



Lecturers' Evaluation of Moodle at the University of Public Service

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ABSTRACT

Due to the Covid-19 lockdown, the diffusion of digital learning methods has been accelerated. Several studies deal with students' satisfaction and the methodological challenges in the field before and during the lockdown, but another essential factor has received minimal attention. Understanding the lecturers' attitudes to new solutions deserves additional effort. This pilot study aims to explore lecturers' experience with Moodle based on a limited sample of 118 respondents at the University of Public Service, Budapest, Hungary. The results show that the lockdown led to a relevant increase in Moodle use, and a significant proportion of them continued to use the services of Moodle. The satisfaction with Moodle does not depend on age or faculty affiliations within the University. The results suggest targeted training for lecturers focusing on experimentalizing to enhance the recognition of Moodle use.

CCS CONCEPTS

• Education; • Information systems applications; • Law, social and behavioral;

KEYWORDS

E-learning, Moodle, Public service lecturers, Technology acceptance

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1 INTRODUCTION

The digital transformation of higher education started long before the Covid-19 pandemic, which boosted the development of methods and tools. New education models were elaborated in line with the development of info-communication tools [1] [2]. The digital support for the learning process has been appreciated. In 2020, due to the lockdown, forced implementation of distance education was placed worldwide; it can be called emergency remote training [3] [4]. According to emergency remote teaching, it must be noted that this situation differs from normal circumstances [3] [5]. Typically, learning activities and training for using Moodle are carefully

planned and supported [3]. The urgent need for satisfactory solutions in the fundamentally changed environment led to some shortcomings, but the experience of this period is valuable. It is confirmed that lecturers must develop new competencies that were not previously necessary [6].

Silva et al. [4] found visible changes in pedagogical practices that emerged with the lockdown, but there is ambiguity and disagreement about the workload, content, and teaching strategies.

There is a conceptual diversity in the literature about the methods and framework applied for supporting the endeavors by the technological background, the pedagogical purposes, and the form of education. A virtual learning environment (VLE) is a software system designed to support teaching and learning, providing tools for assessment and communication, including chat, administration, uploading of content, sharing external content, collecting students' essays, and other features over the Internet [7]. There are various concepts, including learning management system (LMS), course management system (CMS), learning content management system (LCMS), managed learning environment (MLE), learning support system (LSS), or learning platform (LP) [7]. A generally accepted expression is the learning management system (LMS) which is an online system that allows users to share information and collaborate online [8]. LMS should not be confused with elearning, digital learning, virtual learning, or distance learning [9]; it can be considered a tool for them [10]. New technologies, especially the Internet, grant new tools that can be used to improve the education process [7], but their full exploitation has yet to be realized.

Moodle (Modular Object-Oriented Dynamic Learning Environment) is a popular – originally designated as a course management system (CMS), but based on the categorization and the features, it is an LMS – framework for supporting various forms of digital education. According to online education, a study found that Moodle can meet most needs [11]. Moreover, Moodle is an excellent supplementary tool for attendance education as well. The system allows lecturers to organize, manage, and deliver course materials, including creative elements and multimedia tools [7]. Moodle is a cost-effective learning environment that may stimulate students' interest in homework tasks and their commitment to solving them [12].

Successful implementation of Moodle [13] and impressive progress in digitalized education requires studying the infrastructural, content, and human aspects of the efforts. This paper focuses on some questions about Moodle's acceptance among the lecturers at the University of Public Service as a pilot study. A former study [14] emphasized that lecturers were not partners in implementing Moodle; however, their competencies and commitment are essential to the successful application of the system. Beyond learning the opinions of the lecturers about using Moodle through a survey, the

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study aims to outline typical patterns of lecturers' approaches to Moodle in order to provide a basis for targeted improvements.

