

Developing an Implementation Framework for Adaptive Learning: a Case Study Approach

Victoria Mirata, Per Bergamin

Distance University of Applied Sciences of Switzerland, Brig, Switzerland

victoria.mirata@ffhs.ch

per.bergamin@ffhs.ch

Abstract: Although the interest in using adaptive learning in online teaching is steadily growing, its broad implementation remains low. This is despite positive attitudes of institutional leaders towards its adoption and promising results of early studies on its empirical impact, for example, on students' learning outcomes and course dropouts. Recent studies have identified and discussed the challenges that prevent higher education institutions from using adaptive learning for their teaching purposes. However, little empirical research has been done to clarify the interdependency or interplay of these challenges. Our work aims to close this gap by identifying the relationships between the different types of challenges of adaptive learning. From this, we then develop an implementation framework of adaptive learning to propose effective implementation strategies for adaptive learning concepts in higher education. A Delphi design was used to collect the data from two universities, the North West University of South Africa (NWU) and the Swiss Distance University of Applied Sciences (FFHS), as our two case studies. For the data analysis, the Grounded Theory Coding approach was applied. The proposed framework shows the five empirically identified dimensions, such as technology, teaching & learning, organization, law & regulations, and cultural & political conditions, and lays out a basic structure for challenges, prerequisites, and facilitators enabling the implementation of adaptive learning. Our findings suggest that multiple perspectives on the challenges of adaptive learning should be considered when implementing adaptive learning concepts in a higher education setting. The findings are valuable for institutions that seek to implement or already pilot adaptive learning in blended and online teaching.

Keywords: adaptive learning, implementation framework, challenges to adoption, Delphi technique

1. Introduction

Higher education faces many challenges today, including high costs, lifelong learning, equal access to education and a high diversity of students with different socio-economic backgrounds, needs and lifestyles. Some innovative teaching approaches are emerging to meet these challenges. One of them is adaptive learning, which enables a personalized learning experience in blended and online learning environments. Adaptive learning refers to technologies that monitor learner progress and use data to continuously modify teaching content to the behavior and needs of individual learners (Alexander et al, 2019). Today, interest in adaptive learning concepts is growing rapidly, but their broad implementation remains low (Green, 2018). This is despite promising findings on student learning outcomes, course dropouts, and positive attitudes of board members towards their adoption (Daines, Troka and Santiago, 2016; Green, 2018; Holthaus, Pancar and Bergamin, 2019). Recent studies have identified barriers and challenges that prevent universities from using adaptive learning concepts (Tyton Partners, 2016; Johnson and Zone, 2018). Most of these studies provided insights and recommendations on how to overcome implementation barriers and facilitate the introduction of adaptive learning in education. However, to date little research has been conducted to clarify the relationships between the different challenges identified or to develop an implementation framework for adaptive learning. To address this issue, we report on the current progress in the development of an implementation framework for adaptive learning in educational institutions. Based on the data collected within a Delphi study spanning two universities, this paper aims to identify and interpret connections between the challenges of adaptive learning by specifying their context. From this, we propose a first draft of the implementation framework of adaptive learning that is grounded in the participants' data.

2. Methodology and instruments

In this paper, we further analyse the data collected in the Delphi study on the challenges of adaptive learning (Mirata et al, in preparation). Delphi is a research method used to collect anonymous judgements of experts usually on a poorly defined topic or complex problem without face-to-face interaction using a series of questionnaires with interspersed controlled feedbacks (Skulmoski, Hartman and Krahn, 2007). Delphi can be designed to generate new ideas, predict future developments, reach consensus or obtain experts' opinions

(Linstone and Turoff, 1975; Häder, 2014). We used Delphi as a research method, because it allowed a group of participants, as a whole, to deal with the evolving concept of adaptive learning in a flexible but still structured way. Our Delphi study was designed to obtain experts' opinions on the challenges of adaptive learning. According to Häder (2014), this type of Delphi is well suited for deriving interventions to respond to a problem identified in the study. Two simultaneous Delphi surveys were conducted at two universities with different socioeconomic, organizational backgrounds and implementation stages of adaptive learning: The North West University of South Africa (NWU) and the Swiss Distance University of Applied Sciences (FFHS). These universities were selected as our case studies to include different perspectives on adaptive learning. A purposive sampling strategy was used to identify participants with necessary expertise based on predetermined criteria, for example, years of working experience in a technology-based learning area (Elo et al, 2014). 27 experts from NWU and 24 experts from FFHS including lecturers, researchers, technology advisors, and administration staff participated in the Delphi study. The data was collected via online surveys with open-ended questions. The experts were asked to identify, describe and prioritize challenges related to adaptive learning.

