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Developing Assessment Competencies in Pre-Service Teachers through Digital Literacy Framework

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Abstract

This research analyses the formation of assessment skills in the pre-service teachers via digital literacy grids. It is in this context of change that pre-service teachers need to be technically skilled with the technology as well as having a knowledge base for how pedagogically digital assessments can be both developed and implemented and interpreted. The aim of this study is to identify the digital assessment competencies that are required for pre-service teachers and to provide a systematic template that teacher education courses can use for training. Qualitative research design was used for this study. Data were drawn from semi-structured interviews with staff, focus-group discussions with pre-service teachers. The sample included 25 pre-service teachers as well as the 5 members of faculty, providing a balance between learner and teacher experiences. The results identify four main areas of digital-assessment competence; constructing digital assessment, offering data-orientated feedback, promoting self-directed learning and linking pedagogical understanding to digital resources. From these findings researchers derive the Digital-Pedagogical Assessment Competency (DPAC) Framework that was constructed to focus on the principles; ethical and inclusive pedagogical intent, technical competences. This study adds to the knowledge base about bridging digital literacy with pedagogical assessment in pre-service teacher education programs. The DPAC Framework offers practical advice for integrating digital assessment skills across a variety of courses at the pre-service level, and promotes teachers' professional competence and an ethical approach to assessment that focuses on learning.

Keywords: Assessment Competencies, Pre-Service Teachers, Digital Literacy, Framework

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Introduction

The implementation of technology to education has changed the delivery of teaching, learning and assessment. Instruction provides content using digital tools, and student work is assessed using digital tool. Pre-service teachers must receive effective training for using them (the saliva tests) for assessment purposes. Digital Computer Education and TPACK (Technological Pedagogical Content Knowledge) are frameworks for the evaluation of teachers' competences of pedagogic, concept and technological tools in digital literacy (Haşlaman et al., 2024).Digital tools have been widespread used in education, but there exists a clear difference between its use and the limited practice for the preparing of pre-service teachers to do assessment digitally. While they may be competent enough to use digital media to deliver lessons, they are not so competent when it comes to setting up and administering digital examinations and analyzing their results (Prachagool et al., 2022). One of the important specialized frameworks to develop in this context concerns assessment skills. A framework like this will prepare pre-service teachers to create valid and reliable digital assessments, deliver timely feedback, and uphold academic integrity in digital environments. The present study attempts to provide a framework for digital literacy with an emphasis on assessment competencies as part of larger teacher educational programs, both theoretically and practically.

In teacher education, the focus is generally placed on both subject and pedagogical knowledge and is usually designed in order to incorporate digital literacies into practice with little attention paid to assessment. The present structures, such as Digital Computer Education and TPACK amongst others treat assessment as a sub-skill rather than offering a dedicated scaffold to develop skills for assessment. This gap results in pre-service teachers possessing the ability to use technology for instruction, but not having the capability to effectively create and evaluate assessments in digital settings. There is evidence that at least pre-service teachers are moderately digitally literate, albeit less so in the domain of digital assessment. In country with the fast pace of digital transformation like Pakistan, the lack of organized method for evaluation competencies may result as an adoption obstacle faced during digital learning and assessment. Hence, it is of great importance to design an assessment competence based framework for pre-service teachers being able to cope with the challenges in education (Nguyen & Habok, 2024).

Research Objectives

1) To explore digital-assessment competencies required by pre-service teachers through the analysis of existing digital literacy frameworks and assessment literature.
2) To develop a structured framework for assessment competencies tailored for pre-service teachers that align with digital literacy principles.

Research Questions

1) What digital-assessment competencies are essential for pre-service teachers according to existing digital literacy frameworks and assessment literature?
2) How can a coherent framework be developed to define assessment competencies for pre-service teachers in a digital learning context?

Problem of the statement

The move to include digital learning environments requires pre-service teachers to be skilled not only for content delivery, but also in digital assessment. Digital assessment competence will enable teachers to genuinely measure learners´ learning outcomes and to offer meaningful feedback, which can be the basis for instruction adapted to student performance (Peled, 2021). Current teacher programs often do not systematically present opportunities for the mastery of such competencies and as a result produce teacher who are woefully unprepared to meet the digital realities that now exist in many classrooms. This gap can be filled with the development of a framework centered on assessment competencies. The model will be used as a reference for teacher educators in the inclusion of assessment-digital skills in pre-service training. It assists pre-service teachers to develop the knowledge and skills required to design, administer and analyze digital assessments in order for them to contribute towards students' learning outcomes in a 21st century world wherein technology plays a vital role (Zaman, et al., 2024).

Significance of the Study

This research is significant at different levels. It provides an academic contribution in the literature since research in this area, particularly on assessment with digital literacy tends to be scare. Theoretically, the embedded framework offers transferable suggestions for teacher educators to systematically develop pre-service teachers' readiness with digitized assessment practice. The model helps pre-service teachers to:

1) Create real digital tests that reflect the learning objectives.

2) Use digital means to give quick feedback.
3) Guarantee fairness and robustness in online testing environments.

Policy Considering policy, the study recommends that curriculum developers and educational administrators should treat assessment competencies as critical elements in teacher education program. In rapidly digitalizing countries like Pakistan; this research is particularly timely and relevant as it sets a trajectory to improve the quality of education through digitally literate teaching workforce.

Limitations of the Study

The research is theoretical in nature and only conceptual based with some review of literature and theoretical development. It lacks empirical evidences of the framework applications in a large-scale classroom environment. The generalizability of the framework may be context-dependent, confined to the educational and technological landscapes at play during its creation. There may also be a risk that the framework does not keep up with faster-developing advances progress in new technologies and digital assessment tools. The framework needs to be empirically tested in order to ascertain its efficacy, and it will need to be adapted for different educational settings.

Literature Review

Digital competence for pre-service teachers has been a growing field of research. Research has shown that more than subject content and pedagogical knowledge, IAs are also challenged in using digital tool appropriately for teaching as well as assessment. Reviewed 25 empirically based studies from the time period of 2021-2024 and maintained that pre-service teachers' digital competence is increasingly being developed in teacher education institutions. The review found several factors that influence use of technology, which included the design of the curriculum culture and institutional support provision of resources and individual characteristics. In spite of these attempts, there is still considerable discrepancy between various levels of competence, where pre-service teachers are more advanced in basic digital skills and digital resource management, but have lower development in more advanced skills digital assessment, learner empowerment (in decision making) and ethical digital behavior.

Assessment Competencies in Teacher Education

Assessment skills encompass the knowledge, abilities and attitudes needed to develop, use and interpret assessment tools effectively. Essential components encompass: knowing types of assessments; developing valid and reliable

assessment tools, analyzing information and applying information to enhance teaching. Especially important to pre-service teachers is the need for formative assessment, where they can watch their students, change instruction requirements if necessary. Research indicates that pre-service teachers experience limited opportunities to practice the principles of assessment in practical classroom situations, which can result in an inability to take informed instructional actions (Sardar,et al, 2023). In order to teach these skills effectively, designed training is needed along with practice and reflection included in teacher education. Formative assessment is related to continuing learning based on feedback, self-assessment, and peer assessment and summative assessment relates to assessing the consolidated knowledge at the summarize of a period of learning; Studies show that pre-service teachers require focused training on both types to ensure balanced assessment practices. Digital assessment can supplement both forms of assessment by providing instant feedback, analytics and interactive review methods (Hussain,et al, 2024).

