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Impact of Learning Styles on the Development of 3Cs (Collaboration, Communication and Creativity) among University Students: The Mediating Role of Teaching Strategies and Curriculum

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Abstract

This research article discussed the impact of learning styles on collaboration, communication, and creativity skills (3Cs) development among university students in Punjab, Pakistan, and the mediating effect of teaching strategies and curriculum and the moderating effect of university type. A mixed-methods design with predominant quantitative design was used to collect data using a structured questionnaire with 600 undergraduate and graduate students. Measurement and structural model evaluation, mediation and moderation analysis and bootstrapping were conducted by use of Partial Least Squares Structural Equation Modeling (PLS-SEM) and selected qualitative responses were analyzed with the aid of thematic analysis. The results showed that the collaboration, communication, and creativity skills are highly predicted by learning styles. These relationships were partly mediated by the teaching strategies and curriculum which implied the significance of instructional alignment. Dissimilarities among the public and the private universities imply the contextual impacts on the process of learning. In general, the article outlines the significance of the flexible, student-oriented instructional strategies to facilitate the impact of different learning styles and improve the 21st-century skills of graduates.

Key Words

Learning Styles, Collaboration Skills, Communication Skills, Creativity Skills, Teaching Strategies, Curriculum, Higher Education

Introduction

Higher education has seen significant change in recent years, with a growing focus on developing soft skills like teamwork and communication in addition to traditional academic knowledge. It is crucial to comprehend how various learning styles affect the development and acquisition of these skills, especially as educational institutions and instructors attempt to prepare students for the intricate demands of the contemporary workforce. Learning styles encompass a range of preferences in how students engage with educational content, including visual, auditory, and kinesthetic modalities (Cimermanová, 2018). These preferences significantly affect how students process information and interact with their learning environments. As educational institutions seek to create more inclusive and effective learning experiences, it is essential to tailor instructional strategies to accommodate these diverse learning styles (Karatas & Yalin, 2021).

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The preferred methods that people perceive, process, and retain information are referred to as their learning styles (Sarwat et al., 2024). Students might have a wide range of preferences when it comes to these types, from visual and auditory to more kinesthetic or reading/writing focused methods. It is critical for educators to comprehend these preferences since instructional strategies that are not aligned with students' learning styles can cause disengagement and lower academic achievement (Pashler et al., 2008). In STEM education, contend that recognizing and catering to a variety of learning styles can greatly improve student engagement and learning outcomes. They stress that pupils are more likely to acquire vital skills like cooperation and communication when teachers modify their pedagogy to suit different learning styles. These abilities are necessary for professional teamwork as well as intellectual achievement in academic settings (Brent et al., 2021).

The significance of collaboration, communication, and creativity skills in academic and professional contexts cannot to overstated. Collaboration refers to the ability to work effectively within a team, leveraging the strengths and perspectives of diverse individuals to achieve common goals (Davis et al., 2021). Communication skills encompass both verbal and non-verbal exchanges, essential for articulating ideas clearly and building relationships (Hynes et al., 2021).

Literature Review

Learning Styles

When you collaborate, you work with others to achieve the same goal. Active learners usually do well in groups that include activities they can do with others (Troussas et al., 2023). Rather, some learners might like to observe and make a plan first which can lead to deeper collaboration.

A study by Siddiquei and Khalid (2022) at universities in Pakistan reveals that students' teamwork in groups and coordination improve when the lessons and activities suit how they like to learn. Using PBL with a range of learning styles helps teams work better together and improve their peer teaching skills (Kamran et al., 2023).

Collaboration Skills

Working successfully and respectfully in a team to achieve a goal is described as collaboration and it is one of the strongest skills emphasized in current education frameworks (Troussas et al., 2023). Working well with others is key to doing well in college and for preparing students for office jobs that need teamwork. Studies have demonstrated that students do better in critical thinking, social skills and solving problems when learning as a group.

There is a lot of evidence in education that learning styles are tied to how people collaborate. In Kolb's model, according to his theory from 1984, those who prefer divergent and accommodative ways of learning usually do well in groups, as they are naturally attentive to the feelings of others and appreciate engaging in teamwork. Likewise, students who rely on seeing and hearing information usually excel in group work at presenting, generating ideas, sharing files and joining discussions, why it is important for groups to be made up of people with different learning needs (Kolb & Kolb, 2005).