In the present study, all participants' responses were analysed applying the Grounded Theory Coding approach (Charmaz, 2006) and a constant comparative method, which involves making comparisons during each stage of the data analysis (Glaser and Strauss, 1967). This coding approach was chosen, because it provides useful techniques (e.g., focus, axial, selective coding) for looking at the relationships between emerging concepts and categories, and developing hypotheses that interrelate the categories in the model. (Charmaz, 2006). The data was managed, coded, and visualized using the MAXQDA software Analytics Pro12.

3. Results

Due to the limited space, we present the preliminary results directly in the form of illustrations to show the emerged challenges and their interrelationships. Figure 1 shows the individual challenges and their classification into three dimensions and eight categories which were identified.

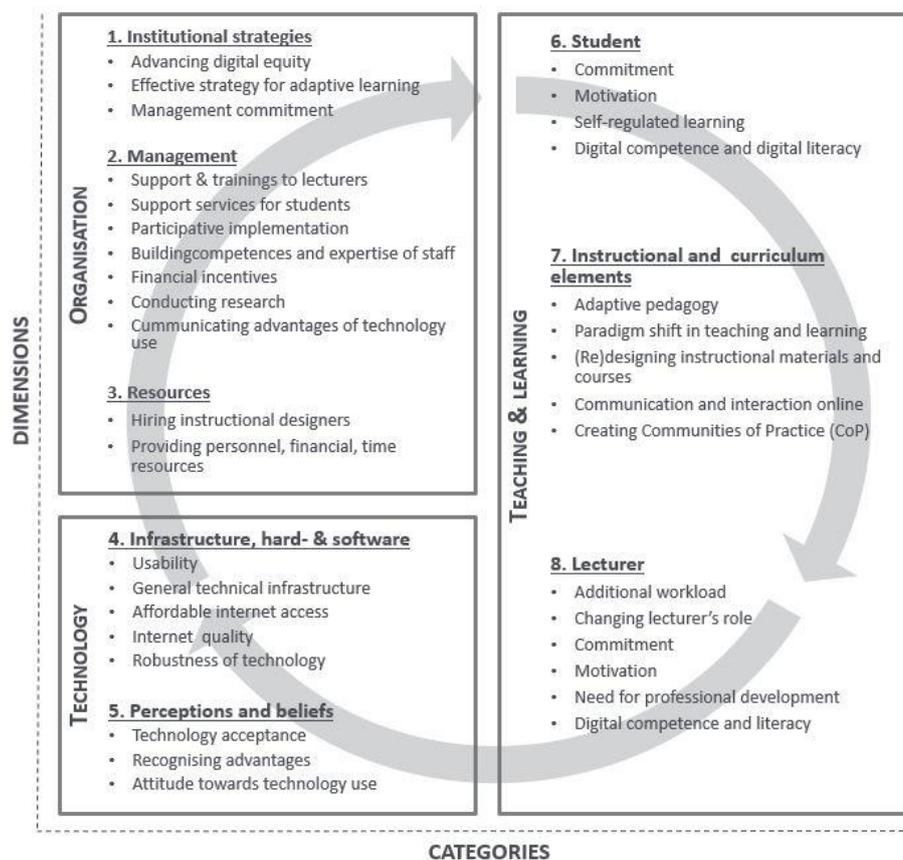


Figure 1: Challenges of adaptive learning, dimensions and categories

Figure 2 depicts exemplarily only the challenges of the technology dimension and their relationships with other challenges including examples of supportive quotations.

