Journal of Multidisciplinary Studies in Human Rights and Science
ISSN: 2752-1400, Vol 08, Issue 2, 48-61

Collective Resistance in Authoritarian Contexts: Insights from Individual, Group, and Institutional Research

Dr Dilip Chanchal
Faculty, Department of Social Sciences and Humanities , JNU, University – India

ABSTRACT
Population aging and the increasing burden of chronic diseases require analytical methods capable of capturing the dynamic nature of health over time. This study introduces a multistate framework for modeling health trajectories across the life course, allowing individuals to move among multiple health conditions, including wellness, chronic illness, disability, and death. The framework employs longitudinal observational data to estimate transition intensities and assess the influence of behavioral, environmental, and socioeconomic determinants on health outcomes. Results indicate that early preventive interventions substantially reduce the likelihood of adverse health transitions in later life. The proposed methodology enhances predictive accuracy and supports evidence-based healthcare planning by identifying critical periods where interventions yield the greatest benefits. The framework provides an effective tool for evaluating health policies and promoting sustainable healthcare systems.

Keywords: Chronic Disease, Health States, Multistate Framework, Longitudinal Modeling, Preventive Healthcare, Aging, Health Transitions

---

Date of Acceptance: 20-01-2026 Date of Publication: 28-03-2026

I. INTRODUCTION

The concept of quality assurance has become one of the biggest drivers of change today in global systems of higher education. Universities now find themselves operating under massification of enrollment, increasing competition, accountability demands, and greater scrutiny from governments, accrediting agencies, employers, and students than ever before. In light of this environment, maintaining acceptable levels of academic standards and providing evidence that students' learning has occurred have become critical to most universities' credibility and sustainability.

Historically, the quality control of higher education has been based on periodic audits, accreditation (program and institution) reviews, peer reviews, and end-of-semester assessments. These methods have reliably provided universities and the general public with a systematic process to ensure that institutions uphold quality; however; these typically occur after the fact, meaning no immediate feedback to provide insight into quality efforts at the time learning was taking place, resulting in little to no opportunity for immediate intervention or continued improvement. In addition to the traditional methods of assuring quality, the rapidly digitising education landscape has significantly impacted the quality of education worldwide. As universities have begun using Learning Management Systems (LMSs), online assessment systems, virtual classrooms, and digital administrative tools to enhance and expand their distance education programmes, they have also begun collecting significantly larger quantities of reorganised educational data than ever before.

Every interaction students have with digital systems can be captured as data traces, providing institutions with evidence of how students engage with digital systems, such as when students log into courses, download course materials, submit assignments, interact and participate in discussions, and complete quizzes.

The development of computational technologies, the discovery of new data mining methods and the advent of artificial intelligence have helped researchers to turn these massive amounts of data into valid information by being able to process these in an efficient way. This transformation has created a new form of quality control systems that allow institutions to move from a reactive "check" and "response" evaluation of educational processes to a proactive and predictive evaluation of educational processes.

In this new paradigm, one of the central mechanisms to understand and improve education is through the use of learning analytics. Learning analytics is a systematic assessment, collection, analysis and interpretation of learner data in order to facilitate improvements in learning experiences and outcomes. Learning analytics allows faculty to look at the micro-level aspects of learning; for example, by breaking down data into discrete events such as participation, progression pathways and initial indicators of disengagement, faculty can identify those learners at most risk for not succeeding, personalize their instructional designs and provide timely targeted intervention prior to problem situations becoming irreversible. Learning analytics can also serve as a basis for designing curricula, allocating resources and formulating policy based on empirical evidence rather than instinct and tradition. Another important piece is the use of academic dashboards which serve as graphical and interactive front end to complex data that make that data easier to interpret and understand.

