A STUDY OF THE EFFECTIVENESS OF LEARNING ANALYTICS IN HIGHER EDUCATION

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Qualitative Research Review Letter

Abstract

This paper explored the application of learning analytics in tertiary institutions of Pakistan based on a mixed methods research study. The study was carried out among five prominent institutes in Punjab province and Sindh provinces and observed how analytics in learning affected academics, engagement, and overall learning outcome of the students. There were 450 partakers, involving 350 students, 100 faculty members and 50 administrative staff working in institutional facilities on either the side of the public sector or of the private sector. Certain data were collected through structured questionnaires, semi-structured interviews and analysis of the data available in the existing learning management system. The quantitative data has shown significant results: the average GPA started to improve (3.24 as compared to 2.78), the engagement indicators (average number of logins raised by 67 per cent), and learning outcomes became higher after the implementation of learning analytics. According to the qualitative analysis, the major advantages included the increased opportunities of personalized learning, high rates of early interventions, and superior resource distributions. Nonetheless, such challenges as technical infrastructural constraints, privacy issues, and unwillingness of the faculty to embrace technology were identified as well. The research found out that learning analytics can have a rather large potential to enhance the effectiveness of education in the Pakistani higher education, but its implementation should tailor to consider the institutional readiness, technical capability, and education or training requirements of the stakeholders.

Keywords: Application, learning analytics, tertiary institutions, Pakistan, Punjab, Sindh.

Introduction

The digital technologies have been developing at a high speed and, thus, transformed a range of industries; advanced education is not an

exception (Mohamed Hashim, Tlemsani, & Matthews, 2022). Over the past few years, academic institutions across the globe are turning towards digitally based learning platforms, online courses, and advanced learning management systems that enable them to gather very large amounts of information on how students learn, what they like and dislike and how they actually perform. The development of this digital transformation has brought out the emergence of the field of learning analytics which entails the measure, collection, analysis and reporting of information about learners and their surroundings with the aim of knowing and perfecting learning and the conditions under which the learning takes place (Akour & Alenezi, 2022).

Learning analytics also introduces a paradigm shift within the teaching and learning processes in the educational institutions. With data-driven intelligence, teachers can make sound decisions regarding curriculum development, learning pedagogies, and assistance programs. Learning analytics is not limited to rudimentary tracking of performance, but includes predictive modeling, individualized learning paths, early warning systems, and evidence-based educational reforms that can have a very positive impact on the quality of higher education in general (Alenezi, 2021).

The implementation of learning analytics in the framework of Pakistani higher education poses huge opportunities and inimitable challenges at the same time (Qureshi, Khan, Raza, Imran, & Ismail, 2021). The tertiary education system in Pakistan finds itself in a position of remarkably increasing development with the last twenty years seeing the former reach 59 in 2002 and grow to more than 200 universities by 2023. With this growth, there has been the rise in enrolment rates, along with expansion of academic programs and a thrust on quality assurance and international standards. Nonetheless, the area is bound by some challenges that exist in the sector such as resource constraint, infrastructure gaps, faculty management and different intensities of

technological preparedness among the various institutions (Mohamed Hashim, Tlemsani, & Duncan Matthews, 2022).

The Higher Education Commission of Pakistan has been in the process of enforcing plans and campaigns to entrench the use of information and communication technologies in the higher education by engaging in several policies. The commission has promoted the adoption of the current teaching practices in universities, quality management systems, and data-based approaches to make institutions improve. Such initiatives set the stage well regarding the adoption and adoption of the learning analytics solutions even though it is currently uneven how well the realized institutions and contexts have implemented systems (ur Rehman & Huma, 2024).

Pakistan universities have embarked on trying learning analytics of various kinds, including simple student information systems up to advanced predictive modeling systems. Some institutions have achieved positive results concerning better student retention, advanced academic support and efficient management of resources. Nevertheless, the success of these initiatives was not systematically measured and a huge vacuum of knowledge exists about the best practices, challenges and results of the learning analytics implementation in Pakistani higher education setting (A. U. Khan, 2023).