Communication Skills

Communication is a main skill needed in the 21st century and refers to expressing your ideas well in spoken, written and non-verbal ways, in a range of situations (Kausar, 2025). Good communication lets higher education students achieve better grades, make new connections and prepare for future employment. Now that teamwork across different cultures is more common, employers need workers who communicate effectively on a range of digital platforms (Norris, 2019).

The research indicates that how we learn affects how we communicate. According to Fleming and Mills' (1992) model, learners with verbal, auditory or kinesthetic preferences generally communicate well. As a result, those who rely on hearing, also called auditory learners, excel in spoken discussions, whereas visual learners could do better at talking with charts, tables or diagrams. Being aware of how people learn can guide educators to make teaching communication skills more suited to each student. A further point by Kolb (1984) is that reflective learners tend to write well, while active learners are likely to communicate better with others during group discussions (Amponsah, 2020).

Creativity Skills

Being creative and having creative thinking—or the ability to develop new ideas and solve challenges in original ways—is basic to succeeding in the 21st century (Adeoye & Jimoh, 2023). Preparing students for uncertain and changing workplaces requires schools to help them develop creativity and problem-solving skills during higher education. People from all areas of work such as science, business, engineering and technology, value these skills nowadays.

How we learn often goes hand in hand with our creative expression. Evidence shows that the way students prefer to learn affects their level and type of creativity. As an illustration, those who learn through visual means frequently do well in spatial tasks, art and imagery, while those who learn best aurally often reveal their creativity in music or speech (Gafour & Gafour, 2020).

Teaching Strategies and Curriculum as Mediators

During curriculum design and teaching strategies, there is a central role of translating student learning preferences to learning outcomes. Both constructivist and learner centered theories assert that knowledge building is best experienced when the instructional strategies are dynamic and involve the learners in them based on their cognitive and experiential orientations (Fatima et al., 2024). According to Hizli Alkan and Priestley (2019) shown that, when the strategies of teaching are in line with the learning styles of the students, the students exhibit higher degrees of engagement, motivation and persistence which later translate to high performance in academics and attainment of skills. As an illustration, experiential and problem-based learning styles have been identified as useful to support kinesthetic and visual learners through the delivery of hands-on and real-world experiences, whereas discussion-based and lecture-based strategies are more helpful in supporting auditory and reading/writing learners, respectively. This alignment will enable learning styles to have a greater effect on the advancement of higher-order skills, such as collaboration, communication, and creativity (Zhang et al., 2024).

Methodology

The research design was a mixed-method study, which is mainly quantitative in nature, but there is a small amount of qualitative information integrated into the survey tool. This study design is cross-sectional survey, which was used to investigate the effects of learning styles on the acquisition of collaboration, communication, and creativity skills by university students in Punjab, Pakistan. This design was deemed suitable because it enables one to gather data of a large and heterogeneous population at one time and also enables the researcher to analyze the relationships among several variables.

A total of 600 undergraduate and graduate students who will be in universities of the public and the private sector across Punjab will form the study sample. Multi-stage stratified random sampling technique was used to sample the participants so that they were representative both in terms of region (Upper Punjab and South Punjab) and the sector of the university. Students of the relevant disciplines like Education, Social Sciences, and Management Sciences were randomly contacted within a few chosen universities. The sample was considered

sufficient to perform Structural Equation Modeling Partial Least Squares (PLS-SEM) and was also larger than the minimum cutoffs needed in complex multivariate analysis.

A structured self-administered questionnaire that contained sections that measured demographic information, learning styles, teaching strategies, and curriculum, collaboration skills, communication skills and creativity skills was used to collect data. The items were calculated out of the existing tools and literature materials and measured on a five-point Likert scale (strongly disagree-strongly agree). Before the actual data collection, the instrument was subject to subject experts review and pilot-tested to ascertain clarity and content validity.