2 RESEARCH DESIGN

2.1 Research goal

Using Moodle is not an exclusive but a worldwide known and popular learning management solution. The dimensions of the pedagogical processes are the opportunity for use, quality of knowledge gained, and students' level of acceptance [12], but an emphasis on the lecturers [3] and other service providers cannot be neglected. Selim [15] grouped the key success and acceptance factors of e-learning systems into four categories: instructor (lecturer), student, information technology, and university support. Students' perspectives about digital learning and its IT support got wide attention in the literature. The latter cannot be a general bottleneck of the adoption, access, and use of internet services spread in Hungary [16]. There is a consensus [17] [18] that students' experience, habits, trust, and concerns regarding computer and internet usage and their attitude toward e-learning must be considered. Beyond the availability of the infrastructure and the well-structured learning materials, attitudes toward e-learning are decisive. Lectures and content developers can be considered top-priority input factors for learning success.

Committed and qualified lecturers are usually just assumed or supposed to be trained quickly and easily. We believe that a detailed understanding of their attitudes to e-learning is essential. The scope of the research presented in this paper is narrower; it focuses on the lecturers' opinions about Moodle as a learning support tool based on a public service education sample. The study contributes to enhancing the knowledge base of e-learning by exploring the characteristic patterns of lecturers' approaches to Moodle. The research question can be formulated as follows:

- RQ1: Are there differences in the assessment of Moodle among lecturers based on the change in utilization before and after the pandemic-forced online education?
- RQ2: What characteristics of the lecturers show differences in satisfaction with Moodle?
- RQ3: Can the lecturers be grouped according to their characteristic opinion patterns?

2.2 Research method and sample

The research used a voluntary online survey among the lecturers at the University of Public Service. The study focuses on the responses collected from the Faculty of Public Governance and International Studies (PGIS), the Faculty of Military Science and Officer Training (MSOT), and the Faculty of Law Enforcement (LE).

The questionnaire includes eight statements about the general assessment of Moodle and twelve statements about its usability. The questions are presented in the results section. The respondents were asked to mark the level of their agreement on a five-point scale between total disagreement or dissatisfaction (value 1) and entire agreement or satisfaction (value 5). The mean values present the results for ease of reference. Non-parametric analysis of variance (K-independent sample Kruskal-Wallis H test) According to the goal of exploring characteristic patterns of the opinions, cluster analysis was performed. Data collection was supported by the LimeSurvey

system of the University of Public Service in April and May of 2022; data processing and analysis were performed in IBM SPSS software. Significance is interpreted at a 95% confidence level.

A sample of 118 responses was available for analysis. The reliability of the survey is very good; Cronbach's Alpha value is 0.922 for the eight questions of general assessment and 0.919 for the usability evaluation. Sample characteristics are summarized in Table 1.

3 RESULTS AND DISCUSSION

3.1 Use of Moodle before and after the lockdown online education

However, Moodle has been available since 2012 at the University of Public Service, and its legal predecessors also used it; the utilization of Moodle was poor before the Covid-19 lockdown [19]. Only 26.3% of the sample reported regular use in that period, while 46.6% have not used it (Figure 1). During the pandemic, the proportion of frequent users has more than tripled, which fell back to 62.7% when attendance education returned.

The respondents were categorized based on the change in use of Moodle:

- 41.5% of the sample was and has remained a regular Moodle user (remained committed),
- 35.6% of the sample has become a casual or frequent Moodle user (became committed),
- 22.9% of the sample lost or remained not interested in using Moodle (lost commitment).

3.2 Evaluation of Moodle

The results on the satisfaction with Moodle are summarized in Table 2. Moodle has the highest value as a storage place for learning materials. 78.8% of the respondents agreed or fully agreed with this statement. The mean values of the responses draw an encouraging picture of satisfaction with Moodle since each one is higher than the medium value (3). Still, the high values of standard deviations and skewness indicators refer to the scattering of the assessments.

We hypothesized that the faculties apply different teaching methods that lead to a different perception of Moodle's usefulness (Figure 2). The general satisfaction and most survey items on utilization are assessed lowest among the PGIS faculty respondents, but they keep Moodle the best storage place for learning and auxiliary materials. File-related activities are found to be the most common Moodle activity [4]. Some results suggest remarkable differences, but these are statistically not significant except for the showy design (Kruskal-Wallis $H=6.672$, $d_f=2$, $sig=0.036$).