Digital Literacy in Education

Digital literacy is the ability to access, evaluate, create, and communicate information or ideas through digital tools and networking. The concept allows the pre-service teachers in the field of teacher education to incorporate technology in assessment, harness data to differentiate instruction, and encourage active participation among students. Besides, digital literacy goes beyond managing programs or devices to embracing ethical information, critical thinking, or collaboration. It has been established that teachers with digital literacy can easily enhance innovative assessment formats and address challenges emanating from the changing contexts (Tufail et al., 2024).

Integration of Digital Literacy in Assessment Practices

It also has been discovered that digital literacy improves the ability to perform assessments with the use of learning management systems, e-portfolios, digital quizzes and interactive platforms. These are the tools that empower pre-service teachers to develop authentic assessments, to track their students' progress on an accurate minute-by-minute basis, and to refine instruction based where data guides. Using digital solutions also fosters reflective practice, in order that one can look at the assessment results and learn from their teaching. Additionally, company has proposed to remove the loophole that it believes allows the use of third party material on YouTube more so now than ever (Asma,et al, 2023).

Challenges in Developing Assessment Competencies

Pre-service teachers encounter a number of barriers in developing assessment literacy in the age of digital technologies. Such constrained exposure to higher-order technologies, lack of training in digital assessing tools, and disinterest in adopting new practices may indeed inhibit skill growth. Learning is also hindered by institutional constraints, lack of mentoring and limited practical experience. Meeting these challenges will necessitate teacher education programs infusing digital literacy frameworks and affording opportunities for student teachers to experience assessment technologies (Ahmad et al., 2024).

Digital Literacy Frameworks for Teacher Education

Pre-service teachers follow these provided structures to use digital tools to build their assessment skills, such as designing online assessments, giving student's feedback, working with student data and promoting digital citizenship. Structured framework is claimed in the literature to increase teachers' confidence, efficacy and flexibility in technology-based assessment settings. Positive results have been reported in various studies on digital literacy frameworks integrated into teacher training. For instance, pre-service teachers who were prepared using e-portfolios and online assessment tools revised their ability to create assessments based on learning objectives (Ahmad et al., 2024). Digital literacy also resulted in more accurate readings of student performance data and better instruction. While the value of digital literacy is acknowledged, there are few papers dedicated to how a digital literacy framework can address assessment knowledge in pre-service teachers. Empirical evidence on the efficacy of such frameworks, the value of hands-on practice and the long-term impact on teacher performance is scarce. These considerations are waiting for empirical evidence and could serve as inspiration to take the teaching of digital literacy into account in the design of training programs.

Current models such as Digital Computer Education and TPACK are commonly applied to structure and evaluate pre-service teacher digital competence. Digital Computer Education highlights six competence areas: professional engagement, digital resources, teaching and learning, assessment, empowering learners and facilitating learners' digital competence. Although these models offer a systematic basis to define teacher digital competence, empirical studies suggest that the assessment dimension is frequently overlooked. Researcher carried out a research

in line with Digital Computer Education and identified that pre-service teachers were more competent in management of digital resources and teaching activities whereas they are less competent on assessment and empowering learners. Studying teacher digital competency profiles in different countries also reveals that assessment-related skills are often underdeveloped, suggesting a global challenge

of uneven development of pre-service teachers' digital competencies (Rani et al., 2024).

Training interventions for digital competence are spreading. The programs commonly include instruction in information and data literacy, communication and collaboration, digital content creation, safety, security and problem solving (Ahmad et al., 2024). Yet, these interventions often disregard assessment competences and instead place heavy emphasis on more general competences, which means that pre-service teachers are ill-equipped for the design and supervision of digital assessments as well as providing valid feedback. These findings suggest that targeted efforts are required to develop assessment-related digital competencies across teacher education programs (Manzoor, et al, 2024).

The literature still presents major gaps in research done on teacher's digital competences and their evaluation practices. Although models like Digital Computer Education and TPACK consider assessment as a dimension, they are general indicative frameworks which do not specifically guide the development of pre-service teachers' teaching related digital skills about assessment. The majority of previous research has been on generic digital literacy or simply technical skills not specifically applying this knowledge in relation to the assessment process, such as when designing assessments, providing feedback and developing learner autonomy (Dastgir,et al, 2024). Studies using empiricism implement self-reporting data that may not truly reflect true competence. The need for performance-based assessments that can measure pre-service teacher's digital assessment design, implementation and analysis in real teaching situations has been identified as short. Additionally, research from high-resource settings overwhelmingly pre dominates the literature and there remains a void in place/context specific research particularly from developing countries with perhaps limited digital infrastructure as well as distinct issues related to the adoption of digital assessment. Lastly, there is a lack of studies on the establishment of the inclusion of assessment-specific DC in pre-service teacher training programs in a systematic and organized manner and its practical applicability for practitioners (Hussain,et al, 2024).

The study will reduce these gaps by creating a unique model for assessing competencies in pre-service teachers. The purpose of this framework is to offer guidance and show how best to design, deliver and evaluate assessments with digital technologies. It is concerned with skills such as assessment, which have been overlooked in the past, and emphasizes 'real world' applicability alongside conceptual understanding. Moreover, the study will suggest ways of incorporating such a framework in teacher training and thus narrow the chasm between what are theoretical competence frameworks and what is happening in real classrooms. By offering context-based advice, in particular for developing nations such as Pakistan,

the work seeks to improve readiness of pre-service teachers for overall technology rich learning environment (Tufail et al., 2024).

Theoretical Framework

Theoretical tools will be used for the development of the proposed framework which are based on a novel combination of techniques. The main theoretical underpinning is the Digital Computer Education framework, which defines six areas of digital competence, including assessment. Digital Computer Education conceptualizes digital competence not only as technical skills, but also as pedagogical, ethical and professional practices which is very relevant for a study that focuses on assessment (Hussain,et al, 2024). The TPACK (Technological Pedagogical Content Knowledge) framework will be employed to demonstrate that digital examination proficiency is integrated into pedagogical and content knowledge. Then TPACK also draws attention to the overlap between technology, pedagogy and content by stressing that effective use of digital assessment tools can extend beyond technical competence requirement since it should be in line with learning goals and pedagogical grounding (Shafiq Ch, Zaman, 2024). Lastly, the research works with the Holistic Digital Competence Theory for Teachers which broadens digital competence to include ethical understanding, data knowledge, digital citizenship, online collaboration and professional participation. It also is consistent with the position that one's level of skill in assessment using digital tools is multi-faceted and includes: not just a procedural knowledge of the use of digital tools, but also pedagogical, organizational, ethical and professional dimensions. There was discussion on other approaches, such as ICT competency frameworks or pure pedagogical models, but these both do not focus on assessment of learning and don't allow us to draw the lecturers' attention to a specific challenge Digital Learning Environment. Connecting Digital Computer Education, TPACK and holistic digital competence theory is meant to create a strong framework for building assessment competencies for pre-service teachers able to be enacted in different contextual settings (Sardar,et al, 2023).

It is evident from the literature that pre-service teachers need to acquire digital competence, in order to be able to teach effectively in today's educational systems. Valuable guidance may be found in existing methods and frameworks; however, evaluation is underdeveloped theoretically and practically. Research findings demonstrate an uneven digital competence among pre-service teachers (PSTs), with their general digital skills being higher than those related to assessment. Digital competence interventions frequently overlook assessment competencies or do not use performance-based assessments of competence (Kanwal,et al, 2023). Moreover, there are few context-specific adaptations of models and frameworks, leaving pre-service teachers in developing countries ill-equipped to address issues related to computer-based assessment. The current project aims to address this need by creating a theoretically-informed context-

sensitive and tailor-made framework for the development of AEs' assessment competences. In addressing a neglected area in literature on digital competences the study contributes both theoretically and practically to teacher education by providing insights into the design of curriculum formations, training interventions and policy consequences for digital learning settings (Ali & Rukhsana, 2023).