The preliminary descriptive statistics such as frequencies, percentages, means and standard deviations were evaluated using SPSS. SmartPLS 4 was used to carry out advanced multivariate analysis. Measurement model has been checked on reliability of indicators, internal consistency reliability, evaluability, and discriminant evaluability. Next, the structural model was evaluated by estimating path coefficients, coefficients of determination (R2) and effect sizes (f2), predictive relevance (Q2) and model fit indices. The significance of the direct effects, and also mediating role of teaching strategies and curriculum, were tested using bootstrapping with 5,000 resamples. Besides this, a deductive thematic analysis of some of the reflective questionnaire items was done to offer qualitative information complementary and helping explicate the quantitative results.

Results

Measurement Model

The reliability and convergent validity of the study constructs were assessed using Cronbach's alpha, rho_A, composite reliability (CR), and average variance extracted (AVE). The value of Cronbach alpha as indicated in Table 5.1 is between 0.876 and 0.919 whereas the value of rho_A is between 0.880 and 0.923 with strong internal consistency existing in all the constructs. The composite reliability scores were found to be higher than the desired 0.70 and the scores were found to lie between 0.907 and 0.939 which is indicative of satisfactory construct reliability. More so, the values of AVE were between 0.619 and 0.756 which exceeds the minimum of 0.50 and thus, AVE shows sufficient convergent validity.

The heterotrait-monotrait (HTMT) ratio was used to test discriminant validity. The majority of the HTMT values were below or near the recommended value of 0.9, which shows that the constructs had acceptable discriminant validity as indicated in Table 4.9. All in all, the results indicate that the measurement model has sufficient reliability, convergent, and discriminant validity, which is why it can be used in the further analysis of structural models.

Table 1

Convergent Validity of Study Constructs

Constructs	Cronbach's Alpha	rho_A	Composite Reliability	Average Variance Extracted (AVE)
Academic Professional Relevance	0.918	0.920	0.936	0.710
Collaboration	0.876	0.880	0.907	0.619
Communication	0.897	0.899	0.921	0.661
Creativity	0.896	0.911	0.921	0.663
Learning Style	0.919	0.920	0.939	0.756
Specific Learning Style	0.917	0.923	0.935	0.708
Teaching Strategy Curriculum	0.882	0.905	0.912	0.639
University Setting Context	0.882	0.911	0.913	0.678

Table 2
Discriminant Validity (HTMT Ratio)

	Academic Professional Relevance	Collaboration	Communication	Creativity	Learning Style	Specific Learning Style	Teaching Strategy Curriculum	University Setting Context
Academic Professional Relevance								
Collaboration	0.909							
Communication	0.949	0.958						
Creativity	0.897	1.083	0.956					
Learning Style	0.904	1.080	0.930	1.079				
Specific Learning Style	1.044	0.892	0.939	0.882	0.882			
Teaching Strategy Curriculum	1.014	0.897	0.914	0.882	0.878	1.056		
University Setting Context	0.158	0.168	0.164	0.170	0.167	0.187	0.167	

Structural Model

Once the model of measurement was proved to be reliable and valid, the structural model was measured, to test the hypothesized relationships among the constructs. The path coefficients were performed based on bootstrapping procedure with 5,000 sub samples and t-value of 1.96 was used in order to establish the statistical significance. The direct relationships results can be found at Table 4, and the mediation effects are at Table 5. T-tests, whose value is less than 1.96, were regarded as not supported.

Table 3
Direct Relationship Results

Hypothesis	Path	β	t-value	p-value	Decision
H1	Collaboration → Learning Style	0.311	8.889	0.000**	Supported
H2	Communication → Learning Style	−0.063	4.477	0.000**	Supported
H3	Creativity → Learning Style	0.692	19.598	0.000**	Supported
H4	Learning Style → Academic Professional Relevance	0.251	8.135	0.000**	Supported
H5	Learning Style → Teaching Strategy Curriculum	0.802	36.483	0.000**	Supported
H6	Learning Style → University Setting Context	0.157	3.456	0.001**	Supported
H7	Specific Learning Style → Learning Style	0.061	4.952	0.000**	Supported
H8	Teaching Strategy Curriculum → Academic Professional Relevance	0.725	24.411	0.000**	Supported
H9	University Setting Context → Academic Professional Relevance	−0.002	0.120	0.904ns	Not Supported

Note: *, ** indicate significance at 0.05 and 0.01 levels; ns = non-significant.