According to the research question RQ2 about the impact of various grouping factors, a set of variance analyses was conducted. A detailed presentation of this dataset goes beyond the limits of the paper, and most of the grouping factors show significant differences sporadic at a 95% confidence level. Males' evaluations are usually higher than females' ones. Significant differences are found about well-arranged ($x_{female}=3.32$, $x_{male}=3.75$, $K-W=5.475$, $d_f=1$, $sig=0.019$) and showy design ($x_{female}=3.08$, $x_{male}=3.52$, $K-W H=4.737$, $d_f=1$, $sig=0.03$), managing a test ($x_{female}=2.92$, $x_{male}=3.54$, $K-W H=7.389$, $d_f=1$, $sig=0.007$). Males like using Moodle, in general, more than females ($x_{female}=3.19$, $x_{male}=3.68$, $k-W H=3.93$, $d_f=1$,

Table 1: Sample characteristics

| | Option | No. | % |
|--------------|---|-----|------|
| Faculty | Faculty of Public Governance and International Studies (PGIS) | 41 | 34.7 |
| | Faculty of Military Science and Officer Training (MSOT) | 46 | 39.0 |
| | Faculty of Law Enforcement (LE) | 31 | 26.3 |
| Gender | Female | 37 | 31.4 |
| | Male | 81 | 68.6 |
| Age category | Less than 40 years old | 21 | 17.8 |
| | 40-49 years old | 42 | 35.6 |
| | 50-59 years old | 35 | 29.7 |
| | 60 years old or more | 20 | 16.9 |

