Professional learning approaches that support digital transformation, enable change or impact practice

IDEAL FUTURE
Integrated Digital Educational Leadership for the Future

An integrated literature review

IDEAL Future

An Integrated Literature Review

Professional learning approaches that support, digital transformation, enable change or impact practice

Authors:

Emma O Brien, Mary Immaculate College Limerick, Ireland

Contents

1. Executive summary

This report is a crucial component of the IDEAL Futures project, specifically aligned with the empathize stage of the project's methodology. It forms part of Work Package 3, which focuses on developing a pedagogical model to support digital transformation in education. The primary objective of this work package is to create and evaluate a multi-level pedagogical model that facilitates transformative dialogue and addresses challenges in digital pedagogical leadership.

To achieve this, an integrated literature review was conducted between October 2023 and July 2024, examining professional learning models that utilize digital technologies to support transformative professional development. This review is complemented by qualitative and quantitative research, including interviews and surveys with pre-service and in-service teachers, as well as educational leaders from various countries. These studies aim to understand the experiences, challenges, and needs of educators in the context of digital transformation.

Key Results

The results of this research highlighted several critical findings:

- **Change and transformation individual, non-linear and complex**, this depends on a variety of factors individual, professional and contextual, all of which must be considered within the professional learning model
- **Need for sustained and supported professional learning**: Those studies in which participants engaged in varied, long term and supported professional learning were more likely to achieve higher level of competence
- **Need for Multi-Level Support**: The findings underscored the necessity for a multi-level pedagogical model that can cater to educators at different stages of digital competence. This model would need to address not only basic digital skills but also deeper knowledge and leadership capabilities.
- **The lack of professional learning research** exploring support to changing practice, particularly at higher level of proficiency. Further research needs to be conducted on the types of learning activities, sequence of these and the optimum duration of the professional learning favourable to leadership, change and transformation
- **The lack of experimental and empirical research around professional learning**

Conclusion

The findings from this work package will serve as the foundation for developing the pedagogical framework that will guide the creation of learning content, activities, and the design of a digital hub for IDEAL Futures. The report outlines the systematic methodology used, the research questions addressed, and the key outcomes of the integrated literature review. It also emphasizes the importance of a multi-level, inclusive pedagogical model that caters to varying levels of digital competence among educators, from awareness and knowledge deepening to leadership in digital learning.

2. Introduction

This report is aligned to the empathise stage of the project methodology (see Figure 1 below). As part of work package 3 partners conduced an integrated literature review of professional learning models to support the development of a pedagogical model for IDEAL future.
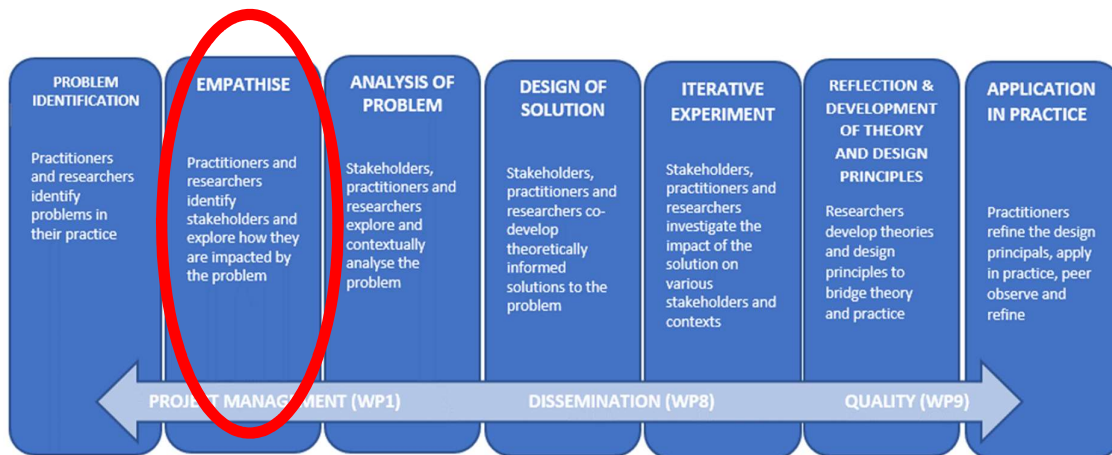

Figure 1: IDEAL FUTURES METHODOLOGY

In parallel partners collaborated with pre-service and in-service teachers and educational leaders in each of their countries to identify the main problems/challenges they experience engaging in professional learning. Through interviews they were encouraged to consider their experiences with digital transformation in their contexts, how to empower digital transformation and supports required through professional learning to enable digital transformation to take place.

The outputs from this work package will form the basis of the pedagogical framework that will underpin the development of the learning content, learning activities and digital hub design. **Key outputs** of the work package include

1. An integrated literature review on the use of digital technology to support transformative dialogical approaches to Professional Development
2. Development of a pedagogical model and position paper

The purpose of this report is to detail the findings of the integrated literature review that was conducted between October 2023 and July 2024

2.1 Objectives and Associated Research Questions
This work package aims to address project objective three outlined in the proposal:

Objective 3: Develop and evaluate a high quality, multi-level, pedagogical model that supports transformative dialogue and leads to a co-operative and integrated approach to addressing issues facing education around digital pedagogical leadership (WP3, WP6 and WP9*)*

As a result, the below objectives have been outlined as well as the associated research questions for the integrated literature review (see table 1)

Objective	Question
Completion of a systematic literature review on transformative approaches to professional development using digital technologies (cross sectoral, international - exploring the various models, the impact on practice, key success factors and the successful use of technology to support such)	What are the most effective models, methods, approaches *(Comparison)* of professional learning *(Intervention)* that professionals *(Population)* engage with to support digital transformation *(outcomes), enable change (outcome) or impact the micro, meso or macro context (outcome)?* How can these be adapted to meet the needs of educational leaders, educators and those in education?

