

6-15-2019

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Recommended Citation

Sevillano, Maria c. EDD and De Jesus Liriano, Ruben EDD (2019) "Improving the Learning Process in the Higher Education Through the Use of a Predictive Tool (Dashboard)," *FDLA Journal*: Vol. 4 , Article 7.
Available at: <https://nsuworks.nova.edu/fdla-journal/vol4/iss1/7>

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Improving the Learning Process in the Higher Education
Through the Use of a Predictive Tool (Dashboard)

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A Florida Distance Learning Association Journal (FDLA) Paper to be published
In a special section of the US Distance Learning Association Professional Journal
Distance Learning
2019

Abstract

Improving the learning process in the high education through the use of a predictive tool (dashboard). De Jesús Liriano, Rubén and Sevillano, María C., 2018: A Florida Distance Learning Association Journal (FDLA) Paper to be published in a special section of the US Distance Learning Association Professional Journal Distance Learning. Interaction/Predictive Tools/Dashboard/Evaluation Learning Process/Automated Process/eLearning Environment/Learning Environment/Learning Management System (LMS)/Cloud Computing/ Learning Performance, and Learning Analytics.

The purpose of this study was the initial step in providing a clear understanding of the use of a predictive tool (dashboard) to improving the learning process in the higher education field. Through further applications and research, the predictive tool must be refined to increase accuracy, and provide expeditious, reliable feedback about the students' progress in an online environment. This information will benefit e-learning facilitators in the following ways: 1) knowing their students and, therefore, identifying how best to deliver content to them; 2) applying the right predictive tool to capitalizing on the new experience and new opportunity; 3) taking value-added approaches to student engagement; 4) bridging connections in a precise manner between enriched content and e-learning; and 5) transforming e-learning into digital experience.

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Introduction

In recent years, the academic industry has seen a widespread development of digital technology and learning analytics. Certainly, the exchange of automatic processing has opened a broad set of new ways and opportunities, allowing additional emphasis on interaction and connectivity. This new learning approach provides improvement in the development of the learning process, as well as developing predictive analytics uses, applied guidelines for effective and efficient efforts and aligning educational decisions processes toward better ways of learning systems.

“Predictive analysis is changing the face of higher education. They are on the cutting edge of advancements predictive analytics in making applications and analytical learning models as the center of digitalization for higher education and the global economy, even reshaping education and the future of work” (Covington, 2016). At the same time, technology continues to evolve and create new waves of advances by redesigning technical capabilities with enormous implications for society. Researchers call it “the next wave of opportunity”, which entitles the use of robotics, machine learning, and Artificial Intelligence (AI). It is also called the deployment of automation technologies, and it has the potential to increase significant performance profits and productivity.

Background, Significance and Impact of the Learning Analytics Dashboards (LAD)

The background of learning performance is intrinsically bonded to the concept of learning analytics and dashboards; therefore, the definition of this concept is imperative as part of understanding its meaning and importance. Learning Analytics is defined as “an emerging area that explores the measurement, collection, analysis and reporting of data which is associated with students’ learning and their environment” (Brown, 2011). For example, the use of log-data in CMS is “one of the most popular research” (Park & Jo, 2015). On the other hand, the term *dashboard* has come to be known as “a visual display mechanism to enable users at every level to receive the information they need to make better decisions that improve learning performance” (Ponniah, 2010, p. 559). Nowadays, when combining both applications, learning analytics dashboards are “an interactive, historical, personalized, and analytical monitoring display that reflects students’ learning patterns, status, performance, and interaction” (Park & Jo, 2015).

For the past decade, these LADs have been trailblazers in the field of educational technology and online instruction. They emerged from the need of collecting users’ data from the already popular cited Course and Learning Management System, where large amounts of learners’ behavioral data were left and accumulated as log files. As a result of LADs, this information can easily be extracted in order to conduct data-mining, and data-warehousing, and consequently, utilize them to improve users’ learning performance using a special type of metrics known as “key performance indicators” (KPIs). KPIs are defined as “quantifiable numeric or scale-based measurements that assess the learning effectiveness or success in reaching its learning goals” (Coronel, Morris & Rob, 2013, p.545). For instance, Pistili and Arnold (2010) provided a real-time academic status for learners to be informed of their current scores, as well

as to give alarm signals, and they showed that these signals helped prevent students from dropping-out, and enhanced their success.

