Science Teachers' Professional Development at Tribhuvan University: Bridging the Policy-Implementation Gap

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Abstract

This study explores how to bridge the policy-implementation gap in science teachers' professional development at the Faculty of Education, Tribhuvan University. Keeping with the sequential mixed-method design of Creswell and Poth (2016), this study uses a QUAN-qual research design. Science education teachers teaching at the Bachelor's and Master's degree programs are the participants of this study. Forty-one respondents for the quantitative survey and six in-depth interviews were taken for the collection of data. Census sampling was taken for the survey, and purposive sampling was chosen to collect qualitative data. A structured survey questionnaire that adheres to Flick's (2019) standards captures quantitative data collection, whereas in-depth interviews and the use of inductive techniques like open coding and thematic content analysis capture quantitative data. The result shows that 4.9% of teachers took item analysis training, 7.3% of them got the opportunity to prepare, and 46.3% did not get the possibility. The study found the significance of institutional support and cooperative efforts for Science Education teachers' preparedness. This study offers implications for educational policymakers, administrators, and practitioners looking to improve the caliber of Science Education. It also acts as a prelude to a thorough investigation into the nuances of science teachers' professional development at the Faculty of Education, Tribhuvan University.

Keywords: Science education teachers, Professional development, Policy implementation gaps

Context

Taking into account the value and necessity of a high-quality education, Tribhuvan University (TU) was founded as Nepal's first university in 1959 with the intention of promoting knowledge creation and dissemination, putting a strong emphasis on research, and bolstering Nepalese tradition. The university, which offers education for the nation, has taken on the duty of equipping people with the information and understanding of today's world to fulfill the demands and expectations of the modern world. With five institutes, four faculties, four research

centers, 61 constituent campuses, and 1085 affiliated colleges with more than 300,000 students, the university has grown to an enormous extent throughout time (Bajracharya, 2021). Over the course of its 60 years of existence, the university has significantly impacted higher education in the country.

Tribhuvan University, the oldest and largest institution in Nepal, represents the best academic standards in the nation. It spreads around 154.77 hectares, which includes the Central Campus and the Central Administrative Office. This expansive area is a reflection of the university's dedication to offering a supportive atmosphere for teaching, research, and administrative duties. With its extensive network of institutes, faculties, departments, campuses, and associated colleges, TU stands resilient, fulfilling its mission to prepare capable human resources (Acharya, 2019), provide standard higher education (Limbu, 2021), preserve national culture (Sharma, 2020), and engage in impactful knowledge creation and research (Nepal, 2020). TU has had a notable development in its academic offerings since its founding, developing into a comprehensive university offering a wide range of programs.

As the oldest and largest university in Nepal, Tribhuvan University holds a venerable position in the nation's academic landscape, offering a comprehensive range of academic programs spanning from Bachelor's degrees to PhD and post-doctoral studies. Its commitment goes beyond the confines of national borders, aiming to develop proficient human resources not only for Nepal but also for the international community. Tribhuvan University plays a pivotal role in shaping the intellectual landscape, contributing significantly to society through rigorous research endeavors. By fostering a culture of academic excellence and innovation, the university serves as a dynamic catalyst in the holistic development of individuals, positively impacting communities and societies both within Nepal and beyond.

Background of the Study

The Faculty of Education (FOE), which was founded in 1956 prior to the establishment of its parent university, TU, has been instrumental in institutionalizing teacher education programs in Nepal. Over time, FOE has grown to be Tribhuvan University's largest faculty, with the most students and a strong nationwide network that includes 26 constituent campuses and 590 affiliated colleges. Due to its wide reach, FOE is regarded as the cornerstone of teacher education in Nepal and makes a substantial contribution to the country's educational sector by generating a wide range of human resources. The faculty has played a pivotal role in providing an extensive

range of educational programs that encompass areas such as science, social studies, and information and communication technology education.

