

# A Technology-Dependent Information Literacy Model within the Confines of a Limited Resources Environment

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## ABSTRACT

*The purpose of this paper is to investigate information literacy as an increasingly evolving trend in computer education. A quantitative research design was implemented, and a longitudinal case study methodology was conducted to measure tendencies in information literacy skill development and to develop a practical information literacy model. It was found that both students and educators believe that the combination of information literacy with a learning management system is more effective in increasing information literacy and research skills where information resources are limited. Based on the quantitative study, a practical, technology-dependent information literacy model was developed and tested in a case study, resulting in fostering the information literacy skills of students who majored in information systems. These results are especially important in smaller universities with libraries having limited technology capabilities, located in developing countries.*

## INTRODUCTION

Many different challenges arise during a graduate's career. Moreover, professional life can involve numerous situations and problems that university students are not prepared for during their college studies.<sup>1</sup> The use of internet sources to find solutions to real problems depends on students'/graduates' information literacy skills.<sup>2</sup> A strong aid to students' learning is the ability to search, analyze, and apply knowledge from different sources, including literature, databases, and the internet.<sup>3</sup>

One of the issues students face concerning technology is its continuous evolution. Although students learn survival skills in their professional lives, they also require special coping skills. A skill that should be considered for all technology-related courses is information literacy. Lin defines information literacy as a "set of abilities, skills, competencies, or fluencies, which enable people to access and utilize information resources."<sup>4</sup> These are part of the lifelong learning skills of students, which put the power of continuous education in their hands.

Another issue is the exclusive allocation of the responsibility for information literacy skill development in smaller educational institutes to librarians or to instructors who majored in library science.<sup>5</sup> This paper has taken another approach to information literacy skill development whereby specialized educators, such as capable information systems faculty members, facilitate this skill development.

A learning management system (LMS) is a widely used form of technology for course delivery and the organization of subject material. Blackboard, Desire2Learn, Sakai, Moodle, and ANGEL, as common LMS platforms, provide an integrated guidance system to deliver and analyze learning.

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These systems can be used to support information literacy instruction. Standard features include assignments and quizzes, while other systems offer tools that allow students to view and comment on other students' portfolios or work, depending on the LMS's features.<sup>6</sup> Before the 1990s, face-to-face learning was common within the educational domain. However, LMS emerged in the twenty-first century as the internet became a suitable alternative to traditional learning. Moodle, an open-source LMS, is an acronym that stands for "Modular Object-Oriented Dynamic Learning Environment." This online education system is intended to make learning available with the necessary guidance for educators. Web services available through Moodle are based on a well-organized structural outline, and they are widely used to perform educational tasks and to analyze statistics helpful to instructors.<sup>7</sup>

Peter et al. (2015) presented an approach related to information literacy instruction in universities and colleges that combines traditional classroom instruction and online learning; this is known as "blended learning."<sup>8</sup> This involves only one seminar in the classroom; thus, it can replace traditional sessions at universities and colleges with education involving information literacy instructions. It has been recommended that a time-efficient method should be adopted by augmenting classroom seminars and literacy instructions through the addition of online materials. However, the findings of this study showed that students who only use online materials do not show greater progress in their learning than those who follow the blended approach.

The results of another study by Jackson more effectively integrated educational services into learning management systems and library resources.<sup>9</sup> Jackson suggested that better implementation was required, and recommended using Blackboard LMS to include information literacy and scaffolding activities into subject-specific courses.

This study intends to determine the most effective method of information literacy education. It evaluates instructors' and students' perceptions of the effectiveness of traditional teaching in comparison to electronic teaching in information literacy. In this study, a quantitative research investigation was conducted with participants. A research model and questionnaire were developed for this purpose with three underlying latent variables. The participants were asked to describe their understanding of learning systems and their preferences in information literacy education. Their requirements varied with their continuing education levels and past educational activities, based on which software or website appeared to be more supportive and compatible with them.<sup>10</sup> This study considered the research results, developed an information literacy intervention model and applied it to a case study.

## **LITERATURE REVIEW**

Previously, educational institutions were limited to face-to-face teaching techniques or classroom-based teaching. Face-to-face teaching is the traditional method still used in most educational institutions. In classrooms, the subject is explained, and books or other paper-based materials are read out of class to enhance understanding.<sup>11</sup> Face-to-face learning or teaching is limited by the number of physical resources available. Therefore, it becomes difficult to accommodate the widespread interest in information literacy through face-to-face learning.<sup>12</sup> Gathering information using only physical resources can lead to information deficiencies.<sup>13</sup> Education has evolved to benefit from advances in technologies by using LMS and online sources. The effective usage of LMS and online sources requires the development of information literacy.

