

FEATURE

ARTICLE

A Survey of University Students' Perceptions of Learning Management Systems in a Low-Resource Setting Using a Technology Acceptance Model

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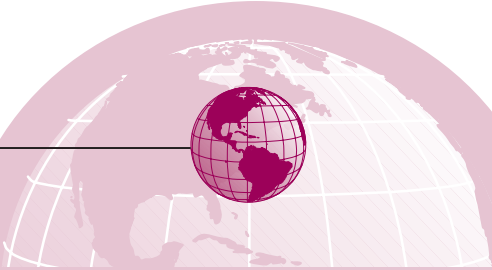
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Learning management systems are software systems designed to aid lecturers to deliver learning content to students,¹ which can also be used to enhance conventional classroom or distance learning.^{1,2} In the current climate of technology expansion, learning management systems in educational institutions are essential tools for delivering course content, facilitating interaction, and administering students' assessments. A research study was conducted to investigate the complexity of factors that could influence the use of learning management systems and to identify the individual, organizational, and technological factors that were affecting the use of the learning management systems for students.

Learning management systems are tools to improve learning outcomes. A study done at the Faculty of Medicine at the University of Puerto Rico of a learning management system to provide students with an introduction to biostatistics, medical informatics, bioethics, and the history of medicine showed that the students using the learning management system achieved better grades.³ Learning management systems have also been specifically advocated for the support of distance learning students. In New Zealand, students using Modular Object-Orientated Dynamic Learning Environ-



Learning management systems have been widely advocated for the support of distance learning. In low-resource settings, the uptake of these systems by students has been mixed. This study aimed to identify, through the use of the Technology Acceptance Model, the individual, organizational, and technological factors that could be influencing the use of learning management systems. A simple quantitative descriptive survey was conducted of nursing and health science students at a university in South Africa as part of their first exposure to a learning management system. A total of 274 respondents (56.7%) completed the survey questionnaire, made up of 213 nursing respondents (87.7%) and 61 health sciences respondents (25%). Overall, the respondents found the learning management system easy to use and useful for learning. There were significant differences between the two groups of respondents, with the respondents from health sciences being both younger and more computer literate. The nursing respondents, who received more support and orientations, reported finding the learning management system more useful. Recommendations are made for training and support to ensure uptake.

KEY WORDS

Education • health science education • nursing education • South Africa • technology

ment (Moodle), an open source learning management system, and Skype reported significantly less travel time to study venues and expressed enthusiasm for these modes of teaching and technology.⁴

Despite these positive attitudes, there has been concern about how learning management systems have been used primarily for course management, document access, and management of course grades with few institutions using

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these systems for instructional or assessment purposes.⁵ This was thought often to be related to the experience levels of staff in the use of learning management system tools.⁵ In addition, learning management systems were still inadequate in supporting the level of interaction, personalization, and engagement demanded by students, and more flexible systems were needed that could be adapted to the students' needs.⁶

To achieve flexibility and greater utility of learning management systems, the evaluation of students' experiences in using learning management systems is essential to address the pedagogic needs of both the students and teaching staff.¹ Using a structured theory, such as the Technology Acceptance Model (TAM),⁷ which models how students may accept and use a technology based on two factors (perceived ease of use and perceived usefulness), these systems could be regularly evaluated for ease of use and usefulness in providing students with feedback and to establish whether the systems can support material in different formats.⁶

A systematic review found that perception of benefits or usefulness of the system was the most common facilitating factor in uptake.⁸ Learning management system factors can also facilitate or hinder use. A study examining students' satisfaction and engagement in interactive learning structures in different learning management systems in online courses found that whether a learning management system supported or hindered active engagement depended on the efficiency in facilitating connections between segments of the course.⁹ Engagement could be increased by grouping course elements together, ensuring easy communication, having clear requirements, and providing formative and useful feedback.⁹

Students in Georgia similarly expressed their satisfaction with learning management systems, stating that using these systems provided them with more contact and better quality of communication with tutors and peers, more flexible learning, better access to learning materials, and faster and easier information retrieval.¹⁰ These evaluations also highlighted administrative issues, such as time commitment⁴ and a lack of administrative support being possible hindrances to their use.¹¹