The present portfolio of educational programs offered by FOE, which includes the Bachelor of Education (B.Ed.), Post-Graduate Diploma (PGD), Three Semester M.Ed., Master of Education (M.Ed.), Master of Philosophy (M.Phil.), and Doctor of Philosophy (Ph.D.) in Education, demonstrates the organization's dedication to excellence. Although professional courses and academic content are combined in these programs, FOE recognizes that theory and practical skills should be given equal weight. FOE is committed to improving the caliber of its teacher education programs by fusing solid theoretical underpinnings with practical professional skills in response to the changing nature of education (Dhungana, 2022). In order to guarantee that graduates have strong pedagogical abilities, this entails a concentration on interactive pedagogy, instructional design, material production, classroom management, and evaluation. There is also a special emphasis on rigorous practice teaching and practicum.

The multifarious objective of FOE-TU is to generate a workforce of qualified teachers, teacher educators, and educational researchers to fulfill the changing demands of the nation's educational system. Through its varied programs, FOE aims to support the development of educational planners, managers, and curriculum designers in addition to teacher training. The faculty's well-defined goals include producing educators, specialists, managers, and administrators; training teachers in partnership with the Ministry of Education Science and Technology (MoEST); and developing top-tier human resources via M.Phil. and Ph.D. programs. With an emphasis on the teacher education sub-system, FOE is actively conducting research projects to improve the education system as a whole.

Tribhuvan University's Master of Education (M.Ed.) program is purposefully structured to accomplish both broad and focused goals with the goal of generating highly qualified academic professionals in the field of education. The overarching objective of the program is to develop a cadre of highly qualified academic personnel, comprising educators, administrators, planners for education, system analysts, and specialists. The development of proficient and skilled teacher educators, the creation of effective educational planners and administrators, the promotion of creative educational practices, and the development of educational leadership capable of revolutionizing the nation's educational systems are some of the specific goals. A

variety of teaching techniques, including class lectures, group discussions, demonstrations, guest lectures, seminars, term paper presentations, case analyses, problem-solving exercises, practical experiences, and fieldwork, are used in the M.Ed. program to create a distinctive learning environment. The goal of these many teaching strategies is to develop students' capacity for independent study, critical thinking, and practical problem-solving. Additionally, the program's structure is built on a 150-day academic year, with theoretical papers often carrying a weekly allotment of lectures and periods. The M.Ed. program uses a semester structure and allots credit hours and class days to make sure that prospective educators have a thorough and productive education.

Among the many Master's programs offered by FoE-TU, the Master of Education (M.Ed.) in Science Education is a notable offering. This extensive two-year program is offered under FOE on constitutional campuses that are placed strategically in Kathmandu and Gorkha. The M.Ed. program's curriculum is carefully designed to provide a comprehensive educational experience. It consists of a combination of specialized courses and professional/ pedagogical core courses. Since 2009, the M.Ed. program has been a focus of ongoing development, with upgrades and adjustments made to both professional and specialty courses. This dedication to improvement guarantees that the curriculum stays in line with the changing environment of educational standards and practices, enabling students to interact with state-of-the-art ideas in science education. The M.Ed. in Science Education, which is a component of Tribhuvan University's larger educational endeavors, is a prime example of the institution's commitment to supporting academic achievement and equipping teachers to handle the ever-changing demands of the modern educational environment.

An essential part of Tribhuvan University's M.Ed. curriculum is the practicum, which is meant to provide students with practical experience by active participation in events either on campus or at high schools. The three main components of practicum classroom instruction, an internship, and curriculum evaluation are all customized to the student's selected area of study. On the other hand, students who concentrate on educational administration and planning replace traditional, dogmatic classroom instruction with other pertinent tasks. This essential course, which lasts six weeks and can be taken either during or after the second year of the M.Ed. program, gives students a practical grasp of the topic they have chosen. Candidates must possess a

Bachelor's degree in education to be eligible for admission to Tribhuvan University's Master of Education program. Admission to other academic specializations needs additional credentials. Prospective students must pass an entrance exam specific to their chosen specialization in order to enroll in the semester system.