Research Methodology

Research Design

This qualitative research sought to produce a framework for evaluation competencies of pre-service teachers using digital literacies. A qualitative design was adopted, as it enabled a focused examination of current practices and attitudes towards or experiences with digital assessment in teacher education. Unlike quantitative approaches, qualitative research generates rich and contextually sensitive data about complex phenomena, which is particularly applicable to an understanding of subtle skills and competencies pre-service teachers need. The design of the study, which utilized semi-structured interviews, allowed a depth of information to be obtained and shaped the approach of work on the suggested framework.

Setting of the Study

The research was carried out in the Department of Education, University of Narowal (Pakistan). This faculty was chosen because it has pre-service teacher education program and integrates digital media in its curriculum. The hybrid environment presented opportunities to access curriculum documentations and staff expertise which was vital for revealing existing digital literacies practices and competencies on assessment (Asma,et al, 2023).

Population and Sample

The participant population for this study consisted of pre-service teachers studying in the programs of BS Education and M.Phil Education, and faculty members related with teacher training and curriculum development. A purposive sampling method was used and selected the participants who had prior experience in digital assessment tools and teacher education programs. The study used sampling strategy and included 25 pre-service teachers and also the five members of faculty. This provided a balance between learner and teacher experiences. The sample size was enough for qualitative analysis as data collection and thematic analysis was manageable (Khanum,et al 2023).

Data Sources and Collection

The researchers conducted semi-structured interviews with teachers as well as focus group discussions with pre-service teachers to obtain data. The tools helped reference their experiences, perceptions and challenges regarding digital assessment and competencies assessed in the study. The interview schedule had open-ended questions about participants' experience with digital assessment and use of digital instruments in teaching and assessment, as well as opinions on competencies needed for proper testing. Focus group discussions with pre-service teachers focused on their experience with digital assessment tools. Their confidence in using technology for assessment and recommendations to their own competencies were also considered (Khanum et al., 2023).

Data Analysis

The study involved thematic analysis of qualitative data derived from interviews and focus group discussions. The study data were recorded, classified into thematic categories, and applied to the study aims manually and word cloud software. Through coding the data, patterns in participant responses emerged that indicated the successes, needs and hurdles in constructing assessment literacy through digital literacies. The interview findings were checked for verification with word cloud software for framework development (Ahmad et al., 2023).

Limitations of the Methodology

The current study was a retrospective one from a single institution with small sample size, and differences may exist in terms of homogeneity. A qualitative source introduces the opportunity for researcher's bias in interpretation of participants 'responses. Besides, due to the time constraints the number of documents and participants were restricted. The method was suitable for the study purpose of constructing a context-sensitive framework for assessment competency, though some limitations would be necessary to point out(Zaman et al., 2023).

Ethical Considerations

The study was ethically approved by Education Department, University of Narowal. Individuals were provided with the description of the research, and consent was taken. Anonymity and confidentiality were pre-served; they could leave the study at any time.

Data Analysis and Findings

The data obtained from semi structured interviews with teacher educators, focus group discussions with pre-service teachers were analyzed by means of thematic

analysis (Braun & Clarke, 2006). The focus of the analysis was to determine competences associated with digital assessment, described in literature and in digital literacy frameworks (Digital Computer Education, TPACK and holistic digital competence theory) needed by pre-service teachers. The coded responses were collapsed into patterns, which expanded to themes and sub-themes.:

RQ1-What essential digital-assessment competencies do pre-service teachers need according to current digital literacy frameworks and assessment literature?

Theme 1: Proficiency in Digital Assessment Design

Sub-theme 1.1: Understanding of Digital Assessment Tools

" Pre-service teachers want to be able to construct quizzes, polls and assignments using tools such as Google Forms, Kahoot or Moodle. They need to know how these tools work and how they are used."

Pre-service teacher PT3 added: "I am comfortable online designing lots of multiple choice questions but I struggle to figure out how to get some of the more complex types (peer review, e-portfolios) in there."

Sub-theme 1.2: Correspondence with Learner Goals

Skills also entail the capability of matching learning outcomes with digital assessments. Faculty member F2 mentioned: "Digital assessments must accurately assess what students are expected to learn increasingly underestimating pedagogy and transferring too much to the side of technology, because technology is only an instrument at the service of pedagogy, it has to be so should guide assessment." Emphasis analysis is supported by document analysis of course syllabuses where "alignment of assessment with curriculum objectives" was frequently found as a digital teaching module.

Theme 2: Digital Feedback Expertise of competence in digital feedback provision

Sub-theme 2.1: Feedback in a timely and positive manner

Participants emphasized the importance of supporting digital feedback and its prompt, unambiguous and actionable delivery by pre-service teachers. PT1 stated: *"When we turn in work online, getting feedback quickly helps me understand what I did wrong. As a future teacher, I need to learn how to use comments or digital rubrics."*

Faculty F3 added: *"It is not just about going in and fixing answers but providing that meaningful digital feedback. Teachers can use Edmodo or Google Classroom to get students reflect on what they write and work to improve"*

Sub-theme 2.2: Harnessing Digital Analytics for Feedback

A skill will be to evaluate student success by utilizing technology. According to F1, *"Pre-service teachers must know how to read the analytics given through online quizzes or learning management systems and adapt instruction accordingly in game-based learning."*

Theme 3: Competence in Supporting Learner Autonomy

Sub-theme 3.1: Empowering Learners through Digital Tools

Participants said assessment should not only measure learning but also enable students to regulate themselves. This was a comment made by PT5 - *"Digital assessments like self-check quizzes or interactive simulations allow learners to monitor their progress. Teachers must know how to enable this independence."*

Sub-theme 3.2: Ethical and Responsible Use of Digital Assessment

The professors highlighted the importance of ethics, privacy and fairness. According to F2, *"the teachers must ensure that the assessment data is confidential and secure. Also, the pre-service teachers must be familiar with the digital ethics of making use of online assessment tools."* Supporting document analysis from the university guided frowning towards the fact that they must comply with the essentials' ethics in carrying out the digital evaluation.

Theme 4: Competence in Integrating Pedagogical Knowledge with Digital Tools

Sub-theme 4.1: Pedagogically Sound Digital Assessments

They said that the use of technology alone does not suffice; the assessment design must be sound pedagogically. According to F4, "*it is insufficient to simply use digital tools while being a pre-service teacher. The pre-service teacher must assess learning that is meaningful, valid and reliable, content-related and pedagogical".*

Sub-theme 4.2: Adaptability and Innovation

Assessments must be adapted to meet the diverse learning needs of students. PT2 observed that *"some students perform better when assessed online through*

interactive simulations, others prefer a canned quiz. The key issue is about an understanding of learning preferences".

This skills set is a composite of inputs from the participants and the literature on digital literacies, which suggest that assessment in digital contexts requires technical skills and pedagogical knowledge. Pre-service teachers must possess a range of competencies which include technical competence, pedagogical content knowledge, feedback literacy, ethical responsibility and learner empowerment.

RQ2-How can a coherent framework be developed to define assessment competencies for pre-service teachers in a digital learning context?"