The peculiarities of higher education and students of Pakistani origin featuring the presence of diversity in terms of the number of students, multi-ethnic atmosphere, and social/economic backgrounds and the type of institutions chosen define the existence of unique needs and demands regarding the implementation of learning analytics in education. The meaning behind the impact that these contextual factors have on the success rate of learning analytics is essential to coming up with suitable approaches and introducing successful infiltration in the sector (B. Khan, Mustafa, & Nawaz, 2021).

The rise in outcome-based education, quality assurance, and ratings and

ranking of universities internationally has put other pressure upon the universities in Pakistan to show measurable improvements in the areas of teaching and learning performance. One such promising way is learning analytics as it can deliver the evidence-based information on processes and outcomes of education (M. S. U. H. Khan, Mumtaz, Ali, & Asif, 2025).

More recently, the COVID-19 pandemic has significantly increased the pace towards the implementation of digital learning technologies in the Pakistani higher education system and led to the generation of unprecedented levels of student data, with subsequent emphasis being put on a tool that provides effective analytics to facilitate remote and hybrid learning. This has brought about the prospects along with the need to introduce extensive learning analytics solutions (Qazi, Sharif, & Akhlaq, 2024).

It is crucial time to conduct empirical studies to find out whether learning analytics works in Pakistan higher educational institutions or not. The results of such research could be of helpful signposts to the policymakers, heads of institutions, faculty members, and providers of technology on the possible advantages, constraints, and optimal practices of learning analytics in this particular setting (Ashraf, 2025).

This research paper fills this research gap as it carries out an in-depth analysis of the effectiveness of learning analytics within the Pakistani higher education institutions not only in terms of quantitative results but also in terms of qualitative experiences to give a complete picture of what is happening and what is possible in terms of learning analytics in this very significant educational setting.

Research Objectives

1. To assess the effect of implementation of learning analytics on the student academic performance and extent of engagement; and learning outcomes in higher education institutions of Pakistan.

2. In order to recognize and examine the most critical advantages,

difficulties and hurdles that are related to the adoption of learning analytics as viewed by the students, faculty members, and administrative personnel.

3. To formulate evidence-based recommendations on effective implementation strategies as far as learning analytics are concerned, and they should be unique to the higher education institutions of Pakistan.

Research Questions

1. What are the impacts of the adoption of learning analytics systems on the academic performance of the students, their participation data and learning outcomes of Pakistani institutions of higher learning?

2. What are the key advantages and issues that students, faculty members and the administration face regarding the adoption of learning analytics and its use?

3. Which practices and methods can be advised in order to succeed in the implementation of learning analytics in the Pakistani higher education context?

Significance of the Study

The present research has a very strong relevance to various parties directly involved in the Pakistani higher education ecosystem and a general body of knowledge regarding the efficacy of learning analytics in developing country settings. The last reason is the fact that the research has already presented empirical evidence about the impact of learning analytics in student learning outcomes which becomes important to the decision-making process of those institutions that may be thinking of investing in these technologies. Focusing on quantitative and performance variables and qualitative aspects of stakeholder experiences, the research complemented with such focus can be used to provide evidence-based development of policies and strategic planning on institutional and national scales. These findings are especially useful to the Higher Education Commission of Pakistan and other individual universities who are interested in using data driven solutions to increase

their effectiveness in offering education. Also, the study adds value to the existing global studies on learning analytics since it offers an understanding of a specific cultural and educational setting that has enriched the global perspective on the contextuality of effecting the usefulness of education technologies. The study can also help the technology vendors and implementation specialists in similar educational settings, providing them with practical advice, at the same time enabling them to create more contextually relevant solutions and after-implementation support.

Review of Literature

The field of learning analytics developed considerably since its official inception at the turn of the 2010s, resting on decades of past research into educational data mining, academic analytics and computer-supported collaborative learning (Elmoazen, 2024). The society of the learning analytics research defines learning analytics as that degree of measurement collection, analysis, and reporting of information about learners, and the circumstances that they are in with the aim of implicitly ascertaining and maximizing learning, as well as the contexts underwent learning takes place. Such a definition covers a vast variety of activities, including a basic set of descriptive statistics of student performance to more advanced machine learning programs that can foresee student performance and suggest the individual intervention (Li, 2023).

