

Impact of Teachers' Challenges And Professional Development in Blended Learning on Students' Personalization



Syed Ahmad Raza Shah Gillani ^a Zafar Khan ^b Fahmida Bibi ^c

Abstract: This study investigates how teachers' implementation challenges and professional development in blended learning influence the personalization of student learning experiences. Conducted in public sector universities of Southern Khyber Pakhtunkhwa, the research employed a quantitative descriptive design. Data were collected from 148 teachers and 341 students using researcher-designed questionnaires. Findings revealed specific obstacles faced by educators and the nature of training they received. Statistical analysis through linear regression was used to determine the significant impact of these teacher-focused factors on the level of personalization attained by students, testing the formulated hypothesis. The study concludes that targeted professional development addressing key implementation challenges is crucial for translating the potential of blended learning into effective, personalized student outcomes.

Keywords: Blended Learning, Teacher Challenges, Professional Development, Personalization, Student Experience, Higher Education

Introduction

Poulin and Straut (2016) define blended learning as a practice that integrates the classroom instruction with the online learning resources, videos, and hardware. It is an amalgamation style to learning that incorporates both face-to-face learning and internet-based education and provides the learners with such flexibility to study anywhere, anytime, and in any way they see fit. The study indicates that the mixture of traditional classroom teaching and online learning improves the level of academic achievements and facilitates the learning styles better. The study by the Department of Education in the U.S. (2016) has shown that this hybrid style of teaching proved more successful than a strictly face-to-face course or a totally online one. Blended learning is an emerging tendency in the school of every part of the world because of the advancement of technology and the availability of online resources (Hrastinski, 2019).

Professional Development and Challenges

Learning is not easy to combine with face-to-face and online learning activities. Introduction of technology in the present day curricula is a very sharp issue. The problem, which teachers must overcome is that they must be able to effectively incorporate digital tools without undermining pedagogical standards. They may even be compounded by technological issues such as low internet connections, outdated hardware (Zhou et al., 2023).

A second huge issue is the ability to cope with the needs of students who are diverse in a blended learning environment. The issue of differentiation of instruction under different skills and instructional styles can be further complex when it is coupled with both the online and individual aspects. The concern of student engagement and motivation is another issue that teachers should consider because online aspects may result in less interaction and participation. Moreover, it is important to consider fair access to technology and

^a PhD (Education) Scholar, Institute of Education & Research, Quaid-E-Azam Campus, Gomal University, Dera Ismail Khan, Khyber Pakhtunkhwa, Pakistan.

^b Assistant Professor, Institute of Education & Research, Quaid-E-Azam Campus, Gomal University, Dera Ismail Khan, Khyber Pakhtunkhwa, Pakistan.

^c Assistant Professor, Institute of Education & Research, Quaid-E-Azam Campus, Gomal University, Dera Ismail Khan, Khyber Pakhtunkhwa, Pakistan.

optimize the problem of the digital divide to prevent the increase of educational inequalities (Zimba, Khosa, and Pillay, 2021).

Monitor Student Progress

One of the biggest problems of studying online is the impossibility of monitoring students because of the absence of close interactions and immediate feedback. In the case of online learning, teachers cannot easily gauge student knowledge and dedication without personal data, e.g., body language or prompt reaction in the discussion. Moreover, the results of self-registration statistics and digital distribution may create discrepancies in the consideration of the actual progress. Students in online settings are found to decrease their responsibilities, which may further complicate the monitoring processes. Moreover, the digital literacy of students at various levels may introduce discrepancies in the skills of communicating the challenges and confusion productively. This complicates the process of educators correcting learning gaps at the appropriate moment. Online learning has been rapidly developing due to the COVID-19 pandemic, which puts these issues into focus and the necessity to implement innovative equipment and approaches to select and support student progress more effectively, even under the conditions of distancing (Khalil and Ebner, 2023).