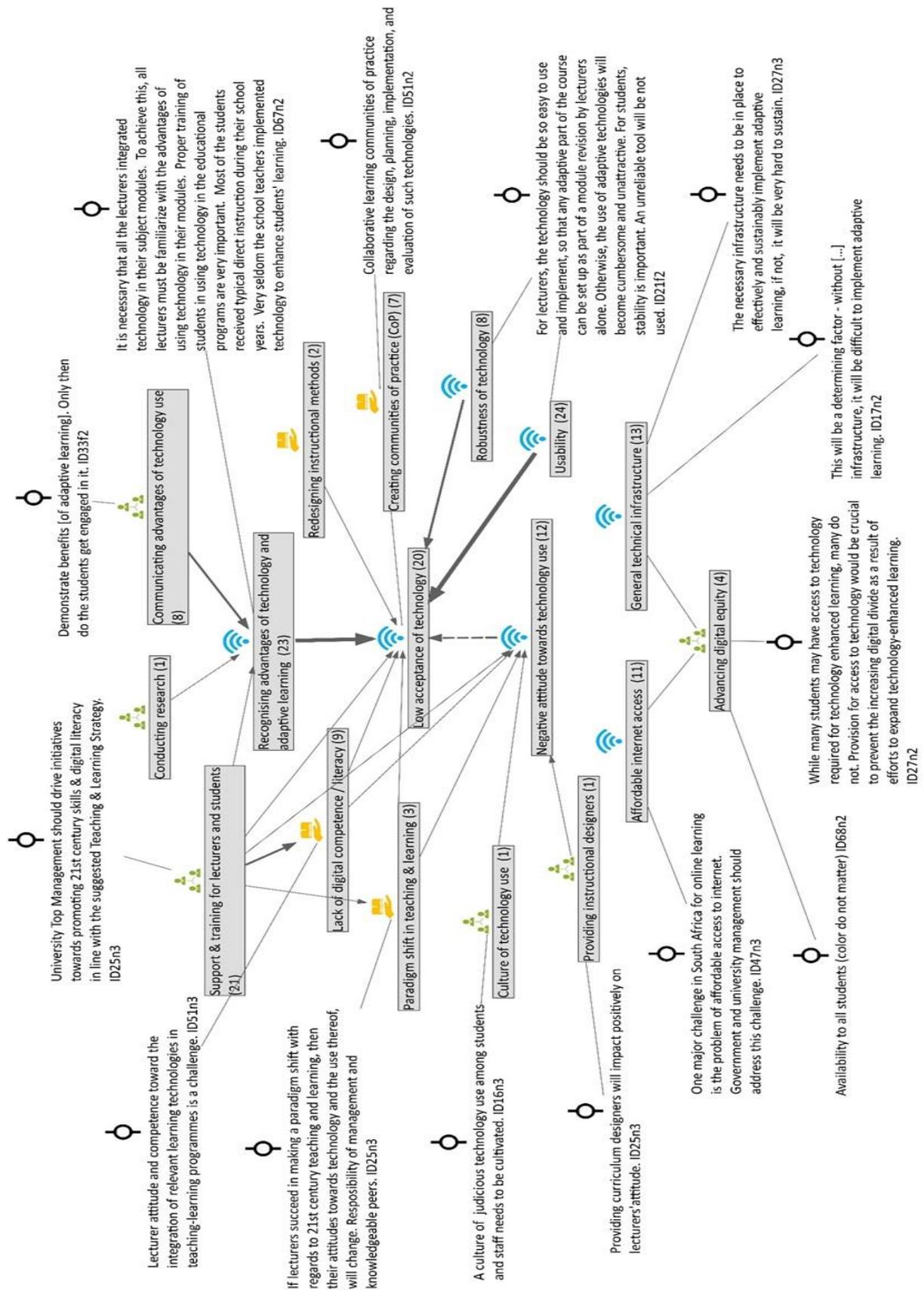


Figure 2: Dimensions: 📶 – technology, 📖 – teaching & learning, 👥 - organization; ⚡- quotations. The number of participants' statements related to a corresponding code are shown in brackets. The frequencies of identified relations between codes are shown through the line width: ——— 1-2 connections, ——— 3-5 connections, ——— 6-14 connections. Dashed lines show hypothetical connections not supported by the data.

4. Discussion and Conclusions

To develop the implementation framework for adaptive learning, we analyzed different challenges (Figure 1) and their interrelationships (Figure 2) by searching for causes and conditions of the observed phenomena. Due to the limited space and the current state of this research, in Figure 2 and the discussion, we focus mainly on the perceptions and beliefs category. We are aware of the limitations of this kind of presentation. However, we present a preliminary prototype of the implementation framework of adaptive learning and discuss briefly the next steps of its further development.

One of the challenges found at both universities is the low acceptance of current technology (e.g., adaptive learning systems). A relevant prerequisite condition for it was that most lecturers and students have not realized the advantages of using technology in teaching practices and learning yet. To support the recognition of the benefits of adaptive learning, the participants suggested improving the communication process between all stakeholders and empirically researching the impact of adaptive learning systems on learning outcomes. This finding is similar to one of the key findings by Brooks (2015), who found that faculty would adopt technology in their teaching practices more, if they had evidence that students benefit from it.