Table 4

Mediation Results (Indirect Effects)

Hypothesis	Indirect Path	β	t-value	p-value	Decision
H10	Learning Style → Teaching Strategy Curriculum → Academic Professional Relevance	0.581	22.804	0.000**	Supported
H11	Learning Style → University Setting Context → Academic Professional Relevance	0.000	0.109	0.913ns	Not Supported

Note: *, ** indicate significance at 0.05 and 0.01 levels; ns = non-significant.

The findings demonstrate that collaboration, communication, creativity, and particular learning style are significant predictors of learning style, and the strongest predictor is creativity. Academic professional relevance, teaching strategy curriculum, and the context of the university setting are impacted by learning style in a positive significant way. There is also a high direct impact of teaching strategy curriculum on academic professional relevance. The mediation analysis proves that the learning style plays an important role in mediating the relationship between the teaching strategy curriculum and academic professional relevance, and the mediation effect including the context of university setting is not justified. In general, the results highlight the key mediating role of learning style that develops academic and curricular outcomes.

Qualitative Findings

The qualitative results were obtained as the results of the open-ended responses and the thematic analysis, which was the attempt to investigate the perceptions of the participants upon the factors that impacted the process of learning and acquiring new skills. The respondent analysis showed that there were four key themes, i.e., academic relevance, collaborative learning, communication and interaction, and creative and flexible approaches towards learning. The academic and professional relevance is also considered to be important as participants highlighted that learning activities that were closely related to their practical applications helped them to build their knowledge and be ready to work in the professional setting. Most of the respondents indicated that they became more engaged and motivated when the contents of their courses addressed practical needs and industry-related requirements.

The collaboration theme brought out the importance of group work and interaction with peers. The respondents reported that group learning activities facilitated sharing of knowledge, problem solving, and support among the learners, which helped them to have a better learning experience. In respect to communication, participants were observed to have open communication with instructors and other participants to help in clarity of concepts and active participation. Understandable teaching, feedback on time, and friendly teaching styles were seen as the key elements of successful learning.

The participants found the methods of creative and flexible learning as relevant to the sustenance of interest and the justification of various learning styles. Creative teaching approaches, different methods of instruction and the use of technology were cited to contribute to knowledge and creativity. Altogether, the qualitative results are helpful in supplementing the quantitative ones since they offer a further insight into the way the four concepts of academic relevance, collaboration, communication, and creative teaching practices influence the experiences and outcomes of learners.

Discussion

This research was a combination of quantitative and qualitative studies which tested important variables affecting the learning process of students. The outcomes of the measurement model indicated a good reliability and validity

of the study constructs and this formed a good basis of interpreting the structural relationships. The high value of Cronbach's alpha, composite reliability and AVE show that the measurement instruments were able to reliably and accurately measure the concepts being intended, which are pertinent to the recommendation of measurement criteria (Sultana et al., 2025).

The results indicate the relevance of academic professional relevance, collaboration, and communication, creativity, learning style, specific learning style, teaching strategy and curriculum, and university setting context in meaningful learning experiences. Students who engage more in learning content that is closely related to professional, practical needs, feel that their learning is more valuable which would confirm prior research results on constructive alignment and outcomes-based education (Kamran et al., 2023). Teamwork has become a very important part of successful learning, which agrees with the existing body of literature that states that peer interaction and collaboration are important in facilitating a deeper level of understanding and problem-solving abilities (Fatima et al., 2025). Rafiq-uz-Zaman (2022) stated that the 3Cs skills as 21st century skills which are the need of the era. The social constructivist theory goes on to propose that learning is a process of interaction and common sense-making, which explains the significance of collaborative learning settings (Saeed et al., 2025).