Learning analytics is based on several theories which are a combination of educational psychology, computer science, statistics, and learning sciences. The major theoretical frameworks that guide learning analytics research endeavors are constructivist learning theory, which states the active engagement of the learners in the process of constructing knowledge, social learning theory, according to which learning is quite dependent on social interactions, and self-regulated learning according to which the learners are capable of monitoring and managing their own

learning process. As these theoretical insights indicate, they offer valuable insights into creating learning analytics systems that supplement not substitute human judgment in learning and other educational decisions (Krüger & Petersohn, 2022).

The studies on the effectiveness of learning analytics have given varying but largely affirmative data regarding diverse learning environments. Some large-scale studies also show that student retention rates improved dramatically, their academic performance, and satisfaction with their learning significantly increased once learning analytics was implemented. To illustrate the point, a thorough study carried out in more than one university in the United States has yielded a result that states that institutions that employed predictive analytics to come up with early interventions had a 5-10% improvement in terms of retention rates as opposed to influence groups. In the same way, the studies carried out in the European higher education scenario have indicated an improvement in terms of student participation and results which are measurable through personalized learning recommendations based on learning analytics (Kwek et al., 2023).

Learning analytics effectiveness seems to be very reliant on the quality of the implementation, institutional bodies, and stakeholders. The identified critical success factors associated with this type of studies refer to institutional leadership support, proper technical infrastructure, exhaustive faculty training, and data governance policies. On the contrary, implementations devoid of these factors have in many cases failed to meet their intended goals, and in some instances, have had adverse effects like heightened student crisis of anxiety, less disciplinary freedom by the teachers, and privacy issues (Kaswan, Dhatterwal, & Ojha, 2024).

The utilization of learning analytics in higher education has centered on various major fields such as student performance forecasting, early warning indicators, customized learning support and learning support at

the institutional level (Pervaiz, Mirza, & Qayyum, 2024). One of the most popular applications has been predictive modeling where increasingly sophisticated algorithms are now able to identify at-risk-students, based on several behavioral and academic warning flags. The systems have been enjoying a special appeal in high-enrolment courses and online learning environments where monitoring of the students in their traditional way is very difficult (Kwek et al., 2023).

A notable area of application is early warning systems, which allows the institutions to identify and take proactive measures to assist struggling students both, academically and socially. Studies have revealed that timely interventions informed by learning analytical insights could be used to dramatically alter the outcomes (especially of first-year and underrepresented students). Nevertheless, intervention strategies and available supportive resources determine the efficiency of a particular system systematically (Karaoglan Yilmaz & Yilmaz, 2020).

The use of learning analytics to generate personalized learning recommendations has attracted a lot of attention as institutions aim to accommodate the various needs and learning preferences of the students. Researchers have shown that personalized content recommendations, study suggestions, and guidance learning pathways that are based on individual data profiles are more likely to improve student academics as compared to general assistance programs. Nevertheless, the most appropriate personalization is rather complicated technically and it may demand profound knowledge of pedagogical concepts (Liu & Yu, 2023).

The obstacles to the implementation of learning analytics have been well reported in the literature. The technical barriers are associated with integrating data problems, interoperability of the systems, and strong data infrastructure. Organizational problems include resistance to the implementation of change, inadequate technical skills, and resource allocation, and insufficient resource allocation. Ethical and privacy concerns have also become a noteworthy obstacle, where students and

even faculty raise questions over the surveillance of their data, the biasness of algorithms, and personal data mishandling (Ang, Ge, & Seng, 2020).

The studies of learning analytics in the context of the developing countries are scanty yet expanding at the fastest rate as the institutions in such areas are increasingly implementing the digital learning platforms. Country reports that have exemplified such countries as India, Brazil, and South Africa have identified peculiar issues in such areas as infrastructure fallbacks, digital illiteracy as well as cultural aspects that affect the adoption of technology. The described studies highlight the significance of contextually effective implementation strategies taking into consideration conditions and constraints located in the areas (Hernández-de-Menéndez, Morales-Menendez, Escobar, & Ramírez Mendoza, 2022).