Although it has been reported that between 55% and 62% of institutions in South Africa, Finland, the Netherlands, and the US use WebCT or Blackboard,¹² few evaluations of learning management systems have been documented in South Africa. A study across 25 African countries found poor knowledge or interest in the use of learning management systems.¹³ Reasons for this were attributed to insufficient infrastructure and resources, poor access to computers and the Internet, and lack of human capacity development in these countries.¹³

The University of KwaZulu-Natal in South Africa formally implemented Moodle in 2009 (Moodle Pty Ltd, Perth, Australia). Learning management champions within the Discipline of Nursing commenced using Moodle in selected units in Nursing and Health Sciences in 2010 to support online student collaborative and interactive learning, act as an accompaniment to traditional classroom teaching, improve

the teaching and learning experiences for students, and provide support and resources to rural learners.^{2,14} The Discipline of Nursing also offered an advanced midwifery diploma program to rural students as part of a strategy to address the Millennium Development Goals. The support of these students in their home settings was a key driver for implementing Moodle.

Similar to findings on the use of learning management systems in Africa,¹³ nursing lecturing staff and students experienced a number of problems in using the learning management system, resulting in poor uptake. A number of students in nursing were considerably older than the norm for university students, having returned to study after the completion of their initial professional nurse training. The students anecdotally reported lower levels of computer literacy and unease in using the new technology. The problems for students in the rural areas were compounded by poor access to computers and the Internet, low bandwidth, and difficulties in accessing the learning management system. Local university-based students also reported problems in having to compete for computers in the computer laboratories and receiving inadequate support while becoming familiar with the learning management system.

To formally evaluate these issues, the TAM framework⁷ was used to conduct a research study to test the hypothesis that individual factors, such as increased age and poorer access to computers and the Internet, would result in lower levels of computer literacy, difficulties in using the learning management system, lower perceptions of usefulness, and an increased need for training and support, and that the impact of training and support would affect the perceptions of ease of use and usefulness of the learning management system.

METHODS

A quantitative descriptive survey was undertaken of initial users of Moodle in Nursing and Health Science units in 2011 and 2012. Ethical approval to conduct the study was obtained from the University of KwaZulu-Natal Humanities and Social Sciences Research Ethics committee and permission to survey the students was obtained by the deans of Nursing and Health Sciences.

The study population consisted of 483 initial learning management system users in nine study units in 2011 and 2012, and no sampling was done. The study units included one health sciences undergraduate unit, five nursing diploma units, and three nursing postgraduate masters' units. The 483 students consisted of 240 students who had enrolled in an undergraduate health sciences unit to conduct research in the Disciplines of Optometry, Sports Science, Occupational Therapy, Audiology, and Physiotherapy and 243 professional nurses from the diploma in advanced midwifery or master's degree in nursing programs, who had returned to university after completion of their basic nurse training.

The survey questionnaire was developed by the researchers, based on the TAM framework.⁷ The TAM provided a framework of the critical factors that influence users' perceived ease of use and perceived usefulness of learning management systems and consequently can be used to predict actual use.⁷ Both these constructs are critical in facilitating adoption of new technology, and the underpinning factors of system design, technical issues, familiarity with technology, and time were the most frequent limiting factors identified in other studies.⁸ The questionnaire consisted of 35 questions on demographics and questions structured to measure the TAM framework.⁷ These questions included the individual factors (age at time of study, computer and technology competence), the organizational factors (training and support of users), and the technology factors (the support of study modules on a learning management system together with motivators, technology alignment, system quality, information quality, and service quality).

Content validity of the questionnaires was established through alignment with the TAM framework.⁷ The questionnaire used 4-point Likert rating scales to measure students' perceptions of ease of use, usefulness, and their attitudes toward using technology. Open-ended questions were included to allow for more detailed comments and recommendations. Poststudy reliability (internal consistency) was calculated using Cronbach's α for the constructs and the overall questionnaire.

Data were collected during 2011 and 2012 by staff. Paper-based questionnaires were handed out in class time at the completion of each unit of study toward the end of a semester. Data were entered and analyzed using SPSS, version 21 (IBM, Armonk, NY). Ease of use and usefulness construct scores were calculated based on the Likert scale rating scores for perceived ease and usefulness of resources, assignments, feedback received, and interactivity using the chat functions. To test the hypotheses, nonparametric statistics for independent samples were calculated and the significance level was set at $P < .05$. The open-ended questions were analyzed using content analysis to identify common themes.