In 2054 BS, the Central Department of Education's Faculty of Education launched the Master of Education (M.Ed.) program in Science Education at the Master's level. This program's continuous existence since its start attests to a persistent dedication to offering superior instruction in science pedagogy. The M.Ed. in science education has probably been essential in the creation of a competent and well-rounded group of professionals in the area by fostering and expanding the knowledge and abilities of science teachers over time. The program's ongoing quality demonstrates the institution's commitment to supporting science education excellence and addressing the changing demands of teachers in this vital field. Teachers are able to improve their methods of instruction, incorporate new technologies, and adjust to shifting educational paradigms because they have access to ongoing training and learning opportunities. The state of professional development for science education teachers at Tribhuvan University would depend on the university's dedication to continuing training programs, the accessibility of resources, and partnerships with other educational establishments. Professional development opportunities could be found in conferences, workshops, seminars, and graduate programs created especially for science teachers. This article analyzes the national policies and programs for science teachers' professional development in FOE-TU.

Research Gap

The unique research gap that exists in Nepal with respect to how science education teachers at TU get ready to implement teaching and learning modalities in their regular courses. I can, however, offer a broad overview of any potential gaps in this field's study. It's possible that there aren't many empirical studies that particularly look into the tactics, difficulties, and efficacy of the teaching and learning environment that TU science education teachers use. The body of existing literature might not go far enough to give a thorough grasp of the real-world experiences, methods, and results in the Nepalese setting. The current study may not have sufficiently addressed Nepal's particular contextual elements, which include the country's unique topography, differing degrees of technology infrastructure, and cultural issues. One possible study gap would be to examine how these factors affect

the adoption of teaching and learning approaches in B.Ed. and M.Ed. Science education programmes by science educators in FoE-TU.

It may be understudied how institutional support helps or hinders science education teachers' preparedness for teaching and learning. The regulations, tools, and professional development opportunities that TU offers to assist teachers in making the switch to virtual modes could be the subject of future research. Although teacher preparation may receive a lot of attention, there may be a study gap pertaining to student viewpoints. It could be beneficial to look at how TU students view and interact with virtual learning in science education programs. A future study could use both qualitative and quantitative techniques, such as surveys, interviews, and classroom observations, to fill in these possible research gaps. Furthermore, comparing research with other international contexts could shed light on practical approaches that could be modified for the Nepalese setting. When implementing virtual teaching and learning, it's critical to take into account the unique opportunities and challenges those TU science education teachers and their students face.

Literature Review

Using a national sample, Garet et al., (2001) literature examines the efficacy of professional development for science teacher educators. Using ordinary least squares regression, the study finds that three key elements (a) a concentration on topic knowledge; (b) chances for active learning; and (c) coherence with other learning activities are important for achieving favorable results. It has been discovered that these fundamental characteristics mediate the effects of structural components such as the activity's duration, form, and level of group engagement. The study provides insightful information about the major elements influencing teachers' self-reported improvements in their knowledge, abilities, and methods of instruction during professional development. Desimone (2009) enhances teacher professional development impact studies, moving toward more accurate conceptualizations and measurements. In order to enhance our conceptualization, metrics, and research methods for examining the effects of teachers' professional development on teachers and students, the author recommends the integration of new research information. A review of the literature is done by Kebritchi et al., (2017) on the problems and difficulties of teaching effective online courses in higher education. The study divides its findings into three main categories using Cooper's framework: problems pertaining to online learners, teachers, and content creation. Expectations, preparation, identity,

and engagement are among the issues that trouble learners. Teachers have to deal with things like position changes, moving from in-person instruction to online instruction, managing their time, and modifying their teaching methods. Content difficulties include instructional methodologies, multimedia integration, the role of instructors in content development, and content delivery. The authors propose that training for students, technical assistance for content development, and professional development for teachers be used to overcome these issues.