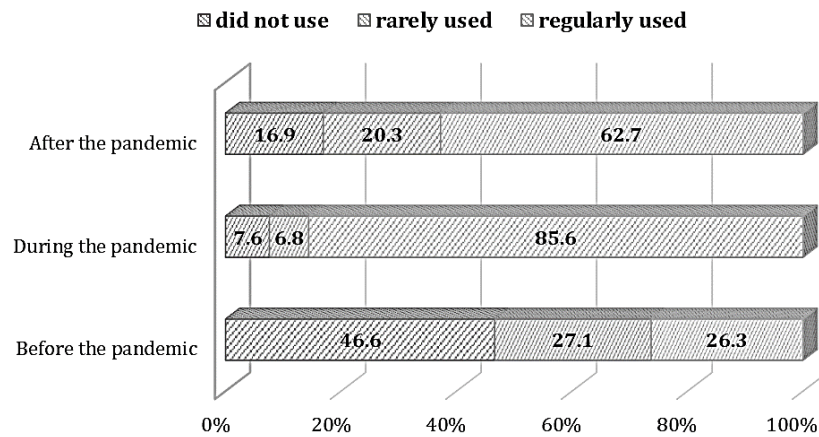


Figure 1: Frequency of Moodle use

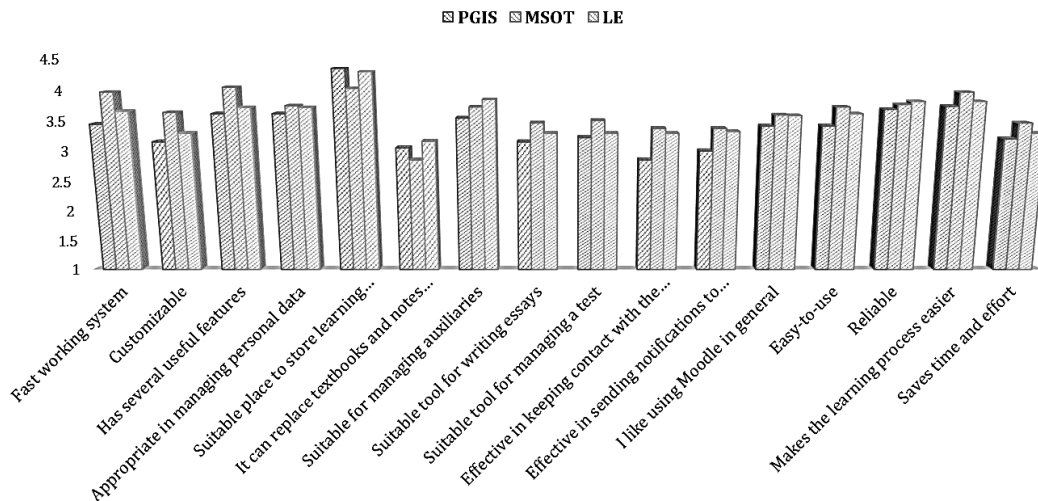


Figure 2: Mean values of the evaluations by faculties

Table 2: Descriptive results

| | Mean | Std. Dev. | Skewness | Kurtosis |
|--|------|-----------|----------|----------|
| General assessment | | | | |
| Well-arranged | 3.62 | 1.161 | -0.809 | 0.027 |
| Showy | 3.38 | 1.07 | -0.431 | -0.327 |
| Versatile | 3.83 | 0.998 | -0.857 | 0.809 |
| Flexible access (usable on smartphones, tablets, etc.) | 3.55 | 1.137 | -0.643 | -0.126 |
| Fast working system | 3.69 | 1.058 | -0.812 | 0.313 |
| Customizable | 3.37 | 1.123 | -0.413 | -0.394 |
| It has several useful features | 3.81 | 0.981 | -0.759 | 0.569 |
| Appropriate in managing personal data | 3.69 | 1.052 | -0.775 | 0.316 |
| Usability of Moodle | | | | |
| Suitable place to store learning materials | 4.2 | 1.129 | -1.462 | 1.384 |
| It can replace textbooks and notes (read them in the system) | 3 | 1.32 | -0.091 | -1.054 |
| Suitable for managing auxiliaries | 3.69 | 1.052 | -0.775 | 0.316 |
| Suitable tool for writing essays | 3.31 | 1.058 | -0.464 | -0.144 |
| Suitable tool for managing a test | 3.35 | 1.135 | -0.292 | -0.595 |
| Effective in keeping contact with the students | 3.17 | 1.065 | -0.216 | -0.379 |
| Effective in sending notifications to the students | 3.23 | 1.057 | -0.163 | -0.431 |
| I like using Moodle in general | 3.53 | 1.189 | -0.62 | -0.275 |
| Easy-to-use | 3.58 | 1.104 | -0.78 | 0.209 |
| Reliable | 3.75 | 1.064 | -0.86 | 0.401 |
| It makes the learning process easier | 3.84 | 1.176 | -0.899 | 0.112 |
| Saves time and effort | 3.32 | 1.28 | -0.328 | -0.85 |

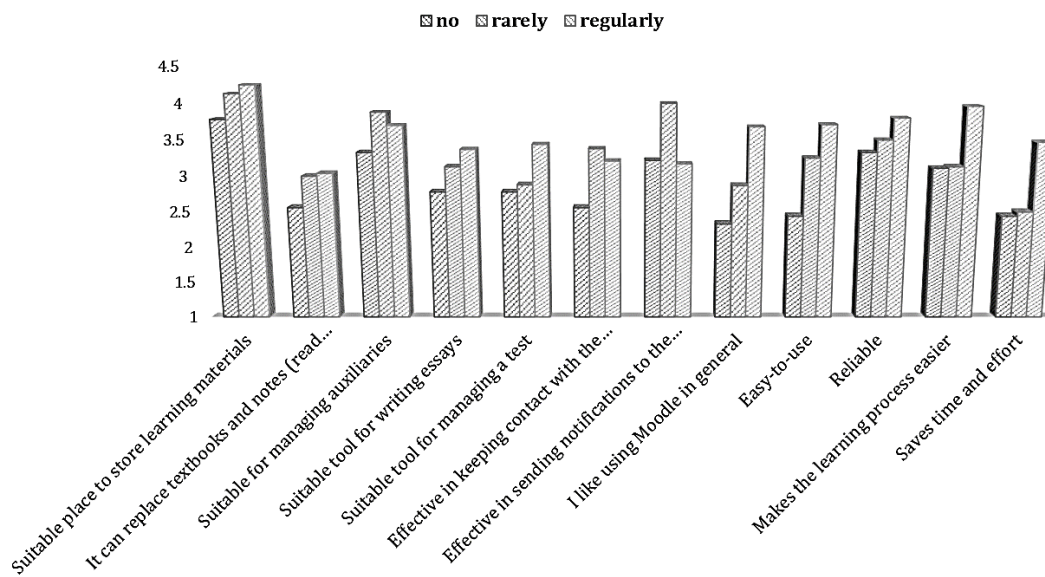


Figure 3: Mean values of the evaluations by the frequency of Moodle use

sig=0.047), and similar results are found about saving time and effort ($x_{female}=2.86$, $x_{male}=3.53$, K-W $H=6.164$, $d_f=1$, sig=0.013).

