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TEACHER TRAINING NEEDS FOR SKILL-BASED EDUCATION: A REVIEW OF COMPETENCIES, BARRIERS, AND PROFESSIONAL DEVELOPMENT GAPS

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Abstract

The resulting deep gap between employer requirements and student acquisition in terms of skills, and employers and students in terms of competencies, produces dire necessity in teacher training redesign. Educators are one of the key leverage points that can be developed to ensure the development of the most important 21st-century skills, such as critical thinking, collaboration, communication, and creativity, as well as digital literacy that determine the success of the workforce. However, the majority of teachers do not receive much training or professional development in skill-based pedagogy, competency models, or learning integration with technology in meaningful learning. This review analyzes the studies on skills-based education and workforce production teacher training requirements in 17+ peer-reviewed articles. The major findings have shown that: (1) The major majority of teachers lack the initial competencies needed to engage in skill-based education such as digital literacy, pedagogical innovation, and awareness of competency frameworks; (2) Teacher preparation programs and professional development are poorly equipped to focus on skill-based education, and the programs remain focused on content-based knowledge and traditional pedagogy; (3) Teachers feel substantial obstacles to innovation such as time scarcity, professional development, technological infrastructure, and institutional support; (4) Professional development is effective when it lasts longer, is based on job The review notes the following crucial areas of teacher training such as a reform-based curriculum redesign, active pedagogies, digital competence, knowledge of social-emotional learning and trauma-informed practice, system thinking and design thinking, and cultural competence and anti-racist practice development. The review draws a conclusion that skill-based education needs to be effective and it involves systemic transformation of teacher training such as reformed teacher preparation, long-term professional development, technological and infrastructural support, collaborative and learning time, and institutional cultures that embrace innovation and continuous improvement.

Keywords: Teacher Training, Skill-Based Education, Competencies, Barriers, Professional Development, Gaps

1. Introduction

The disparity between the work requirements and the preparation in learning institutions is huge and widening. It has always been the case with employers that graduates are short of crucial skills needed to succeed in the workplace such as critical thinking, problem-solving, teamwork, communication, and flexibility (Muhali, 2019). At the same time, still, most teachers stick to traditional pedagogies and focus on the content coverage and the passive delivery of knowledge instead of building more profound competencies and skills of application. This gap in both the expectations of the employer and the practice in education is indicative in large measure of poor teacher preparation and professional growth in skill-based education.

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Essential competencies depend critically on the leverage point of the teachers. Teacher knowledge, skills, attitudes and dispositions are very fundamental to the quality of pedagogy, classroom culture and student learning experiences. However, the majority of teachers are not well prepared or assisted in facilitation of skills development. Teacher preparation programs prioritize content knowledge, and traditional methods of instruction, and little focus on competency frameworks, active learning, design thinking, project-based learning, or integration of technology to gain meaningful learning (Snchez et al., 2020). The professional development programs are usually limited to single-subject areas and lacked follow-up and classroom practice.

This is a comprehensive review of studies that have found training requirements of teachers in skill-based education to prepare the students to succeed in the workforce. The review identifies: (1) the existing state of teacher competencies about the skill based education; (2) gaps in teacher training and development; (3) barriers that the teachers see in implementation of skill based education; (4) the nature of good professional development; (5) competencies the teachers need and (6) the systemic needs to change teacher training.

The review summarizes the research on 17 or more peer-reviewed studies that have studied teacher digital competence, effectiveness of professional development, technology integration barriers, competency-based education, vocational training, and workforce-readiness education. The review offers background to knowledge and responds to the key gaps in teacher training that inhibit the development of skills and preparation of the workforce.

Literature Search Strategy

The search was done through the search of peer-reviewed studies published between 2010 and 2022. Academic databases like Google Scholar, ERIC, and JSTOR were used as the main sources and the key search terms were teacher training, skill-based education, competency-based education, and barriers to skill-based education.

Inclusion and Exclusion Criteria

The studies were eligible provided that they were dedicated to the teacher training or professional development in the framework of the skill-based education. The studies that were reviewed in the specific case did talk about the competencies needed to teach skills based, the barriers to innovation and the strategies that would be able to help the professional develop effectively. Articles that were not related to formal education and those that were content based education and not skill development based were filtered out.

Study Selection Process

Following a preliminary search, duplicate articles and those that were not in line with the focus of the review were eliminated. The ultimate number of articles that were selected to present the best information with respect to teacher training needs, barriers, and effectiveness of the professional development programs was more than 45 peer-reviewed articles. The research was evaluated in terms of the results and input of the research to the established themes.

Synthesis of Findings

The chosen articles were grouped thematically into some major areas:

Digital Competence: Loopholes in the capacity of teachers to incorporate technology in teaching.

Pedagogical Innovation: The requirement of the training in active learning, project-based learning, and student-centered teaching methods.

Barriers to Skill-Based Education: Time, resources, and institutional support.

Professional Development: Best practices in teacher training, such as the necessity of long-term, in-job training, and working in groups.

The analyses were conducted to determine general trends, contradictions, and gaps in which teacher training is inadequate or requires additional training.

2. Current State of Teacher Competencies and Training

2.1 Digital Competence and Technology Integration

Digital competence Digital competence - the combination of technical skills, pedagogical knowledge and capacity to meaningfully incorporate technology in learning - is not yet sufficient among many teachers:

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Gaps in technical skills: Although most of the teachers possess only the basic knowledge of technology, large proportions do not know how to use productivity tools, learning management systems, or platforms to deliver online or blended learning (Snchez et al., 2020). The reason teachers complain of being unconfident with technology especially when technology is not limited to mere content delivery. Although technology became a necessity in pandemic distance learning, most educators did not have the skills to conduct successful online education (Snchez et al., 2020).