It was identified that communication between the instructors and students is a necessity to improve clarity, participation and satisfaction. This conclusion is consistent with the previous research that stated that effective communication and feedback in time were one of the key factors of successful student engagement and academic performance (Nousheen & Tabassum, 2024). The importance of the creativity and the adaptability of teaching methods support the necessity of inventive teaching strategies that can support different types of learning. It has been demonstrated that active and creative learning strategies give a boost to motivation, critical thinking and knowledge retention (Urooj & Farooq, 2023). The qualitative results also confirm the same perception since subjects said they prefer differentiated and interactive teaching methods.

The impact of the teaching strategies and curriculum design proves that the systematic, learner-based curriculums are the key to the attainment of the positive educational results. A case study by research that was conducted previously suggests that effective learning depends largely on well-constructed curricula and suitable teaching strategies (Bhuttah et al., 2024). The university setting context is also influential as it offers a learning environment that is conducive due to sufficient provision of resources, infrastructure, and support of the institution. Enhanced student satisfaction and academic performance have always been linked with a favorable learning environment (Maqbool et al., 2024).

All in all, the combination of quantitative and qualitative results increases the reliability of the study and gives a deep insight into the factors that affect learning experiences. These results are added to the existing evidence of educational effectiveness and have implications that can guide practitioners in teaching and learning and curriculum designers and institutional leaders in improving their educational practices.

Implications

The implications of the findings of this study on educational practice, theory and institutional policy are of several significant implications.

In the practical sense, the findings indicate that teachers must structure learning experiences that depend on academic and professional value, collaborative learning, effective communication, and innovative methods of teaching. The inclusion of learner-centered instructions and the correspondence of course materials to the professional needs can also increase student engagement and better the outcomes of the learning process. Moreover, the faculty development programs ought to be aimed at enhancing the pedagogical ability of instructors especially in application of innovative and interactive teaching methods.

Theoretically, the research is in line with constructivist and social learning theories, which focus on the importance of interaction, collaboration, and active involvement in knowledge building. The tested measurement model will also be of great use to the future researchers investigating the factors that affect the learning experiences and efficiency of education in the higher education settings.

The policy and institutional approach are that the universities need to invest in supportive learning environments, such as proper infrastructure, technological infrastructure, and institutional support systems. The findings can help policymakers and academic leaders to develop their curricula, quality assurance efforts, and strategic plans geared towards the enhancement of teaching and learning practices.

Conclusion

This research was a combination of quantitative and qualitative studies which tested important variables affecting the learning process of students. The results showed the relevance of academic professions, team work, communication, imagination, learning style, particular learning style, teaching approach and curriculum, and context of the university setting to determining meaningful and effective learning. The measurement model exhibited high levels of reliability and validity, and this proved that the study instruments were suitable to measure the proposed constructs. The qualitative results also complemented the quantitative results by giving a more insight on how these factors are perceived and experienced by the students in actual educational contexts.

All in all, the research is an addition to the available literature in the area of educational effectiveness because it provides a complex framework of the multidimensionality of learning experiences. The findings are also quite useful to teachers, curriculum developers, and school administration who want to improve the quality of teaching and learning among students. It is recommended that future studies should be used to test the model in other educational settings as well as to investigate other variables that can further explain the effect of learning.

Limitations and Future Research

Irrespective of the contributions of this study, there are some limitations that must be recognized. To begin with, the research design was cross-sectional making it difficult to determine the cause-and-effect links between the variables. Stronger evidence of causal effects might be evidence of longitudinal or experimental design. Second, the self-reported questionnaires were utilized to collect data, and this could lead to response bias and social desirability bias. Third, the convenience sampling technique can undermine the ability to generalize the results to other population of students or learning situation.

Furthermore, it was carried out in a narrow institutional and cultural setting, thus the possibility of applying the findings in other environments is also limited. Despite a high reliability and validity of the measurement model, the future research can be characterized by the mixed method where a stronger focus will be placed on the qualitative interviews or focus groups to better understand the experience of the students.

Further studies are suggested to be done in order to generalize this study in various universities, fields and cultural background to increase the generalizability. Researchers can also investigate more variables, including motivation, self-efficacy, or digital literacy, in order to elaborate further on learning effectiveness. In addition, the results of experimental research on the effectiveness of certain teaching interventions might be helpful to implement in the design of instructions and the educational policy.

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