RESULTS

A total of 274 respondents (56.7%) completed the questionnaires, 93 (33.9%) in 2011 and 181 (66.1%) in 2012. The

respondents were predominantly female students (228, 83.2%), with an average age of 35.7 (SD, 10.8) years. Of the 274 respondents, 213 (87.7%) were from nursing, and 61 (25%) were from health sciences. As expected, the undergraduate health sciences respondents, being recent school leavers, were significantly younger (21.3 [SD, 2.2] years) than the nursing respondents (mean age, 40.4 [SD, 7.9] years; $P < .001$), who had returned to university at a later age to complete diploma and postgraduate studies. These two groups also differed significantly in terms of previous use of learning management systems, with 58 of the health sciences respondents (95.1%) reporting previous use as compared with 51 of the nursing respondents (24.3%) ($P < .001$) (Table 1). To address the age and previous experience use confounders present, the two groups of respondents (health sciences and nursing) were analyzed and reported on separately.

Perceptions of Ease of Use and Usefulness of Learning Management System

The internal consistencies of the questionnaire (Cronbach's $\alpha = .909$) and the two constructs, ease of use (Cronbach's $\alpha = .855$) and usefulness (Cronbach's $\alpha = .665$), were moderate to high.

Overall, the respondents found the learning management system relatively easy to use, with 210 of the respondents (76.6%) stating that it was either easy (151 [55.1%]) or very easy (59 [21.5%]) to use. There were significant differences between the two groups, however, with more health sciences respondents (52 [85.2%]) than nursing respondents (158 [76.3%]) stating that it was easy to use. Furthermore, when comparing the calculated ease of use between the two groups, significantly lower scores were found for the nursing respondents (10.5 [SD, 3.1]) than the health sciences group (11.5 [SD, 2.7]) ($P = .002$) (Table 2). Similarly, in rating the perceived ease of the use of the different types of activities in the learning management system, the differences between the two groups remained, except for "chat," where fewer than half of the respondents in both groups felt that it was not easy to use ($P = .685$) (Table 2). Comparing the calculated usefulness scores, there were no significant differences between the respondents (nursing, 11.4 [SD, 2.5],

Table 1
Demographics and Characteristics of Respondents

	Health Sciences Group (n = 61)	Nursing Group (n = 213)	Total (n = 274)	Test	P
Male	18 (9.2%)	19 (30.5%)	37 (13.5%)	$\chi^2 = 17.3$	<.001*
Female	41 (90.8%)	187 (69.5%)	228 (83.2%)		
Age, mean (SD), y	21.3 (2.2)	40.4 (7.9)	35.7 (10.8)	$U = 11.4$	<.001*
Previous learning management system use	58 (95.1%)	51 (24.3%)	109 (40.2%)	$\chi^2 = 98.6$	<.001*

Differences between groups tested with χ^2 tests and independent-samples Mann-Whitney U Tests.

*Significance set at $P < .05$.

Table 2

Ease-of-use and Usefulness Scores for Learning Management System



	Health Sciences (n = 61)	Nursing (n = 213)	Total (n = 274)	Test	P
Overall ease of use	52 (85.2%)	158 (76.3%)	210 (76.7%)	$\chi^2 = 18.0$	<.001*
Ease-of-use score (/16), mean (SD)	11.5 (2.7)	10.1 (3.1)	10.5 (3.1)	$K = 3.0$	.002*
Resources easy	53 (86.9%)	113 (58.5%)	166 (65.4%)	$\chi^2 = 16.4$	<.001*
Assignments easy	50 (82%)	103 (52.8%)	153 (59.8%)	$\chi^2 = 16.4$	<.001*
Feedback easy	42 (68.9%)	97 (51.9%)	139 (56%)	$\chi^2 = 5.4$	.020*
Chat easy	25 (41%)	80 (44%)	105 (43.2%)	$\chi^2 = 0.8$	.685
Useful to use score (/16), mean (SD)	11.4 (2.5)	11.9 (2.6)	11.8 (2.5)	$K = 1.7$	.081
Resources useful	55 (90.2%)	181 (91.4%)	236 (91.1%)	$\chi^2 = 0.9$	.764
Assignments useful	51 (83.6%)	164 (84.1%)	215 (84%)	$\chi^2 = 0.01$	.927
Feedback useful	40 (65.6%)	141 (72.3%)	181 (70.7%)	$\chi^2 = 1.0$	.313
Chat useful	21 (34.4%)	140 (73.3%)	161 (63.9%)	$\chi^2 = 30.3$	<.001*

Differences between groups tested with χ^2 tests and independent-samples Kruskal-Wallis tests (K).