Pedagogical knowledge gaps: Teachers in most cases are not knowledgeable of how to incorporate technology in a meaningful way in learning. Integration of technology can occasionally include old wine in new bottles, i.e., technology as a way to present traditional material in traditional ways instead of using the specific capabilities of technology when it comes to active and collaborative learning, as well as to personalized learning (Istiningsih, 2022). The teachers need pedagogical information on when technology can be helpful in learning and when it creates a barrier.

The gap of techno-pedagogical competence: The studies of flipped learning prove the significant techno-pedagogical gaps in knowledge in teachers of how to teach through technology in a manner that may help students learn (Snchez et al., 2020). The teachers can be knowledgeable about the concept of flipped learning but may be lacking skills in applying it in practice. Such a divergence between the theory and practice speaks of not being trained and supported as a teacher.

Gaps in digital citizenship: The digital citizenship knowledge levels of many teachers are low with regard to digital citizenship, online safety, protection of privacy, or responsible use of technology (Aurangzeb et al., 2021; Snchez et al., 2020). The educators find it difficult to equip students to be responsible in their use of technology without having a clear example or training on how to do so.

Self-efficacy issues: The self-efficacy of teachers is the confidence that they have with technology which plays a major role in integrating technology. Studies show that a large number of teachers exhibit low self-efficacy towards the use of technology, and this restricts their desire to implement technology even after realizing its importance (Drossel and Eickelmann, 2017). Technical, but not confidence and self-efficacy-focused professional development can lead to a modest change in classroom.

2.2 Pedagogical Innovation and Active Learning

Other than technology, the teachers themselves are frequently not trained in pedagogies required to support skill-based learning:

Gaps in project-based learning: Project based learning is effective in cultivating skills of the 21st century, but many educators have no experience or training in PBL (Megayanti et al., 2020). The teachers are challenged in the design of meaningful projects, student autonomy, ambiguity, and demonstration of competence. Teachers will still stick to the old methods even when trying to do projects without a solid model and training of projects-based learning.

Cooperative and student-centered learning: In traditional teacher preparation the teacher centered, direct instruction is the focus. Student-centered active pedagogies that presuppose teachers facilitating, but not leading, are a substantial change that will demand considerable training (Snchez et al., 2020). Educators are not trained in how to handle student-centered learning, facilitate peer learning, or how to facilitate.

Design thinking and innovation Design thinking - systematic thinking on how to solve creative problems- Design thinking is not well known by most teachers. Although being accepted as a powerful approach to creating innovation and problem-solving, design thinking expects teachers to be aware of methodology and be capable of leading design processes (Avsec & Jagieo-Kowalczyk, 2021). These approaches are not widely trained to teachers.

Evaluation of competencies: Traditional evaluation focuses on knowledge measurement by way of assessment tests. Different methods are needed to evaluate such competencies as collaboration, creativity, or critical thinking, such as performance assessment, rubrics, portfolios, or observation (Shute and Rahimi, 2017). Most instructors have not been trained to use genuine assessment methods and as a result, they are unable to gauge or build more profound competencies.

2.3 Competency Framework Understanding

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The interpretation of competency frameworks of the 21st century is vital to competency-oriented learning:

Little framework knowledge: Not all teachers are aware of competency frameworks that define core skills- 4Cs (Critical thinking, Communication, Collaboration, Creativity) that are 21st-century skills, skills required in the workforce. Teachers do not know what competencies to build and how to purposefully cultivate them without knowing frameworks (Notanubun, 2019).

Misunderstanding of the meaning of skills: Although frameworks are in place, the vague definitions (or diverse definitions) introduce confusion. Different educators understand critical thinking in different ways, which constrains their understanding and uniform use (Septikasari and Frasandy, 2018). Educators need readily agreed definitions of competencies that promote common meaning and practice.

Integration with content: Teachers find it difficult to integrate competency development and content instruction. Instead of seeing competencies as independent of academic content, competencies can be effectively built by investigating content and applying it in the real world (Notanubun, 2019).

2.4 Social-Emotional Learning and Trauma-Informed Practice

SEL and trauma-informed practice continue to be poorly covered by teacher training but are becoming more well-known as critical to student development and learning:

Gaps in SEL knowledge: Although social-emotional learning covers such areas as emotional regulation, relationship, responsible decision-making, and self-awareness, most teachers are not trained in SEL. It is common to hear some teachers say that SEL is a burden to existing full curricular plans and that they do not comprehend the ways that SEL can be integrated in the instructional process (Muhali, 2019).

Trauma awareness gaps: A good portion of students have been found to have both learning and behavioral trauma. However, teachers usually do not receive education on the impact of trauma and trauma-informed practices or the ways to establish safe and supportive contexts among traumatized students (Masonbrink and Hurley, 2020). Teachers occasionally conceive symptoms of trauma as behavioral issues that need punishment instead of care that continues to cause harm.

Cultural competence gaps: Teachers are not usually trained in cultural competence, anti-racist, and culturally sustaining pedagogy. In the absence of these kinds of training, teachers might unintentionally promote biases, marginalize different viewpoints and make learning environments hostile to students belonging to marginalized groups (Sayer & Braun, 2020).

2.5 Vocational and Career-Focused Education

Vocational and career-technical educators are not always trained in the new areas or the combination of academic instruction with technical expertise:

Quick changes in fields: changes in most vocational fields (programming languages, manufacturing technologies, renewable energy systems) occur at an accelerated rate than teacher retraining. The problem is that teachers who are educated in outdated technologies find it hard to prepare students to work in the present-day workplace (Istiningsih, 2022).

Academic integration: Successful career-technical education incorporates academic writing and technical ability into one. Nevertheless, most vocational teachers do not have the background in academic content and academic teachers do not have vocational knowledge. Teamwork and unity presuppose the fact that neither of the two may be trained (Notanubun, 2019).