Real-time graphical visualizations (Dashboards) of performance data such as attendance patterns, assessment scores, engagement rates, retention figures and progression percentages using charted representations of high volumes of raw information create visual representation tools for stakeholders at numerous levels (faculty members, departmental heads, Administrative staff and Executive management). This allows for the rapid identification and evaluation of performance trends and the ability to make informed decisions. The visualization of trends not only allows for early identification of problems, but it also promotes transparency, accountability, and continuous monitoring. Dashboards can be thought of as bridges between technical analytic systems and the practical application of decision-making processes.

The integration of learning analytics and academic dashboards (as identified in "Ongoing Evaluation of Adequate Classroom Performance" and "Quality Assurance: A Challenge in Higher Education") represents a paradigm shift in the manner with which quality assurance is both defined and applied. Through the development of real-time monitoring systems that will facilitate continued evaluation and improvement, institutions will no longer need to rely on periodic, compliance-based, performance evaluations. In addition, this new paradigm will align with the current trend of moving toward evidence-based management practices and outcome-based education systems. These systems will enable institutions of Higher Education to routinely assess their performance against strategic performance metrics, provide evidence of institutional effectiveness to external parties, and rapidly adjust to changing educational demands. Furthermore, they will support the development of more student-centered services and instructional strategies by using real-time evidence of student learning needs.

Although these technologies continue to be adopted at an increasing rate, their potential for transformation is still an area of controversy. Many people believe that the use of analytics will fundamentally change teaching, learning and governance; however, critics of the use of quantitative measures argue that using them as a sole measure for assessing educational processes is an oversimplification of complex functions. The use of such technologies also raises concerns over student data privacy, ethical use of data collected on students, bias in algorithms, and unequal access to technology to facilitate the collection and use of data, all of which present challenges to the successful implementation of these systems. In addition, while technology sophistication is important for the creation of systems that use learning analytics and dashboards, the human factors such as the data literacy of individuals who will use these systems, the organizational culture of the institutions that will use these systems, and the involvement of key stakeholders are equally important. If appropriate training of users and governance structures are not provided, data dashboards may not be adequately utilized or may be misinterpreted, thereby limiting the positive impact of these technologies on institutional quality improvement efforts.

Given these opportunities and challenges, there is an urgent need for ongoing research regarding the use of data-driven quality monitoring systems in a variety of postsecondary educational institutions. To determine if learning analytics and dashboards have a positive effect on the ability of institutions to monitor their performance, there needs to be empirical evidence regarding how these systems have been adopted, the measurable outcomes of the use of these systems, and users' experiences with these systems. This requires investigation not only of the technological capabilities of the quality monitoring systems, but also of how educators and administrators interpret the data produced by these systems and how they use this data to make decisions related to institutional performance and quality improvement. Through this research, it is possible to

identify the conditions under which analytics can contribute meaningfully to institutional effectiveness, as well as the barriers that may impede the effective implementation of analytics.

This study therefore seeks to examine the role of data-driven quality control systems in higher education with particular emphasis on learning analytics and academic dashboards as instruments of performance monitoring. By analyzing institutional usage patterns, assessing their influence on academic outcomes, and exploring the perceptions of key stakeholders, the research aims to provide a comprehensive and nuanced understanding of how these technologies reshape quality assurance practices. Through this investigation, the study contributes to both theoretical discourse and practical policy development, offering insights that can guide institutions toward more effective, ethical, and sustainable integration of analytics in higher education.

II. REVIEW OF RELATED LITERATURE

According to Arnold and Pistilli (2015), when Purdue University's Course Signals system was implemented, it was shown that with timely feedback (predictive analytics), students were retained better and completed more courses than if they had not used the system. The study showed that early warning (i.e., alerts) could be used to notify instructors to provide assistance earlier in the academic process, thereby providing a clear example of the benefits to be gained from real-time monitoring. Similar results were found by Lonn, Aguilar, and Teasley (2015), who reviewed student motivation as it relates to analytic-supported interventions. They found that when students received timely and personal feedback from instructors, they displayed increased motivation and persistence.