The study by Tigelaar et al., (2004) aims to address the need for a comprehensive framework for teaching competencies in higher education. They developed and validated a framework consisting of four domains: the person as teacher, expert on content knowledge, facilitator of learning processes, organizer and scholar/ lifelong learner. The study was employed in order to address the need for a thorough framework for teaching competences in higher education (Tigelaar et al., 2004). With the help of 63 educational experts and the Delphi technique, the study produced 104 items, of which 59% had a solid consensus. The model's suitability was validated by confirmatory factor analysis, offering a framework that is trusted to assess teaching competencies in higher education. The authors of 'The Professional Learning of Teachers in Higher Education' (Knight et al., 2006) discuss the issue of professional development on a worldwide scale. They underscore the significance of non-formal learning and the popularity of event-driven strategies in professional development. The authors of 'Professional Identity Development: A Review of the Higher Education Literature' (Trede et al., 2012) thoroughly examine twenty papers that address this topic in the field of higher education. The study emphasizes the need for additional research to fully comprehend the conflicts between personal and professional values, structural influences, power dynamics, workplace learning, and the interaction between discipline-specific and generic education in forming professional identities, even though the articles draw from a variety of theories and pedagogies. Johnson's (2015) thorough guide, 'On Being a Mentor: A Guide for Higher Education Faculty,' offers insightful information about the mentorship role in higher education. It addresses a variety of mentoring topics, which makes it a helpful tool for mentors and mentees in academic settings. Johnson's (2015) thorough guide, 'On Being a Mentor: A Guide for Higher Education Faculty,' offers insightful information about the mentorship role in higher education. It addresses a variety of

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The situation of science education in Nepal is discussed in the report, with particular attention paid to issues including inadequate funding, pathetic management, and a dearth of cooperative initiatives. Science education in Nepal confronts challenges despite government reforms and initiatives, such as a lack of national competency requirements, a paucity of research institutions, and a teacher shortage. In order to attain sustainable development goals in Nepal, the article highlights the necessity of science education reform legislation, curriculum re-framing, dedicated funding, and increased teacher quality (Paudel & Rajbhandary, 2022). The author of this Panthee study from 2021, 'Teachers Professional Development at Public Campuses of Nepal,' examines the beliefs and methods that educators have when it comes to professional development on public campuses. The results show that although educators recognize the need for professional development to foster growth, they are not satisfied with the offerings at public universities. In the 2013 article 'Professional Development for Science Teachers' by Wilson, the focus is on the upcoming need for large-scale professional development (PD) for science teachers due to the 'Next Generation Science Standards'. The article emphasizes the complexity of the U.S. educational system and suggests that systemic interventions hold promise for improving the effectiveness of PD for science teachers.

Towndrow et al., (2010) explore the circumstances that influence science teachers' responses to policy reforms in science practical assessment. Drawing on research from Singapore and Hong Kong, the authors compare contrasting approaches to the implementation of assessment reforms. The paper highlights the importance of in-situ professional development in shaping teachers' assessment practices, emphasizing the need to consider teachers' experiences and learning processes to ensure ongoing innovation in laboratory-based work assessment. Luft and Hewson (2014) featured an overview of research on science teacher professional development programs. It explores key aspects and findings related to these programs, offering a valuable resource within the broader context of science education research.

Methodology

As suggested by Creswell and Poth (2016), the research technique used in this study is primarily based on a sequential mixed-method design, specifically the QUAN-qual approach. This approach combines quantitative and qualitative methods

of data gathering and analysis to offer a thorough understanding that guides theory and practice in the field of professional development for science teachers. The study is carried out at the Nepalese campuses of Tribhuvan University (TU), which offers Bachelor's and Master's degree programs in Science Education. The site selection for this research study guarantees a targeted investigation of the professional development environment in the university's science education initiatives. All of the science education teachers working at OFE-TU campuses that offer Science Education programs at the Bachelor's and Master's degree levels are included in this study. Six participants for in-depth interviews and forty-one science education teachers' responses for the quantitative component comprise the study's population. To enable a more thorough analysis, both quantitative and qualitative samples were chosen and data analyzed.

A self-reported structured survey questionnaire that complies with Flick's (2019) recommendations is used to gather quantitative data. Furthermore, rules for comprehensive interviews are created to obtain qualitative insights. By combining both quantitative trends and qualitative narratives, this set of tools guarantees a detailed investigation of the study's issues. A variety of methods are used in the data analysis. Units of meaning are identified by an inductive method (open coding) for qualitative data obtained from in-depth interviews. These units were then categorized and interpreted using thematic content analysis. In contrast, the SPSS approach is used to analyze quantitative data in order to find patterns and correlations in the survey responses.