*Significance set at $P < .05$.

and health sciences group, 11.9 [SD, 2.6]) ($P = .081$) (Table 2). Similarly, in rating the perceived usefulness of the different types of activities in the learning management system, both groups rated these highly, except for chat, where there were significant differences between the groups with 73.3% of the nursing respondents rating chat as useful as compared with only 34.4% of health science respondents ($P < .001$) (Table 2).

Factors Influencing Learning Management System Use

The TAM framework⁷ predicts that the two constructs, ease of use and usefulness, will influence future use of technology such as a learning management system, and that these two constructs are influenced by three factors, namely, individual, organizational, and learning management factors. Each of these factors is discussed below in the following paragraphs.

Individual factors: Individual factors included owning a computer, computer literacy (perceived competence in typing, the use of computers and the Internet, and applying computer skills to do assignments), and individual attitudes toward using technology (Table 3).

Although most respondents owned computers (244 [89.7%]), there were differences in computer literacy, with respondents from the health sciences reporting higher levels of perceived ability for typing ($P = .031$) and computer competence ($P < .001$) (Table 3). Similarly, major differences were reported with higher use of the Internet (98.4% vs 74.2%), social networking (72.1% vs 25.4%), e-mail (86.9% vs 48.8%), and word processing (73.8% vs 50.7%), $P < .001$ for these students (Table 3).

Computer literacy appeared to have a major impact as to whether the students found the learning management system easy to use. For the nursing respondents, perceived computer competence ($U = 3.1$, $P = .001$) and typing ability

($U = 3.1$, $P = .002$) were strongly associated with higher ease-of-use scores. This association was not present for the health sciences respondents (computer competence, $P = .956$, and typing ability, $P = .229$). Similarly, for the nursing respondents, perceived computer competence ($U = 3.1$, $P = .001$) and typing ability ($U = 3.1$, $P = .002$) were strongly associated with higher usefulness scores ($U = 2.3$, $P = .016$ and $U = 3.1$, $P = .001$) although, again, this association was not present for the health sciences respondents (computer competence $P = .770$ and typing ability $P = .405$).

These findings were supported by the qualitative comments provided by students. For some students, it was the first time that they had used a computer and they reported finding it very difficult due to the fact that they had to learn two new skills simultaneously: "it is a new thing to us"; "it is my first time using it, the more I use it, it will be easy"; "it is not easy as I am not used to computers."

In measuring respondents' attitudes toward using a learning management system instead of paper-based materials, there was a strong association between positive attitudes and higher ease-of-use scores for both health sciences ($U = 2.4$, $P = .018$) and nursing respondents ($U = 3.3$, $P = .001$). However, the health sciences respondents reported significantly more negative attitudes (76.1% vs 57.4%, $P < .004$) than the nursing respondents. In considering what effect positive attitudes may have on usefulness scores, nursing respondents showed a significant association between positive attitudes and high usefulness scores ($U = 5.3$, $p < .001$), though for health sciences respondents, no association was found ($U = 1.5$, $P = .115$).

A similar pattern in attitudes toward innovation was noted, with the health sciences respondents reporting more negative attitudes toward ease of learning new material as compared with nursing respondents (62.3% vs 78.5%, $P = .011$) (Table 3). This difference did not affect the association between innovation attitudes and ease-of-use scores, with significant associations between positive innovation attitudes and higher ease-of-use scores for both the health

Table 3

Differences in Individual, Instructor, Organizational, and Learning Management Factors Between Respondent Groups