Locating Quality Online Resources

On the one hand, locating some appropriate digital materials in education lesson plans may prove to be quite a daunting endeavor, given the fact that the digital world is growing at an extremely fast pace. The abundance of accessible material often leaves teachers confused about where to start, and most of these materials differ in their credibility, relevance, and correspondence to the curriculum standards. The spread of content digitally has resulted in a paradox of choice where the very proliferation of the materials can cause a situation of decision fatigue and confusion as to which materials will actually benefit student learning. Moreover, the digital gap is also a significant obstacle, and not all educators can obtain the skills required to be digitally literate and the skills required to be digitally literate in order to include those resources into the lesson. It has also been revealed that 85 percent of teachers use digital resources regularly, and only 30 percent of them are sure they can evaluate the quality and adequacy of such materials. It means that there is a dire necessity to implement more powerful training and support mechanisms to make sure that educators identify and utilize high-quality digital materials to enhance their educational experience instead of disabled ones (Koomsap, Cooper, and Stjepandic, 2023).

Enforce Discipline among Students

One of the most important aspects of the effective teaching practice in a blended learning setting is student discipline, with the teacher assignments and professional development being the key stakeholders in such a scenario. The principle of blended learning (adding real life teachings to the online facet) assumes the alteration of the disciplinary measures in real and online classroom. According to the studies, teachers should possess the capability to generate a differentiated understanding of the online programs and classroom managing approaches with the purpose of developing an environment that promotes commitment and educational success. Professional development program is also pertinent in providing the teachers with the ability to correct behavioral problems. In cases where instructors are able to address these issues through provision of special training, these learning conditions can be organized in a conducive manner, a factor that can assist towards improving student discipline, commitment, and academic performance. This model is cognizant of the fact that they should have a continuous professional development as far as adapting to the dynamic needs of blended learning is concerned (Graham, 2006).

Online Discussions

Blended learning has been discovered to be fundamental in the formation of the universities and a very crucial academic process involving online studying and conventional privatized education. Mixed studying practices are imposed by educational institutions in their teachers, who are central stakeholders. This is normally influenced by challenges and career advancements opportunities. The current researches have

shown that teachers can mentor teachers to use the technical equipment, adapt themselves to the various requirements of learners, and use their time effectively, and that is a very important issue that defines the effectiveness of blended learning. Blended learning will alter a professional development plan, which will allow educators to overcome these issues and promote innovative learning strategies that can increase student devotion and achievement. Blended learning also involves online discussions that enable the students to learn in a collaborative setting as they have the opportunity to interact with their fellow learners and teachers in an asynchronous manner. Research shows that they will be able to create more interactive and meaningful online conversations as long as they keep on developing professionally. Therefore, the concerns of teachers and their professional development should be considered in order to ensure that the blended practice of learning is as productive as possible on the university level (McCarthy and Palmer, 2023).

New Technologies Potential

There are high chances that the integration of new technologies into the blended learning practices will mitigate the challenges encountered as a teacher, improve teacher development, and ultimately impact on student commitment and student performance at the university levels. One of the key stakeholders involved in the process of acquiring and adopting these technologies that can revolutionize traditional pedagogical practices will be teachers. Examples of tools that can be employed to make learning experiences more individualized, monitoring the student progress, and promoting interactive experience include Learning Management System (LMS), Artificial Intelligence (AI), Data Analysis, and Virtual Reality (VR). However, such problems as technical flexibility, resource limitations, and career should be addressed as to enjoy the best of this. According to the recent study, teachers who receive a constant training process and apply innovative technologies report the improvement of their teaching strategies and student motivation. Universities are capable of equipping educators with the skills and resources necessary to help make the learning environment more active and accommodating and ensure that blended learning practices result in a better student experience and performance outcomes (Garvis and Keane, 2023).

Sense of Accomplishment

The feeling of accomplishment of the teachers working in blended learning conditions is directly linked to the possibility of overcoming the difficulties and taking part in the process of constant professional development. Teachers, as the main stakeholders, usually struggle as a result of the technological barriers, time management concerns, and pedagogical strategies to fit the blended models. Nevertheless, these issues could be addressed with the help of specific professional growth to increase their confidence and competence, which would result in a feeling of achievement. Educators who undergo continuous training and support initiatives are more satisfied and efficient in the application of blended learning practices. This sense of whole performance not only best encourages the instructors to use better teaching methods, but it also leaves a wonderful effect on the commitment and performance of scholars. The tackling of difficulties and focus on professional growth will help teachers to establish a more dynamic and integrated mastering environment and, ultimately, facilitate the enhancement of educational outcomes at the university level (Porter et al., 2014).