An important factor in the research design is ethics. Prior to survey participation, participants provided written informed consent, and researchers took proactive measures to address ethical and safety concerns. Participants' privacy is safeguarded by confidentiality and anonymity mechanisms, and data access is limited. Oral consent is sought for in-depth interviews, and participants were offered. The choice to stay the participants' welfare and the integrity of the research process are guaranteed by this ethical framework. Science education teachers need to take part in professional development if they want to stay current with the newest pedagogical strategies, curriculum advancements, and technological advancements in science education. Because they have access to continual professional development and learning opportunities, teachers may enhance their teaching and learning strategies, integrate new technologies, and adapt to changing educational paradigms.

Findings

Examining national policies and programs for the professional development of science teachers, a complex environment is revealed. A thorough analysis shows that the policies in place acknowledge the importance of ongoing professional development for science education teachers. However, there are still implementation issues that differ between locations. Although a framework is in place, there are substantial obstacles in the form of resource limitations and regional inequities that make it difficult to actually translate it into effective programs. The results point to the necessity of more streamlined and easily available professional development programs in order to guarantee standardized, superior science instruction throughout the nation. Examining teachers' reactions to instruction in FOE-TU science education programs, important insights are uncovered by investigating how teachers respond to teaching-learning experiences at Tribhuvan University's (TU) science education programs. Science Education teachers generally have favorable things to say about the quality of education, and they emphasize how important experiential learning is. Nonetheless, some questions about the sufficiency of resources and contemporary teaching techniques are raised. Science Education teachers express a wish for more hands-on learning experiences, laboratory spaces, and practical implementations of abstract ideas. These results highlight the necessity of a dynamic, student-centered approach to science education that incorporates real-world components to improve the overall educational process. It is clear that matching instructional strategies to teachers' expectations can make TU's scientific curriculum more interesting and successful.

The survey findings underscore the crucial need for ongoing professional development for science education teachers, shedding light on the extent of their engagement in these initiatives. A substantial 78% of respondents affirmed their active participation in teacher training programs, showcasing a commendable commitment to continuous learning among a majority of science education teachers. Conversely, 22% reported never taking part in any professional development program. This distribution emphasizes the dedication of a significant portion of Science Education teachers to lifelong learning and professional growth. These results strongly advocate for the recognition and funding of professional development opportunities. They affirm the importance of such initiatives in keeping teachers abreast of evolving pedagogical approaches, thereby contributing to an overall

improvement in the educational environment. The findings highlight the value of sustained training for educators, showcasing the active involvement of Science Education teachers and emphasizing the imperative role of ongoing professional development in enhancing teaching practices and educational outcomes.

The results indicate specific areas of emphasis for Science Education teachers' evaluation training. An important indication of the importance placed on the development of assessment items is the fact that 39% of participants completed item writing training. Conversely, item analysis (4.9%) and item banking (7.3%) showed lower reported percentages. Remarkably, 2.4% of participants mentioned having received training in Tao, indicating a distinct yet uncommon area of expertise. Nonetheless, a sizable 46.3% of respondents claimed never to have undergone any kind of evaluation training. The distribution of skill sets among Science Education teachers is demonstrated by this, indicating possible areas for focused professional development to guarantee thorough comprehension and proficiency with a range of evaluation techniques. The results show that science teachers use a wide range of teaching techniques, which emphasizes the need for an extensive pedagogical tool set. Conventional classroom instruction is common; according to 61% of respondents, lectures are the most favored method.

Field trips, teamwork, and problem-solving strategies collectively account for 24.4% of the total number of teachers. However, the relatively low utilization of laboratory techniques (4.9%) extends to interactive, hands-on learning techniques. One of the most important areas of attention for Tribhuvan University (TU) science education teachers in Nepal has been preparing them for the use of a virtual method of teaching and learning in their regular programs. The results show that they apply a variety of approaches and a broad landscape of readiness. A significant portion of educators have taken an active part in programs for professional development pertaining to online teaching strategies. Science Education teachers now have the tools they need to teach science online thanks to workshops, seminars, and training programs created especially to improve digital literacy and virtual teaching abilities.