Employer engagement: Although the employer input on the workforce requirement has the potential to improve vocational preparation, most teachers do not have experience in engaging employers or learn about employer needs (Hardie et al., 2020). Lack of communication between schools and employers leads to the development of training not in line with the real demands of the workplace.

3. Teacher Preparation Program Gaps

3.1 Limited Attention to Skill-Based Education

The undergraduate teacher preparation programs normally concentrate on the content knowledge and conventional pedagogies having little emphasis on skill-based learning:

Content-based programs: In the majority of teacher preparation programs, the organization is around academic content areas (science, mathematics, language arts) without much focus on competencies or integration (Alizai

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et al., 2021; Snchez et al., 2020). Content courses focus on what to be taught and not how to build the competency of the students.

Inadequate courses in pedagogy: Pedagogy courses are courses that deal with teaching techniques, but usually focus on traditional, direct instruction, not active, student-centered pedagogies. The limited focus is on project-based learning, design thinking, and other strategies promoting the acquisition of skills (Notanubun, 2019).

Technology integration gaps: Technology has been growing more and more involved in teacher preparation, although it remains detached in many cases. Instructors can complete technology course and fail to learn how to use technology in content instruction (Snchez et al., 2020).

Limitations in field experiences: The field experience (mainly student teaching) is essentially a traditional classroom experience based on traditional pedagogies with a teacher. The pre-service teachers are exposed to minimal innovative and skill-centered methods, which restrict their models in teaching (Snchez et al., 2020).

3.2 Limited Preparation in Diverse Learners

Teacher training to serve diverse student populations: English learners and students with disabilities, low-income students, students representing disadvantaged racial/ethnic communities all: teachers continue to be insufficiently trained.

EL preparation gaps: Preparation gaps exist in the large number of teachers who are not trained to serve English learners even though they are growing in number (Sayer and Braun, 2020). Teachers usually do not know the language development process, strategies of scaffolding, or culturally sustaining pedagogy with ELs.

Education gap Special education: General education teachers usually do not have much special education training and fail to accommodate the included students with disabilities (Masonbrink & Hurley, 2020). The general education content and training of special educators on co-teaching may be problematic with regard to inclusive practice.

Creating cultural, race-free, and relevant pedagogy: The culturally sustaining pedagogy, anti-racist, and culturally relevant teaching are not taught substantively in most teacher preparation programs, yet research shows these methods improve engagement and learning among students in marginalized groups (Sayer and Braun, 2020).

Lacuna in equity focus: In spite of the fact that many teacher preparation programs do not focus on systemic inequities, educational racism, or intentional way to develop inclusive and equitable classrooms. In case of the lack of such preparation, teachers usually have to reproduce biases or marginalize some students (Sayer & Braun, 2020).

3.3 Limited Emphasis on Collaboration and Systems Thinking

Individual teacher practice in own classroom is generally a focus of teacher preparation:

Isolation focus: A lot of preparation is concerned with the effectiveness of individual teachers, and not with teacher collaboration, school improvement, or systemic thinking (Snchez et al., 2020). Educators complete their programs perceiving themselves as solitary professionals as opposed to being part of professional communities.

Poor leadership training: The majority of teacher preparation does not include leadership, managing change, and organizational dynamics that influence teaching (Gu et al., 2019). Educators have no clue on how to be a leader in schools or practice in different fields.

Weaknesses in systems thinking: Preparation has limited understanding of how individual practice is related to any structure, such as school, district, community, society (Gu et al., 2019). Teachers are known to think about problems as individual problems and not as systemic.

4. Professional Development Gaps and Inadequacies

4.1 Limited Time and Resources

Although professional development is seen as an important issue that is receiving more and more attention, it is usually not allocated enough time and resources:

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Little time investment: The majority of districts spend very little time (usually only a few days a year) on professional development. This is not adequate to significant learning, practice, and assimilation, especially on intricate subjects such as the project-based learning or social-emotional learning incorporation (Snchez et al., 2020).

One-shot workshops: Many professional development processes are based on one-time workshops or conferences, which introduce a topic without support, feedback, or application (Snchez et al., 2020). The studies have shown quite clearly that one-shot professional development brings minimal change to the classroom.

Funding constraints: Professional development funding usually is funded by discretionary budgets, first eliminated in time of economic stringency. Numerous districts are finding it difficult to finance meaningful professional development (Drossel & Eickelmann, 2017).

Release time barriers: Release time or substitute coverage is required to provide teachers with time to conduct meaningful professional development, which is a financial and logistical burden (Drossel & Eickelmann, 2017).

4.2 Disconnection from Classroom Practice

Professional development is usually not linked to the everyday work of the teachers:

Decontextualized, generic content: The content of professional development is frequently generic as it does not relate to the context of teachers, their grade levels, or subject areas, making it difficult to apply to a specific situation (Drossel & Eickelmann, 2017). Educators find it difficult to generalize in specific circumstances.

Poor follow-up support: The professional development events end without follow-up, feedback, and problem-solving, and the teachers will execute their responsibilities independently. This results in uneven application and ultimate relapse into the previous practices (Drossel & Eickelmann, 2017).

A lack of coaching and feedback: The studies show that job-based coaching that is followed by the classroom implementation can significantly improve the effectiveness of professional development, but only a small number of schools are coaching (Snchez et al., 2020).

Weak peer work: The professional development based on individual learning, not on collaborative learning among colleagues of schools restricts peer support and collective solving of problems (Gu et al., 2019).

4.3 Misalignment with School Goals and Contexts

Professional development in many cases is not tied to school improvement priorities:

Top-down imposition: The topics of professional development do not always correspond to the school needs or priorities but may as well portray state or district requirements. Erickion, adoption of professional development is minimized because teachers view it as irrelevant as mandated (Drossel and Eickelmann, 2017). Limited choice and voice: Teachers do not tend to have much voice in what they learn about professional development or how. This makes motivation and engagement lower than those professionals development teachers choose depending on personal priorities (Gu et al., 2019).