Table 1: Research objectives and Associated questions

3. Methodology

This work package adopted an exploratory sequential mixed methods research design to develop an evidence based pedagogical model that empathised with the needs of educators and educational leaders. Qualitative narrative interviews facilitated a deeper understanding of professional learning experiences current and desired of potential teacher academy participants, this enabled the partners to empathise and understand the overall experience desired. In addition, surveys enabled partners to understand the scale of the needs to assist the rigorous development of a pedagogical model (or instrument). The integrated literature review enabled researchers to ensure that the pedagogical model leverages from evidence-based models.

Significant research has already been conducted on professional learning within the teaching profession, therefore, it is important to consolidate and build on this in the context of supporting transformation and transformative learning. In addition, research has also been conducted on digital transformation however the majority of such is in the private sector. Research to date has been limited on the skills to support leaders in enabling transformation and digital transformation in a digital context and the professional development models that support such. Consequently, the research team felt that adopting a mixed methods approach that consolidates and criticises existing literature, understands their experiences in leading digital transformation and conducts a quantitative analysis of the current and future skills needs of educators and educational leaders provides a representative view of the current and future status to enable the development of a pedagogical model. Therefore, the following data collection approaches have been used. Integrated literature review on transformative approaches to professional development using digital technologies.

- Interviews will be conducted with 10 to 15 pre-service, 10 to 15 in-service teachers and 5-10 educational leaders in each partner country on their experiences of leading digital transformation, engaging in professional development and perceptions of a successful pedagogical model
- Surveys will be conducted with 100 to 150 pre-service teachers 100 to 150 in-service teachers and 40-50 educational leaders in each country on the skills they need and how to support the development of such skills

This report critically analyses the findings of the integrated literature review. Initially it was proposed to conduct a systematic literature review. However, due to the volume of results it was decided to adopt an integrated review methodology as the results will be used to develop the pedagogical model for IDEAL future. It will follow the steps outlined by Petticrew and Roberts, (2006)

- Question
- Types of studies
- Search

- Screening
- Analysis and Reporting: Describe, Synthesise
-

3.1 Research question

The main research question to be answered through the integrated literature review is outlined below. the focus is on exploring models of characteristics of professional learning that enable change, transformation or impact in education.

The question was developed using the PICO format to ensure it is specific and measurable
- Population - educators and educational leaders
- Intervention- digital professional development
- Comparison – compare models of digital professional development
- Outcome support digital transformation or change in education

What are the most effective models, methods, approaches *(Comparison)* of professional learning *(Intervention)* that professionals *(Population)* engage with to support digital transformation *(outcomes), enable change (outcome) or impact the micro, meso or macro context (outcome)?* How can these be adapted to meet the needs of educational leaders, educators and those in education?

3.2 Types of studies and Search strategy

When constructing the research question there was concern about the meaning of 'effective' about models of professional development. Effective can be demonstrated from either through quantitative or qualitative means. Quantitative would imply measurable outcomes on teaching and learning such as the use of digital technologies, an increase in digital competence, confidence or an improvement of student learning or teacher knowledge in a specific context.

Furthermore, effectiveness could be defined from a qualitative context such as enjoyment of the professional development, engagement in further professional development, change in perception of attitude towards digital technologies which may not be measure able through quantitative means. It is notable from Kirkpatrick's, 2011[1] work on evaluation of training model that professional development impact is difficult to measure, and the impact can be often longitudinal, so it is important to include such studies in the review. Therefore, it was felt that an analysis of both quantitative and qualitative studies was required to get a broad overview of experiences, particularly about professional learning models and experiences.

The types of studies that were included in the study are:
- Quantitative studies quasi experimental, observational analytic studies, and longitudinal studies- Khan, 2020
- Qualitative studies in particular qualitative design, case study design, ethnography, phenomenology, narrative analysis (grounded theory will not be included, unless it has undergone a quant study)[2] and longitudinal studies

3.3 Search Strategies

Below is an overview of the databases that were searched and the proposed search strings (Table 2)

---

[1] Kirkpatrick, D. and Kirpatrick, J.D., 2011. *The Kirkpatrick four levels*. Kirkpatrick Partners.
[2] Booth, A., 2016. Searching for qualitative research for inclusion in systematic reviews: a structured methodological review. *Systematic reviews*, *5*(1), pp.1-23.