Zamora-Antuñano et al. [3] found that teachers become less confident with technology with age. This is not confirmed by the sample; no significant differences were found by age categories in the results.

Based on the utilization frequencies of Moodle during and after the lockdown, the results show significant differences in the evaluation of usability. The lockdown period is worthy of attention since it can be considered a forced situation with limited options to manage the learning process (Figure 3).

Table 3: Analysis of variance by cluster membership

| | remained committed | became committed | lost com- mitment | Kruskal- Wallis H ($d_f=2$) | Sig. |
|--|-----------------------|---------------------|----------------------|-------------------------------------|------|
| Well-arranged | 3.67 | 3.67 | 3.44 | 1.104 | .576 |
| Showy | 3.27 | 3.43 | 3.52 | 1.011 | .603 |
| Versatile | 3.82 | 4.00 | 3.59 | 3.451 | .178 |
| Flexible access (usable on smartphones, tablets, etc.) | 3.61 | 3.57 | 3.41 | .622 | .733 |
| Fast working system | 3.73 | 3.71 | 3.59 | .266 | .875 |
| Customizable | 3.39 | 3.43 | 3.26 | .345 | .842 |
| It has several useful features | 3.92 | 3.86 | 3.52 | 2.879 | .237 |
| Appropriate in managing personal data | 3.82 | 3.71 | 3.41 | 3.110 | .211 |
| Suitable place to store learning materials | 4.53 | 4.17 | 3.67 | 9.766 | .008 |
| It can replace textbooks and notes (read them in the system) | 3.37 | 2.71 | 2.78 | 6.574 | .037 |
| Suitable for managing auxiliaries | 3.84 | 3.74 | 3.33 | 3.135 | .209 |
| Suitable tool for writing essays | 3.37 | 3.45 | 2.96 | 6.120 | .047 |
| Suitable tool for managing a test | 3.61 | 3.29 | 2.96 | 6.839 | .033 |
| Effective in keeping contact with the students | 3.20 | 3.21 | 3.04 | .536 | .765 |
| Effective in sending notifications to the students | 3.14 | 3.29 | 3.30 | .330 | .848 |
| I like using Moodle in general | 4.00 | 3.52 | 2.67 | 24.260 | .000 |
| Easy-to-use | 3.90 | 3.62 | 2.96 | 10.655 | .005 |
| Reliable | 3.90 | 3.81 | 3.37 | 6.345 | .042 |
| It makes the learning process easier | 4.10 | 3.98 | 3.15 | 17.797 | .000 |
| Saves time and effort | 3.67 | 3.45 | 2.48 | 17.239 | .000 |

The analysis of variance shows significant differences between the three groups only in the case of reliability ($K-W H=7.882$, $d_f=2$, $sig=0.049$), but the results are notable. The evaluations of rare and regular users are close to each other and differ from non-users about Moodle's suitability for storing materials and writing essays. At the same time, the respondents' perceptions differ in terms of writing tests, saving time and effort, and supporting the learning process. Liking Moodle shows a positive correlation with the frequency of use.

A similar analysis was conducted based on the grouping by the changes in Moodle use with non-significant results on the general assessment, but there are significant differences in most items for usability (Table 3).

The lecturers who remained committed to Moodle have higher trust in the suitability of the system for storing learning materials and its role in replacing traditional textbooks and notes. Beyond this, general satisfaction, easiness of use, and managing test-writing show remarkable differences from lecturers who became committed. Ones with lost commitment undervalued most items compared to the other groups, except for keeping contact with students and sending notifications. This agreement goes with a relatively low mean value in each group, and the differences are not significant.