Research also focuses on how the field of education is using improved methods of evaluating data models. For example, Brooks, Thompson, and Teasley (2015) established a method for using time-series interaction analysis as a means of creating predictive models for performance based on log data from students. They were able to demonstrate that by using fine-grained behavioral data, academic risk could be reasonably predicted. Moving forward from retrospective reporting of quality indicators to using predictive methods of assessment means that colleges are able to take action before problems arise and utilize preventative strategies. Additionally, a study by Papamitsiou and Economides (2016) examined how quality indicators based on educational data mining and learning analytics can support decision-making when it comes to making evidence-based instructional decisions.

Frameworks for conceptualizing educational practices, as well as those providing infrastructure to support these practices, have been examined. Brown, Dehoney, and Millichap (2015) discussed how next-generation digital learning environments are formed with the inclusion of analytics, interoperability, and personalized support services. They also concluded that data infrastructures are the foundational components of contemporary educational ecosystems. Greller and Drachsler (2015) provided an overall framework for transforming learning processes into measurable variables indicating that scalable approaches to analytics will only be successful with systematic representations of data. In summation, both successful use cases for implementing analytics in education will be derived from theoretical frameworks and data architectures.

A number of studies have investigated the intellectual development of the discipline of learning analytics. Dawson, Gašević, Siemens, and Joksimović (2016) performed a citation network analysis to identify the historical trajectory of learning analytics research and discovered growing trends and thematic clusters. Results of the network analyst revealed that learning analytics research had moved from exploratory research through institutions to the implementation of practice-based research. Ferguson and others (2016) reviewed existing literature supporting the use of analytics within educational practice concluding that while there is evidence of promising outcomes resulting from the use of analytics, there are very few documented rigorous evaluations of implementation. The conclusion offers further compelling rationale for the need to conduct systematic education-based empirical studies investigating how effectively these applications of analytics can be implemented in real-world educational contexts.

The authors also focused on the pedagogical and instructional aspects of learning analytics. Gašević, Dawson, Rogers and Gašević (2016) contend that analytics cannot take a standardised approach and that the pedagogical conditions in which analytics have been used mediated the effectiveness of the analytics. They demonstrated that whether the insights obtained through data will create meaningful changes will be a function of the contextual and pedagogical alignment. Extending this argument, Knight, Buckingham Shum and Littleton (2017) examined the epistemological and pedagogical assumptions associated with learning analytics and concluded that interpretations of data must be grounded in established educational theory. They both highlighted that if analytics are to be effective they will require integration with pedagogical practices and not merely a technology solution.

Researchers have generally only begun to explore dashboard design and usability due to the rapid increase in analytics tools. Jivet, Scheffel, Specht and Drachsler (2017) investigated how to design dashboards

for use in educational practice, and their research illustrated that the ease of interpretation and alignment to user needs were critical for the successful adoption of dashboards. Roberts, Howell, Seaman and Gibson (2016) examined student perceptions of dashboards, and the results suggested that students had generally positive attitudes toward dashboards that provided them with clear and actionable feedback. Schwendimann and others (2017) also conducted a systematic review of dashboard-related research, and they concluded that dashboard designs make it possible to transform complex performance data into understandable formats and, as a result, facilitate timely interventions.

Recent studies (Matcha, Ahmad Uzir, Gašević, & Pardo, 2019) confirm that dashboards increase awareness and self-regulation, even though a lack of consistency in how they are used limits their effectiveness. Therefore, these studies show that visualisation technologies act as an important bridge between analytics and decision making in practice.

Institutional adoption and organisational readiness is another important strand of literature. Bichsel (2016) conducted a survey of higher education institutions regarding the benefits and barriers related to integrating analytics into their operations, including improved decision-making versus challenges related to culture, skills and infrastructure. Tsai, et al. (2018) extended Bichsel's research by investigating specific adoption patterns for educational institutions and found that support from leadership, ongoing professional development and alignment with institutional strategy were all important contributors to successful implementation of analytics. Their findings also indicate that analytics initiatives require systemic change, rather than simply investing in technology. Dede, Richards & Saxberg (2018) introduced the concept of learning engineering and outlined a structured approach to the iterative design and evaluation of digital learning systems. They view analytics as part of an ongoing process of continuous improvement within educational organisations.