The Context of Learning Analytics in E-Learning Environment

Learning analytics is defined as “the collection and analysis of usage data or records associated with the student learning process” (Brown, 2011). The goal of learning analytics in the e-learning environment is “to transform the educational system from a time-based system to a learning-based system” (Linehan, 2018). In addition, it provides records to prove that the user has mastered competencies, skills, abilities, and knowledge required in a particular area of study. “In other words, it is not about time, it’s about what the learners know and are able to do” (Linehan, 2018). Brown enhanced this statement by saying “learning analytics will provide the capacity of collecting and analyzing data from a variety of sources to provide information on what works and what does not.” (2011).

A dashboard tool is one of the techniques of the analytical world, and it is a performance management system, which provides visual displays of central information arranged on a single screen. Also, it gives accurate data to make an adequate and precise decision on what is going on within the learning environment. Consequently, the possibility of using a dashboard as an analytical tool is significant because it provides useful evidence to participants and facilitators in the e-learning environment regarding essential contribution, social connections, and knowledge representation, which proposes meaningful indication about e-learning. “Quantitative analyses have exposed a basis level of learning assessment and reporting on learning activity. Similarly, qualitative tools and approaches have demonstrated how deep exploration of content and context learning can reveal the types of contributions made, and as a result, it promotes learning” (Fournier, Kop, & Sitlia, 2011). Therefore, the use of dashboards seems like a powerful key in giving meaning to interactions and actions in the learning environment. “Indeed, using an analytic tool empowers scope for personalized learning and the creation of more effective learning environments and experiences” (Fournier, Kop, & Sitlia, 2011). A new wave of e-learning models has emerged, and learning analytics tools provide an opportunity for information filtering and visualization, and most importantly, they support users in pursuing their learning goals.

The Learning Architecture Framework of Learning Analytics

A framework infrastructure is a priority in an e-learning architectural environment. It is like a blueprint plan to build a house. The learning architecture supports facilitators, learners, and the educational setting to be more effective in delivering learning results and performance. At this point, within learning analytics, “there are so many metrics and frameworks that could be tracked that it is absolutely essential for participants to identify what types of outcomes they desire from users” (Rogers, MacEwan & Pond, 2008, p. 233). Then, there are four essential objectives for the effective use of learning analytics in education: “1) defines the goals or objectives; 2) measures the outputs and outcomes; 3) uses the resulting data to make improvements; and 4) shares the data for the benefit of others” (Hendricks, Plantz & Pritchard, 2008). Additionally, by defining goals and using those goals to determine what details need to be captured, facilitators run less risk of “drowning in data” (Snibbe, 2006).

On the other hand, Oblinger and Campbell (2008) explained academic analytics as “an engine to make decisions or guide actions, which consists of five steps: 1) capture; 2) report; 3) predict; 4) act; and 5) refine. The addition of the final step, *refine*, recognizes analytics as a “self-improvement blueprint” in which “monitoring the impact of the task is a continual effort, and statistical models should be updated on a regular basis”. Despite the recognition of the importance of ongoing improvement of the system in learning analytics, the literature related to this process is scarce (Elias, 2011). In spite of this, Dron and Anderson (2009) presented a model that is also useful in defining the processes of learning analytics called *the Collective Application Model*, which consists of five layers divided into three cyclical phases: 1) information gathering; 2) information processing; and 3) information presentation. This model also emphasizes the cyclical nature of the analytical processes and the on-going need to refine and improve the system. After comparing these two architecture frameworks of learning analytics, seven related processes of learning analytics emerge: 1) Select; 2) Capture; 3) Aggregate & Report; 4) Predict; 5) Use; 6) Refine; and 7) Share (Elias, 2011).

To sum up, the development of a robust learning architecture framework of learning analytics is an important move to improve digital learning experiences and opportunities. Without a doubt, it maximizes the delivery of higher education outcomes and accommodates the evolving educational needs.

Definition of Terms

Algorithm is defined as “a step-by-step search in which improvement is made every step until the best solution is found” (Sharda, Delen, & Turban, 2015. P. 634)

Analytical Models is defined as “mathematical models into which data are loaded for analysis”. (Sharda, Delen, & Turban, 2015. P. 635).