Databases	Search Strings
Academic Search Complete Business Source Complete Education source ERIC (Education Resources Information Center,) EBSCO	Year: Between 2013 and December 2023 Languages: English Sample Search Strings: Note these were composed from the PICO format in table 3 Professional* OR "Teachers" OR "Educators" OR "Teaching" OR "Training" OR "Trainers") AND ("informal learning" OR "formal learning" OR "Teacher education" OR "Teacher Pedagogy" OR "Teacher Training") AND ("Digital" OR "Technology" OR "Technological") AND ("Change" OR "Innovation")) Professional* OR "Teachers" OR "Educators" OR "Teaching" OR "Training" OR "Trainers") AND ("Professional Development" OR "Professional learning" OR "continuous professional development" OR "continuing professional development" OR "learning and performance" OR "Training and development" OR "learning and development") AND ("Digital" OR "Technology" OR "Technological") AND ("Change" OR "Innovation"))

Table 2: Search terms

COL 1	COL 2	COL3	COL 4	COL 5
Population	**Context 1 (Exposure/Intervention)**	**Context 2 (Exposure/Intervention)**	**Outcome 1**	**Outcome 2**
"Professionals" OR "Teachers" OR "Educators" OR "Teaching" OR	"Professional Development" OR "Professional learning" OR "Continuous professional development" OR	"Informal learning" OR "Formal learning" OR "Teacher education" OR "Teacher Pedagogy" OR "Teacher Training"	"Digital transformation" OR "Digital learning" OR "Remote learning" OR "Online learning"	"Change" OR "Innovation"

| | "Training" OR "Trainers" | "Continuing professional development" OR "Learning and performance" OR "Training and development" OR "Learning and development" | | OR "Digital Pedagogy" OR "Digital leadership" OR "Digital Skills" OR "ICT Skills" | |

Table 3 Composition of search strings

3.4. Screening, analysis and reporting

The team screened, analysed and reported through four phases, initial screening, quality review and second screen, data extraction, and analysis and reporting.

3.4.1 Phase 1: Initial screening

The research team used the below inclusion and exclusion criteria when screening abstracts for consideration within the systematic literature review. The screening criteria are based on terms, type of studies, sampling, rigor (see table 4 for screening criteria)

Inclusion	Exclusion
Terms: IMPACT/EFFECT study explores impact/effect of professional development models in a rigorous manner. -There are details about advancement during professional development? There are elements of explanation of the impact and change . - Context and socio-technical environment is considered There is an empirical evaluation of the professional learning	**Rigor** Recommendations or discussions are not evidence based **Rigor:** Not a peer reviewed journal article **Terms:** Study Does not measure impact/effect of the proposed intervention in a rigorous manner.
Terms: MODE/CHARACTERISTICS of professional learning studies At least one of them: - The type of Professional Learning - The characteristics of the Professional Learning - A description of the Professional Learning environnent - The means / tools used (type of platform, media or other)	**Terms:** Study does not include details of the characteristics of professional learning

Sample type: All professionals	Sample type: students that are in higher education or schools
Qualitative studies - Sample size: Above 2 - Type of study: qualitative, phenomenology, case study, ethnography, narrative and longitudinal - Year: post 2013 - Rigour: Studies that address validity and reliability in particular bias that may impact the study	**Qualitative studies** - Sample size: 2 minimum - Type of study: Grounded Theory that has not been tested in other studies - Year: pre 2013
Quantitative studies - Sample size: Above 200 - Type of study: experimental, quasi experimental, observational analytic studies, and longitudinal studies - Year post 2013 - Rigour: Studies that address validity and reliability through statistical measures	**Quantitative studies** - Sample size: below 200 - Type of study: experimental - Year: pre2013

Table 4 Screening Criteria

3.4.2 Phase 2 Quality review and second screen

A second screen of the full articles, and a quality review of these were completed. The reviewer considered each article using the screening criteria in table 4. If article was excluded the reviewer noted this in an excel file including

- o File name of the article
- o Reference of the article
- o Reason for excluding

3.4.3 Phase 3: Data extraction

Data from the articles were extracted using the template below. These were recorded in a document for each article detailing the table below. A different word document will be created for each article and the file will be named authorname_YEAR.doc and will be stored in a shared folder on teams

Theme	Data extracted
Type of study	
Country	
Sector	
Level	
Duration of PD (PROFESSIONAL DEVELOPMENT)	
Strengths of research	
Weaknesses of research	
Characteristics of model	
Impact of model	
Enablers to implementation/success	
Pedagogical learning pathway the model and research are aligned to: Knowledge Awareness/Knowledge Deepening/ Leadership	

Table 5: Data extraction table

The reason for extracting the pedagogical pathway was to determine the proficiency level that the participants attain through engaging in professional learning. This is based on existing proficiency levels identified in competence frameworks such as DigCompEdu as well as other models of levels of technology integration.

Regarding competency frameworks, DigCompEdu uses 6 levels of proficiency; Newcomer (A1); Explorer (A2); Integrator (B1); Expert (B2); Leader (C1); Pioneer (C2).[3] Whereas UNESCO use three levels knowledge awareness, knowledge deepening and knowledge creation.[4]

Many of these proficiency levels map to phases of technology integration such as that outlined by Christensen et al, 2001[5]; Stage 1 Awareness, Stage 2 Learning the process, Stage 3 Understanding and application of the process, Stage 4 Familiarity and confidence, Stage 5 Adaptation to other contexts, Stage 6 Creative application to new contexts. The SAMR model- Substitution, Augmentation, Modification and Redefinition[6]. Both of which end with redefining and remodelling learning through technology.