Theme 1: Integration of Digital Literacy and Pedagogical Knowledge

Sub-theme 1.1 Assessment aligned with learning objectives

Respondents stressed that any framework should closely align digital assessment competences with curriculum goals. Faculty member F1 stated*: "A framework should begin with well-defined learning outcomes. They need to be using digital tools in ways that are connected to what teachers expect students to be learning, and then assessment competencies should also be linked into all of that"* Pre-service teacher PT3 added: *"If we know the goal of the learning, we can select the right digital tool to assess that. We need a framework that will lead us from learning goals to type of assessment, step by step."*

Sub-theme 1.2: Integration of Teaching Philosophy

Teaching, faculty noted, should lead the use of digital. F2 mentioned: *"Digital literacy is not sufficient. And the pedagogical side needs to be woven through that as well, demonstrating how classroom practices support student-driven learning."*

Theme 2: Core Digital Assessment Competency Specifications

Sub-theme 2.1: Skill to Use Technical Roles and Digital Tools

Participants advised the framework should explicitly state the technical skills needed to work with digital platforms. PT1 explained: *"The framework needs to enumerate the foundational digital tools and capabilities in use, such as for creating online quizzes, interactive simulations or e-portfolios, so that pre-service teachers know specifically what they need to learn."* Faculty F3 added: *"The framework has a tangible aspect by identifying tools and competences. Teachers should be able to teach the skills they want rather than vague concepts of 'digital literacy.' "*

Sub Theme 2.2: Feedback and Data Interpretation Skills

The tool should focus on the capacity to give high quality digital feedback and interpret assessment results. F4 stated: *"Pre-service teachers should be supported in using analytics for interpreting the data upcoming from online assessments. The framework should set a standard for how to give relevant feedback and how teaching should change in response to data."*

Theme 3 Structured competence levels

Sub-theme 3.1: Progressive Competency Development

Participants emphasized that the framework should include different levels of mastery, which could range from beginner to advanced. F1 commented: *"A clear progression can help teachers transition from straightforward online tests to more sophisticated types of assessment practices, like peer review and self-regulated learning activities."* PT4 added: *"It's helpful if the framework lays out beginner, intermediate and advanced skill."* In this manner, pre-service teachers can develop their competencies incrementally.

Sub-theme 3.2: Infusion to Teacher Education Curriculum

Embedding the framework into existing courses for the practical and direct application of this was suggested by participants. F2 stated: *"The curriculum must be aligned with the framework. For any given course or practicum, a handful of competencies can be covered to allow teachers to progress by degrees."*

Theme 4: Emphasis on Ethical and Inclusive Practices

Sub-theme 4.1: Ethical Use of Digital Assessment Tools

Ethical issues were cited as key. F3 said: *"A framework has to have privacy and fairness and transparency. We want teachers to be aware of the ethical implications of digital assessment."*

Sub-theme 4.2: Participation in Online Testing

Participants underscored the importance of this framework leading teachers to develop assessments that are accessible by all students. PT2 mentioned: *"Digital tools may not unfairly disadvantage students served by schools with fewer resources or students with disabilities. These are issues the framework should cover."*

Theme 5: Practical Guidance and Support

Sub-theme 5.1: Examples and Templates

Faculty recommended that such a framework include practical tools, like templates and sample electronic assessments. F4 stated: *"Sample rubrics, quizzes, projects in the framework can assist pre-service teachers to try out concepts right away."*

Sub-theme 5.2: Continuous Professional Development

Respondents recommended that it must develop continual learning and adaptation. F1 commented: *"Digital tools evolve rapidly. The framework should support ongoing learning and reflection to ensure teachers continuously develop their knowledge."* Participants stressed that a learning framework needs to be explicit, organized and actionable around how to grow digital assessment competencies as pre-service teachers that also reflect pedagogical purposes. These results are consistent with current research on digital literacy frameworks and teacher assessment competencies. Overall, this suggests the need for a context-specific and comprehensive framework.

Theme 6: Curriculum Integration

Sub-theme 6.1: Embedding Digital Assessment Competencies in Courses

Participants stressed the need to incorporate assessment skills in a teacher education curriculum that currently lacks them. Faculty F1 stated: *"The framework should not be a plugin. That's something digital assessment skills will have to replace in all the other courses where we want students to learn them and practice learning them, along with the substantive content on which they're being evaluated."* Pre-service teacher PT3 added: *"It's good when assessment of digital skills is embedded into existing courses. So for example when we learn how to do lesson planning, we should also be learning how to create assessments using digital tools."*

Sub-theme 6.2: Linking Practicum Experiences

One of the suggestions from participants was to integrate classroom practicum with digital assessment training. F2 mentioned: *"Pre-service teachers should use digital testing during teaching practice. The model provides a focus for mentors and tutors to review these competencies in live classroom situations."*

Theme 7: Use of Technology and Resources

Sub-theme 7.1: Provision of Digital Tools and Platforms

If education is to take place properly then delegates emphasized that digital tools must be made available. *"Google Classrooms, Moodle and online quiz tools should be compatible with our devices,"* noted PT2." *If we do not have enough knowledge of these technologies, the framework will never work*." F1 added, *"Institutions must invest in technology infrastructure and resources for the real-time implementation of this framework.*

Subtheme 7.2: Simulated and Practice Settings

Participant suggested that we need to create safe practice spaces. PT5 remarked that "*doing a 'practice run' with digital assessments in the virtual classroom first, before using it with live children, would definitely help".* Simulation exercises can be incorporated in the framework.

Theme 8: Continuous Monitoring and Evaluation

Sub-theme 8.1: Feedback Mechanisms for Pre-Service Teachers

Rich feedback on digital assessment performance needs to be ensured as participants have highlighted. F2 stated: *"With regular auditing and positive feedback to make sure they follow the framework. Mentors are able to support pre-service teachers in enhancing their use of digital tools for assessment."*

Sub-theme 8.2 Assessment of Implementation of the Framework

Based on the framework, participants said there should be evaluation and fine-tuning. F3 added that *"institutions should assess whether the framework is delivering on its goals. The study of teacher practice, feedback quality, and student learning is important."*

Theme 9: Encouraging Reflective and Adaptive Practice

Sub-theme 9.1: Reflective Journals and Self-Assessment

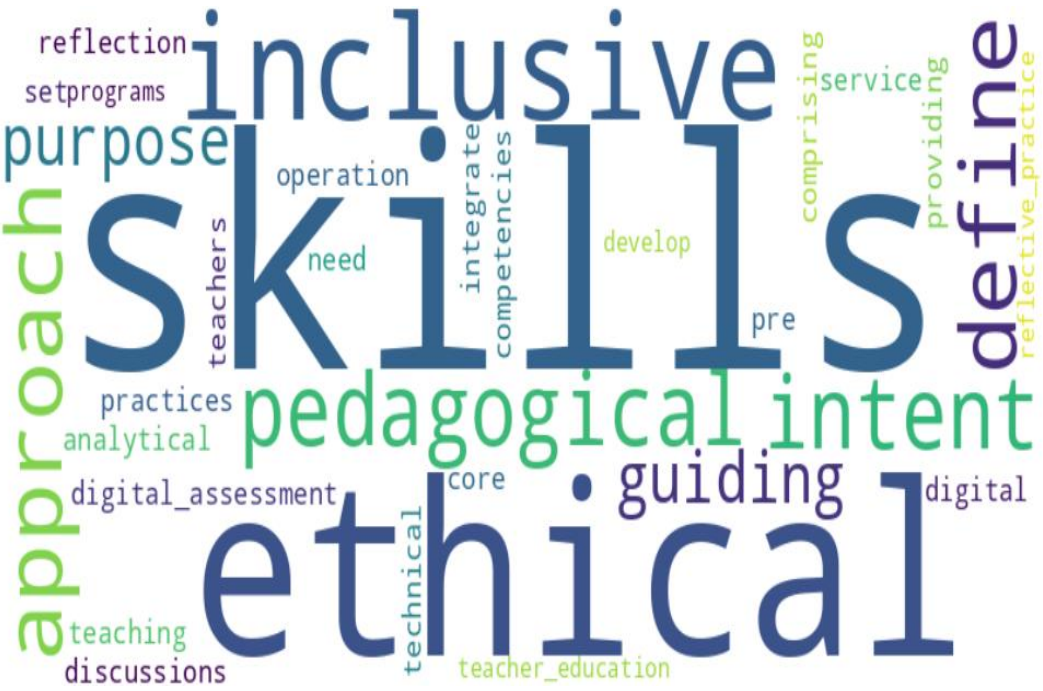
Respondents recommended reflective methods of learning reinforcement. PT1 stated: *"We could also keep reflective journals or portfolios on how we design and implement digital assessment. This promotes self-awareness and the urge to not stop yet."*