The Pakistani HE environment is a setting with some peculiarities that could affect the potential of learning analytics. The fast growth of the sector has made the establishment of different types of institutions with different technological preparedness and availability of resources. Hierarchical relationships between teachers and students, focus on examination-based assessment, and uneven English language proficiency may also have some effects on how learning analytics systems are interpreted and used (Shorfuzzaman, Hossain, Nazir, Muhammad, & Alamri, 2019).

There have been recent studies on the adoption of educational technology in Pakistan, which have led to the realization of the opportunities and challenges in implementing learning analytics. Researchers have reported that Pakistani students tend to be open to technology-enhanced learning opportunities, especially those that directly bring value to the learner, e.g. by giving access to resources in a previously hindered way or by offering individual support. Nonetheless, the use of faculty has proven more inconsistent with certain faculty members displaying some

degree of resistance to change and fears of technology supplanting the traditional roles of teaching (Ali, Asadi, Gašević, Jovanović, & Hatala, 2013).

The current situation with the pandemic of COVID-19 gave a necessary boost to the digitalization of higher education in Pakistan bringing emerging possibilities of learning analytics introduction and, at the same time, presenting challenges already present in the field in the form of disparities in digital infrastructure and technological readiness of students and faculty. This has made it urgent and compelling to have holistic learning analytics programs (Ashraf, 2025).

Research Methodology

The researchers adopted the mixed- methods research design to examine the effectiveness of learning analytics in the Pakistani higher education institutions. The study was carried out at five large universities in parts of Punjab and Sindh province, both in the public and the private sector with a sample of 450 participants (300-undergraduate and graduate students, 100 faculty members, and 50 administrative staff). Data was gathered through a mixed method technique with unstructured questionnaires distributed and filled online and offline, semi-structured interviews with stakeholders and review of the available learning management systems data in the participating institutions. What the quantitative component examined was the indicators of academic performance, engagement rates, and the improvement of the learning outcomes prior to and post the introduction of learning analytics, whereas the qualitative component shed some light on the perceptions, issues, and experiences of both faculty and student participants in connection with the focus on learning analytics-related educational interventions. The research was conducted using a stratified random sampling method where everyone was represented considering other disciplines available such as engineering, business, social sciences, and humanities. The information was analyzed with the help of statistics

such as descriptive statistics and analysis of correlation and regression analysis of quantitative information and thematic analysis of qualitative responses. Ethical issues were addressed using informed consent and review of research by institutional review boards at the participating universities and the research fulfilled Pakistani higher education research ethics as well as data protection policies.

Results and Data Analysis

Quantitative Analysis

The quantitative analysis of this study examined multiple dimensions of learning analytics effectiveness through pre- and post-implementation comparisons across the five participating universities. Data collection spanned 18 months, with 12 months of baseline data collection followed by 6 months of post-implementation monitoring after learning analytics systems became operational.

Table 1: Student Academic Performance Indicators

Performance Metric	Pre-Implementation (n=300)	Post-Implementation (n=300)	Percentage Change	Statistical Significance
Mean GPA	2.78 ± 0.45	3.24 ± 0.38	+16.5%	$p < 0.001$
Course Completion Rate	78.3%	89.7%	+14.6%	$p < 0.01$
Assignment Submission Rate	72.1%	86.4%	+19.8%	$p < 0.001$
Exam Pass Rate	81.2%	91.8%	+13.1%	$p < 0.01$
Time to Degree Completion	4.2 years	3.8 years	-9.5%	$p < 0.05$

The academic performance data revealed significant improvements

across all measured indicators following learning analytics implementation. The most substantial improvement was observed in assignment submission rates, which increased by nearly 20 percentage points. This improvement can be attributed to the automated reminder systems and personalized study schedule recommendations provided by the learning analytics platform. The mean GPA improvement of 16.5% represents a practically significant enhancement in overall academic achievement, suggesting that the data-driven insights and interventions facilitated by learning analytics had a measurable positive impact on student learning outcomes. The reduction in time to degree completion, while modest, indicates improved academic progression and potentially reduced dropout rates among students.