Reflective Skills

Reflective skills are critical in improving the blended learning practice among teachers, especially in the challenge confrontation and professional development. As stakeholders, instructors are entitled to carefully assess their teaching methods, find out the areas to improve, and adjust to the changing needs of blended learning settings. Reflective practices have the potential of enabling teachers to interpret their experiences, have feedback and embrace new practices that would suit the students and hence enable interaction and academic successes. The same study proposed that the barriers to the blended learning, including barriers of technology and various levels of preparation of students, can be surmounted by reflective skills and help in the constant professional growth. Educators can also become better teachers because they can reflect on their

own teaching process and collaborate with colleagues to offer a university student a learning experience that is more effective and more inclusive (Wittmann and Olivier, 2021).

Improve Teaching Methods

In order to enhance the process of teaching in the blended learning environment, one should address the tasks of the teachers and focus on professional growth. Teachers are some of the key stakeholders in providing blended learning activities that enhance the commitment and performance of the students. Studies have revealed that professional development programs that are altered to blended learning possess skills required by teachers to successfully incorporate technology and deal with obstacles like technical challenges and pedagogical acclimatization. Moreover, the innovative educational practices can be encouraged, and the teachers should be empowered to design the interactive and student-centered learning process through continuous training and support. Resolving these issues and investing in professional development can help universities to make sure that teachers are prepared enough to make use of blended learning tools, and finally reach the goals through better results and engagement of students (Alammary, Sheard, and Carbone, 2014).

Gamification Skills

Gamification skills have been confirmed to be an important approach to enhance the involvement of scholars in blended learning settings, particularly in college level. Using the support of the incorporation of recreation-like aspects, including factors, badges, leaderboards, and assignments, into the learning process, the instructors might provide an additional interactive and immediate experience to the students. Nonetheless, the practice of gamification requires teachers to deal with the difficulties along with technical proficiency, curriculum focus, and the necessity of lifelong professional development. Teachers as stakeholders are significant to the design and implementation of gaming activities that can address diverse learning needs and, at the same time, foster the spirit of competition and collaboration amongst students. Recent research indicates that successful gamification not only increases the level of engagement but also positively affects academic achievement by making learning fun and goal-oriented. Thus, teachers must be provided with the necessary skills and resources that will allow them to employ gamification in order to achieve the greatest influence on the practice of blended learning (Sailer and Homner, 2020).

Personalization

Personalization in schooling means the ability to fit mastery review to the character needs, interests, and hobbies of every student. This strategy recognizes the fact that beginners have different backgrounds and that acquiring knowledge of styles, and it uses the technology to provide tailor-made avenues to learning. The process of personalization can be approached in the form of adaptive learning technologies that adjust the content and exams according to the overall performance of the pupils, allowing an allowance of an additional individual approach to the idea that will facilitate mastering the ideas (Wang et al., 2020). The studies have shown that individualized mastery can make the student motivation and involvement beautiful and result in high academic achievements (Walkington, 2013).

Moreover, personalization of education may include shared goal-setting between the students and the educators, and includes a sense of ownership in the learning process. The teacher can build more pertinent and valuable learning experiences by integrating the interests and choices of students into their learning plans (Merrill, 2020).

Pace at Your Comfort

Individualization in learning enables students to learn at their own pace, which is a great benefit to the old models, one-size-fits-all. This personalized teaching method allows the learners to move through materials at their own pace when they have mastered concepts, instead of the curriculum dictating how they are to be taught. An example is adaptive learning technologies, which allow students to progress in the event that the student exhibits competence and offer extra assistance or backup when necessary. Such flexibility can be

used to alleviate the fear of falling behind and facilitate more thorough learning, because students can have a greater influence on their learning process (Chen et al., 2023).