Different quality of implementation: Professional development even covering relevant issues differs significantly in quality. A poorly constructed professional development can even decrease the practice improvement (Drossel and Eickelmann, 2017).

5. Barriers Teachers Perceive to Skill-Based Education Implementation

5.1 Time Constraints

The lack of time has always been recognized by the teachers as an obstacle in attaining skill-based education:

Pressure on curriculum coverage: High-stakes testing accountability puts pressure to cover as much content as possible and as a result has little time to complete long-term or in-depth projects (Snchez et al., 2020). There is a conflict that teachers are caught between understanding and coverage.

Administrative tasks: The increase in administrative tasks and roles data entry, test preparation, record keeping, etc. take up teaching time and leave less time on the skill-based learning experiences (Drossel and Eickelmann, 2017).

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Time constraint in preparation: Teachers are short in time to prepare instruction. Meaningful projects need a lot of preparation, performance assessment design, or student-centered learning preparation puts a strain on limited preparation time (Snchez et al., 2020).

One job expanding into more than one: A lot of teachers find it hard to fit in skill-intensive pedagogy into already busy days. Project implementation, time of working together, and differentiation is time-consuming, building a perception of addition, but not integration (Gu et al., 2019).

5.2 Technology and Infrastructure Barriers

Although technology could help in education that is skill-focused, obstacles still exist:

Poor devices and connectivity: Several schools have inadequate devices and high-quality broadband connectivity among students. The deficient connectivity and shared devices make technology integration meaningful hard (Kim and Padilla, 2020).

Obsolete technology: Technology availed is frequently obsolete, faulty, or in disrepair, so irritating educators who are trying to implement meaningfully (Snchez et al., 2020).

No technical assistance: In case of technical issues, the lack of technical support also irritates teachers and does not allow them to use it further (Snchez et al., 2020).

Lack of infrastructure: Learning management systems, collaboration, or skill-based learning support applications might be missing or expensive (Snchez et al., 2020).

5.3 Assessment and Accountability Pressures

The conventional methods of accountability are incompatible with skill-based education:

Standardized testing interest: The high-stakes standardized testing accountability puts the schools under the influence of test preparation over building of skills. Standardized tests assess narrow skills (mostly factual knowledge, simple procedures) and give little information regarding the ability to perform such tasks as creativity or teamwork (Shute and Rahimi, 2017).

Challenges in skill assessment: Although the deployment of traditional tests is not that challenging, the evaluation of such competencies as critical thinking or collaboration is more complex and time-consuming. Such assessment is not trained in teachers and does not have time to do so (Snchez et al., 2020).

Urge towards quantifiable results: Accountability mechanisms require the results that can be readily measured. The development of skills, especially long-term outcomes and soft skills, cannot be easily measured, which imposes pressure on traditional assessment types in comparison to real assessment of the skill development (Shute & Rahimi, 2017).

5.4 Institutional and Cultural Barriers

Pedagogical innovation can be, in most instances, resisted by the culture of schools:

Tradition and conservatism: Schools can be perpetually conservative even when the evidence indicates otherwise. Teachers view innovation as something dangerous in contrast to the conventional practices (Gu et al., 2019).

Leadership obstacle: There are times when school leaders fail to comprehend and advocate skill-based education. Teachers find it difficult to implement innovations without the support of the leadership (Gu et al., 2019).

Peers resistance: Educators who seek innovation can be resisted by their peers, which inhibits social barriers to change (Gu et al., 2019).

Resource allocation priorities: Sometimes schools have priorities in resource allocation more towards traditional programs instead of funds towards innovation. The lack of resources makes innovation the personal task of teachers (Snchez et al., 2020).

6. Characteristics of Effective Professional Development

It has been found that there are features of good and bad professional development:

6.1 Duration and Sustained Engagement

Multiyear programs: Multi-year, as opposed to single-year events, of professional development creates changes in teacher practice and student outcomes of a greater scale (Snchez et al., 2020). It takes time before teachers acquire new competencies, practice, get feedback, and improve practice.

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Job-based continuous assistance: Professional development as part of ordinary work of teachers: during collaboration time, coaching, teacher learning communities, and so on brings more positive results than isolated professional development experiences (Aurangzeb et al., 2021; Drossel & Eickelmann, 2017).

Cumulative learning: Programs that develop cumulatively with subsequent learning building on the previous one and integration of new knowledge ensure superior results compared to separated workshops (Snchez et al., 2020).

6.2 Active Learning and Collaboration

Active participation: The effective professional development involves teachers as active learners first-hand experience of practices, interest in problems, cooperating with colleagues, and not passively receiving information (Drossel and Eickelmann, 2017).

Peer collaboration: Teachers An individual learning is less effective than professional development in which teachers engage in mutual learning, problem-solving, and refining their practice (Gu et al., 2019).

Observation and practice: Teachers enjoy the advantages of watching competent practitioners, trying new practices, getting feedback, and the practice refinement (Drossel and Eickelmann, 2017).

Learning communities: Teachers in professional learning communities/learners in lesson study groups that solve common problems exhibit greater practice change than do isolated teachers (Gu et al., 2019).

6.3 Alignment with Teacher Needs and Contexts

Voluntary nature: The teachers who select professional development topics according to their interests and needs are more engaged and implemented compared to those who have to attend compulsory sessions (Drossel and Eickelmann, 2017).

Context-specific: Professional development that targets specific grade of teachers, subject, and school context is more effective than the generic, decontextualized professional development (Snchez et al., 2020).

Problem based: Professional development that is structured around actual problems teachers have to solve includes issues with student discipline, low engagement, and confusion over content, creates a stronger engagement compared to an abstract theoretical content (Drossel and Eickelmann, 2017).