Lastly, ethical considerations have emerged as a key theme in the literature on analytics. Pardo & Siemens (2015) defined a series of ethical and privacy principles related to learning analytics, including transparency, informed consent and responsible data stewardship.

West et al. (2018) suggested that there is a need for the ethical lens to be applied to analytics practices and indicated that surveillance of students through the use of data should be avoided. They mentioned that building trust and fairness in order to achieve sustainable adoption are significant to the future. Their comments on this issue were echoed across the field, reinforcing the notion that a robust governance mechanism is required to collect and assess individual learner data.

The comprehensive syntheses also contributed to consolidating the field. For instance, the Handbook of Learning Analytics was edited by Lang, Siemens, Wise, and Gašević in 2017, consisting of a compilation of theoretical models, approaches and case studies, which offered a comprehensive overview of how the field has evolved. This combined both aspects of learning analytics and academia dashboards in this regard represented a multifaceted foundation consisting of technological, pedagogical and organisational factors that generate a detailed understanding of how we view analytics.

Overall, the literature reviewed resulted in learning analytics and academic dashboards being increasingly identified as beneficial to generate successful student achievement, provide information for improving instructional practices and strengthening institutional accountability. The literature generally provides empirical evidence to demonstrate the positive effects of predictive modelling, feedback mechanisms and visual dashboards on student engagement and retention. However, at the same time, the researchers consistently identified challenges including data literacy, readiness for adoption and ethical governance. Although numerous studies have highlighted localized successes, limited research has examined how these systems function as part of a more comprehensive institutional quality assurance mechanism.

Consequently, the existing scholarship established both the promise and the limitations of analytics technologies. It suggested that data-driven approaches could transform performance monitoring, yet it also revealed the need for integrated, context-sensitive, and ethically grounded implementations. The present study built upon this foundation by examining how learning analytics and academic dashboards operated specifically as components of data-driven quality control systems in higher education, thereby addressing the empirical gap identified in earlier research and contributing to a deeper understanding of their role in institutional performance monitoring.

Objectives

- The primary objective of this study is to analyze the contribution of data-driven quality control systems — specifically, learning analytics and academic dashboards — to performance monitoring in higher education.
- Secondary objectives include understanding stakeholder perceptions, identifying implementation challenges, and proposing recommendations for effective integration of analytics into institutional quality frameworks.

III. RESEARCH METHODOLOGY

The mixed-methods research incorporates both quantitative measures (data driven, dashboards of performance metrics) and qualitative measures (through interviews and surveys with faculty and administrators). The study utilized an explanatory sequential design to inform qualitative research based on quantitative results. Data was collected over a three-year period from three different universities that have implemented analytics systems. Quantitative data consisted of student engagement scores, course completion rates, and number of times dashboards were accessed over the three-year period, while qualitative data consisted of semi-structured interviews conducted with 30 individuals (Instructional Designers, Academic Leaders and Faculty). Quantitative data analysis included descriptive statistics and regression analysis to examine relationships between dashboard usage and performance indicators. Qualitative data analysis included thematic coding which enabled the interpretation of the experiences and perspectives of stakeholders.

IV. DATA ANALYSIS AND INTERPRETATION

This analysis of data was meant to look at how the impacts of learning analytics and academic dashboards have an effect on the performance of institutions as they monitor their student outcomes through learning analytics and academic dashboards. By following best practices set forth by organizations such as EDUCAUSE and The Society for Learning Analytics Research, we used both quantitative data and qualitative data as a way to understand the full effectiveness of learning analytics and academic dashboards. Quantitative data was based on institutional databases by looking at measurable academic variables over a three-year period while qualitative data was gathered through interviews with faculty members, program coordinators, and academic administrators. By using both types of data, we were able to use statistics to see trends and then utilize people's lived experiences to supplement the analysis and provide more validity to the results of our analysis.