Sub-theme 9.2: Environmental and Innovative Practices

Participants believed flexibility is critical to implement the models concerning emergent technologies and learner diversity. Faculty members F4 stated: *"the pre-service teachers should be enabled to try new tools and methods that conform to emergent technologies and learning learner diversity"*. One participant said, *"doing and evidence of faculty readiness and ongoing support is imperative for the successful implementation of the model in TEPs"*. These approaches are also in agreement with reports in the literature for teacher competencies within digital literacy and assessment.

After performing a thematic analysis, the investigator collated his step by step findings to create a conceptual model. The Word Cloud software was also used to visualize and cluster these insights appropriately figure 1 represent the word cloud pedagogical and technical concepts. Through introducing the themes (and sub-themes) obtained from data into software, such program identified the most frequent and significant ideas emerging from our findings. Such a process enabled the researcher to determine essential components, interrelationship and patterns across the findings. They clearly visualized the framework, which they are able to conceive how unit of its element is correlated with the model. The usage of Word Cloud also enabled us to convert qualitative results into a human cogent and visually structured form for more analysis and discussion directly.

Figure 1: Word Cloud of Pedagogical and Technical Concepts



Digital-Pedagogical Assessment Competency (DPAC) Framework

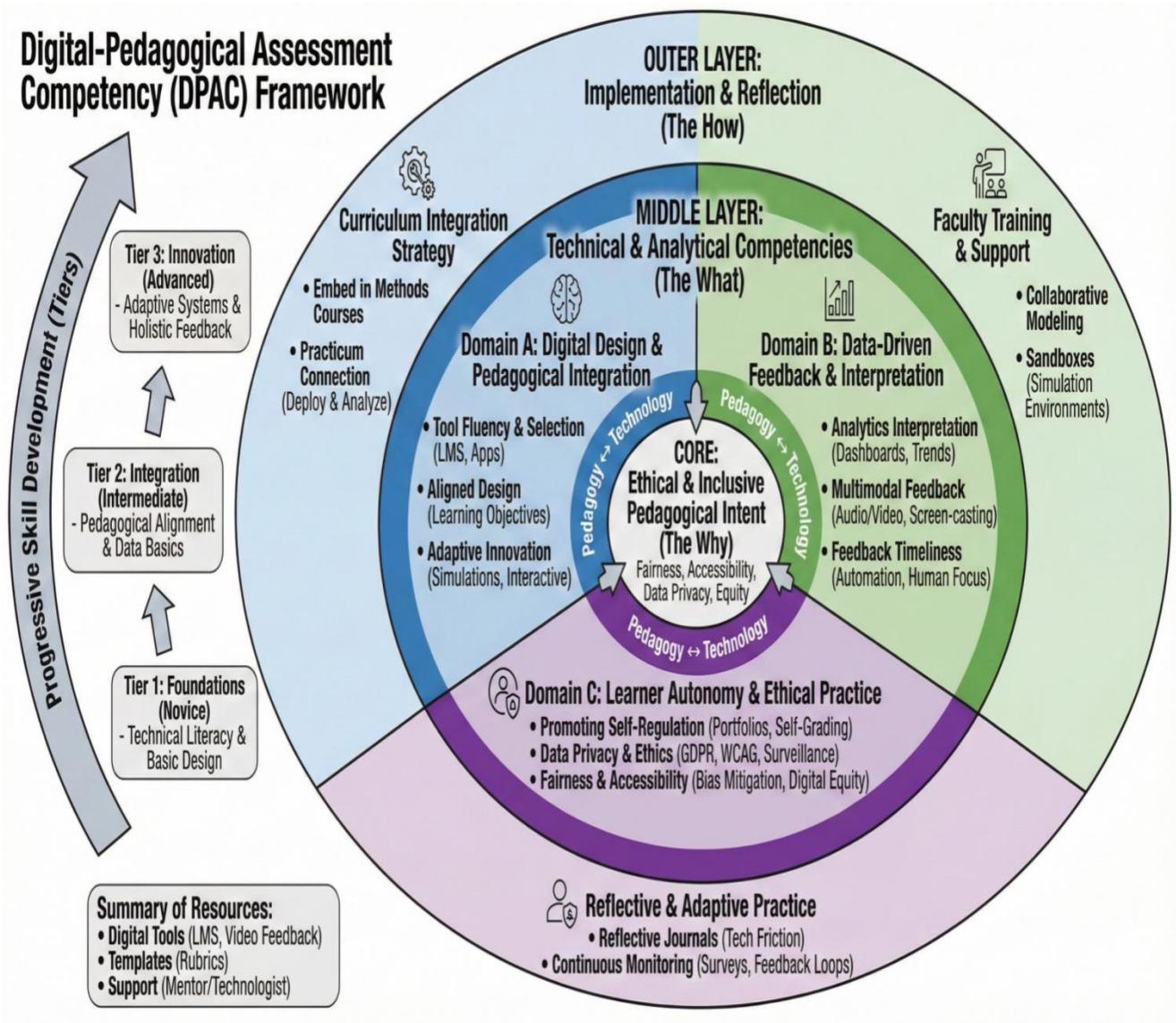
The DPAC (Digital-Pedagogical Assessment Competency) Framework has been constructed on the basis of thematic analyses of qualitative data from semi-structured interviews with teachers and focus group discussions with pre-service teachers. The framework aims to scaffold pre-service teacher assessment literacy development, moving them from technical digital literacies towards pedagogical assessment reasoning. The DPAC Framework underscores the blending of digital tools and pedagogical strategies to prepare pre-service teachers to develop, use, analyze, and reflect on assessments in digital learning spaces responsibly.

Conceptual Overview of DPAC Framework

The DPAC Framework consists of concentric models which are interconnected by pedagogy, technology and ethics.
1) The guiding purpose of (digital) assessment practices is the Why (the Why). It is a pedagogical Intent that is Ethical and Inclusive.
2) The technical and analytical skills are the core set of DT skills the pre-service teachers must have.

3) The outer layer which is the 'how' has operational planning and talking on how you can implement these competences for teacher education programs and developing a reflective practice.

Figure1: Digital Pedagogical Assessment Competency (DPAC) Framework



The framework envisions a concentric model that stresses the integrated levels of teaching competencies. The foundational reasoning for assessment is Ethical and Inclusive Pedagogical Intent (EIPI). The essence of the core is that equity, security

of privacy data, inclusivity related aspects and making ethical decision-making must be taken into account in the design and use of digital assessments. The middle layer of TACTs stands for Technical and Analytical Competencies which are deemed as crucial competences that pre-service teachers need to develop to apply DA. Finally, the most outward and visible layer of this model, Implementation and Reflection, considers how teacher education programs can help pre-service teachers develop opportunities to practice these competencies through integrated curriculum, mentorship support from faculty, reflective exercises, and ongoing assessment. The concentric model shows that all practice activities are grounded in ethical concerns, ethical intent is converted into effective practice through technical competence, and a well-supported program environment facilitates the development of competencies (Hussain,et al, 2024).