Choice and flexibility: In terms of the way teachers practice professional development, it will be recommended to provide options and flexibility which will enhance ownership and engagement (Gu et al., 2019).

6.4 Integration of Content, Pedagogy, and Practice

Subject specific: Pedagogy that focuses on how to teach specific material using skill-building strategies have been found to produce superior results compared to generic pedagogy (Snchez et al., 2020).

Modeling and demonstration: Exposure to effective practice by way of demonstration and feedback practice yields higher results than description alone (Drossel and Eickelmann, 2017).

Evidence and research: It allows professional development that links practices to research evidence and student outcome data, which enhances the confidence and commitment of teachers (Snchez et al., 2020).

Mechanisms of accountability: Teacher follow-up on implementation, student work or classroom observation review, helps maintain implementation (Drossel and Eickelmann, 2017).

6.5 Support from Leadership and Systems

Leadership support: The apparent support of school leaders on issues of professional development, such as their participation in it, enhances teacher involvement and enactment (Gu et al., 2019).

Resource allocation: The allocation of resources (time, funding, materials, technology) helping with implementation helps teachers to implement learning (Snchez et al., 2020).

Policy alignment: Policies that facilitate or at least do not hinder skill-based education such as flexibility in testing rules, the possibility to work on longer projects, etc. help in the process (Drossel & Eickelmann, 2017).

Sustainability planning: The long-term implementation is enhanced by planning to sustain the support after the initial development of the professionals (sustainable support and coaching, peer learning, and resources support, etc.) (Gu et al., 2019).

7. Essential Teacher Competencies for Skill-Based Education

7.1 Content Knowledge and Disciplinary Expertise

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Although content knowledge is still required, education founded on skills demands different relation to content:

Deep knowledge instead of breadth: Teachers need deep knowledge that would help them direct students in their inquiries to aid conceptual comprehension and use instead of memorization (Snchez et al., 2020).

Interdisciplinary relationships: Educators are expected to learn how the content in their discipline is related to other disciplines, which will allow the use of interdisciplinary projects to solve real-world problems (Megayanti et al., 2020).

Knowledge of application in the real world: Teachers must be familiar with the way of application of disciplinary knowledge in real life, careers, community issues, real-life phenomena through which they can be able to connect the abstract content and its real-life application (Hardie et al., 2020).

Emerging knowledge: Educators in fast-changing disciplines need systems that are abreast with new developments, be it in a process of continuous learning, employer alliances or professional associations (Istiningsih, 2022).

7.2 Pedagogical Content Knowledge and Skill-Based Pedagogy

Educators need to know how to impart material to teach skills:

Design and facilitation Project-based learning: Teachers ought to learn about components of designing meaningful projects that fulfill learning standards, provide students with inquiry and autonomy, deal with ambiguity, and evaluate competency demonstration (Megayanti et al., 2020).

Active learning facilitation: Educators are expected to be aware of various active, student-centered pedagogies, such as a discussion, collaborative problem-solving, peer teaching, and have higher-quality strategies to facilitate them (Snchez et al., 2020).

Demonstration of competencies: Teachers are expected to know how to create and conduct authentic tests that would measure such competencies as collaboration and creativity with the help of performance tasks, portfolios, rubrics, and observation (Shute and Rahimi, 2017).

Differentiation and personalization: Educators are expected to know how to customize their teaching to different learners with different needs, interests, and learning preferences to help all students gain competencies (Snchez et al., 2020).

Technological integration: Teachers must know how to effectively integrate technology in a way that promotes skill-based learning not merely by content delivery technology, but by using the distinct features of technology to collaborate with each other, create, and probe (Istiningsih, 2022).

7.3 Digital Competence and Pedagogical Technology Knowledge

Digital competence does not only include technical skills:

Technical: Teachers should be functionally competent with devices, applications, learning management systems, and other technology tools that they will work with in the classroom (Snchez et al., 2020).

Digital citizenship: The educators should be able to teach the concepts of online safety, privacy protection, cyberbullying, digital ethics, and responsible use of technology and students (Snchez et al., 2020).

Information literacy: The educationist must be capable of assessing the credibility of digital information, identify bias and misinformation, and impart them to students (Alkureishi et al., 2021).

Pedagogical technology knowledge (TPACK): Abduly, most importantly, teachers must have pedagogical technology knowledge, which is the knowledge of when, how, and why to use technology to achieve specific learning goals, based on the fact that technology facilitates some learning processes and imposes barriers on other learning processes (Istiningsih, 2022).

Skills in adaptive technology: Teachers should learn technology capabilities, but they need to be knowledgeable about technology capabilities in general and be able to acquire new tools quickly, since technology changes constantly (Snchez et al., 2020).

7.4 Social-Emotional and Cultural Competence

Educators need to be competent in social-emotional learning and culturally sustaining pedagogy:

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Social-emotional awareness: Educators must learn about social-emotional development, emotional regulation, relationship skills, and responsible decision-making and apply SEL to the entire instruction process (Muhali, 2019).

Trauma-informed practice: Teachers are expected to be aware of effects of trauma, know signs of trauma, prevent re-traumatization, and establish a supportive and safe environment (Masonbrink & Hurley, 2020).

Cultural competence: Teachers are required to be culturally aware and know various cultures, identities, and perspectives; be aware of their biases; and use culturally sustaining pedagogy that authenticate students and their home communities (Sayer and Braun, 2020).

Anti-racist practice: The teachers are expected to be able to recognize the structures and forms of racism, explore their own biases and socialization, and consciously overcome racism in the classroom and school (Sayer and Braun, 2020).

Community and family engagement: Teachers are to know how to cooperate with families and communities as resources, not issues, communicate respectfully, and capitalize on the strengths of a community (Sayer and Braun, 2020).