The first tier of the analysis was to look at how many departments adopted academic dashboards. The frequency with which faculty used their dashboards was recorded by logging into the dashboard and recording how often they logged in, how long they were logged into the dashboard, and how many performance reports they generated through their dashboards. From this data, we divided courses into three categories based on their usage of academic dashboards: high, moderate, or low. Table 1 includes the average monthly usage rate of each course based on a breakdown of the number of courses within each usage group. As you can see from the data in Table 1, approximately one-third of the courses were categorized as having high engagement with their use of the dashboard, which indicates a significant number of faculty members used the dashboard to help inform their decision-making regarding the instruction they provided to students. However, the presence of low-usage categories suggests uneven adoption, pointing toward variability in digital competence and perceived utility.

Table 1: Distribution of Dashboard Usage Across Courses

Usage Category	Number of Courses	Mean Monthly Usage (hours)	Percentage of Total
High	42	18.6	34%
Moderate	51	9.4	41%
Low	31	2.1	25%
Total	**124**	—	**100%**

Following the categorization of usage levels, the second stage evaluated whether differential adoption translated into variations in academic performance. Completion rate, pass percentage, and average grade point average were used as outcome indicators. Comparative analysis revealed that courses with high dashboard engagement consistently outperformed those with minimal usage. Table 2 indicates that high-usage courses recorded a 12 percent increase in completion rates and higher mean GPA scores, suggesting that the availability of timely performance data enables instructors to intervene more effectively when students display signs of difficulty. The interpretation of these findings supports the argument that analytics-informed teaching enhances instructional responsiveness and reduces attrition.

Table 2: Comparison of Academic Performance by Dashboard Usage

Indicator	High Usage	Moderate Usage	Low Usage
Completion Rate (%)	88%	81%	76%
Pass Rate (%)	91%	84%	78%
Mean GPA	3.28	3.06	2.87

The third stage focused on behavioral engagement metrics, including time-on-task, login frequency, and participation in digital discussions. These indicators provide insight into the processes underlying performance gains rather than merely the outcomes. Correlation analysis demonstrated positive relationships between instructor dashboard use and student engagement behaviors. Courses in which instructors regularly monitored analytics and provided feedback exhibited higher levels of active participation. Table 3 presents the correlation coefficients, which indicate moderate to strong associations. These findings suggest that dashboards may indirectly influence learning outcomes by fostering greater student involvement and sustained interaction with course materials.

Table 3: Correlation Between Dashboard Use and Student Engagement Indicators

Variable	Value
Time-on-Task	0.62
Login Frequency	0.58
Interaction Posts	0.66

To further understand predictive relationships, regression analysis was conducted to determine whether dashboard usage independently predicted academic success after controlling for demographic and prior achievement variables. The regression model demonstrated that dashboard engagement remained a statistically significant predictor of course completion and GPA even when other variables were accounted for. Table 4 shows that dashboard usage explained a substantial portion of variance in outcomes. This indicates that analytics adoption contributes uniquely to performance improvements rather than merely reflecting pre-existing student capabilities.

Table 4: Regression Model Predicting Academic Outcomes

Predictor Variable	Beta Coefficient (β)	t-value	Significance (p)
Dashboard Usage	0.41	4.87	< 0.001
Prior GPA	0.36	4.02	< 0.001
Attendance	0.29	3.45	0.002
Model R^2	0.52	—	—

While quantitative results established measurable effectiveness, interpretation would remain incomplete without examining stakeholder perceptions. Consequently, qualitative interview transcripts were coded thematically to identify recurring patterns. Participants frequently described dashboards as tools that enhanced transparency and facilitated early intervention. Faculty noted that visualizations allowed rapid recognition of disengaged learners, while administrators emphasized improved reporting for accreditation and internal review. Nevertheless, several respondents highlighted obstacles such as information overload, difficulty interpreting complex metrics, and insufficient professional development. Table 5 summarizes the thematic distribution, demonstrating both supportive and critical perspectives. These qualitative insights contextualize the statistical findings and reveal that the success of analytics systems depends heavily on user competence and institutional support structures.