Another finding was that the low acceptance of technology is also a result of insufficient digital competence and digital literacy of lecturers and students. Indeed, improving digital literacy was recognised as one of the significant challenges impending technology adoption in higher education (Alexander et al, 2019). The participants stated that top management should provide institutional support to improve digital literacy, for example, in the form of training for lecturers and tutorials for students. Similar strategies to improve digital literacy were proposed by Adams Becker et al (2018). Overall, through the data analysis, institutional support and trainings were identified as relevant facilitators to improve digital literacy and acceptance of technology.

Although there is a significant amount of empirical evidence that attitude towards technology impacts its acceptance (Ertmer, 1999), our study could not confirm this connection. It remains thus a hypothetical relation waiting for its empirical confirmation.

Challenges related to the affordable internet access and technical infrastructure were identified as such solely at the NWU. A large number of participant statements indicate the importance of these challenges (Figure 2). Some participants referred to the infrastructural challenge as a “determining factor” when implementing adaptive learning. However, only few relations were found with the other challenges. This finding indicates thus that infrastructural and internet challenges can be fundamental prerequisites for the successful implementation of adaptive learning. Addressing these types of challenges in the South African context, some participants referred to the concept of “digital equity” - a difficult challenge for which solutions remain elusive to date (Adams Becker et al, 2018). Our data revealed however that its key solutions might lie outside of an institution, but rather in other social and global dimensions (Saba & Shearer, 2018), that address cultural, political, and regulatory frameworks of a particular county.

Based on the preliminary results of this study, we propose a first draft of an implementation framework of adaptive learning that comprises five dimensions with challenges, prerequisites, and facilitators enabling the implementation of adaptive learning (Figure 3). Whereas the identified dimensions remain for every implementing institution stable, challenges, prerequisites, and facilitators might very dependent on its specific context (e.g., socioeconomic background). An institution may start with identifying prerequisites (e.g., affordable internet access) and continue with determining their specific challenges (e.g., acceptance of adaptive learning systems). Then, it may look for possible facilitators (e.g., conducting research) along the proposed dimensions. Depending on a specific context (e.g., for NWU), some online learning challenges may appear relevant for the implementation of adaptive learning.

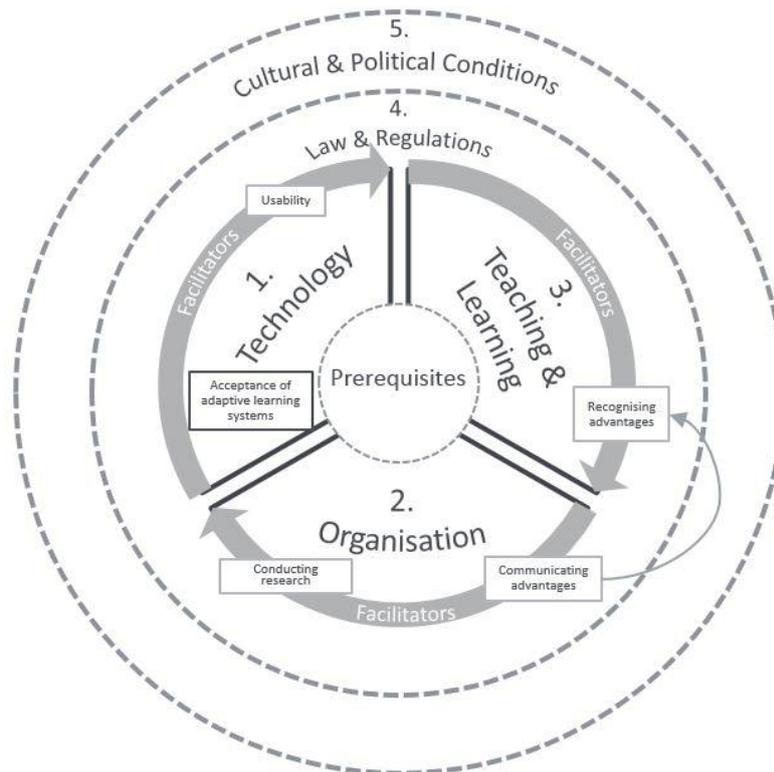


Figure 3: Adaptive learning implementation framework

So far, only few implementation models have been developed specifically for adaptive learning. For example, Johnson and Zone (2018) proposed an adoption model with five functional components (faculty, chairs/senior faculty, academic/administrative consultants, support staff, administrators) involved in the implementation process. This model focuses mainly on questions of the stakeholders, but hardly explains the relationships with other aspects in the implementation process.