Personal Needs

Individualization of training enhances personalization to influence the mastering process to form the unique desires of each pupil, and thus, through this process, one can more effectively prepare the content in a personal way. Personalized learning systems can determine the personal strengths and weaknesses in addition to likes and dislikes by making use of data-driven insights, adaptive learning technologies, and differentiated instruction. This will enable teachers to modify the speed, materials, and instructional strategies to accommodate the needs of every learner who may take more time to learn some of his/her subjects, have more practice, or simply require a new approach in learning the subject. As an example, various students with special needs can be given specific interventions, and gifted students will be able to proceed to more difficult tasks. This flexibility not only assists the students in meeting their learning objectives but also assists them in developing a feeling of agency and confidence over their learning process (Hattie, 2023).

Learning Style

Individualization in education improves the educational process by matching instructional plans to the individual learning styles of a student, which enables a student to have a successful and more engaging education. Each student is unique in the way he/she takes in and process information; some students may be good at taking up visual media, others at doing practical courses, but still others can be good at hearing courses explained to them. Personalised learning allows the teacher to modify the content presentation to these styles, either by use of visual aids, simulations, or group projects. Such flexibility not only helps college students to learn complex standards more easily without trouble, but also enhances the level of motivation and interest, since students are inclined to believe that the learning process is adjusted to their requirements. Personalized learning allows building a closer attachment to the material by identifying and supporting the various learning preferences, encouraging a higher retention rate and academic achievement (Buskila, 2023).

Instructors in Learning

Educational personalization can significantly enhance student engagement through the establishment of learning experiences related to individual needs, which results in motivation and engagement. When learning is made to conform to the strengths of the student, interests, and type of learning that he/she prefers, it gives the student a feeling of being wealthy and relevant, thereby making the contents of the learning process more sense and interesting. This method would enable students to learn at their own pace, get specific assistance on the problem, and investigate areas of interest. Studies have revealed that students who feel that the learning process suits their individual requirements tend to have more interest in the learning, have greater persistence, and will assume an active role in their learning (Walkington, 2023).

Learning Materials to Control Learning

The access to online learning materials is a critical factor in the process of personalization in education as it allows students to gain control over their very learning process. The greater the incorporation of digital platforms and resources, the more personalized learning becomes a possibility since students will be able to access various materials that reflect their needs and preferences in learning. The material used in online learning, like video lectures, interactive simulations, testing, and adaptive learning platforms enable students to engage with content at their own pace and in a manner that is most appropriate to students' learning styles. This autonomy also enhances the engagement as it offers students more control over how, where, and when they learn, in addition to offering real-time feedback and dynamism of the learning material depending on the performance. As an example, modular, on-demand lessons provide learners with the ability to re-learn difficult concepts or use mastered areas to keep progressing, which encourages mastery and motivation (Cao et al., 2023).

Feedback Is More Accessible

Individual feedback has been given greater accessibility in the contemporary learning setting and has greatly contributed to the increased student engagement and individual development. The utilization of digital tools and platforms will make it possible to provide feedback more often and in real-time, and in a format adjusted to the needs of each student. Contrary to the traditional techniques where feedback may be delayed or generalized, personalized feedback may be specific, actionable, and immediate, and assist students in correcting their misconceptions in real time and keep up with their learning objectives. Such adaptive learning systems as those provide automated but personalized feedback according to the performance of students and include immediate information about areas of strength and those that need improvement. Such immediate feedback also contributes to increased engagement because a student will become more motivated when there are specific correlations between their actions and achievement (Chen et al., 2023).

Challenging Topics

Education personalization, especially when it is dedicated to tackling difficult subjects and assisting students to navigate difficult material at their own pace and according to their male or female preferences, is especially effective. This directed instruction facilitates more cognition in the challenging material because the learners can be provided with more resources, scaffolding, or differentiated strategies that can be altered to the level of student comprehension. In case a student is having problems with a certain concept, a personalized learning system can give personalized attention, which may include step-by-step instructions, more practice activities, or other possible ways of explanation that are compatible with his or her learning styles. Such a personal approach to challenging material not only improves understanding and comprehension but also gives students more confidence and interest to learn as they cannot easily feel overwhelmed and will only continue to struggle (Walkington, 2023).