They also relate to elements outlined within theories regarding models of change such as the stages of concern in the Concerns Based Adoption Model (CBAM), which again an outline six stages ranging from awareness to refining or developing new ideas.[7]

It has been acknowledged in the research that change is complex and often not linear, in addition sometimes people need to be reassured, and information or awareness may need to be provided, thus phases may overlap. [8] [9]. It is important that this is considered within the analysis. Furthermore, apart from DigCompEdu many of these descriptors do not consider the progression to leadership or innovators. To enable overlap between the levels and map profession to leadership it was decided to map existing models to three levels Knowledge Awareness, Knowledge Creation and Leadership.

This amalgamates the proficiency levels in the DigiCompEdu framework, to create consistency between frameworks and allow for broader definitions to remove the concept of linearity. It also considers models such as technology integration levels SAMR, CBAM. See Table 6 for an overview of these

	Outcome	Focus
Knowledge awareness	Awareness of the pedagogical and professional potential of digital learning technologies	Supporting them to understand their beliefs about digital learning technology, building their critical understanding of digital learning technologies and encouraging them to apply it to their practice
Knowledge deepening	Engage in critical discourse with stakeholders regarding the selection and application of digital	Reflective experimentation, collaboration and knowledge

[3] EU (n.d.) DigCompEdu proficiency levels
[4] UNESCO (2018) UNESCO ICT Competency Framework for Teachers; 2018
[5] Christensen, R., Griffin, D. and Knezek, G., 2001. Measures of Teacher Stages of Technology Integration and Their Correlates with Student Achievement.
[6] Puentedura, R.R. (2006). Transformation, technology, and education
[7] Hall, G. E., & Hord, S. M. (2020). Implementing Change: Patterns, Principles, and Potholes (5th ed.). Pearson.
[8] Sansom, D.W., 2020. Investigating processes of change in beliefs and practice following professional development: multiple change models among in-service teachers in China. Professional development in education, 46(3), pp.467-481.
[9] Fullan, M., 2016. The elusive nature of whole system improvement in education. Journal of Educational Change, 17(4), pp.539-544.

	learning. They will discuss with peers, students and other stakeholders about their experiences with digital learning to date, empathize with these and adapt their practice based on this dialog, observations of their own experimentation and reflection	exchange to become digital pedagogical leaders
Leadership	Develop critical thought leaders in digital learning leadership. They will question the adequacy of contemporary digital and pedagogical practices and challenge current systems, technologies and processes regarding their feasibility to support contemporary education needs. They will support a culture of innovative practice within and beyond their own context and within their organizations act as an advisor and sounding board for new ideas regarding digital learning. They will have the ability to collaborate with organizations at national and international levels both in education and beyond to develop novel pedagogical and professional practices within education.	Supporting those to plan and actively collaborate on projects and problems regarding digital learning across the sector, conduct action-based research to address such and disseminate

Table 6: Pedagogical Pathways Descriptors for Data extraction

3.4.4 Phase 4: Analysis and Reporting

From the interviews and surveys the need for a multilevel, inclusive and user centred pedagogical model is evident. In addition, the research highlighted that there are disparate competence levels of teachers across Europe ranging from a lack of knowledge of the potential of technology and negative inherent beliefs of such, the lack of opportunities to apply learning in practice to deepen their understanding and the lack of opportunities to lead systematic change due to cultural and mindset issues. The research highlighted the need for a multi-level model of professional learning. In the initial screening it was apparent that there are a wide range of professional learning models that were successful and that often these were associated with different teacher's experiences.

The data was extracted into individual records for each article using the data extraction table in Table 5. A thematic analysis of each of the characteristics of the study and professional learning pathways was conducted and consolidated into an excel spreadsheet which was analysed using descriptive statistics.

From this the position paper will formulate a pedagogical model for each level of competence and recommend different pedagogical approaches that successfully support the user in transitioning to the next level of competence

4   Integrated literature review

This section will give an overview of the search results, the characteristics of the studies analysed as well as the theoretical frameworks they were based on and associated characteristics of professional learning that lead to impact, change or digital transformation.

4.1 Workflow

In total four databases were searched Academic Search Complete; Business Source Complete; Education source; ERIC; EBSCO using the search terms outlined in section 3.3. A total of 1, 971 articles were found. Of these 37 were duplicates. The remaining 1, 934 went through an initial screening of titles and abstracts using the screening criteria in 3.4.1. In this process 1491 articles were excluded, and 443 articles were fully screened. From the full screening stage (In which full articles were reviewed using the screening criteria) 265 articles were excluded. In total 178 articles were analysed for the integrated literature review and were part of the extraction stage. See Figure 2.
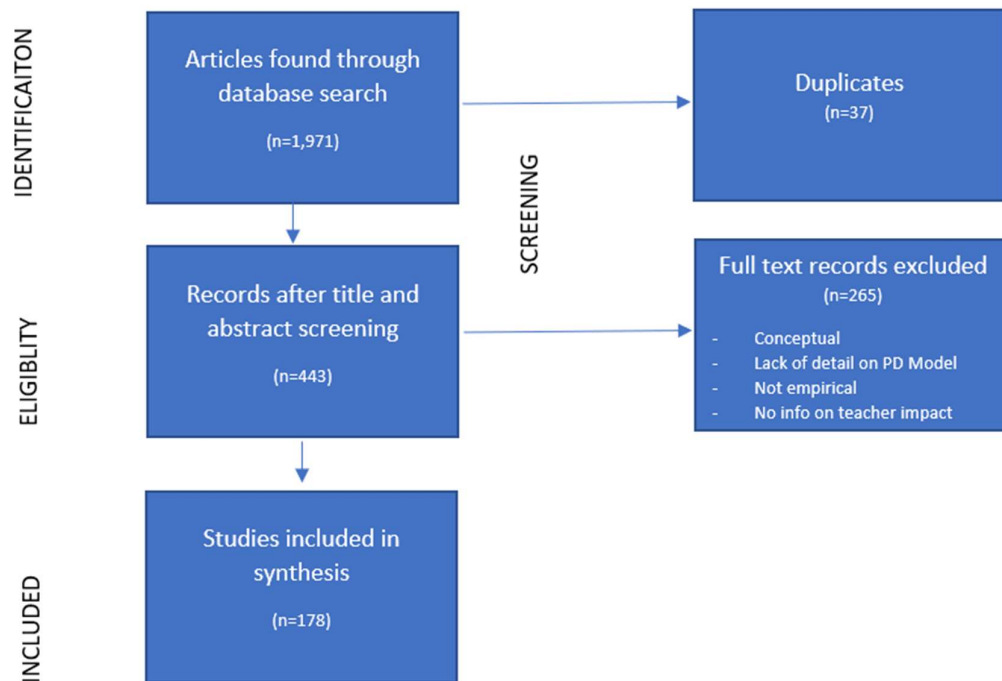