Table 5: Qualitative Themes from Stakeholder Interviews

Theme	Frequency of Mentions	Interpretation
Improved monitoring and transparency	24	Greater visibility of trends
Early identification of at-risk students	21	Timely intervention possible
Need for training and support	19	Professional development required
Personalized teaching strategies	18	Adaptive instruction enhanced
Data overload and complexity	15	Difficulty interpreting metrics

Together, both the analysis and interpretation demonstrate that learning analytics (LA) and academic dashboards (AD) have a strong, significant, and measurable impact on performance monitoring in higher education. The quantitative data evidences that with the higher use of dashboards there is a positive relationship between the number of dashboards used and enhancements to students' course completion rates, increased student engagement, and improved student success. Qualitative data supports these results by providing additional explanations for improvements seen in quantitative data (i.e. increasing awareness of how to improve their teaching and facilitating quick decision making), and making proactive instructional changes as necessary.

Yet the existence of adoption barriers reveals that the mere existence of LA and AD are not sufficient to ensure successful adoption of LA and AD in higher education. Successful integration of LA and AD into higher education institutions requires an investment by colleges/universities into the training of staff, proper governance policies, and the creation of data literacy amongst educators. As such, these findings suggest that dashboards are not simply reporting tools for LA, but actually facilitate the transformational nature of pedagogical practices in higher education. When LA is practised in a culture of reflection and supported by the appropriate amount of development, LA utilised within a data-rich environment can build enhanced quality assurance processes and support the long-term development of improved outcomes in higher education.

V. FINDINGS OF THE STUDY

This study set out to understand how data-driven quality control systems—particularly learning analytics and academic dashboards—shape the way institutions monitor student performance and improve quality in higher education. By combining hard performance data with insights from faculty, administrators, and other stakeholders, the research painted a clear picture: when analytics-based monitoring systems are used thoughtfully, they bring real academic benefits and influence the institution as a whole.

The numbers told a compelling story. Courses in which instructors regularly engaged with academic dashboards consistently showed better outcomes. Completion rates were higher, pass percentages improved, and average grades increased compared to courses where analytics tools were used only occasionally. In fact, the roughly 12% rise in course completion rates suggests that access to real-time data allows instructors to step in at the right moment—addressing learning gaps, reaching out to struggling students, and preventing small issues from turning into dropouts. This wasn't a random improvement. It reflected the practical advantage of ongoing monitoring, where early signs of disengagement can be spotted and addressed before they become serious problems.

The study also found that dashboards don't just influence final results—they shape students' day-to-day learning behaviors. Indicators such as login frequency, time spent on tasks, and participation in discussions were moderately to strongly linked to instructors' use of analytics. When teachers regularly reviewed performance trends and provided feedback based on real data, students tended to participate more actively and stay more consistent in their efforts. In other words, the presence of dashboards appeared to create a more responsive and interactive learning environment, where students felt seen and supported rather than overlooked.

Regression analysis strengthened this conclusion. Even after accounting for factors like prior academic performance and attendance, students' own use of dashboards remained a significant predictor of academic success. This suggests that analytics tools do more than simply reflect existing ability—they can actively contribute to improved performance. Dashboards become not just reporting tools, but mechanisms that shape teaching strategies and student support systems in meaningful ways.

The qualitative findings added depth to these statistical patterns. Faculty members described dashboards as tools that increased transparency and gave them immediate insight into class progress. With that visibility, they felt better equipped to adjust instruction to meet individual student needs. Administrators, meanwhile, valued the visual summaries of aggregated data, which supported strategic planning, accreditation documentation, and resource allocation. Many participants noted that analytics encouraged a shift toward evidence-based decision-making. Instead of relying on intuition alone, decisions were increasingly grounded in measurable trends and documented outcomes. This shift signaled broader organizational change, extending well beyond individual classrooms.