Individualized Learning towards a Full Life

Individualization in education is important in enabling students strike a balance between the academic tasks and their personal lives by providing more flexibility in the way, time, and location of learning. Personalized learning allows students to choose their own timetable, focus on their own learning according to their individual needs, and select the learning patterns that are convenient to them and their lifestyle. This flexibility helps decrease the stress experienced during strict times of classes and standardized work because students can study at their own time regarding other personal needs like work, family, or extracurricular activities. Adaptive learning technologies, which allow them to customize learning materials depending on their work progress, permit students to work with lessons and complete assignments on their own time, which can reduce the time spent in the classroom learning intensively and provide a more self-directed environment (Cao et al., 2023).

Academic Needs

Individualization in education is also important in assisting students to juggle their academic and non-academic lives by providing more flexibility on how, where, and when learning takes place. In individualized learning, the student gets to control their speed, focus their learning according to their needs, and get learning modalities that suit themselves and their time schedules and lifestyles. This conduciveness minimizes the anxiety that comes with fixed class schedules and standardized homework, which allows students to now control their education to their own schedule, like work, family life, or other extracurricular activities. Individualized learning technologies that tailor the material to each user can allow a student to proceed with the lesson at their own pace and complete the task at their convenience, sometimes without having to spend hours per week in the classroom, and can provide a more self-guided learning experience (Cao et al., 2023).

Statement of the Problem

Although blended learning provides an avenue through which education can be personalized, this requires a lot of challenges to be met. Poor technological infrastructure, lack of time to redesign the course, and absence

of long-term training are some of the challenges faced by many educators. The barriers impede their abilities to mature and provide genuinely individualized learning experiences in a blended setting. As a result, a desperate lack of connection exists between the possibility of blended learning to support the needs of the individual students and the realities in many learning institutions, directly affecting the quality of student learning and personalization. This research, hence aims to explore the individual effects of these particular implementation issues and the quality of professional education offered to teachers on the extent of individualization that students experience in actual sense.

Research Objectives

1. To know the teachers' challenges and professional development in blended learning.
2. To know the impact of teachers' challenges and professional development in blended learning on students' personalization.

Research Question

1. What are the teachers' challenges and professional development in blended learning? (Align with Obj # 1)

Research Hypothesis

H_{01} : There is no significant impact of teachers' challenges and professional development in blended learning on students' personalization. (Align with Obj # 2)

Significance of the Study

- ▶ Guides strategic teacher training by pinpointing which professional development areas most directly help teachers overcome blended learning challenges to personalize instruction.
- ▶ Centers the student outcome by tracing how teacher challenges and growth directly impact students' experience of a tailored education.
- ▶ Bridges theory and practice by showing how to turn the ideal of personalization into a classroom reality through focused educator support.

Delimitations

The delimitations of the study were:

1. Public sectors Universities of the Southern Districts of Khyber Pakhtunkhwa
2. Only Teachers and Students

Research Methodology

In this study, the research design used was quantitative and descriptive in nature because it aimed at exploring how the practices of engagement and collaboration by teachers taught in blended learning settings affect the assessment and feedback offered to students. The target population included students (students who were pursuing BS, M.Phil., and Ph.D. in universities) and faculty members in the southern districts of Khyber Pakhtunkhwa. Stratified random sampling method with guidance of Krejcie and Morgan formula (1970) was used to proportionally select the sample of participants who had to be distributed across five different universities, with a final sample of 148 teachers and 341 students ($n=489$). Two researcher-designed questionnaires with a 5-point Likert scale (Never=1 to Always=5) were used to collect the data. The initial tool was used to collect the demographic data and quantify the involvement and cooperation of teachers in blended learning activities. The second tool measured the perceived effect of these teacher practices on the student feedback and assessment. Physical administration of questionnaires was done to the participants with high returns (91% among teachers, 94% among students). The received data were

transformed into an analytical form and analyzed by descriptive statistics (frequencies, percentages) and inferential statistics (linear regression) to justify the hypothesis that was formulated in the research.