The results emphasize the value of institutional resources and assistance as well. Teachers who indicated they have institutional support and access to sufficient technology resources showed a higher degree of readiness for remote teaching and learning. A helpful community of practice has also been greatly aided by the cooperative efforts of science education faculty members, who share creative

solutions and best practices. But difficulties still exist. More specialized training in virtual pedagogy and technological integration is needed, according to some educators, especially when it comes to teaching science. For a more comprehensive adoption of virtual teaching methods, specific solutions are needed to overcome challenges caused by connectivity issues and limited access to digital infrastructure in some places. The results highlight, in summary, how dynamically TU Science Education teachers prepared for the virtual mode of instruction and learning. Enhancing the ability of science educators to successfully navigate the opportunities and challenges presented by virtual education in the context of Nepalese higher education requires a combination of professional development opportunities, institutional support, and cooperative efforts.

In-depth interviews with Science Education teachers revealed the vital significance of Teacher Professional Development (TPD) trainings. They bemoaned the lack of options for TPD training, which they felt was necessary in order to stay up-to-date with the latest pedagogical approaches. The teachers emphasized how important this kind of training is for improving article writing abilities, participating in online learning successfully, creating proposals, managing academic programs effectively, and utilizing cutting-edge techniques like Problem-based Learning (PBL) and flipped classrooms. They bemoaned the lack of opportunities for such growth offered by the Faculty of Education (FOE) and the campus. This reveals a worrying lack of assistance for teachers, impeding their capacity to develop and flourish in their positions. Although the teachers acknowledged the significance of TPD, they expressed sorrow for not having had the opportunity to participate in it, indicating a need for institutional change and a stronger focus on assisting teachers in developing as professionals.

Discussion

A complicated system is revealed by reviewing national policies and programs for Science Teachers' professional development, which recognize the significance of continuing professional development. However, difficulties with implementation, such as scarce resources (Pillay et al., 2017) and geographical disparities (Luo, 2004), make it difficult to effectively translate ideas into programs. The results highlight the requirement for professional development programs to be simplified and made easily accessible in order to guarantee high-quality, standardized science education across the country. This resonates with the literature on teacher professional development,

which often highlights the importance of accessible and well-designed programs to enhance teaching practices (Gubbins & Hayden, 2006; Ingersoll & Strong, 2011; Ko, 2006).

Examining how teachers respond to Science Education programs at TU provides insightful information. Teachers emphasize the value of experience learning even though they are generally satisfied with the caliber of education (Acharya, 2016). Concerns are voiced regarding the availability of sufficient resources and modern teaching methods, as well as a desire for more experiential learning opportunities and real-world applications of abstract concepts. This is consistent with previous research (Kolb, 1984; Williams, 2017) that highlights the value of hands-on learning and the incorporation of real-world applications in science education. The results emphasize how important it is to teach science in a dynamic, student-centered way that meets their expectations. The results of the study on continuing professional development for teachers of Science Education confirm that the majority of respondents are dedicated to lifelong learning. Nonetheless, it is concerning that a sizable portion of teachers have never taken part in professional development programs. These findings are consistent with research showing that, in order to improve teaching effectiveness and student outcomes, teachers must engage in ongoing professional development (Darling-Hammond et al., 2017).

The results support funding and recognition of professional development opportunities more, which is in line with the literature's recommendation to support teachers' continuous learning (Ingersoll & Strong, 2011). The respondents' varied skill sets in the field of assessment training for Science Education teachers point to possible areas for focused professional development. In comparison to the lower stated percentages for item analysis and item banking, item writing training is noticeably prioritized. On the other hand, a sizable disparity is indicated by the notable portion who reported receiving no evaluation training. This aligns with literature emphasizing the importance of teacher training in assessment practices to ensure fair and effective evaluations (Darling-Hammond, 2020; Fjørtoft, 2020; Popham, 2009; Wise et al., 1085; Wormeli, 2023). The results show that science teachers use a wide range of instructional tactics. Although lectures and other traditional classroom-based training are still widely used, there is potential to improve interactive, hands-on learning strategies. Unrealized potential is indicated by the comparatively limited use of flipped classrooms and laboratory techniques. These

results are consistent with research that supports the use of a variety of pedagogical tools, such as active learning techniques, to increase student comprehension and engagement (Freeman et al., 2014; Hendrickson, 2021; Hodges, 2020; Soe et al., 2021; Prince, 2004). The way TU science education teachers are trained for virtual instruction in Nepal demonstrates a proactive methodology.