3.3 Characteristic patterns

Besides using the grouping opportunities of the respondents above, an attempt was made to establish opinion groups through cluster analysis based on the utilization assessment.

It is noteworthy that involving more items in the analysis was unavailable in this sample size ($n=118$). Since the non-parametric

correlation analysis could show at least a moderate level with significant correlations between most items, dimension reduction was performed. The principal component analysis with Varimax rotation suggested two factors that save 63.1% of the variance; factor loadings are presented in Table 4.

Using the principal component analysis results, a hierarchical cluster analysis was performed by the Ward method to minimize the cluster-level variance (Figure 4).

Three clusters were identified, showing significant differences in all survey items for assessing general satisfaction with Moodle and its usability. The mean values are presented in Figure 4. 64.4% of the respondents belong to the first cluster, 11.9% to the second cluster, and 23.7% to the third cluster. Cross-tabulation found significant differences between the grouping factors and the cluster membership limited to the frequency of Moodle use during the online education period of the pandemic.

The most populous first cluster includes lecturers who like Moodle the most, and the least dense second cluster includes those who dislike the system. Comparing the first and third clusters offers valuable information for developing Moodle-supported education. Assuming the commitment of the members in the third cluster to the Moodle, the lack of their satisfaction compared to the first cluster can designate the critical points of development. Based on the differences, effective notifications to the students, a replacement role for textbooks and notes, and contact with the students need more attention. The next items with high differences in the assessment are supporting writing essays or tests and developing flexible usability on different devices.

Table 4: Factor loadings

| | Factor 1 | Factor 2 |
|--|--------------|--------------|
| Suitable place to store learning materials | 0.734 | 0.23 |
| Suitable for managing auxiliaries | 0.554 | 0.419 |
| I like using Moodle in general | 0.795 | 0.396 |
| Easy-to-use | 0.816 | 0.202 |
| Reliable | 0.813 | 0.241 |
| It makes the learning process easier | 0.804 | 0.362 |
| Saves time and effort | 0.761 | 0.311 |
| It can replace textbooks and notes (read them in the system) | 0.357 | 0.528 |
| Suitable tool for writing essays | 0.41 | 0.626 |
| Suitable tool for managing a test | 0.374 | 0.632 |
| Effective in keeping contact with the students | 0.221 | 0.806 |
| Effective in sending notifications to the students | 0.126 | 0.781 |

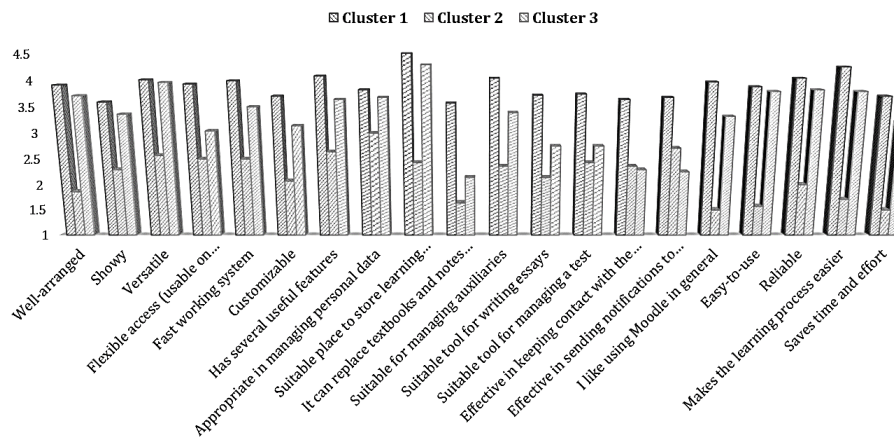


Figure 4: Mean values of the evaluations by cluster membership

4 CONCLUSIONS

Moodle is a tool for increasing the efficiency and effectiveness of the learning process. Students’ satisfaction with the system is primary, but missing the focus on the lecturers’ side cannot be allowed in achieving resounding success in the utilization.