Results And Discussions

Table 1

Teachers' Challenges and Professional Development (Align with Q # 1)

Stakeholders	Challenges and Professional Development											
	Never		Rarely		Sometimes		Often		Always		Total	
	N	%	N	%	N	%	N	%	N	%		
Teachers	5	3.7	25	18.5	50	37	40	29.6	15	11.1	135	

The frequency and percentage level of responses of teachers on the issue of challenges and professional development in blended learning are shown in the table. Only a small percentage of teachers (3.7) never encounter difficulties and never participate in professional development, and 18.5% do so seldom. Certainly, a high percentage (37%) of them occasionally face difficulties or are involved in professional growth, which means they are not necessarily engaged. Also, 29.6% will struggle with or practice professional growth frequently, and 11.1% will always do this, which indicates steady participation.

Figure 1

Challenges and Professional Development

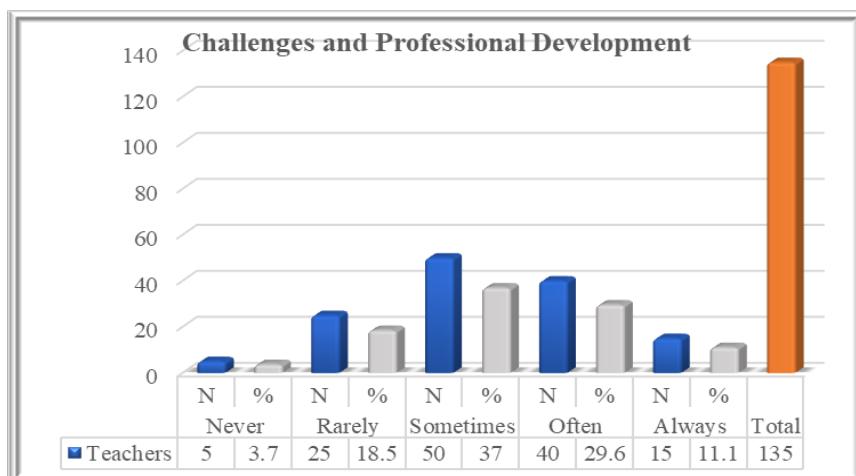


Table 2

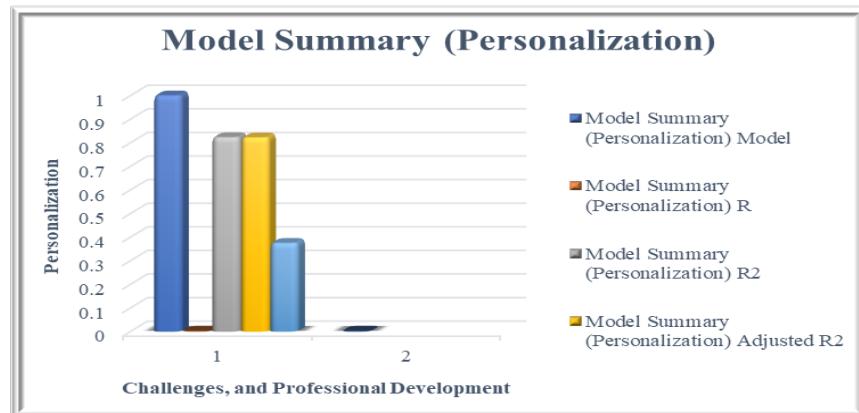
Impact of Teachers' Challenges and Professional Development Practices on Students' Personalization (Align with H_{01})

Model Summary (Personalization)				
Model	R	R ²	Adjusted R ²	Std. Error of the Estimate
1	.907a	.823	.822	.375
Predictor: (Constant), Challenges and Professional Development				

Challenges/professional development and personalization outcomes have an exceptionally strong association as demonstrated by the regression analysis ($R = 0.907$). The fact that the R^2 is 0.823 shows that these variables explain around 82.3 percent of the variation in measures of personalization. The good fit of the model with very minor overfitting is indicated by the adjusted R^2 (0.822). The standard error of 0.375 implies a high level of predictive accuracy, whereby the scores of personalization actually observed are expected to have a differentiation with the predicted values of less than 0.375.