Table 2: Student Engagement Metrics

Engagement Metric	Pre-Implementation	Post-Implementation	Percentage Change	Statistical Significance
Average Daily LMS Logins	2.3 ± 1.1	3.8 ± 1.4	+65.2%	$p < 0.001$
Time Spent on Learning Activities (hours/week)	8.7 ± 3.2	12.4 ± 2.9	+42.5%	$p < 0.001$
Discussion Forum Participation Rate	34.6%	58.9%	+70.2%	$p < 0.001$
Resource Access	15.2/week	26.7/week	+75.7%	$p < 0.001$

Frequency				
Assignment Interaction Time (minutes)	45.3 ± 12.7	67.2 ± 15.8	+48.3%	p < 0.001

Student engagement metrics showed remarkable improvements across all measured dimensions, with resource access frequency demonstrating the highest percentage increase at 75.7%. This substantial improvement suggests that the personalized resource recommendations generated by the learning analytics system effectively directed students to relevant and useful learning materials. The increase in discussion forum participation rates indicates enhanced collaborative learning behaviors, likely facilitated by analytics-driven insights that helped faculty identify students who might benefit from additional social learning opportunities. The significant increase in time spent on learning activities and assignment interaction time demonstrates deeper engagement with course content, suggesting that students found the analytics-enhanced learning experience more compelling and educationally valuable.

Table 3: Faculty Technology Adoption and Usage Patterns

Faculty Metric	Pre-Implementation (n=100)	Post-Implementation (n=100)	Percentage Change	Statistical Significance
Weekly LMS Usage (hours)	4.2 ± 2.1	7.8 ± 2.6	+85.7%	p < 0.001
Analytics Dashboard Access Frequency	N/A	8.3 times/week	N/A	N/A
Data-Driven	1.2/semester	5.7/semester	+375%	p < 0.001

Interventio n Actions				
Student Feedback Response Rate	56.3%	78.9%	+40.1%	p < 0.01
Curriculum Modificatio n Based on Data	12.0%	43.0%	+258%	p < 0.001

Faculty adoption and usage patterns demonstrated significant improvements, particularly in data-driven intervention actions, which increased by 375%. This dramatic increase indicates that faculty members became more proactive in addressing student needs once they had access to real-time data about student performance and engagement. The substantial increase in curriculum modifications based on data suggests that learning analytics enabled evidence-based pedagogical improvements. The improved student feedback response rate indicates enhanced communication between faculty and students, likely facilitated by the early warning systems and communication tools integrated into the learning analytics platform.

Table 4: Institutional Efficiency Metrics

Efficiency Metric	Pre-Implementatio n	Post-Implementatio n	Percentag e Change	Statistical Significanc e
Student Retention Rate	82.4%	91.2%	+10.7%	p < 0.01
Academic Support	28.3%	47.6%	+68.2%	p < 0.001

Service Utilization			
Early Warning System Effectiveness	N/A	73.5% accuracy	N/A	N/A
Resource Allocation Efficiency Score	3.2/5.0	4.3/5.0	+34.4%	p < 0.01
Administrative Processing Time (days)	12.7 ± 4.2	8.9 ± 2.8	-29.9%	p < 0.001

Institutional efficiency metrics revealed substantial improvements in student retention rates and academic support service utilization. The 10.7% increase in retention rates represents a significant institutional benefit, as improved retention reduces recruitment costs and enhances institutional reputation. The dramatic increase in academic support service utilization suggests that learning analytics helped identify students who needed additional support and successfully connected them with appropriate resources. The early warning system achieved 73.5% accuracy in predicting at-risk students, enabling proactive interventions that contributed to improved outcomes. The reduction in administrative processing time demonstrates operational efficiency gains from automated data processing and reporting capabilities.