7.5 Systems and Design Thinking

Teachers need to know about systems and design strategies:

Systems thinking: It is learning to see how practice at the individual level is related to the larger systems, how the change in one area influences others, how to address problems systemically instead of individually (Gu et al., 2019).

Design thinking: Design process as a creative solution to problems that includes empathy of end-users, ideation, prototyping, iteration, and testing (Avsec & Jagieo-Kowalczyk, 2021).

Ecological insight: Comprehending the role of learning ecosystems in contexts including formal, informal learning, the experience of diverse learners and lifelong learning (Sangrà et al., 2019).

Change leadership: learning how to guide change in organizations, create buy-in, counter the resistance, and make innovations sustainable (Gu et al., 2019).

7.6 Metacognitive and Reflective Practice

Teachers also need the ability to continue learning and reflecting:

Reflective practice: Capability to practice reflection, to make diagnoses of what is functioning and what is not, what areas need growth, and modify practice in relation to this diagnosis (Snchez et al., 2020).

Action research: Participating in research and practice cycles, i.e. asking questions, gathering data, analyzing patterns, trying out changes, etc. - fostering ongoing improvement (Drossel & Eickelmann, 2017).

Professional learning: Accepting personal responsibility of continuous learning, determining what one needs to know, pursuing professional growth, and staying competent in dynamic areas (Snchez et al., 2020).

Metacognitive modeling: The instruction involves assisting students in metacognitive awareness by modeling their cognition, aiding the students in tracking their cognition, and enable the students to engage in self-directed learning (Notanubun, 2019).

8. Frameworks for Teacher Competency Development

8.1 Digital Competence Frameworks

There are a number of frames according to which digital competence is developed:

DigiCompEdu (Digital Competence Framework for Educators): The broad framework of educator dimensions of digital competence such as professional engagement, content creation, assessment, learner empowerment, and accessibility (Mezentceva et al., 2020). Framework gives shared language and format on how to develop competence.

TPACK (Technological Pedagogical Content Knowledge): Framework that acknowledges the knowledge of teachers has to incorporate technology, pedagogy and content knowledge. TPACK offers an organization that assists teachers to comprehend the way to meaningfully combine technology instead of treating it as distinct (Istiningsih, 2022).

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Frameworks that centre on pedagogical focus: Unlike previous frameworks that focus on technology in isolation, current frameworks focus on how technology can be used to address pedagogical and learning objectives. Such a change in the technology-specific to learning-specific orientation is a significant development (Mezentceva et al., 2020).

8.2 21st-Century Competency Frameworks for Teachers

Even teachers require 21 st century competencies:

4Cs to teachers: The teachers are expected to role model and build critical thinking, teamwork, communication, and creativity in their practice. Instructors who do not think critically, collaborate, communicate and model creativity have difficulties in developing these skills with the students (Notanubun, 2019).

Digital citizenship: Teachers ought to demonstrate the digital citizenship they are teaching, such as ethical use of technology, responsible use of technology, and modeling digital wisdom (Snchez et al., 2020).

On-going learning: Teachers are also expected to be constant learners who provide examples of inquiry, intellectual humility, and willingness to continually learn among the students (Snchez et al., 2020).

8.3 Competency Frameworks for Different Teacher Roles

There are varied emphasis on competencies in different teacher roles:

General education teachers: Are to possess competencies in a variety of approaches and a range of approaches that are based on skills and support of diverse learners, and depth in specific content areas (Snchez et al., 2020).

Special educators: They need the specific skills in assessment and differentiation, work with students with learning differences, and collaboration with general education (Masonbrink and Hurley, 2020).

Career-technical teachers: Demand existing knowledge on technical topics, employer interaction, and academic content in addition to technical competence (Istiningsih, 2022).

Teacher leaders: Leadership competencies such as facilitation, systems thinking, change management, and coaching should be in place (Gu et al., 2019).

9. Systemic Approaches to Teacher Training Transformation

9.1 Reforming Teacher Preparation Programs

Extensive transformation of teacher training considers a variety of factors:

Competency-based approach: Making teacher preparation focused on competencies that teachers must possess in order to teach skill-based education, diverse learners, and combine technology into their work, rather than credit-hours and courses (Snchez et al., 2020).

Skill-based Pedagogy: centralizing, but not peripheralizing, preparative skill-based pedagogy. Such pedagogy has to be practiced by the pre-service teachers during the preparation period, which prepares them to use it (Snchez et al., 2020).

Various learner focus: Significantly widening the preparations about supporting English learners, students with disabilities, students of different cultural background and other diverse learners (Sayer and Braun, 2020).

Technology integration: Embarking on the integration of technology across the preparation and not in different courses. Technology must be an implementer of pedagogical objectives, exemplified and utilized during the preparation (Snchez et al., 2020).

Field experiences in a variety of settings: Field experiences and diversity in settings must involve a variety of schools with a variety of students and using a variety of pedagogical practices, not just traditional (Gu et al., 2019).

Clinical practice requirements: Significant student teaching under the guidance of advanced-level mentor teachers who demonstrate skill-based education and not just traditional teaching that is content-based (Snchez et al., 2020).

Coherence of the programs: Teacher preparation programs should be coherent, have all parts of the program focused on the central vision and competencies and not fragmented courses (Snchez et al., 2020).

9.2 Comprehensive Professional Development Systems

Instead of ad-hoc professional development, schools need to come up with holistic systems:

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Needs assessment: The systematic evaluation of the needs of professional development based on surveys, analysis of student outcome data, analysis of practice, and teacher feedback (Drossel and Eickelmann, 2017).

Coherent focus: structuring the professional development on the number of priority areas that should be multi-year-focused instead of trying to cover many topics in a shallow manner (Snchez et al., 2020).

Job-based coaching and assistance: Coaching that helps with classroom application, not just the participation in the workshop (Drossel & Eickelmann, 2017).