Moreover, crucial components found are institutional support and active participation in professional development programs. Obstacles include the requirement for specialized training in virtual pedagogy and the resolution of connectivity problems, which are in line with international research highlighting the significance of pedagogical and technological assistance for effective virtual teaching (Acharya, 2019; Johnson et al., 2023; Jongsma et al., 2023; Means et al., 2013; Salendab, 2023). It entails a careful examination of the difficulties, nuances, and potential fixes that come with matching the goals of policy with the practical experiences of scientific teachers. The identification of the variables causing the policy-implementation gap is a crucial component of the conversation. This could involve problems including a shortage of resources, unclear policy instructions, or a mismatch between the tactics that are recommended and the real needs of science teachers. Comprehending these variables is essential for formulating focused interventions that tackle the underlying reasons for the disparity. The conversation also explores the viewpoints and experiences of Tribhuvan University's Science Education teachers. The study attempts to represent the lived reality of educators involved in professional development efforts by including their voices. This qualitative component is crucial for developing a comprehensive grasp of the difficulties teachers encounter because it offers situation-specific insights that can guide the development of customized solutions. This is in line with research (eg. Akcanca, 2020; Bragg et al., 2021; Brand, 2020; Sancar et al., 2021; Svendsen, 2020). The finding may delve into methods for closing the implementation-policy gap while making recommendations. This could entail improving the channels of communication between practitioners and policymakers, tailoring professional development courses to the particular requirements of science educators, or making infrastructural and resource investments to ensure successful implementation.

The findings uncover the wider ramifications of closing the policy-implementation gap in science teacher preparation. Working together stakeholders such as educators, administrators, and legislators becomes essential to developing

solutions that are both practical and conceptually sound. This shows that collaboration is a must among science teachers, educators, administrators, and policy-level people. This finding is in line with Niemi and Lavonen (2020). Good professional development enhances the quality of scientific instruction overall as well as the professional development and job happiness of educators. The anticipated results of educational changes are more likely to be realized when policies are in line with the realities of the classroom. It shows the discourse around the professional development of science teachers at FOE-TU. With regards to closing the policy-implementation gap, this is a complex investigation that necessitates a thorough comprehension of the difficulties encountered by science instructors. The goal of this discussion is to provide educational stakeholders and policymakers with useful insights by exploring the subtleties of this relationship in order to improve the efficacy of professional development programs for science teachers. The results that have been addressed together highlight the need for ongoing professional development for science teachers, the necessity of a student-centered approach in science instruction, and the necessity of a variety of teaching techniques. They also stress how important it is to have professional development programs that are easily available and well-designed, to connect them with the expectations of Science Education teachers, and to integrate technology into virtual instruction. These observations add to the continuing conversation on strengthening science education policies and practices in Nepal. Additional investigation may explore the particular difficulties encountered by science teacher educators in the Nepalese setting, offering customized suggestions for improving science learning.

Recommendation

This research makes a strong case for radical changes in Science Education in Nepal based on a thorough analysis of national policies and programs for the professional development of science teachers as well as teachers' responses to science education programs at Tribhuvan University (TU). The thorough examination of the study highlights the advantages and disadvantages of the current system, highlighting the necessity of simplified and easily available professional development programs to guarantee consistent, excellent science learning across the country. The essay also emphasizes how important it is to take a student-centered approach and add real-world elements to improve education as a whole. Additionally, the results of the study regarding the participation of Science Education teachers in continuing professional

development demonstrate the commitment of a sizable majority, highlighting the critical role that ongoing learning plays in enhancing instructional strategies and student outcomes.

In addition to supporting professional development opportunities' acknowledgment and funding, the research points out particular areas in instructional practices and assessment training that call for focused interventions. Furthermore, the examination of the opportunities and difficulties related to virtual teaching methods in the context of Nepalese higher education provides insightful information, highlighting the need for professional development, institutional support, and cooperative efforts to successfully navigate the ever-changing virtual education landscape. All things considered, the results offer policymakers, teachers, and institutions a road map for improving Science Education in Nepal and creating a more effective, inclusive, and future-ready learning environment.

Acknowledgments

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