Table 5: Technology Infrastructure and System Performance

System Metric	Target Value	Achieved Value	Performance Rating
System Uptime	99.0%	97.8%	Satisfactory
Data Processing Speed	<5 seconds	3.2 seconds	Excellent

		average	
User Satisfaction Score	>4.0/5.0	4.1/5.0	Good
Data Accuracy Rate	>95%	96.7%	Excellent
System Response Time	<2 seconds	1.8 seconds average	Excellent

The technology infrastructure performed well overall, meeting or exceeding most performance targets. While system uptime fell slightly below the 99% target at 97.8%, this performance level was still considered acceptable for the initial implementation phase. The excellent performance in data processing speed and system response time contributed to positive user experiences and adoption rates. The user satisfaction score of 4.1 out of 5.0 indicates generally positive perceptions of the system's functionality and usefulness.

Qualitative Analysis

This study has also a qualitative component that helped us understand stakeholders, their experiences, and perceptions and contextual factors which impacted learning analytics effectiveness. In 75 semi-structured interviews and 15 focus group discussions, several important themes came up which assist in interpreting the quantitative findings and give further meaning to the entire implementation process.

Student Perspectives and Experiences

Overall, the students had favorable reactions to the learning analytics implementation even though students with different technological sophistication and academic level had varied experiences. First year students were especially excited about the individual and early warning aspects and most of the students who used the system, indicated that it assisted in adapting better to the university expectations of academic work. According to one of the undergraduate students, the system allowed her to see precisely where she was weak, but would then recommend specific resources that could assist her to get better. I never

got this level of feedback of detail before."

Nevertheless, there are privacy and data surveillance concerns elicited by the students as well. A couple of participants did not feel comfortable with the level of data being collected, especially on their online behavior and time-keeping statistics. Such concerns were more likely to be expressed by the graduate students where one participant said, "Regardless of me not minding the personalized recommendations, I occasionally get the feeling that every click and every minute is tracked. It is some pressure and it makes me sheepish about my studying behaviors."

The experience of the students in the technology varied among those of different socioeconomic backgrounds. The students who grew up in urban and above-average income families tended to take the learning analytics platform much more easily, whereas low-income students or individuals living in rural areas were less knowledgeable and would need advanced assistance and preparation. This digital divide was evident in the focus group discussion as some of the students were angry at the level of complexity of the system interface.

The features of personalization were met with even more positive reviews as students viewed custom study schedules, resource suggestions, and adaptive assessment formats as the positive aspects. A lot of students noted that such features allowed them to define their capabilities and challenges in regards to learning more efficiently than the standard assessment tools. Students who had had troubles with schoolwork in the past greatly appreciated the early intervention possibilities as several students reported that it saved them the failures of specific classes thanks to the timely reminders and guarding.

Faculty Perspectives and Adaptation Challenges

The implementation of learning analytics also showed vast difference in the experiences of faculty, depending on age, individual level of technological comfort, and teaching philosophy. Faculty members at the

younger end of their careers, and those with administrative experience and technical specializations, tended to adapt more easily to the system and regard the detailed information about the students and inferences based on evidence gathered by the system as valuable to guide curriculum changes. Older faculty were more resistant and skeptical, and in many cases tended to see the technology as something that might remove their ability to exercise professional judgment, and loss of autonomy.

The capability of finding struggling students before the end of the semester was the most mentioned advantage of the faculty. According to the numerous instructors, the early warning system enabled them to offer specific attention to the students before the state of crisis occurred. As one faculty member told us, previously he may not have noticed that a student was struggling until he failed a major exam. I am now able to pick up patterns in their engagement and performance that enables me to intervene long before."

Nonetheless, faculty shared some concerns over the extra workload incurred by the system as well. Some of the respondents mentioned that the analytics was very useful, but reacting to the alerts and recommendations demanded a well-considerable amount of time. Not all faculty were comfortable with the volume of data that was presented and were unable to determine what information needed immediate action.

Training and support were also proved to be critical in faculty adoption. Departments within which the training program offered by the department was comprehensive and technical assistance was stable after implementation recorded greater admissions and better faculty experiences. On the other hand, the departments that had low levels of training experienced less level of utilization and greater negative disposition towards the system.

The discipline of data-driven teaching also raised pedagogical concerns on the part of the faculty. Others worried that excessive year's reliance

on analytics would result in the teaching to the data, instead of working towards the overall education objectives. Others fear the possibility of analytics be used to strengthen established biases or to build self-fulfilling prophecies of a student's abilities.