	Health Sciences (n = 61)	Nursing (n = 213)	Total (n = 274)	Test	P
Individual factors					
Computer owner	54 (88.5%)	190 (90%)	244 (89.7%)	$\chi^2 = 0.20$	.730
Typing skills	61 (100%)	198 (94.3%)	259 (95.6%)	$\chi^2 = 3.7$	.074
Typing competence				$\chi^2 = 4.6$	.031*
Good to very good	42 (68.9%)	112 (53.3%)	154 (67.8%)		
Average to poor	19 (31.1%)	98 (46.7%)	117 (43.2%)		
Frequency of computer use					
<1 a week	0 (0%)	29 (13.8%)	29 (10.7%)	$\chi^2 = 9.4$	.002*
>1 a week	61 (100%)	181 (86.2%)	242 (89.3%)		
Computer competence					
Good to very good	49 (80.3%)	90 (42.7%)	139 (51.1%)	$\chi^2 = 26.9$	<.001*
Average to poor	12 (19.7%)	121 (57.3%)	133 (48.9%)		
Use Internet					
Social networking	60 (98.4%)	155 (74.2%)	215 (79.6%)	$\chi^2 = 17.1$	<.001*
E-mail	44 (72.1%)	53 (25.4%)	97 (35.9%)	$\chi^2 = 44.8$	<.001*
Word processing	53 (86.9%)	102 (48.8%)	155 (57.4%)	$\chi^2 = 28.0$	<.001*
Able to apply computer skills to do assignments	45 (73.8%)	106 (50.7%)	151 (55.9%)	$\chi^2 = 10.2$	.001*
	56 (91.8%)	178 (89%)	234 (89.7%)	$\chi^2 = 6.5$	.011*
Individual attitudes					
Easy to learn something new	38 (62.3%)	157 (78.5%)	195 (74.7%)	$\chi^2 = 6.5$	.011*
Happy to use Moodle in place of paper-based outlines	35 (57.4%)	150 (76.1%)	185 (71.1%)	$\chi^2 = 8.1$	.004*
Prefer Moodle to paper	35 (57.4%)	141 (72.7%)	176 (69%)	$\chi^2 = 5.1$	.024*
Instructor factors					
Support for using Moodle	21 (34.4%)	150 (72.1%)	171 (63.6%)	$\chi^2 = 18.0$	<.001*
Training in using Moodle	20 (32.8%)	137 (65.6%)	157 (58.1%)	$\chi^2 = 20.8$	<.001*
Organizational factors					
Access to computer	60 (98.4%)	170 (81.3%)	230 (85.2%)	$\chi^2 = 10.8$	.001*
Internet access	60 (98.4%)	193 (91.5%)	253 (93%)	$\chi^2 = 3.5$	.085
Access to Moodle on Internet	57 (93.4%)	160 (76.7%)	217 (80.4%)	$\chi^2 = 8.6$	.003*
Moodle factors					
Using Moodle was appropriate	54 (88.5%)	166 (85.1%)	220 (85.9%)	$\chi^2 = 1.4$	.765
Moodle assisted my learning	44 (72.1%)	173 (87.4%)	217 (83.8%)	$\chi^2 = 7.9$	.005*

Differences between groups tested with χ^2 tests.

*Significance set at $P < .05$.

sciences ($U = 3.2, P = .001$) and nursing groups ($U = 2.7, P = .007$). This also did not affect the association between innovation attitudes and usefulness scores with significant associations between positive innovation attitudes and higher usefulness scores for both the health sciences ($U = 2.6, P = .010$) and nursing groups ($U = 4.9, P < .001$).

Organizational Factors: Organizational factors included instructors providing training and support and access and technical support provided by the university. Although the university provided easy access to computers and the Internet through computer laboratories (“Resources were available and easy to access,” “...Can do your work at home or anywhere”), fewer nursing respondents reported access to computers than did the health sciences respondents (81.3% vs 98.4%, $P = .001$) (Table 3).

As the two groups reported significantly different training (health sciences 32.8% vs nursing 65.6%, $P < .001$) and

support experiences (health sciences 34.4% vs nursing 72.1%, $P < .001$), it was hypothesized that this would affect perceived ease-of-use and usefulness scores. Lack of training was not associated with low ease-of-use scores ($U = 0.2 [P = .835]$ and $U = 1.8 [P = .061]$ for nursing and health sciences respondents, respectively) or low usefulness scores in the nursing respondents ($U = 1.0, P = .314$), but was significantly associated with lower usefulness scores in health science respondents ($U = 2.4, P = .016$). Lack of support was strongly associated with lower ease-of-use scores (health sciences, $U = 2.5, P = .010$; nursing, $U = 2.9, P = .004$) and lower usefulness scores in both groups (health sciences, $U = 3.2, P = .001$; nursing, $U = 3.2, P = .001$).