At the same time, the study did not overlook the challenges. One of the most common barriers was limited data literacy. Several instructors admitted they lacked confidence in interpreting complex metrics or translating analytics into practical teaching adjustments. Information overload was another concern; when too much data was presented at once, it sometimes created confusion rather than clarity. Ethical questions also surfaced, particularly around student privacy and responsible data use. Participants emphasized the need for clear policies to guide ethical practice. In addition, uneven technological skills across departments led to inconsistent adoption, and some resistance to change slowed implementation.

Taken together, the findings make one thing clear: data-driven quality control systems hold significant promise, but their success depends on more than technology alone. Dashboards and analytics can enhance performance monitoring and institutional effectiveness, but only when they are supported by proper training, clear governance, ethical safeguards, and thoughtful integration into teaching practices. The study ultimately highlights both the transformative potential and the practical complexities of embedding learning analytics and academic dashboards into higher education.

VI. CONCLUSION

The purpose of this study is to investigate the growing influence of data-based quality control processes within the postsecondary education system, as well as to analyze the contribution of learning analytic tools and academic dashboards for measuring performance and the effectiveness of institutions of higher education. This research confirms that higher education institutions today can no longer depend solely on past-focused methods for producing quality assurance. Continuous and evidence-based monitoring has become essential in an age defined by digital learning platforms, large enrollment sizes, and heightened levels of accountability. Learning analytics and dashboard technology are positioned as a critical component of enabling educational stakeholders to meet these expectations by turning previously unprocessed educational data into useful information that can guide decision-making in teaching and learning as well as governance.

In conclusion, learning analytics and academic dashboards represent powerful instruments for strengthening quality assurance in higher education. When thoughtfully integrated and ethically managed, they enable institutions to transition from reactive evaluation toward continuous improvement and informed decision-making. The future of higher education quality control is therefore likely to be increasingly data-informed, collaborative, and adaptive, with analytics serving not merely as monitoring tools but as catalysts for sustainable educational transformation.

REFERENCES

[1]. Arnold, K. E., & Pistilli, M. D. (2015). Course signals at Purdue: Using learning analytics to increase student success. Proceedings of the 5th International Conference on Learning Analytics and Knowledge, 267–270.

[2]. Bichsel, J. (2016). Analytics in Higher Education: Benefits, Barriers, Progress, and Recommendations. EDUCAUSE Center for Analysis and Research.

[3]. Brooks, C., Thompson, C., & Teasley, S. (2015). A time series interaction analysis method for building predictive models of learners using log data. Proceedings of the Learning Analytics & Knowledge Conference, 126–135.

[4]. Brown, M., Dehoney, J., & Millichap, N. (2015). The Next Generation Digital Learning Environment: A Report on Research. EDUCAUSE.

[5]. Dawson, S., Gašević, D., Siemens, G., &Joksimović, S. (2016). Current state and future trends: A citation network analysis of learning analytics. Proceedings of LAK Conference, 231–240.

[6]. Dede, C., Richards, J., & Saxberg, B. (2018). Learning Engineering for Online Education. Routledge.

[7]. Ferguson, R., Brasher, A., Clow, D., Cooper, A., Hillaire, G., Mittelmeier, J., Rienties, B., Ullmann, T., &Vuorikari, R. (2016). Research evidence on the use of learning analytics. Journal of Interactive Media in Education, 1(1), 1–17.

[8]. Gašević, D., Dawson, S., Rogers, T., &Gasevic, D. (2016). Learning analytics should not promote one size fits all: The effects of instructional conditions. British Journal of Educational Technology, 47(3), 550–568.

[9]. Greller, W., &Drachsler, H. (2015). Translating learning into numbers: A generic framework for learning analytics. Educational Technology & Society, 18(3), 42–57.

[10]. Jivet, I., Scheffel, M., Specht, M., &Drachsler, H. (2017). License to evaluate: Preparing learning analytics dashboards for educational practice. Proceedings of LAK Conference, 31–40.