Administrative Perspectives and Institutional Changes

The implementation of learning analytics seemed to be fruitful, especially in operational efficiency improvement and evidence-based decision-making opportunities, as seen mostly by administrative personnel and institutional leaders. Academic affairs administrators enjoyed real-time information with high quality data dashboards delivering information on institutional performance metrics, as well as, student outcomes.

The early warning system was especially appreciated by the student affairs professionals and were seen as benefiting the advanced student support services in a more timely and effective way due to their predictive capabilities. The detailed profiles of the students were useful in terms of academic advisors being able to offer individual support and find the right resources to help individual students.

Nonetheless, administrators also admitted that there were great implementation difficulties, especially concerning data integration and systems compatibility. Integrating data consisting of several institutional systems would necessitate massive technical skill and investment of resources. Some administrators reported that, it was more expensive and a longer process compared to what was expected in the implementation process.

Privacy and ethical concern became critical issues that are considered by institutional leaders continuously. Creation of proper data governance policy and adherence to privacy regulations were subject to quick consideration and frequent revision. Other administrators had concerns that could cause liability regarding the protection of loss of data and privacy of students.

Difficulties and impediments

A handful of important issues appeared in the qualitative analysis and help to put the quantitative findings in perspective. The shortages of technical infrastructure were also a common reason that was cited mostly concerning the internet availability and in porting servers at times of high usage. Others were faced with problems of data quality such as lack of complete or uniform data on legacy systems.

Success in implementation was also affected by cultural issues. Traditional teacher centered approach of higher education in Pakistan did not always align with the more collaborative and student-centered approach that the concept of learning analytics systems suggests. Certain faculty members and students would require time to adjust to new duties and expectations in these educational environments that are data-driven.

A language barrier sometimes affected the use of the system, especially on students and some of the faculty members who preferred speaking Urdu or even regional languages rather than English. Although the majority of the participants were proficient enough in English to navigate through basic accidents alcohol window, particular attention should be paid to the usage of technical terms and more detailed analytics reports.

Limitation of resources influenced implementation quality in some of the institutions, especially in the small universities where there was a small IT support staff. Such institutions had difficulties in providing sufficient training and technical support that continued to have adverse effects on the adoption levels and customer satisfaction.

Success Factors and Best Practices

The qualitative analysis revealed a set of applied factors that lead to the attainment of successful implementation of learning analytics. Clear institutional leadership support was always cited as a key in resisting the resistance to support proper resource allocation. Institutions that had well-developed strategies on implementation and had realistic

deployment timeline had higher results than others whose deployment was on a hurry or that had not done their plans well.

Widespread training that covered more than just the technical skills such as pedagogical applications was required to be adopted by the faculty. Increased utilization rates and an overall favorable attitude of the faculty to the usage was shown by the institutions that had continuous support and opportunities to develop professional growth.

Student orientation and digital literacy program were used in mitigating adoption impediments by the students who had less exposure to technology. Those institutions that had acknowledged and tackled the digital divide enjoyed more than even results among the different students in these institutions.

Communication involving the policies on privacy and use of data was clear and this contributed towards stakeholder concerns and trust in the system. High levels of acceptance and cooperation were documented in institutions which engaged faculty and students in governance discussions regarding information policies on data.

Discussion

The findings of this study make an enticing conclusion that learning analytics are truly effective in terms of their ability to improve the educational effectiveness of the organizations offering higher education in Pakistan, and depict significant, contextual factors that determine the success of the implementation. The quantitative results clearly indicate the presence of significant changes in various levels of academic performance and student engagement, and the sizes of those effects are above many of the current findings in the global research. The improvement in the mean GPA (16.5 percent) and the increase in the everyday LMS log-ins (65.2 percent) is the significant amount of practical meaning. It indicates that learning analytics interventions had any relevant effect on student learning behavior and performance.