Dashboard is defined as “a visual presentation of critical data for executives/educators. It allows them to see hot spots in seconds and explore this situation” (Sharda, Delen, & Turban, 2015. P. 636).

Data visualization is defined as “a graphical, animated, or video presentation of data and the results of data analysis” (Sharda, Delen, & Turban, 2015. P. 636).

Predictive Analytics is defined as an “analytical approach toward forecasting (e.g. demand, problems, opportunities) that is used instead of simple reporting data as they occur” (Sharda, Delen, & Turban, 2015. P. 643).

New Trends and Innovation in the Learning Process

The 21st century has created a new digital and interactive educational atmosphere. It has transformed education for the next generation. Today, the world is a wide-open scenario, which takes into account individual learning patterns. As Vassiliou stated, “the online and open education world is changing how education is resourced, delivered and taken up. Over the next 10 years, e-learning is projected to grow fifteen-fold, accounting for 30% of all educational provision” (2014).

The new trends in higher education, based on this European Commission Report, are focused on: “1) developing individualized learning approach; 2) creating a more diverse higher education system; 3) increasing global visibility in an international context; 4) enhancing personalized learning informed by learning analytics, and better data recollection; and 5) advancing on greater global and local collaboration and cooperation” (European Commission, 2014). These inclinations are bringing innovations and addressing concerns, thus changing higher education and e-learning instruction. The art of obtaining information from collected data and utilizing it for predictive behavior patterns and trends is the world of predictive analytics tools (Covington, 2016, p. 93).

Educational leaders are embracing the new trends in analytics since they have a direct impact on e-learning education and tomorrow’s learning environments. “Higher education institutions face a time of innovation and exploration. New combinations of tools, services, and instructional strategies are possible, maximizing the benefits of multiple resources” (Best Colleges, 2017).

The e-learning industry has an opportunity to deepen learning approaches, which are influencing the educational field. These tools are modeling the e-learning education for a more accurate and evaluative methodology and increase in value through interaction models of communication with users. Experts have expressed that deep learning methods are the next big change in businesses and academia at large. The benefits of these new developments are endless; among them, rising new ways of delivering learning and managing the learning process (Mueller & Massaron, 2016, p. 57).

The goal of these new features is to allow leaders and professionals to perform better and more precisely, to understand operations more effectively, and to address important challenges that were previously ignored. Additionally, these tools can collect significant statistics to learn more about key facts to control, such as the audience, satisfaction, and performance. In summary, online access is accepting new tools to increase much broader participation in higher education programs. As always, it will be up to leaders in the field to navigate the fast-moving changes to enhance e-learning atmospheres and make the best decisions for the future.

The Application and Use of a Predictive Tool in E-learning Platform

It is important to point out that numerous Course Management Systems are already taking advantage of the use of dashboards in different ways. However, integrating the use of dashboards into any CMS might bring many challenges; in fact, research has shown that before the implementation of dashboards, the tools’ acceptance and usefulness are important factors that influence the adoption of learning analytics tools (Santoso, et.al, 2018).

Additionally, there is also the participants’ trend to ignore the dashboard altogether. At first, users might ignore the dashboard because they might not understand how the data will be useful for them; and, over time, the dashboard might become less interesting (Skorka, 2017). Therefore, making sure that the participants understand the different graphical aspects of the dashboard is one of the first steps towards implementation. One of the ways in which this could be accomplished is leading by example; for instance, the head of the department can do a

demonstration on how he or she makes sense and use of the data provided by the dashboard.

Afterwards, keeping the dashboard updated and adding new customizable features might take care of the staleness factor of its constant use. Skorka (2017) stated that the success or failure of a dashboard is closely related to data visualization and aesthetics, clarity, and expressiveness; these are the cornerstones of successful visualization. Consequently, to achieve successful data visualization, the institution will need to determine which ones are the Key Performance Indicators that the facilitators value the most to make sure that these KPIs are being properly displayed in the dashboard.

The usefulness of the information shown on the dashboard is another key factor for the success of its implementation into any e-learning environment. Basically, the main goal of visualization is the speed in which it provides relevant information for participants. Once participants understand the data, they can easily make decisions on which actions they must take within their online courses, thus improving the evaluation process and the overall efficiency of an online course. After all, applying dashboards in the e-learning environment is a matter of combining the administration's due diligence and orientation practices, and the participants' attitudes and knowledge about the use of a dashboard.