Figure 2: Summary of workflow of integrated review

4.2 Study characteristics

The number of studies in professional learning and innovation/change/digital transformation has increased exponentially over the past ten years -peaking in 2021. It is important to note that COVID had a significant impact on the number of articles being published in digital leaning and professional learning. (see figure 3)
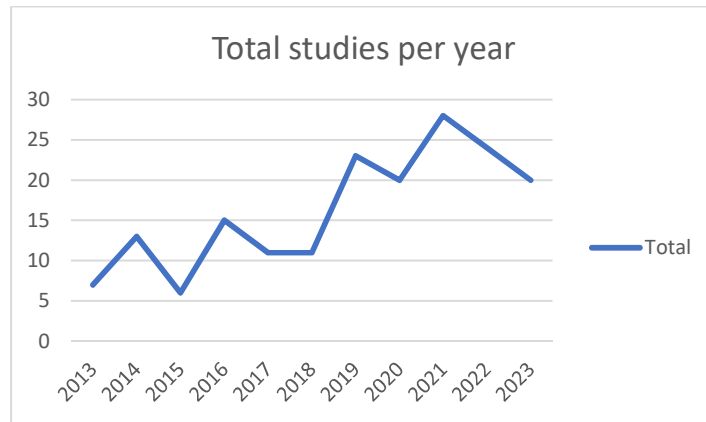
Figure 3: Studies published by year between 2013-2023

Many studies were US based, followed by international or cross-country studies and thirdly studies in Australia. (see figure 4)
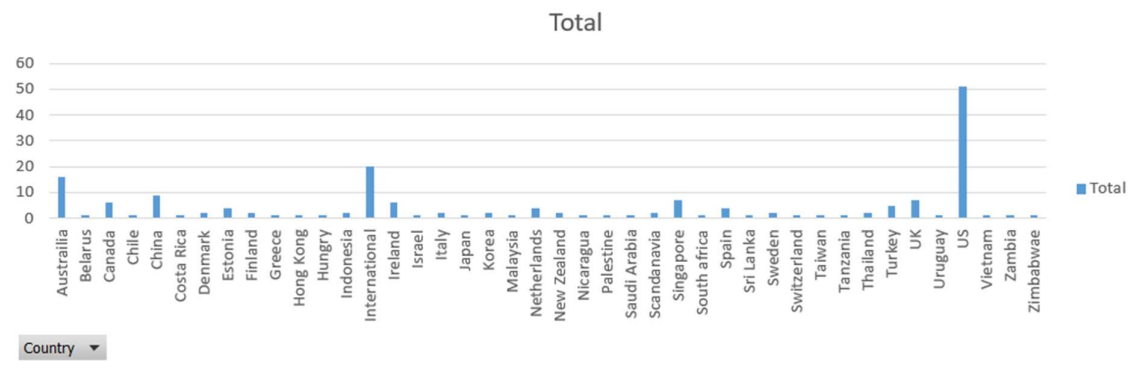

Figure 4: Studies by country

Qualitative studies dominated the literature followed by mixed methods. There was only one experimental study in the articles that were screened (see Table 7). This data is reflective of the discipline of the research which is education or social science based.

Of those articles the average Qualitative study had a sample of 42 with mixed studies having an average sample of 72. As expected, Quantitative studies averaged significantly higher.

Type of study	Number of publications	Type of study	Average of Sample Size
Experimental	1	Experimental	4
Mixed	56	Mixed	72
Qual	101	Qual	42
Quant	20	Quant	2428
Total	**178**	**Total average**	**319**

Table 7: Types of study and sample size

Of the studies the majority impacted the participants knowledge deepening level of proficiency in that those that engaged with the professional learning discussed resulted in the ability to adapt

learning and apply to their own practice in a collaborative and critical manner through dialog, observations of their own experimentation and reflection (see table 8: studies by level of proficiency)

	No of studies	% of studies
Knowledge awareness	60	34%
Knowledge deepening	95	53%
Leadership	23	13%
Total	178	100%