One advantage of our framework is that it is grounded in data and can therefore be continually reevaluated and improved with additional data (e.g., through research at other universities). It also lays out a basic structure, in which new challenges, prerequisites, and facilitators can be included based on a specific institutional context (e.g., socioeconomic background, organizational structure, implementation stage). The framework helps institutions to prepare the implementation of adaptive learning by identifying context-dependent prerequisites first and then considering their specific challenges and facilitators along the five identified dimensions.

At this point, we point to limitations of the current model. Some relationships must still be saturated with additional data, and students were not included in the initial sampling strategy. Considering these limitations, investigating other universities with different socioeconomic and structural characteristics forms our next research step to improve the validity of the framework.

5. References

- Adams Becker, S., Brown, M., Dahlstrom, E., Davis, A., DePaul, K., Diaz, V. et al. (2018) *CMN Horizon Report: 2018 Higher Education Edition*, Louisville, CO: EDUCAUSE, 2018.
- Alexander, B., Ashford-Rowe, K., Barajas-Murphy, N., Dobbin, G., Knott, J., McCormack, M., et al. (2019) *EDUCAUSE Horizon Report: 2019 Higher Education Edition*. Louisville, CO: EDUCAUSE, 2019.
- Brooks, C. (2015) *ECAR Study of Faculty and Information Technology, 2015*. Research report. Louisville, CO: ECAR, October 2015.
- Charmaz, K. (2006) *Constructing Grounded Theory. A Practical Guide Through Qualitative Analysis*. London: SAGE Publications.
- Daines, J., Troka, T. and Santiago, J. (2016) 'Improving Performance in Trigonometry and Pre-Calculus by Incorporating Adaptive Learning Technology into Blended Models on Campus', *123rd Annual ASEE Conference & Exposition, New Orleans, Louisiana*.

- Elo, S., Kääriäinen, M., Kanste, O., Pölkki, T., Utriainen, K., and Kyngäs, H. (2014) 'Qualitative Content Analysis: A Focus on Trustworthiness', *SAGE Open*, 4(1).
- Ertmer, P. A. (1999) 'Addressing first- and second-order barriers to change: Strategies for technology integration', *Educational Technology Research and Development*, 47(4), pp. 47–61.
- Glaser, B. and Strauss, A. (1967) *The Discovery of Grounded Theory. Strategies for qualitative research*. Chicago: Aldine.
- Green, K. (2018) *Campus Computing 2018: The 29th National Survey of Computing and Information Technology in American Higher Education*. Encino, CA: Campus Computing, October, 2018.
- Häder, H. (2014) *Delphi-Befragungen: Ein Arbeitsbuch*. 3.Aufl. Wiesbaden: Springer.
- Holthaus, M., Pancar, T. and Bergamin, P. (2019) 'Recommendation Acceptance in a Simple Adaptive Learning System', *The Eleventh International Conference on Mobile, Hybrid, and On-line Learning, eLmL 2019, Athen, Griechenland*, Februar 2019.
- Johnson, C. and Zone, E. (2018) 'Achieving a Scaled Implementation of Adaptive Learning through Faculty Engagement: A Case Study', *Current Issues in Emerging eLearning*, 1(5), pp. 49-95.
- Linstone, H. A. and Turoff, M. (eds.) (1975) *The Delphi Method - Techniques and Applications*. Addison-Wesley Educational Publishers Inc.
- Mirata, V., Hirt, F., van der Westhuizen, C., and Bergamin, P. (in preparation) 'Challenges and contexts in establishing adaptive learning in higher education: findings from a Delphi study'. Research article in preparation [unpublished].
- Saba, F. and Shearer, R. (2018) *Transactional distance and adaptive learning: Planning for the future of higher education*. New York, London: Routledge.
- Skulmoski, G., Hartman, F. and Krahn, J. (2007) 'The Delphi Method for Graduate Research', *Journal of Information Technology Education*, 6, pp. 001–021.
- Tyton Partners. (2016). *Learning to adapt 2.0: The evolution of adaptive learning in higher education*. Available at <http://tytonpartners.com/library/learning-to-adapt-2-0-the-evolution-of-adaptive-learning-in-higher-education/> (Accessed: 12.04.2019).