Professional learning communities: This recognizes the arrangement of educators into grade-level or subject-based teams that explore a common inquiry, exchange their practice, and assist one another (Gu et al., 2019).

Peer observation and feedback: Developing mechanisms that would facilitate peer observation and positive feedback in favor of the ongoing improvement (Drossel and Eickelmann, 2017).

Evidence-based practice: The student work with classroom observations and outcome data is used to determine the effectiveness of professional development and refine it (Snchez et al., 2020).

Distributed leadership: Creating teacher leadership towards professional growth instead of external consultant services, which facilitates professional development, which is sustainable and context-specific (Gu et al., 2019).

9.3 Supporting Implementation and Change

New approaches can be implemented with the help of systemic approaches:

Resource allocation: to ensure enough resources in the form of time, funding, technology, and materials to participate in the implementation (Snchez et al., 2020).

Policy alignment: Policies should not impede skill-based learning, and in this regard, there should be policy changes like sureness that the curriculum is timed to suit a child, testing necessities, and organization of classes (Drossel and Eickelmann, 2017).

Fostering leadership: Preparing principals and teacher leaders as people knowledgeable about and advocating skill-based education, leaders who give vision and create capacity in their institutions (Gu et al., 2019).

Recognition and incentives: Rewarding teachers who undergo professional growth and innovation by paying them, promoting them, or naming them (Drossel and Eickelmann, 2017).

Dealing with barriers: Systematically eliminating barriers perceived by teachers, such as time and infrastructure gaps, assessment pressures, and so forth instead of letting teachers overcome barriers on an individual basis (Snchez et al., 2020).

Sustainability planning: Planning the continued implementation during years, keeping the orientation and support during the personnel changes and other disturbances (Gu et al., 2019).

9.4 Partnership with Employers and Communities

Teacher training may be enhanced through external partnership:

Employer engagement: Collaborating with employers to gather information about the labour market, offer a real-world problem setting, mentor higher education students, and offer internships (Hardie et al., 2020).

Community partnerships: community organizations, cultural institutions, and community leaders are partners in education and teacher development (Sayer and Braun, 2020).

Professional insight: Teachers learn by observing professionals in other fields they are teaching, such as engineers, artists, entrepreneurs, healthcare workers, etc., and gain knowledge of what a genuine practice might look like (Hardie et al., 2020).

Family involvement: Collaboration with families as co-teachers and professionals on their children, enhancing family assets (Sayer and Braun, 2020).

10. Particular Needs for Specific Teacher Populations

10.1 Early Career Teachers

Special support is especially needed by early career teachers:

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Induction programs: The induction programs that include matching new teachers with seasoned mentors, time to work together, and specific professional development (Snchez et al., 2020).

Mentoring and coaching: consistent and meaningful mentoring and coaching of classroom practice, not just procedure-based assistance (Drossel and Eickelmann, 2017).

Peer learning: Learning opportunities in professional communities with other new teachers and experienced teachers (Gu et al., 2019).

Confidence building: Development of efficacy and confidence: It is important to note that early career teachers may be overwhelmed with fear, which can be alleviated by encouraging their confidence (Drossel and Eickelmann, 2017).

10.2 Career Changers

Teachers who have a background in other professions can contribute to their new work, however, they require a specific adaptation:

Shorter content and pedagogy preparation: Career changers might possess excellent knowledge of the content, but require intensive pedagogy preparation to acquire the skills of teaching (Snchez et al., 2020).

Mentoring and support: Career changers receive mentoring that assists them to learn school operations and teaching profession, which is often vastly different than other previous careers (Drossel und Eickelmann, 2017).

Utilizing professional experience: career changers are advised to use their professional knowledge, that is, to introduce the views, connections, and knowledge of practitioners into the teaching (Hardie et al., 2020).

10.3 Teachers in High-Poverty and Under-Resourced Contexts

The educators in the difficult situations need specific assistance:

Professional growth on an intensive basis: In high-poverty schools, teachers should also receive more investment as they do not need less support (Sayer and Braun, 2020).

Stability and retention aid: Helping high-poverty schools that lose the most teachers to turnover, by providing decent working conditions, good pay, and acknowledgment (Sayer and Braun, 2020).

Leadership and autonomy: In high-poverty schools, the leaders should trust the teachers to guide the improvement, make decisions, and use professional autonomy instead of top-down control (Gu et al., 2019).

Resources and support: It is better to make sure that there are sufficient resources, technology, and support instead of placing a burden on teachers to do more with less (Snchez et al., 2020).

10.4 Teachers of Color and Teachers from Under-Represented Groups

Multicultural instructors offer valuable visions yet might encounter special difficulties:

Belonging and inclusion: Designing of welcoming professional settings that are inclusive of the teachers of color and make them feel that they are part of them and are appreciated (Sayer and Braun, 2020).

Leadership opportunities: Leadership pathways: The support into leadership of teachers of color, which has to be intentionally recruited and supported (Sayer and Braun, 2020).

Affinity groups and peer support: Providing teachers in under-represented groups with a place to meet and help one another and pursue mutual objectives (Sayer and Braun, 2020).

Anti-racist and inclusive professional development: Investing the whole staff in anti-racist professional development, not just teachers of color (Sayer and Braun, 2020).

11. Addressing Critical Gaps: Research-Based Recommendations

11.1 Immediate Actions

Audit existing professional development: Evaluate existing professional development in terms of time span, involvement, subsequent support, and correspondence to the requirements of skill-based education and determine gaps (Snchez et al., 2020).

Place job-embedded coaching first: Start offering job-embedded coaching in aid of classroom application of an active pedagogy and using technology integration (Drossel and Eickelmann, 2017).

Learning communities Launch Teacher Learning communities: Group teachers around common instructional problems or interests, and assist in solving problems collectively (Gu et al., 2019).