Table 8: Studies by level of proficiency

Studies that considered the experiences of in-service teachers dominated the research with 71% of papers exploring professional learning for this cohort. Only 33 papers of 178 considered the experiences of preservice teachers
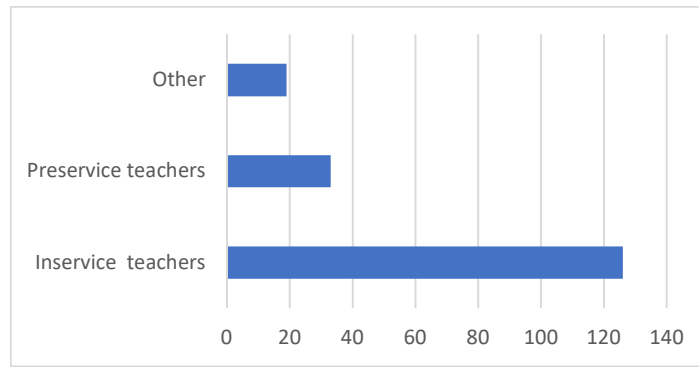

Figure 5: Papers by research participants.

Those studies that considered pre-service professional learning impacted the knowledge awareness and deepening levels of proficiency with few progressing to the leadership stage.
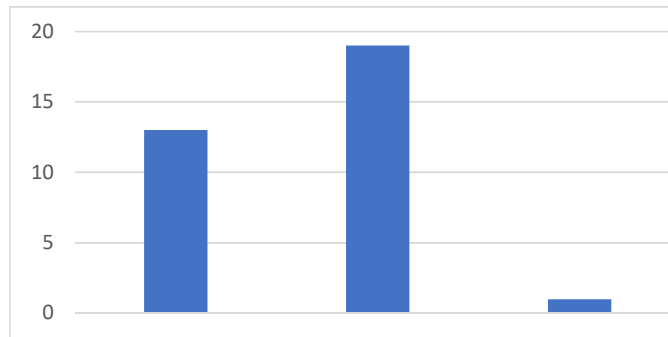

Figure 6: Studies with pre-service teacher as research participants by level of proficiency

4.3 Theoretical frameworks

A review of the theoretical frameworks' studies leveraged from was conducted in the analysis. Many of the studies did not have a theoretical frame. Of those that did the majority leveraged from TPACK (Technological, Pedagogical and Content Knowledge), particularly regarding content design and evaluation. In addition, social learning models such as the communities of practice, inquiry and learning communities featured quite highly. Theories of change and innovation including the

Interconnected model of professional growth and other models such as Rodgers Diffusion of Innovation theory[10], mentored innovation model,[11] teacher centred systematic reform[12] etc were also considered within studies. As the studies were about professional learning for change, transformation and impact it is expected that these models would inform many of the studies. The broader context of these studies in professional learning and change in education will be discussed in Section5: Discussion

Theoretical frame	Number of studies
None	90
TPACK	15
Communities of Practice/Communities of Inquiry/Learning communities	13
Interconnected model of professional growth (IMPG)	6
Change/innovation theories (other than IMPG)	6
Social learning/network theory/networked learning	6
Design based research	5
Schon reflective learning	4
Cognitive apprenticeship, social cognition, social constructivism	4
Learning culture/organisational learning	2
Technology acceptance model	2
Culture context theory	2
Identity formation	2
Other	21
Total	178

Table 9: Summary of theoretical frameworks informing the study

4.4 Characteristics of Professional Learning

Regarding the characteristics of professional learning that support change, transformation or impact practice an analysis of studies under the categories of Knowledge Awareness, Knowledge Deepening and Leadership were constructed. An overview of these descriptors used for the analysis is available in section 3.4.3.

One of the characteristics explored was who do teachers collaborate with during their professional learning. This varied between those at different levels of competency. For those engaging with learning at the level of knowledge awareness collaboration was within their own organisation or international – note many of the international research was around Massive Open Online Courses (MOOCs) and so this may have been international collaboration driven by individual's interest. In addition, this cohort engaged in more individual learning.

In comparison those at the knowledge deepening level of proficiency engaged in more collaborative professional learning across their own organisations, locally or nationally.

---

[10] Rogers, E. M. (2003). *Diffusion of innovations* (5th ed.). Free Press.

[11] Kárpáti, A., & Dorner, H. (2008). Mentored innovation model in teacher training using two virtual collaborative learning environments. In J. Zumbach, N. Schwartz, N. Seufert, & L. Kester (Eds.), Learning and Instruction with Computers, Beyond Knowledge: The legacy of competence meaningful computer-based learning environments (pp. 29–41). Wien: Springer Verla

[12] Gess-Newsome, J., Southerland, S. A., Johnston, A., & Woodbury, S. (2003). Educational reform, personal practical theories, and dissatisfaction: The anatomy of change in college science teaching. American Educational Research Journal, 40(3), 731-767. https://doi.org/10.3102/00028312040003731

Finally, those engaging in the leadership proficiency level were more likely to engage in professional learning nationally, with students, industry and other external partners. This aligns to research that highlights those with a greater social network are more likely to innovate.[13] [14] [15] See table 10

Type of collaboration	Knowledge awareness	Knowledge Deepening	Leadership
Cross org industry partner;Uni Partner	2%	1%	0%
Cross org local	10%	22%	20%
Cross org national	16%	17%	28%
Cross org national;Industry partner	0%	0%	4%
Cross org national;Student	0%	0%	8%
Cross org national;Uni partner	0%	4%	4%
Cross sector	2%	1%	0%
Individual	11%	4%	0%
International	23%	9%	8%
Interprofessional	0%	3%	0%
Within own org	36%	37%	24%
Within own org; Student	0%	1%	4%

Table 10: Professional learning collaboration by level

The average duration of professional learning across all levels was 11.6 months. When broken into the levels of proficiency, those at the more advanced leadership levels had a longer duration and sustained professional learning experience. Within leadership levels professional learning averages at 19 months compared to an average of 6 months at knowledge awareness levels. (see figure 5) This aligns to existing research that advocates for sustained long term professional learning models, [16]as often change happens over time rather than in a transformational manner. [17] [18] [19].

