluating the impact of professional development. *RELC J.* **2018**, *49*, 195–216. [CrossRef]

52. Bragg, L.A.; Walsh, C.; Heyeres, M. Successful design and delivery of online professional development for teachers: A systematic review of the literature. *Comput. Educ.* **2021**, *166*, 104158. [CrossRef]

53. Hunzicker, J. Effective professional development for teachers: A checklist. *Prof. Dev. Educ.* **2011**, *37*, 177–179. [CrossRef]

54. Kuijpers, J.M.; Houtveen, A.A.M.; Wubbels, T. An integrated professional development model for effective teaching. *Teach. Teach. Educ.* **2010**, *26*, 1687–1694. [CrossRef]

55. Jerrim, J.; Sims, S. The Teaching and Learning International Survey (TALIS) 2018: June 2019. 2019; pp. 130–160. Available online: https://assets.publishing.service.gov.uk/media/5f6484c2e90e075a01d2f4ce/TALIS_2018_research.pdf (accessed on 23 October 2023).

56. Mishra, P.; Koehler, M.J. Technological pedagogical content knowledge: A new framework for teacher knowledge. *Teach. Coll. Rec.* **2006**, *108*, 1017–1054. [CrossRef]

57. Bower, M.; Hedberg, J.G.; Kuswara, A. A framework for Web 2.0 learning design. *Educ. Media Int.* **2010**, *47*, 177–198. [CrossRef]

58. Magen-Nagar, N.; Peled, B. Characteristics of Israeli school teachers in computer-based learning environments. *J. Educ. Online* **2013**, *10*, 1–34. [CrossRef]

59. Lampert, M. Learning teaching in, from and for practice: What do we mean? *J. Teach. Educ.* **2010**, *61*, 213–224. [CrossRef]

60. Matherson, L.; Windle, T.M. What do teachers want from their professional development? Four emerging themes. *Delta Kappa Gamma Bull.* **2017**, *83*, 28.

61. Chai, C.S.; Koh, J.H.L.; Tsai, C.C.; Tan LL, W. Modeling primary school pre-service teachers' Technological Pedagogical Content Knowledge (TPACK) for meaningful learning with information and communication technology (ICT). *Comput. Educ.* **2011**, *57*, 1184–1193. [CrossRef]

62. McConachie, S.M.; Petrosky, A.R. Engaging content teachers in literacy development. In *Content Matters: A Disciplinary Literacy Approach to Improving Students' Learning*; Wiley: New York, NY, USA, 2010; pp. 1–14. [CrossRef]

63. Moje, E.B. Chapter 1 Developing socially just subject-matter instruction: A review of the literature on disciplinary literacy teaching. *Rev. Res. Educ.* **2007**, *31*, 1–44. [CrossRef]

64. Li, S.; Yamaguchi, S.; Sukhbaatar, J.; Takada, J.I. The influence of teachers' professional development activities on the factors promoting ICT integration in primary schools in Mongolia. *Educ. Sci.* **2019**, *9*, 78. [CrossRef]

65. Vangrieken, K.; Meredith, C.; Packer, T.; Kyndt, E. Teacher communities as a context for professional development: A systematic review. *Teach. Teach. Educ.* **2017**, *61*, 47–59. [CrossRef]

66. Avidov-Ungar, O.; Amir, A. Between generic digital literacy and disciplinary digital literacy: A pioneer study—First language teaching. In Proceedings of the ECER 2016, Dublin, Ireland, 22–26 August 2016.

67. Zheng, B.; Warschauer, M.; Lin, C.H.; Chang, C. Learning in one-to-one laptop environments: A meta-analysis and research synthesis. *Rev. Educ. Res.* **2016**, *86*, 1052–1084. [CrossRef]

68. Ahmadi, S.; Keshavarzi, A.; Foroutan, M. The application of information and communication technologies (ICT) and its relationship with improvement in teaching and learning. *Procedia—Soc. Behav. Sci.* **2011**, *28*, 475–480. [CrossRef]