Figure 2

Model Summary (Personalization)



Findings

1. The data indicate that challenges and engagement in professional development for blended learning are prevalent among teachers, with only a minimal proportion (3.7%) never experiencing these issues. While a combined 21.2% report rare or no involvement, the majority, constituting 37%, encounter difficulties or participate in development activities only intermittently. A significant 40.7% of teachers, however, face these challenges or engage in professional growth frequently or consistently, suggesting that for a substantial portion of the teaching body, these experiences are a regular and integral part of their practice. (Align with Table # 1)
2. Based on the regression analysis, teachers' challenges and professional development practices are a powerful predictor of personalization in student learning. The model demonstrates an exceptionally strong positive relationship ($R = 0.907$), indicating that these teacher-focused factors explain approximately 82.3% of the variance in personalization outcomes. The high predictive accuracy of the model, evidenced by an adjusted R-squared of 0.822 and a low standard error of 0.375, confirms that changes in teachers' experiences with challenges and professional growth are closely associated with significant changes in the degree of learning personalization achieved for their students. (Align with Table # 2)

Discussions

1. The finding, which shows most teachers regularly face challenges and engage in professional development, aligns closely with the conclusions of Rana, Shrivastava, & Raut (2022). Their study describes blended teaching as involving a state of "constant negotiation," where encountering obstacles and seeking new skills are not occasional events but a standard and recurring part of the job. This directly supports the data indicating that for the majority of educators, these experiences form a consistent and integral element of their professional practice. (Align with Finding # 1)
2. The latter result is directly linked to the current study by Torres Olave and Dillon (2022), as their multilevel analysis in the Journal of Research in Science Teaching revealed that the predictors of differentiated instruction were the most significant, i.e., the professional growth of teachers and their adjustment to learning challenges in the classroom. The fact that these issues are the ones that primarily cause the variation in personalization practices is empirically supported by the fact that the present model has a high explanatory power ($R^2 = 0.823$), which, in turn, proves that personalization is inherently tied to the presence of the given teacher-level conditions. (Align with Finding # 2)

Conclusions

1. The findings reveal that navigating challenges and pursuing professional development are not isolated events but are instead widespread and routine aspects of a teacher's role in a blended learning

environment. The experience is common, with a clear majority of educators reporting some level of ongoing engagement. While the frequency varies, from occasional to consistent, the data underscores that confronting instructional hurdles and seeking growth opportunities constitute a fundamental and recurring component of contemporary teaching practice. (Align with Obj # 1)

2. Based on the presented statistical model, a decisive conclusion can be drawn: the professional experiences of teachers, specifically their encounters with challenges and their engagement in development activities, are fundamentally linked to their capacity for personalizing student learning. The analysis establishes these factors as a primary and robust determinant, directly accounting for the vast majority of variation in personalization outcomes. This powerful statistical relationship confirms that supporting teachers through their professional obstacles and growth is not merely beneficial but is, in fact, essential for achieving tailored and effective student-centered instruction. (Align with Obj # 2)

Recommendations

- ▶ Establish a mandatory and continuous professional development program for all teachers to ensure consistent, rather than occasional, engagement with training and support in blended learning methods.
- ▶ Focus all professional development content specifically on practical strategies for personalizing student learning, directly linking teacher training to the improvement of this critical outcome.

Guidelines for Future Researchers

1. Future research can expand this study by including private institutions and other regions of Pakistan to see if the results are different in other settings.
2. Using interviews or focus groups alongside surveys in future work would help explain the reasons behind the strong statistical relationship found in this study.
3. Conducting a study that follows teachers and students over a longer period of time would show how professional development affects personalized learning in the long run.

References

Alammary, A., Sheard, J., & Carbone, A. (2014). Blended learning in higher education: Three different design approaches. *Australasian Journal of Educational Technology*, 30(4). <https://doi.org/10.14742/ajet.693>

Buskila, Y. (2023). Raising the teacher's professional status in Israel during the corona crisis. *Social Sciences & Humanities Open*, 7(1), 100425. <https://doi.org/10.1016/j.ssaho.2023.100425>

Cao, Y., Jian, F., Wang, J., Yu, Y., Song, W., Yisimayi, A., ... & Xie, X. S. (2023). Imprinted SARS-CoV-2 humoral immunity induces convergent Omicron RBD evolution. *Nature*, 614(7948), 521-529. <https://doi.org/10.1101/2022.09.15.507787>

Chen, H., Sun, D., Yang, Y., Looi, C., & Jia, F. (2023). Detecting and visualizing research trends of blended learning: A bibliometric analysis of studies from 2013-2022. *Eurasia Journal of Mathematics, Science and Technology Education*, 19(10), em2336. <https://doi.org/10.29333/ejmste/13592>

Garvis, S., & Keane, T. (Eds.). (2023). *Technological innovations in education: Applications in education and teaching*. Springer.