[13] Kim, J., Pak, S. and Cho, Y.H., 2021. The role of teachers' social networks in ICT-based instruction. *The Asia-Pacific Education Researcher*, pp.1-10.

[14] Cangialosi, N., Odoardi, C., Peña-Jimenez, M. and Antino, M., 2023. Diversity of social ties and employee innovation: the importance of informal learning and reciprocity. *Revista de Psicología del Trabajo y de las Organizaciones*, *39*(2), pp.65-74.

[15] Konstantinidou, E. and Scherer, R., 2022. Teaching with technology: A large-scale, international, and multilevel study of the roles of teacher and school characteristics. *Computers & Education*, *179*, p.104424.

[16]Darling-Hammond, L., Hyler, M.E. and Gardner, M., 2017. Effective teacher professional development. *Learning policy institute*.

[17] Prestridge, S., 2017. Examining the shaping of teachers' pedagogical orientation for the use of technology. *Technology, Pedagogy and Education*, *26*(4), pp.367-381.

[18] Nespor, J., 1987. The role of beliefs in the practice of teaching. *Journal of curriculum studies*, *19*(4), pp.317-328.

[19] Becker, H.J. and Riel, M.M., 2000. Teacher Professional Engagement and Constructivist-Compatible Computer Use. Teaching, Learning, and Computing: 1998 National Survey. Report# 7.
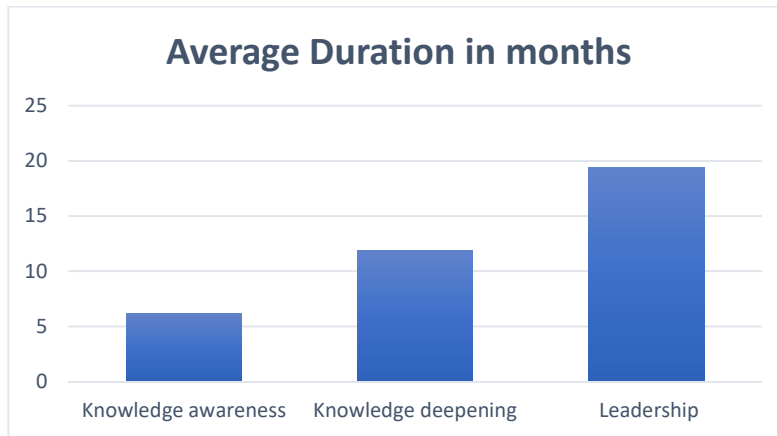
Figure 5: Average duration of professional learning by level (in months)

The average duration of pre-service training was 6 months. Most professional learning for pre-service teachers is in the form of Initial teacher education within a university course and so often digital learning is 3-month modules. Of the 33 pre-service studies 25 of these were three months or less.

Furthermore, the characteristics or types of learning activities individuals engage with at levels of professional learning varies. Those at the higher levels of proficiency engaged in a larger number of activities in their professional learning; those at the knowledge awareness level engaged in an average of 3.22 activities, knowledge deepening an average of 4.53 and leadership 5.07 activities.

In addition, there was a broader range of learning activities in the deepening level of proficiency compared to the awareness and leadership levels. For Deepening the activities ranged across 39 different types compared to 28 at knowledge awareness and 34 at leadership.

The type of activities had some similarity with formal and reflective based activities being widely used across all three levels of proficiency. Innovation and co design activities were more prevalent at knowledge deepening and leadership levels. With dissemination, piloting, leading professional learning and modelling activities being adopted mainly at leadership levels. This indicates as levels of proficiency increase so does collaboration networks and outward dissemination and knowledge sharing.
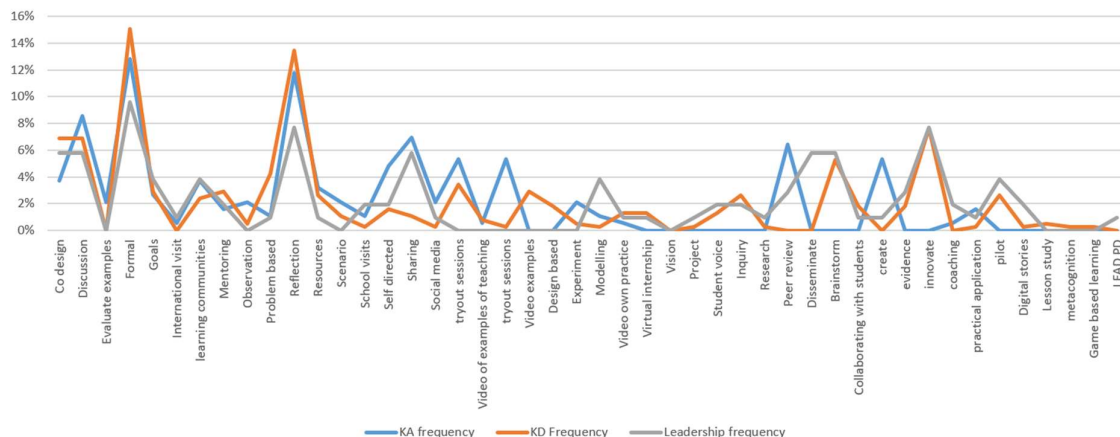
Figure 6: The type of learning activities engaged in by level of professional learning

Furthermore, it must be noted that there was no specific sequence for these activities, some started with formal learning others initiated professional learning through reflection or collaboration. Bolstering the need for non-linear professional learning activities.