Phase 1: Key Competency Domains and Sub-Competencies

The DPAC Framework structures the assessment competencies around three broad domains, each consisting of specific sub-competencies related to practical activities. The first domain, Digital Design and Pedagogical Integration centers on the pre-service teacher's skills to design assessments that are valid and instructionally useful. Such domain focuses on tool fluency and selection to allow teachers to choose suitable platforms (e.g., Google Forms, Kahoot or Moodle) according to particular learning goals and assessment activities. Both faculty and pre-service teachers emphasized the importance of understanding the technical features of these tools in order to design effective assessments. The second sub competency, aligned design, aims to prevent digital assessments from evoking unintended competencies through distracting non-target features (e.g., aesthetics). For example, alignment of digital learning tasks to Bloom's taxonomy can also be achieved by mapping assessment items in the system the mapped to Bloom's Taxonomy. Lastly, adaptive innovation allows teachers to create types of assessment that wouldn't be possible within a traditional paper format: interactive simulations or branching scenarios that change their focus according to different student answers, for example, ensuring engagement and higher-order thinking (Ahmad et al., 2024).

The second area, Data-Driven Feedback and Interpretation is directed at college of education students' capacity to interpret assessment data, as well articulate results in a way that will contribute to learning. The interpretation of analytics allows teachers to read dashboards, follow student progress and isolate at-risk learners. Faculty stressed that teachers who know their students' time on task, types of quiz attempts, participation rates can intervene preventatively. The sub-competency multimodal-feedback is not limited to text, it enables pre-service teachers to give feedback in audio, video or screencast format that brings nuance and helps the learner with understanding. Moreover, giving feedback promptly helps to make sure that low level skills are provided with instantaneous remediation

by automatic tools so that a teacher can provide feedback for more complex, personalized instruction is delivered and to do so without sacrificing efficiency for effectiveness.

The third area, Learner Autonomy and Ethical Practice: Empower and Foster Ethics in the Learner is Culture-Lead, encourages learner empowerment based on ethical and inclusive norms. The promotion of self-regulation includes creating assessments that allow students to track their own learning such as electronic portfolios and self-assessment rubrics. Privacy and ethics We are educators, so student privacy and ethical considerations are important (e.g., pre-service teachers should be able to know about laws like the GDPR and FERPA, as well as some of the underlying issues related to surveillance or proctoring tools. The sentiments of fairness and access also indicate the importance of addressing bias in algorithmic grading, provide access for students who are disabled, and design assessment that is appropriate to low-bandwidth conditions or reliance on assistive technologies as demonstrating a commitment to inclusive education.

Phase 2: Structured Progression of Skills

In order to enable effective competencies building, the DPAC Framework uses a staged progression from beginner/intermediate to advanced. In Tier 1 (Foundations/Novice), the focus is on technical literacy and basic design, so that pre-service teachers are able to transcribe paper-based quizzes into a digital format and have an awareness of privacy basics. Tier 2 (Integration/Intermediate) where integration of the pedagogy occurs in conjunction with basic data analysis skills; interpreting pre-determined sample datasets, and establishing formative assessment loops with several digital tools. Tier 3 (Innovation/Advanced) focuses on adaptive assessment systems, and all-round feedback via pre-service teachers' design of semester-long assessment plans, use of interactive simulations, and evaluation of the practice in class with action research. The tiered format encourages structured, sequenced and progressive competency development.

Phase 3: Implementation Strategies for Teacher Education Programs

There is a need to adopt multi-level strategies in teacher education institutes, for the effective roll out of DPAC Framework. Curriculum integration stresses the need to embed digital assessment capabilities into, rather than teach them separate from, the methodology course base. For instance, pre-service teachers can develop digital assessment creation skills as they study content-specific pedagogy within "Math Methods" or "Literacy Methods" courses. The integration of these competencies and practicum can provide student-teachers with opportunity to use digital assessment skills in the real classroom context within a secure area where experiential learning is safeguarded. Faculty preparation is equally critical. The framework advocates for faculty to do modeling collaboration, demonstrating

competencies they expect pre-service teachers to obtain through their own use of digital tools for teaching and assessing. (Patient safety during the early learning phase is preserved through simulation environments or 'sandboxes,' where pre-service teachers can practice grading, feedback and analytics interpretation without the cost of real students.) Reflective and tailored practice also promotes reflective journaling, portfolio capturing, and self-assessment performances as part of professional development and responsiveness to technology-enhanced pedagogical challenges. Ongoing assessment via surveys and performance reviews are in place to ensure the competencies of the three domains are being developed and retained.

1. **Conceptual Visualization**: The DPAC Framework is conceptually illustrated as a cycle of concentric circles with bidirectional arrows connecting pedagogy and technology. At the center of it all is a central 'core' layer, your ethical and inclusive practice. The core capability dimensions are depicted within middle-most layer - digital design, feedback interpretation, and learner autonomy. The outer circle reflects programmatic supports, such as faculty development, curriculum integration, and resource availability. The two-way arrows on each side indicate that both pedagogy and technology interact with, as well as inform and are informed by, one another and not in a static, linear manner but rather iteratively contingent.
2. **Resources Required:** The framework is based on access to digital platforms, including LMS sandbox video feedback tools (e.g., Flip and Loom), or software for data visualization. You should use the word count feature before your submission to avoid this. A digital mentor, or technology instructor in residence, can assist teaching staff and pre-service teachers to embed and sustain practice.
3. **Academic Implications:** The DPAC Framework is a well-structured, evidence-based framework that can help develop pre-service teachers' assessment competences in digital learning environments. In this way, technical skill more openly gets associated with knowledge of teaching, ethical behavior and reflection strategies in digital assessment. It connects with modern studies of frameworks of digital literacy and teacher competencies. An educational researcher recommends a Teacher Education Institutes that prepares teachers in digital competence and ethical conduct and can deal with contemporary challenges of the classroom.

Discussion

The findings of this work contribute valuable information to the construction of pre-service teachers' assessment abilities in the context of digital literacy. The thematic analysis was driven by the research aims and yielded core domains and sub-competencies for competent digital assessment practice. Summary and

Implications The preceding sections integrate the results regarding our existing literature, theoretical frame, and for teacher education programs.

Digital Assessment Competencies in Pre-Service Teachers

The first research goal was to unpack which digital-assessment competencies are crucial for pre-service teachers, based on the previously reviewed digital literacy frameworks and assessment studies. Four key skills were identified by the analysis of data: designing digital assessments; giving digital feedback; supporting learner autonomy and integrating pedagogy with technology. The ability to develop digital assessments was identified as a baseline skill. Faculty members and pre-service teachers indicated the significance of digital tool awareness and compatibility with learning objectives. The results are consistent with findings from DigCompEdu indicating that teachers should make efficient use of digital tools in accordance with pedagogical objectives. Participants identified challenges in developing more advanced assessments (e.g., peer review, e-portfolios, interactive simulations) and a lack of formal training to support the use of advanced digital assessment methods..This confirms technical mastery in and of itself is not adequate; pre-service teachers need to comprehend how digital tools mediate pedagogic intentions into effective inputs for assessment, conception of pedagogical content knowledge and its alignment with TPACK. Digital feedback was reported to be just as important. Subject emphasized timely, positive and multimodal feedback. This is in line with the existing literature which suggests that good feedback between digital contexts helps learner not only to get instruction but to reflect and improve learning (Zaman, et al., 2023). The significance of data literacy as a competency for teachers to assess student learning was confirmed by digital analysis. The findings increase the conceptual assumptions of holistic digital competence since they consider the integration of feedback literacy and the analysis of data into initial training.