Learning Management System Factors: The learning management system factors were measured in terms of the appropriateness of the study modules and the specific comments made by students.

Both groups felt that the learning management system was appropriate for the study modules for which it was used, but more nursing than health sciences respondents (87.4% vs 72.8%, $P = .005$) felt that the learning management system assisted their learning (Table 3). Some learning management issues were reported by the students, such as “If you have forgotten your password, you can’t go through. Need to have two passwords”; “it is difficult because I was unsuccessful to go through. I was helped by someone working at the Internet café”; “[Moodle] needs to be simplified ‘cause (sic) it’s sometimes difficult to find the information you recognize”.

From the analysis of the open-ended questions, the respondents suggested the following recommendations: (1) computer literacy training (“Is [Moodle] advisable for students who are computer illiterate,” “Computer literacy should be initiated or started in the 1st year or so to gain more skills”) and (2) orientation and training at the start of using a learning management system (“We did not receive training, and we are battling,” “Give a proper and good orientation and ensure that they [the students] understand,” “give more time on teaching of use of Moodle.”

DISCUSSION

Although the respondents found the learning management system easy to use, the study confirmed the hypothesis that individual factors such as age and computer literacy will have an impact on perceived ease of use of technology such as a learning management system.

There were significant age differences in the sample, with nursing students being, on average, nearly 20 years older than the health science students. Although age may not be a direct factor in the adoption of technology,⁸ the fact that the older students came from an era of paper-based learning and many of them reporting that coming back to university had been their first exposure to computers may have resulted in significant differences in computer literacy and perceptions of ease of use. Familiarity with technology (computer literacy) is an important factor significant to implementation.⁸ This was confirmed in the study with high computer literacy associated with both high perceived ease of use and usefulness for the older nursing students. In the younger health science students, computer literacy did not affect either of these measures, which may be explained by the fact that for younger people, technology adoption has already occurred.

A second finding in the study is the effect of positive attitudes toward technology and innovation on perceived ease and usefulness of learning management systems. Although there was a strong association between positive attitudes and ease of use of learning management systems, the direction of this association is not clear. The study did find more negative attitudes toward changing from paper-based

system and the usefulness of learning management systems in the younger health sciences students. The differences may be due to an appreciation of the older nursing students, who are based off campus, of having easier access to electronic resources, which may have previously been difficult for them, similar to other students stating that using learning management systems provided them with better access to learning materials and faster and easier information retrieval.¹⁰ These students also share similarities with online students, who are older, more likely to have work or childcare responsibilities, and less likely to be located on campus.¹⁵

The differences in attitudes may also be related to the amount of training and support the different groups have received. It is evident from the findings that lack of training in the health sciences group had a strong association with low perceived usefulness of learning management systems and that lack of support was strongly associated with low ease of use and low usefulness perceptions for both groups. The nursing group reported higher levels of training, which is similar to studies that have found that implementation success is dependent on the provision of good training and support strategies⁸ and is hindered by a lack of administrative support.¹¹

The third and most important finding is that the nursing students reported that using a learning management system assisted their learning. In analyzing the key features central to the success of learning management systems to facilitate learning, namely, feedback and discussion,⁹ the study found that just over half of the nursing students found the feedback easy to follow. This finding may be related to the different assessment structures in the units ranging from multiple-choice questions in the undergraduate program to essay-type questions in the nursing units. Constructing online assignments and assessment tests that will provide students with feedback in different formats⁶ is a challenge, which should be addressed through training of teaching staff in the appropriate use of learning management systems.

The second feature, discussion, is normally achieved through online chat or forum activities. While both groups reported that the chat feature was difficult to use, the nursing group found it more useful. This was due to fact that some nursing units, especially at a masters’ level, made use of the chat feature for discussion and reflection. Integrating these features is central to learning, and success in uptake can be achieved by using key teaching staff to design appropriate educational activities.⁸

There were a number of limitations in the study, including as the low response rate from health science students and the absence of a variable capturing rurality.

CONCLUSION

The adoption of a learning management system is complex and is influenced by a variety of factors and organizational

issues, but using monitoring systems in the early stages of implementation, as in this study, is essential.⁸ This study showed that despite varying levels of computer literacy in students, positive acceptance of the use of a learning management system can be achieved with orientation and training and continuing support by the organization in the form of Internet access and well-designed module content and activities.

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