Graham, C. R. (2006). Blended learning systems. In *The handbook of blended learning: Global perspectives, local designs* (pp. 3-21). Pfeiffer.

Hattie, J. (2023). *Visible learning: The sequel: A synthesis of over 2,100 meta-analyses relating to achievement*. Routledge.

Hrastinski, S. (2019). What do we mean by blended learning? *TechTrends*, 63(5), 564–569. <https://doi.org/10.1007/s11528-019-00375-5>

Khalil, M., & Ebner, M. (2023). What massive open online course (MOOC) stakeholders can learn from learning analytics? In *Learning, design, and technology: An international compendium of theory, research, practice, and policy* (pp. 3731–3760). Springer. https://doi.org/10.1007/978-3-030-98258-1_166

Koomsap, P., Cooper, A., & Stjepandić, J. (Eds.). (2023). Leveraging transdisciplinary engineering in a changing and connected world: Proceedings of the 30th ISTE International Conference on Transdisciplinary Engineering, Hua Hin Cha Am, Thailand, July 11–14, 2023 (Vol. 41). IOS Press.

McCarthy, S., & Palmer, E. (2023). Defining an effective approach to blended learning in higher education: A systematic review. *Australasian Journal of Educational Technology*, 39(2), 98–114. <https://doi.org/10.14742/ajet.8356>

Merrill, T. W. (2020). The economics of leasing. *Journal of Legal Analysis*, 12, 221–272. <https://doi.org/10.1093/jla/laz007>

Porter, W. W., Graham, C. R., Spring, K. A., & Welch, K. R. (2014). Blended learning in higher education: Institutional adoption and implementation. *Computers & Education*, 75, 185–195. <https://doi.org/10.1016/j.compedu.2014.02.011>

Poulin, R., & Straut, T. T. (2016). WCET distance education enrollment report 2016: Utilizing US Department of Education data. WICHE Cooperative for Educational Technologies (WCET). <https://wcet.wiche.edu/>

Rana, S., Shrivastava, A. K., & Raut, S. K. (Eds.). (2022). *Promotional practices and perspectives from emerging markets*.

Sailer, M., & Homner, L. (2019). The Gamification of learning: A meta-analysis. *Educational Psychology Review*, 32(1), 77-112. <https://doi.org/10.1007/s10648-019-09498-w>

Torres Olave, B., & Dillon, J. (2022). Chilean physics teacher educators' hybrid identities and border crossings as opportunities for agency within school and university. *Journal of Research in Science Teaching*, 59(10), 1795-1821. <https://doi.org/10.1002/tea.21774>

Walkington, C. A. (2013). Using adaptive learning technologies to personalize instruction to student interests: The impact of relevant contexts on performance and learning outcomes. *Journal of Educational Psychology*, 105(4), 932-945. <https://doi.org/10.1037/a0031882>

Walkington, N. J. (2023). Nesterov's method for convex optimization. *SIAM Review*, 65(2), 539-562. <https://doi.org/10.1137/21m1390037>

Wittmann, G. E., & Olivier, J. (2021). Blended learning as an approach to foster self-directed learning in teacher professional development programs. *The Independent Journal of Teaching and Learning*, 16(2), 71-84.

Zhou, Q., Huang, Y., Luo, Y., Bai, X., Cui, Y., Wang, Y., & Chen, N. (2023). Implementation of blended learning at the institutional level. In *Handbook of educational reform through blended learning* (pp. 159-198). Springer Nature Singapore.

Zimba, Z. F., Khosa, P., & Pillay, R. (2020). Using blended learning in South African social work education to facilitate student engagement. *Social Work Education*, 40(2), 263-278. <https://doi.org/10.1080/02615479.2020.1746261>