According to the author, assessment can promote learner autonomy and integrity, as it engages learners while being judicious and confidential. Experts also highlighted the need for assessments that bolster self-regulation, ethics, and access. The holistic digital competence framework emphasizes the necessity for ethical decision making, case scenario handling and the capability to deal with privacy and data protection issues and inclusivity in online learning environments (Hussain,et al, 2023). Finally, teaching with technology requires developing assessments that are digitally mediated, pedagogically sound and suitable for various classes of learners. People attending the meeting stated that assessments must take into consideration different learning styles and must be innovative, especially digital ones. This demonstrates motivation with respect to the theoretical principles underpinning social cognitive theory, in particular reciprocal causation amongst technological capacity pedagogical know-how and learner engagement (Hussain et al., 2023).

1) **Development of a Coherent Framework:** The aim of the second research objective developed the soundness of the structure that describes the pre-service teachers' assessment ability. The DPAC Framework developed from thematic analysis. This presents as a cogent layered framework including ethical purpose. Capability with technical aspects and analytic approaches and the ability to plan for practice change. This framework is based on ethical and inclusive pedagogical intent, and it resonates with emerging data concerning fairness, accessibility, and privacy. Evaluation skills ought to come from educational principles and that should not be merely a technical skill. Skills such as tool fluency, feedback reading and analytics application are operationalized in the second tier of technical/analytical competencies. By spanning novices through to advanced digital assessment users, the iterative progression of skill development constructs an organized pathway for PSTs, Responding to their literature review concerns in relation delivered fragmented or ad hoc digital assessment training (Zaman et al, 2023).The implementation and introspecting outer layer ensures that teacher preparation stakeholders will model, assign to curriculum and field experiences the skill set in aiding teacher candidates to be competent professionals. Implementable ideas for change included integrating digital assessment in the methods course (within curricular, not adjunct, silos), tying competencies to practicum and internships, offering some sandboxes within which practice is safe against punitive consequences, and encouraging reflective journals. The approaches are consistent with the theory of experiential learning which suggests that learning comes from engaging and reflecting on experiences, making it possible for effects to be transferred to real classroom situations.
2) **Practical Strategies and Implications:** The third research aim addressed the implementation issues of the assessment-competency framework in practice. Five interrelated approaches were identified: curriculum integration, faculty development and support, technology and resource availability, continuous assessment and reflective-practice participation. Incising digital assessment skills into learning area courses by subject-area expert teacher's means that pre-service teachers are exposed to how to design assessments at the same time as they acquire content knowledge. Faculty modeling and professional development support the recursive nature of learning, as pre-service teachers need help to engage with changing digital tools. The framework is premised on the value of reflective practice to provide a mechanism for teachers to change and create meanings, with implications that are supported by social cognitive theory where self-efficacy and reflective observation have been identified as mediating factors in skills acquisition (Hussain,et al, 2024). The focus on ethical and inclusive practices in the framework covers an important research gap identified by previous literature related to both morality of digital assessment (i.e., lack of guidance for fair digital assessment) and ethical questions specifically related to online contexts. Importantly, through the incorporation of exemplars and templates with simulated environments, the DPAC Framework also provides practical steps that teacher preparation

providers can implement now to ensure assessment competencies are theoretically anchored and practically manageable.

3) **Integration with Theoretical Framework:** The DPAC Framework is a conceptualization that draws on TPACK, DigCompEdu and holistic digital competence theories to understand how digital literacy, pedagogical knowledge and assessment practice converge. The results affirm that sound digital assessment competencies require mastering a range of technical, pedagogical and professional skills, as expected from theory. Also, the framework implements this theory in a hierarchical tiered manner that enables the sequential development of skills, moving pre-service teacher from beginner to proficient competencies in a systematic way (Ahmad et al., 2024).
4) **Conclusion of Discussion:** It is apparent from this exchange that pre-service teachers will require multileveled competencies to design, implement, and interpret digital assessments. The DPAC Framework It has a comprehensive model linking theory to practice while respecting learning objectives, ethical grounding and pedagogy principles. It provides specific guidance for how to integrate digital literacy and assessment competencies, fulfilling a gap in the literature. The framework helps teacher education institutions develop the capacity of student-teachers to meet the demands of technological-enhanced teaching and learning through systematic training.

Conclusion

This research examined pre-service teachers' assessment literacy during the teacher preparation program. This study further investigates how the pre-service teachers develop understanding towards student-centered assessment and learning, utilizing digital texts. As per the objective of the study, the research seeks the core digital-assessment competency along with the development of a comprehensive framework and the suggestion of practical strategies for its integration into teacher-training programs. Data were acquired through the semi-structured interviews of the academics, FGDs with student-teachers and document analysis which were thematically analyzed and subsequently led to the formulation of a Digital Pedagogical Assessment Competency (DPAC) Framework. The results highlight that pre-service teachers need multi-dimensional skills when working in digitalized educational environments today. Four broad themes were established: “designing digital assessment,” “delivering digital feedback,” “promoting learner autonomy,” and “reconciling pedagogy and technology. A set of sub-competencies in these areas, including the ability to use tools fluently, connect with learning objectives, interpret ‘analytics’ and provide critical feedback as well as ethical practice and learner empowerment were identified as essential. These observations support and further develop the existing theoretical implications such as those presented in DigCompEdu, TPACK, and holistic digital competence theory that effective assessment in digital environments will demand technical skills combined with pedagogical knowledge, ethical awareness, and reflective thinking (Manzoor, et al, 2023).

The DPAC Framework is a student-centered, practical model connecting theory and application. Ethical and inclusive pedagogical intent occupy the core, into which technical and analytical competences are layered, surrounded or encircled by implementation strategies and reflective practice. Progression from novice to expert. The framework supports progression through advancement of skills for pre-service teachers, ensuring proficiency in basic digital skills as well as deeper assessment strategies. Throughout the text there is also a strong focus on practical strategies for teacher education programs including institutional implementation of competencies into curriculum courses and involvement within practicum experiences, faculty training, as well as provision of digital tools, simulation environments, and reflective practices (Ahmad et al., 2024).

According to social cognitive theory, the research theoretically confirms mutual influence that pre-service teachers' competencies grow through a relationship between their personal capacities, pedagogical knowledge and the digital tools used in teacher training. The model embodies elements of TPACK and holistic digital competence theory, which suggests that assessment expertise, is effective when technology, pedagogy and ethics are holistically integrated. The investigation shows that the application of the DPAC Framework in assessment results in greater achievement by pre-service teachers and, by extension, their pupils and can be the basis of research. Longitudinal studies could explore the sustainability of competence development over time and other dimensions like cross-cultural adaptability, advanced intelligence analytics, as well as AI visualization tools. This framework would further validate the overall framework as well as strong confidence for policy infusion in teacher education programs. According to the study, the creation of a culture of assessment among pre-service teachers through digital literacy framework can prepare them to proactively tackle various contemporary educational challenges. Notwithstanding the practical and theory-driven nature with an integration of technical expertise, pedagogical fit, ethical consideration and reflective practice the DPAC Framework holistically. This could be beneficial for teacher prep programs, student-centric assessment methods, and student learning in online environments.

Recommendations

Here are five big career tips from your work on "Developing Assessment Competencies in Pre-Service Teachers through Digital Literacy Frameworks."

1) Digital assessment skills should be integrated across a teacher education program and not delivered discretely. Practicum experiences should be associated with specific competencies in order for pre-service students to

practice skills within actual classroom settings as they relate to learning outcomes.