The use of Dashboard to Improve the Learning Process in Higher Education

The use of a predictive tool to improve the learning process is achievable. The creation of a powerful interactive visualization and predictive tool, such as a dashboard, helps better communicate a complex dataset in a simple and commanding way. Dashboards bring understanding of users' trends and needs to quickly act on circumstances and synthesize rules for creating active and engaging learning activities and assessment practices. The learning analytics dashboard is an application to display student accomplishments, as well as helping troubled learners. True research studies have confirmed that both functional learning environment and experiences can have a positive impact on performance through the implementation of predictive tools.

The integration of an e-learning platform together with a predictive tool, in this case a dashboard, serves as a support to adjust the learner's needs and opportunities. "Information architecture should be applied to organize information components in the dashboard system to navigate between the information and the evaluation dashboard; also, to monitor the usability of the system and the effectiveness of the data structure design" (Santoso, et al., 2018). For that reason, the application and use of predictive tools in e-learning platforms offers many opportunities to the e-learning community. The adoption and adaptation of these tools provide clues of what the changes that the industry is going through.

As a final observation, information is the life force of every organization and it is guided based on particular requirements, which leads the way to support data-driven applications, tools and digital technologies; it provides experiences on forecasting to continue to expand. The target is to identify data-driven analytic applications and/or predictive tools for the e-learning environment using point solutions (KPIs), and making them sustainably real to support-decision making.

Who gets the most benefits and how can we move ahead?

When asking who gets the most benefits from improving the learning process in the higher education by implementing a dashboard, a fresh study demonstrated that dashboards are common in today's world within an e-learning platform because they benefit all participants. In fact, they help to enhance the delivery of instruction, and the judgement process for the facilitators while also improving the students' learning experience by providing quick access to key information.

The varied results regarding the value of dashboards in e-learning education require that additional research studies be conducted. Nevertheless, and based on the evidence-built in this paper, the question is how can we move ahead? Through the literature review, it is evident that there are benefits derived from the use of learning analytics' dashboards for learners and faculty members alike. For instance, facilitators can easily determine if certain topics might need re-teaching or make modifications to their method of instruction; and students will easily be able to identify in which areas within the course they will need to improve.

These first steps of reviewing the dashboard technology as a predictive tool in the e-learning environment give the participants the opening to endorse their learning experiences based on a global scale. These are baby steps, but nevertheless, important steps because they show the demand for an increment in the use of dashboards in the educational system, and also, they give the participants the opportunity to be better organized based on the given requirements. Therefore, "the development of learning analytics dashboards is still driven by the need to leverage learning data available, rather than a clear focus of improving and supporting learning" (Santoso, 2018).

From this conclusion, the answer to this section's question becomes clear, and needs to be reiterated: all participants will benefit from this new technology. Technology has the potential to make e-learning education a more personalized learning experience. It has transformed and created an innovative way of doing e-learning instruction. Consequently, in order to develop a precise and concise learning approach while integrating dashboards, recognizing the strengths and risks of today's higher education diversity is fundamental. In the end, it is all about building today's e-learning digital tools to meet tomorrow's learner needs.

Conclusion

The necessity for an accurate predictive tool in the e-learning environment is essential to the higher education landscape. Santoso (2018) has proposed three approaches for using research in developing and evaluating learning analytics dashboards. He stated the following: 1) supporting decisions related to the dashboard design through educational concepts; 2) validating measurement instruments for measuring to support learners' competences; and 3) understanding contrasting results when reviewing learner responses to using learning analytics dashboard. Indeed, the use of a dashboard is a milestone system that has been developed in recent years. Although there may be difficulties with its implementation, it has proven to be useful for measurement and supporting learner academic performance, including learners who are struggling educationally in an e-learning environment.

In conclusion, the extent to which the higher education industry can capitalize on e-learning technology to meet needs in a relevant way requires a lot of effort and leadership. The predictive tools and dashboard solutions are leading the industry with standards, structures, and knowledge to improve the decision making process. After all, "organizations that are able to use their data with intelligence and purpose to effectively and affordably manage learners will stand apart from the competition" (Coronel, Morris, & Rob, 2013, p. 35).