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Evaluate and develop digital competence: Evaluate the digital competence of teachers, establish a gap, offer them specific professional development, focusing on the areas that take priority (Snchez et al., 2020).

Connect with employers: Initiate employer interactions, knowledge of workforce requirements, and partnerships (Hardie et al., 2020).

11.2 Medium-Term Reforms (1-3 years)

Redesign teacher preparation: Introduce substantive teacher preparation reform based on skill-based pedagogy, different learners, integration of technology, and competent development (Snchez et al., 2020).

Build up to whole-professional development systems: Introduce multiyear professional development systems with consistent emphasis, job-based assistance, and evidence-based development (Drossel & Eickelmann, 2017).

Develop teacher leadership: Educate teachers to be leaders and facilitators of professional development, with a sustainable, contextual capacity (Gu et al., 2019).

Allocate resources: Deploy substantive time, funding, technology, and resources to act in favor of implementation of skill-based education (Snchez et al., 2020).

Partner with communities: Form alliances with employers, families and community organizations which help in teacher development and authentic learning (Sayer and Braun, 2020).

11.3 Long-Term Systemic Transformation (3+ years)

Realign the policies and accountability: Change the system of policies and accountability with an emphasis on skill-based education and teacher professional development (Drossel and Eickelmann, 2017).

Professionalize teaching: Pay teachers more, give them more autonomy and status to reflect the importance and complexity of teaching (Snchez et al., 2020).

Infrastructure: It is important to make sure that all schools have technology, broadband, learning spaces, and these infrastructures should support skill-based education (Kim and Padilla, 2020).

Change institutional cultures: Develop school cultures that embrace innovation, continuous improvement, collaboration and equity (Gu et al., 2019).

Sustain research and learning: Implement systems that would allow constant learning about what works with whom, and make changes to practice (Snchez et al., 2020).

12. Conclusion

The facts are evident: to equip students with the 21 st century skills that would help them succeed in the workplace, the transformation of teacher training is required. At present, the majority of educators are not prepared and developed to teach skills in the form of education. Content knowledge and traditional pedagogies are the two main aspects of teacher preparation programs with little emphasis on active learning, competency development, or the use of technology. Professional development can offer inadequate time, was not linked with classroom practice and was not sustained in helping to implement it. At the same time, educators feel significant impediments to skill-based education such as time, technology, and testing.

However, effective professional development clearly brings changes in the classroom that facilitates the growth of student skills. The studies outline the features of effective and ineffective professional development: multiyear-term, on-the-job coaching and collaborative learning, attention to the teacher requirements and school situations, content/pedagogy and organizational support. Such professional development systems would go a long way to enhance teacher capacity towards skill-based education.

Skill-based education compiles to critical teacher competencies beyond content knowledge such as pedagogical content knowledge of project-based learning and active pedagogies, digital competence that includes both technical and pedagogical technology knowledge, social-emotional learning and trauma-informed practice, cultural competence and anti-racist practice, systems and design thinking and reflective practice that facilitates continuous improvement. The majority of teachers do not have proper development in the areas.

A transformation in teacher training must be systematic with many elements involved: reformed teacher training programs based on skills-based pedagogy and heterogeneous students; multi-year focus, job-based coaching, and leadership in teacher training; resources and policies to support implementation;

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employer-community partnerships; and leadership vision and commitment. Individual efforts to resolve individual factors are not enough; it requires a concerted effort.

The employees are becoming more and more 21st-century competency demanders. But schooling goes on equipping students with models of education which are twentieth century industrial models. Such an imbalance does not indicate a lack of teacher ability but instead the lack of teacher training and facilitation to guide skill based education. This basic gap can be bridged by transforming teacher training, so that teachers can be able to impart the necessary competencies to students and equip them with complex and changing futures.

Investment in teacher training is an investment in the future of students and the society. It takes political goodwill, investment of resources and the appreciation of the complexity and the significance of teaching. The study shows well clearly what a good teacher training is like. Evidence-based teacher preparation and professional development strategies would help a great deal to enhance the development of the student skills and prepare them to work. The necessity is obvious; the facts are strong; the time is here.

13. References Summary

This review of the research incorporated 18 or more, peer-reviewed studies that analyzed the teacher training requirements of skill-based education. Key sources included:

Sr. No.	Target Items	Key Sources
1	Research about digital competence and adoption of technology	(Drossel and Eickelmann, 2017; Istiningsih, 2022; Mezentceva et al., 2020; Smolyaninova and Bezyzvestnykh, 2019; Snchez et al., 2020).
2	Studies about the efficacy of professional development	(Drossel and Eickelmann, 2017; Gu et al., 2019; Snchez et al., 2020)
3	The systems of competency development	(Istiningsih, 2022; Notanubun, 2019)
4	Research on various learners and inclusive practice	(Masonbrink and Hurley, 2020; Sayer and Braun, 2020)
5	The studies on pedagogical innovation and active learning	(Avsec et al., 2021; Hardie et al., 2020; Megayanti et al., 2020)
6	We need to discuss the equity and access studies	(Alkureishi et al., 2021; Kim and Padilla, 2020).

The review shows that there is a consensus among researchers and practitioners about critical gaps to teacher training and effective strategies to respond to this issue. Evidence-based recommendations implemented can significantly change teacher preparation and professional development so that educators could successfully meet the required competencies in students and equip them with the required skills to succeed on the workforce.

Final Recommendations

To be executed within the nearest time possible:

Audit existing systems: Evaluate teacher preparation programs and professional development in terms of their skills based education requirements.

Introduce intensive professional development: Establish multiyear, job-based professional development in project.

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Informed Consent Statement

The participant in the study gave their informed consent.

Statement of Data Availability

The corresponding author can provide the data used in this study upon request.

Conflict of Interest

The authors declare no conflict of interest.

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