The study results show that the Covid-19 pandemic could force an exceptional use of Moodle, but after a short period of fully online education, rearrangement can be observed. It is welcome that the range of users is expanded because the diffusion of Moodle use at a university can promote process transparency and quality assurance and allows comprehensive access to knowledge for all university citizens. Of course, solving this problem goes much beyond Moodle; it can support development endeavors. According to the RQ1 research question, the items of general assessment in the survey show a uniform picture based on the categorization based on Moodle use before and after online education, but satisfaction with the utilizations gives statistically significant differences. Raman and Don [20] confirmed the views that performance expectancy and effort expectancy have an impact on behavioral intention, and that must be exploited by an effective strategy.

According to the RQ2 research question, it can be concluded that satisfaction with Moodle cannot be characterized by the grouping factors of the sample. However, some differences are suggested by the results, liking and using Moodle seems statistically independent of age, faculty, and other descriptive data. A repeated study with more expansive data collection is required to justify the nature of these differences.

The RQ3 aimed to find characteristic patterns of opinions about Moodle to support targeted actions for improving the competencies and commitment according to Moodle use. A cluster analysis outlined three groups of opinions. Many respondents have a positive approach to Moodle, while only a minor group seems to refuse it in all aspects. The results highlighted the key development opportunities in lecturer-student communication and their applicability for knowledge measurement. In other words, the asynchronous nature of communication is expected to be changed. Checking the technical documentation of Moodle, these options are available. A practical implication is enhancing lecturer training in the field, focusing on experimentalizing.

Comparing the experience of the study with a former investigation on the topic among public service students [21], the bottlenecks

of utilization appear along similar survey items. This implies that development actions should involve both the students and the lecturers. The main conclusion of the study is that it is worth listening to customers' voices, especially if different customers have the same voice. The next step of the research is to develop a framework model based on a technology acceptance model [22] both for students and lecturers to promote effective development strategies.

Nevertheless, there are some limitations in the interpretation of the results. The sample is limited to lecturers in public service education. Although the University of Public Service has a dominant role in Hungary, the generalization of the results is not achievable. Other faculties of various universities should be involved in establishing system development conclusions. Due to the voluntary survey, the response rate was low, and the representative nature of the sample cannot be assured. Distortions of the self-managed survey also must be considered. The authors consider the study a pilot work that gives an emphasis on the critical problems and may help prepare broader research.