References

- Brown, M., (2011). Learning analytics: the coming third wave', EDUCAUSE
Retrieved from <https://library.educause.edu/resources/2011/4/learning-analytics-the-coming-third-wave>.
- Best Colleges (2017, March). Online Education Trends Report: Retrieved from
<https://www.bestcolleges.com/wp-content/.../2017-Online-Education-Trends-Report.p...pdf>.
- Coronel, C., Morris, S., & Rob, P., (2013). *Database Systems: Design, Implementation, and Management*. Boston: Course Technology: Cengage Learning.
- Covington, D., (2016). Analytics: data science, data analysis and predictive analytics for business: Middletown, DE.
- Dron, J. and Anderson, T. (2009). On the design of collective applications, Proceedings of the 2009 International Conference on Computational Science and Engineering, Volume 4, pp. 368-374.
- Elias, T. (2011). Learning Analytics. *Learning*, 1-22. Retrieved from
<https://pdfs.semanticscholar.org/732e/452659685fe3950b0e515a28ce89d9c5592a.pdf>.
- European Commission (October, 2014). Report to the European Commission on New Modes of Learning and Teaching in Higher Education. Luxembourg: Publications Office of the European Union. (68). ISBN 978-92-79-39789-9. doi:10.2766/81897.
- Fournier, H., Kop, R., & Sitlia, H., (2011). The value of learning analytics to networked learning on a personal learning environment. Conference Paper (PDF Available) · February 2011 with 668 Reads DOI: 10.1145/2090116.2090131 Source: DBLP. Conference: Conference: Proceedings of the 1st International Conference on Learning Analytics and Knowledge, LAK 2011, Banff, AB, Canada, February 27 – March 01, 2011.

- Hendricks, M., Plantz, M. C., & Pritchard, K.J., (2008). *New Directions of Evaluation*. Retrieved from <https://eric.ed.gov/?id=EJ810326>.
- Linehan, C., (2018). *Building 21: Designing a network for competency-based education*. Retrieved from <http://www.gettingsmart.com/2018/07/building-21-designing-a-network-for-competency-based-education>.
- Mueller, J.P., & Massaron, L., (2016). *Machine Learning*. New Jersey; John Wiley & Son, Inc.
- Oblinger, D., and Campbell, J. (2008). *Academic Analytics*. Retrieved September 21, 2018 from <http://www.educause.edu/ir/library/pdf/PUB6101.html>.
- Park, Y., & Jo, I.H. (2015). Development of the Learning Analytics Dashboard to Support Students' Learning Performance. *Journal of Universal Computer Science*, vol. 21, no. 1 (2015), 110-133.
- Ponniah, P. (2010). *Data Warehousing Fundamentals for IT Professionals*. New Jersey: Wiley & Sons, Inc., Publication.
- Pistilli, M. D., & Arnold, K. E.: In practice: Purdue Signals: Mining real-time academic data to enhance student success, *About Campus*, 15, 3, (2010) 22-24.
- Rogers, P.C., and McEwen, N.R., and Ponds, S. (2010). The design and evaluation of distance education. *Emerging technologies in distance education*, pp 231-247.
- Santoso, H.B, Batuparan, A.K, Isal, R.Y. & Goodridge, W.H., (2018). The Development of a Learning Dashboard for Lecturers: A Case Study on a Student-Centered E-Learning Enviroment. *Journal of Educators Online*. Retrieved from <https://eric.ed.gov/?id=EJ1168957>.
- Sharda, R., Delen, D., & Turban, E., (2015). *Business Intelligence and Analytics: Systems for Decision Support*. New Jersey: Pearson.
- Snibbe, A.C. (2006). Drowning in data. *Stanford Social Innovation Review*, Fall 2006, pp. 39-45. Retrieved on September 20, 2018 from http://ssireview.org/pdf/2006FA_feature_snibbe.pdf
- Skorka, A. (2017). Successful dashboard implementation in practice: how to overcome implementation barriers and ensure long term sustaining ability. *International Journal of Market Research*. Vol. 59 (2), 239-262.
- Vassiliu, Y. (2014). The use of e-learning course management systems to support learning strategies and to improve self-regulated learning. *Educational Research Review*, 2(1), 64-74.