On review of the qualitative comments regarding each study a thematic analysis was conducted. The main impacts of the professional learning were adaptations to practice (36), application to practice (11), increase in self-efficacy (17), understanding the complexity of technology and learning (8), sharing (6). In some instances, it was noted the impact was different depending on the beliefs or broader contextual factors of those engaging in the professional learning indicating that professional learning impact is nuanced and complex. (Sansom, 2020).

For much of the formal learning it took place in dedicated blocks either during summertime, weekends or dedicated periods that released educators. Furthermore, professional learning was routine and regular, even though formal learning was in dedicated blocks other activities such as discussion, meetings, reflection took place weekly or monthly.   In very few instances did participants only engage in one activity as part of their professional learning, at all levels participants engaged in several activities. These were mostly prescribed however in some cases participants had a choice of activities they wanted to engage in. This enhanced agency and autonomy, key to this was balancing autonomy and structure as often choice can lead to an additional cognitive load and decision for participants who are already overwhelmed. Critical to this was goal setting or creating a vision for both individual participants and the communities for which they are part of this should be aligned to the digital learning goals of the educational organisation of which they are part of to ensure harmony and consistency as well as opportunities to apply learning in practice.[20] (Fullan, 2016)

5. Discussion

From the review it is evident that participants who engaged in sustained, varied, regular and supported professional learning with clear goals were more likely to progress to higher levels of proficiency. Much of this aligns to the theories of change. The integrated literature review alludes to the complexity associated with developing professional learning environments that support and advocate change, transformation or impact. There are few studies that illustrate progression to leadership levels of proficiency. Also, few studies were based on theoretical frameworks which capture the complexity associated with supporting change. This section will explore these further to understand the broader context and theoretical framework that may inform the literature.

Many of the theories of change and innovation models start with the individual person, with regards to their beliefs and attitudes regarding the change and confidence to make change, in many cases this is influenced by their context such as their profession, societal norms or organisational culture (including who they work with and for). Based on this the individual will decide to make a change or not, how and where that change is made depends on their professional context and if they have the agency to adapt their practice and also the knowledge or information (such as professional learning) they are provided with or engage with to support them to make that change. The change bears an impact and depending on that impact they may continue to use the practices they change or may decide to revert back. Some individuals who have negative experiences and are not supported to

---

[20] Hubers, M.D., D. Endedijk, M. and Van Veen, K., 2022. Effective characteristics of professional development programs for science and technology education. *Professional Development in Education*, *48*(5), pp.827-846.

reflect and learn from such may no longer engage in change practices. [21] [22] [23] (Gess et al, 2005). Furthermore, depending on their context change if change takes place it may occur at different levels, ranging from individual up to the inter-organisational level [24] (Fullan, 2016). Furthermore, change takes time and despite theories of innovation transformation rarely takes place overnight. A shift in beliefs, culture and attitudes needs time for reflection, engagement with practice and dialog, aligning to the findings of the integrated review.

6. Recommendations for pedagogical model

Based on the integrated literature review the below recommendations are made for the IDEAL future pedagogical model.

- Professional learning should **be sustained and supported over time**. Raising awareness of this at the outset amongst participants and leaders is critical as well as the importance of patience
- Participants must be encouraged to **determine goal**s for their experience over time and revisit these
- Professional learning should be **non-linear and iterative** providing opportunities for participants to revisit concepts, attitudes and beliefs, it is recommended that **formal learning and reflection are included at every level of professional learning** to encourage this. Furthermore, learners should be provided with a **choice of activities** rather than a prescriptive pedagogical pathway
- Participants should be encouraged to **apply learning to practice** at each stage – either by being provided with resources and asking them to try them out and reflect on the impact or adapt or create resources based on their learning and again examine the impact.
- Participants should be encouraged and supported to **observe their progress**, particularly within a sustained and long-term professional learning model to enable them to realise their success.
- For **pre-service teachers'** professional learning in digital learning and education should extend beyond three-month modules and be integrated across programmes

---

[21] Ajzen, I., 1991. The theory of planned behaviour. *Organizational behaviour and human decision processes*, *50*(2), pp.179-211

[22] Hall, G.E., 1974. The Concerns-Based Adoption Model: A Developmental Conceptualization of the Adoption Process Within Educational Institutions.

[23] Clarke, D. and Hollingsworth, H., 2002. Elaborating a model of teacher professional growth. *Teaching and teacher education*, *18*(8), pp.947-967.

[24] Pettersson, F., 2021. Understanding digitalization and educational change in school by means of activity theory and the levels of learning concept. *Education and Information Technologies*, *26*(1), pp.187-204.