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REFERENCES

- [1] Jeff Cobb, 2013. *Leading the learning revolution: The expert's guide to capitalizing on the exploding lifelong education market*. Amacom, New York.
- [2] Ching Sing Chai, Joyce Hwee Ling Koh and Chin-Chung Tsai, 2013. A Review of Technological Pedagogical Content Knowledge. *Educational Technology & Society* 16, 2, 31-51. <https://www.jstor.org/stable/jeductechsoci.16.2.31>
- [3] Marco Antonio Zamora-Antuñano, Juvenal Rodríguez-Reséndiz, Miguel Angel Cruz-Pérez, Hugo Rodríguez Reséndiz, Wilfrido J. Paredes-García and José Alfredo Gaytán Díaz, 2022. Teachers' Perception in Selecting Virtual Learning Platforms: A Case of Mexican Higher Education during the COVID-19 Crisis. *Sustainability* 14, 195. <https://doi.org/10.3390/su14010195>
- [4] Susana Silva, Joana Fernandes, Paula Peres, Vanda Lima and Candida Silva, 2022. Teachers' perceptions of remote learning during the Pandemic: A case study. *Education Sciences* 12, 698. <https://doi.org/10.3390/educsci12100698>
- [5] Aras Bozkurt and Ramesh C. Sharma, 2020. Emergency remote teaching in a time of global crisis due to CoronaVirus pandemic. *Asian Journal of Distance Education* 15, 1. <https://doi.org/10.5281/zenodo.3778083>
- [6] Linda Daniela and Arta Rüdöfä, 2019. *Learning Platforms: How to Make the Right Choice*. In: Daniela, L. (eds.) *Didactics of Smart Pedagogy*. Springer, Cham. https://doi.org/10.1007/978-3-030-01551-0_10
- [7] Teresa Martín-Blas and Ana Serrano-Fernández, 2009. The role of new technologies in the learning process: Moodle as a teaching tool in Physics. *Computers & Education* 51, 1, 35-44. <https://doi.org/10.1016/j.compedu.2008.06.005>
- [8] Steven Lonn and Stephanie D. Teasley 2009. Saving Time in Innovating Practice: Investigating Perceptions and Uses of Learning Management Systems. *Computers & Education* 53, 3, 686-694. <https://doi.org/10.1016/j.compedu.2009.04.008>
- [9] Yiouli Kritikou, Panagiotis Demestichas, Evgenia Adamopoulou, Konstantinos Demestichas, Michael Theologou and Maria Paradia, 2008. User Profile Modeling In The Context Of Web-Based Learning Management Systems. *Journal of Network and Computer Applications* 31, 4, 603-627. <https://doi.org/10.1016/j.jnca.2007.11.006>
- [10] Kamla Ali Al-Busaidi and Hafedh Al-Shihi, 2010. Instructors' acceptance of learning management systems: A theoretical framework. *Communications of the IBIMA*, Article ID 862128. <http://www.ibimapublishing.com/journals/CIBIMA/cibima.html>
- [11] Raymund Dilan, Mark Anthony Gali and Darwin Llavore, 2022. ICSCA 2022: 2022 11th International Conference on Software and Computer Applications, 29-40. <https://doi.org/10.1145/3524304.3524309>
- [12] Dan Beňa, Gabriela Bologa, Simona Dziřac and Ioan Dzitac, 2015. University level learning and teaching via e-learning platforms. *Procedia Computer Science* 55, 1366-1373. <https://doi.org/10.1016/j.procs.2015.07.123>
- [13] Hisyam Athaya, Rezky Dwi Amaliah Nadir, Dana Indra Sensuse, Kautsarina Kautsarina and Ryan Randy Suryono, 2021. Moodle Implementation for E-Learning: A Systematic Review. *SIET '21: Proceedings of the 6th International Conference on Sustainable Information Engineering and Technology*. 106-112. <https://doi.org/10.1145/3479645.3479646>
- [14] Cedric Bheki Mpungose, 2020. Beyond limits: Lecturers' reflections on Moodle uptake in South African universities. *Education and Information Technologies* 25, 5033-5052. <https://doi.org/10.1007/s10639-020-10190-8>
- [15] Hassan M. Selim, 2007. Critical success factors for e-learning acceptance: Confirmatory factor models. *Computers & Education* 49, 2, 396-413. <https://doi.org/10.1016/j.compedu.2005.09.004>
- [16] László Berényi, Nikolett Deutsch, Bernadett Szolnoki and Zoltán Birkner, 2021. Perception of e-learning among Hungarian engineering students. *Electronic Journal of E-learning* 19, 5, 376-387. <http://doi.org/10.34190/ejel.19.5.2471>
- [17] Byoung-Chan Lee, Jeong-Ok Yoon and In Lee, 2009. Learners' acceptance of e-learning in South Korea: Theories and results. *Computers & Education* 53, 4, 1320-1329. <https://doi.org/10.1016/j.compedu.2009.06.014>
- [18] Abdullah Alhabeeb and Jennifer Rowley, 2018. E-learning critical success factors: Comparing perspectives from academic staff and students. *Computers & Education* 127, 4. <https://doi.org/10.1016/j.compedu.2018.08.007>
- [19] Gábor László and Judit Szakos, 2021. How Open Source Tools Could Help Remote Learning During the First Lockdown In Hungary? – Case Study of University of Public Service. *CEE e|Dem and e|Gov Days 2021*, 187-194. <https://doi.org/10.24989/ocg.v34i.13>
- [20] Arumugam Raman and Yahya Don, 2013. Preservice teachers' acceptance of learning management software: An application of the UTAUT2 model. *International Education Studies* 6, 7, 157-164. <https://doi.org/10.5539/ies.v6n7p157>
- [21] László Berényi, 2022. Use of Moodle among public service students: pandemic effects. *CEEeGov '22: Proceedings of the Central and Eastern European eDem and eGov Days*. 18-24. <https://doi.org/10.1145/3551504.3551544>
- [22] Pedro Isaias and Tomayess Issa, 2015. *High level models and methodologies for information systems*. Springer, New York.