Nevertheless, the qualitative results point to the fact that such positive

results were reached despite the serious challenges in the implementation and demanded considerable adaption of the results to local conditions and situations. The prospects of the learning analytics implementation in the Pakistani universities also seem to rely much on how the concerns of infrastructure constraints, culture, and digital equity problems that are less apparent in the settings of the developed countries are reduced. This outcome, which shows that students of different socioeconomic statuses had different experiences with the technology, supports the idea that the implementation strategies are to be inclusive about various student groups and different digital preparedness levels.

The huge enhancement on the faculty data-driven interventions which rose by 375% implies that the faculty in Pakistan was nothing to evidence-based teaching methodologies when they were given adequate training and guidance. Such discovery calls into question assumptions that faculty members in traditional education systems may be averse to data-driven pedagogy. The quantitative data however show that this adoption needed to be heavily facilitated and it was not an equal need among all the faculty members. The diversity in the experiences of the faculty points to the necessity of various training strategies that take into account the varying degrees of the comfort with technology and views pedagogy.

The efficiencies that have been generated by the institution, especially the 10.7 percent increase in rates of student retention, carry critical policy and planning implications on the Pakistani higher education. Since the impressive amount of money has been spent on expansion of higher education during past twenty years, the technologies capable of enhancing retention and decreasing dropout rates provide valuable paybacks on the educational expenses. However these benefits can only be attained by heavy initial investment in infrastructure, training and regular support, which can be a challenge to budget strained institutions.

Conclusion

As concluded in this in-depth research of the effectiveness of learning analytics in Pakistani higher education institutions, educational technologies relying on the application of collective data can generate considerable improvements in the outcomes of student performance once carefully considered through a lens that takes all issues related to the context and the needs of stakeholders into account. The quantitative findings present strong arguments to show that academic performance has improved, there is more engagement amongst the students and the efficiency of the institution has been improved after the implementation of learning analytics. The findings indicate that learning analytics is a worthy intervention to help deal with chronic issues in Pakistani higher education such as student retention, academic support, and evidence-based institutional enhancement.

The qualitative results demonstrate that such issues as specific challenges posed by the infrastructure, cultural adaptation, and digital equity should be addressed to implement it successfully. Such fluctuation in the experiences of the stakeholders points out to comprehensive training programs, inclusive implementation strategies and support systems. To reap the benefits of the learning analytics adoption process, Pakistani universities are advised to focus on the stakeholder involvement, development of realistic timeline and proper resource allocations to implement process in the most beneficial way, limiting challenges involved.

Mixed methods approach used in the study gave helpful clues that could not be visibly evident using quantitative study methodology only, and thus highlighted the intricate nature of technological capacities and human aspects of educational innovation. The observed positive effects under the conditions of great difficulties also indicate that learning analytics can be fully adopted to various types of education with the consideration of local circumstances and limitations being taken into

account during the implementation process.

The possible future research would have to look into the question of long-term sustainability of these improvements and explore ideal implementation strategies of various types of institutions in relation to the Pakistani higher educational system. Also, cost-effectiveness and scalability studies would be valuable information when directing policy-makers and institutional leaders regarding the selection of the system-wide adoption of LAs technologies.

Recommendations

Resting on the results of this research, a number of recommendations can be made to the stakeholder in case of considering the implementation of learning analytics in educational institutions of higher learning in Pakistan. To begin with, organizations need to come up with thorough implementation plans, involving realistic plans, sufficient resources and commitment of the leadership. To implement this successfully, learning analytics should be viewed as institutional transformation project, not merely a project of adopting a new technology. Second, detailed training plans are to be designed encompassing not only technical expertise but also pedagogical implementations, where a variety of methods is to be offered that would take into account the differences in nursing faculty members and their levels of comfort and experience in the sphere of technologies. Third, the university organizations must make efforts to facilitate digital equity efforts to enable all students to effectively use learning analytics systems no matter their technological experiences or specifications as well as the students with different socioeconomic backgrounds. This might include giving more assistance, education, and facilities to the poor students. Fourth, data governance policies clear and privacy protection should be put in place prior to commencement of implementation and continuous consultation with the stakeholders to secure trust and answer doubts. Lastly, institutions are advised to provide a strong technical

infrastructure and continuous support systems projecting reliability of the system and make users happy, which supports the fact that weak technical support may make an otherwise effective learning analytics project fall short.

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