2) Offer continuous training to teacher educators to improve their skills in digital assessment and pedagogy. Best practice and a drive to experiment with digital assessments in safety, requires faculty to be role models with access to training, peer learning and simulation capacity in this area of scholarship.
3) Provide access to different digital environments and resources, such as rubrics, sample assessments and data dashboards for pre-service teachers. The infrastructure should provide reasonable access, including low-bandwidth options and assistive technology to students in need.
4) Include training on ethical use of digital assessment resources, data privacy, fairness and inclusivity. Promote reflective pedagogies (e.g., journals, portfolios, self-assessment) in order to promote flexibility and innovation in teaching by respecting learner rights.
5) Establish feedbacks and e-valuations to monitor progress of pre-service teachers in digitally mediated assessment competencies. Ongoing monitoring of the effectiveness, small scale intervention projects (action research approach) and practicality of use will guarantee development and relevancy.

These guidelines center on curriculum and faculty readiness, resources, ethics of practice, and ongoing evaluation for programs looking to implement digital assessment competency development in their teacher preparation program.

References

A.Manzoor, N. Tufail, F. Z. (2024). Exploring the Impact of Four-Years BS Education Program on Teacher Preparedness and Classroom Performance: A Case Study of Narowal District. *Journal of Development and Social Sciences*, *5*(II). https://doi.org/10.47205/jdss.2024(5-ii)38

Ahmad, M., Hussain, S., & Ui, Z. A. (2024). Comparison Between Virtual Reality and Integrating Blended Learning Flipped Classroom Model: An Experiment on Secondary School Students. *International Research Journal of Management and Social Sciences*, *1*(1), 1–11. https://irjmss.com/index.php/irjmss/article/view/201

Ahmad, M., Hussain, S., Zaman, F.-U.-, & Qahar, A. (2023). Learning Outcomes by Integrating Blended Learning Flipped Classroom Model: An Experiment on Secondary School Students. *International Research Journal of Management and Social Sciences*, *4*(3), 566–578. https://doi.org/10.5281/zenodo.10725219

Ali, A., & Rukhsana, M. (2023). Effect of Experiential Learning on Academic Achievements of Students at Secondary Schools of Lahore. *Journal of Development and Social Sciences*, *4*(3).

Dastgeer Ghulam, F.Zaman, A. Q. (2024). Empowering Environmental Stewardship: Pedagogical Approaches for Integrating Green and Clean Land Practices in Educational institutions of Pakistan. *Pakistan Social Sciences Review*, *8*(I). https://doi.org/10.35484/pssr.2024(8-i)42

Dastgir, G., & Fakhar-Ul-Zaman, D. A. A. (2023). Unveiling the hidden curriculum: exploring the role of teachers in shaping values and moral lessons for students through the hidden curriculum beyond the classroom. *Jahan-e-Tahqeeq*, *6*(3), 516–524.

Zaman. (2023). Fostering Global Citizenship : A Qualitative Study on Civic Education for Pakistani Students on The Palestine- Israel Conflict Through Innovative Pedagogical Approaches. *International Research Journal of Management and Social Sciences*, *IV*(4), 217–234.

Zaman, Sarwar, M., & Ali, M. S. B. (2024). Holistic Development Of Novice Educators: Insights From The Seven Habits Of Highly Effective People. *Pakistan Journal of Education*, *41*(1), 19 44.http://ezproxy.uct.ac.za/login?url=https://www.proquest.com/scholarly-journals/holistic-development-novice-educators-insights/docview/3200059702/se-2?accountid=14500%0Ahttps://media.proquest.com/media/hms/PFT/1/mmwgc?_a=ChgyMDI1MDYwODExMDA1NjkzMjo0NjA3ODU

Haşlaman, T., Atman Uslu, N., & Mumcu, F. (2024). Development and in-depth investigation of pre-service teachers' digital competencies based on DigCompEdu: a case study. *Quality and Quantity*, *58*(1), 961–986. https://doi.org/10.1007/s11135-023-01674-z

Hussain, R. (2024). *Education in Public Schools Analyzing the Role of Teacher Training Programs on the Effectiveness of STEM Education in Public Schools*. *V*(2), 876–886.

Hussain, S. (2023). Why Quality of Education is Low at the Secondary Level in Pakistan : A Group Discussion. *Why Quality of Education Is Low at the Secondary Level in Pakistan: A Group Discussion Why*, *IV*(4), 190–205.

Hussain, S. (2024). TPACK and ICT, the new hope for Pakistan's education system: analysis of the perception of prospective teachers. *Internaional Rsearch Journal F Edcation and Innovation*, *V*(1), 28–38.

Hussain, S., Masood Ahmad, Fakhar Ul Zaman, & Altaf Ahmad. (2023). Comparative Study of Administrators' Supervisory Skills and Teachers' Pedagogical Skills Towards Quality Education in Public and Punjab Education Foundation Funded Schools at Secondary Level. *Journal of Education and Educational Development*, *10*(2), 329–347. https://doi.org/10.22555/joeed.v10i2.906

M.Kanwal, A.Manzoor, F.aman, C. (2023). Effect of Teacher Motivation and Effective Classroom Participation on Students ' Critical Thinking Skills. *Pakistan Languages and Humanities Review*, *7*(3).

Nasir, et, A. (2023). Examining the Role of Autonomous Learning Model in Promoting Student Centered Learning and Possible Obstacles to Implement Autonomous Learning in School Settings. *Pakistan Journal of Law, Analysis and Wisdom*, *9*(2), 356–363.

Nguyen, L. A. T., & Habók, A. (2024). Tools for assessing teacher digital literacy: a review. In *Journal of Computers in Education* (Vol. 11, Issue 1). Springer Berlin Heidelberg. https://doi.org/10.1007/s40692-022-00257-5

Peled, Y. (2021). Pre-service teacher's self-perception of digital literacy: The case of Israel. *Education and Information Technologies*, *26*(3), 2879–2896. https://doi.org/10.1007/s10639-020-10387-x

Prachagool, V., Nuangchalerm, P., & Yawongsa, P. (2022). Digital Literacy of Pre-service Teachers in the Period Time of COVID-19 Pandemic. *Journal of Educational Issues*, *8*(2), 347. https://doi.org/10.5296/jei.v8i2.20135

Rani, N., Dastgir, G., & Zaman, F. U. (2024). Effects of Classroom Environment on Students Learning at Elementary Level. *Journal of Development and Social Sciences*, *5*(2), 207–217. https://ojs.jdss.org.pk/journal/article/view/1047

Sardar, R. (2023). Effect of Motivational Techniques used by Departmental Heads on University Teachers ' Job Performance. *Pakistan Social Sciences Review*, *7*(3).

Shafiq Ch, Muhammad, Zaman, F. (2024). Teacher Preparation: A Holistic Framework for Equipping Future Educators with 21st Century Skills and Innovative Practices. *Hamdard Educus Revolutionizing*, *3*(1), 17–29. www.hamdardeducus.com

Tufail, N., Hayat, K., Manzoor, A. A., & Zaman, F. U. (2024). A Turning Point for Novice Educators of BS Education During Teaching Practice Activity by University of Narowal. *Journal of Education and Social Studies*, *5*(2), 214–228. https://doi.org/10.52223/jess.2024.5202

Zaman, F. U., Muhammad, S., Hussain, S., & ... (2023). Challenges and Risks for Higher Education Now and Beyond the 2030. *… Research Journal of …*, *IV*(3), 180–192. https://doi.org/10.5281/zenodo.10497841

Zaman, F. U., Ullah, T., & Waris, S. (2023). Factors Influence Female Teachers' Academic Competencies at the Secondary School Level. *Global Educational Studies Review*, *VIII*(II), 318–329. https://doi.org/10.31703/gesr.2023(viii-ii).29