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### ***Information Literacy***

Information literacy includes technological literacy, information ethics, online library skills, and critical literacy.<sup>14</sup> Technological literacy is defined as the ability to use common software, hardware, and internet tools to reach a specific goal. This ability is an important component of information literacy that enables a graduate to seek answers by using the internet and digital resources.<sup>15</sup> Hauptman defines information ethics as “the production, dissemination, storage, retrieval, security, and application of information within an ethical context.”<sup>16</sup> This skill is essential to preserve the original rights of researchers cited in a study, based on the ethical standards of the graduate conducting the study. Another important component of information literacy comprises online library skills, which can be defined as the ability to use online digital sources, including digital libraries, to effectively seek different knowledge resources by using search engines, correctly locating required information, and using online support when needed.<sup>17</sup> Critical literacy is a thorough evaluation of online material that allows for the appropriate conclusion to be reached on the suitability of the material for the required investigation.<sup>18</sup> Seeking answers from appropriate sources is important to allow graduates to find and report on accurate and valid data. These components of information literacy enable information extraction from topics related to the desired course or field of research. Students, professors, instructors, employees, learners, and educational policy administrators are the major knowledge seekers who use information literacy skills.<sup>19</sup> With improved online resources available for learning, many learning requirements are moving toward providing services that are exclusively online.<sup>20</sup>

Gray and Montgomery studied an online information literacy course.<sup>21</sup> They found that teaching with the aid of information literacy is helpful for students in obtaining improvised instruction. The authors also compared an online information literacy course and face-to-face instruction, focusing primarily on the behaviors and attitudes of teachers and college students toward the online course. The students agreed that the application of information literacy techniques would be particularly helpful to them in clarifying their understanding of complicated instructions. The teachers also indicated that an information literacy course would result in better regulation of academic processes than face-to-face learning.

Dimopoulos et al. (2013) measured student performance within an online learning environment, finding that the online learning environment has direct relevance for the completion of challenging tasks within academic settings.<sup>22</sup> The findings further indicated that an LMS could improve teaching activities. As an LMS, Moodle was also helpful for students to ensure their development of collaborative problem-solving skills. They concluded that Moodle includes different useful modules such as digital resource repositories, interactive Wikis, and external add-in tools that have been related to student learning when incorporated into the LMS environment, resulting in better performance.

Hernández-García and Conde-González focused on learning analytical tools within engineering education, noting that engineering students are more likely to understand complicated concepts better. Therefore, the application of the information literacy model resulted in better performance.<sup>23</sup> Further, educating students about information sources was found to be helpful for the instructors in enhancing the students’ learning by improving their online information retrieval skills. This study indicated that students can develop their learning traits more effectively through online learning than through face-to-face learning.



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Many researchers in this area have developed models that are only theoretical.<sup>24</sup> However, this paper develops a practical information literacy model that can be tested for improvement in information literacy skills. This is especially relevant for computer and information systems courses, which can sometimes fall outside the purview of library-related training or education in universities with limited resources. The inclusion of information literacy training within computer and information systems courses is not regularly done in the information literacy field.<sup>25</sup> Additionally, although some information literacy has been implemented practically in research, no other study has developed a practical information literacy model based on educators' and students' information literacy dispositions as well as both information literacy theory and practice.<sup>26</sup>

### ***Moodle as an LMS***

Moodle is a useful and accommodating open-source platform with a stable structure of website services that allows instructors and learners to implement a range of helpful plugins. It can be used as a lively online education community and an enhancement to the face-to-face learning process.<sup>27</sup> Moodle is used in around 190 countries and offers its services in over seventy languages. It acts as a mediator for instruction and is widely adopted in many institutions. Moodle provides services such as assignments, wikis, messaging, blogs, quizzes, and databases.<sup>28</sup> It can provide a more flexible teaching platform than traditional teaching. Health science educational service providers facilitate self-assurance in their learners. Several educational campuses operate by using face-to-face learning strategies, whereby learners obtain their training on-campus locations. The objective of Moodle is to enable the education of learners through internet access.<sup>29</sup> Xing focused on the broad application of the Moodle LMS for developing educational technology within academic settings, suggesting that academic organizations should promote technology as a solution for common problems with students' learning processes.<sup>30</sup> Such suggestions have been supported by Costa et al. (2012) who found that Moodle is significantly helpful for developing an e-learning platform for students. They emphasized that engineering universities must use the Moodle LMS to provide students with extensive technical knowledge.<sup>31</sup> Costello et al. (2012) stated that Moodle, if used, will significantly help students improve their skills and knowledge effectively.<sup>32</sup>

### **METHODOLOGY**

In information literacy skill development, there are studies that support using only face-to-face education or only using an LMS. For example, Churkovich and Oughtred found that face-to-face learning leads to better results in information literacy tutorials than online learning.<sup>33</sup> At the same time, Anderson and May concluded that the use of an LMS is viewed by students as a better method than face-to-face instruction in information literacy.<sup>34</sup> To test which educational pedagogy (traditional or technology) is better regarding information literacy, the following two hypotheses were posited:

H1: Face-to-face learning has a significantly positive influence on information literacy disposition.

H2: Moodle learning has a significantly positive influence on information literacy disposition.

To provide a better understanding of the most effective method of information literacy instruction, a quantitative research design was used. The wording of the questionnaire items (shown in table 1) was inspired by the studies of Ng, Horvat et al., Abdullah, and Deng and Tavares.<sup>35</sup> Online

questionnaires were prepared and distributed to students, teachers, trainers, and professors as well as administrative departments in a small private university located in the Arabian Gulf region. Initially, a pilot study was conducted to test the instrument. This pilot study involved forty-nine participants and fifteen questions on information literacy. It also included demographic questions.

Variables	Code	Item Wording
Face-to-face Education Disposition (FED)	FED1	Information literacy skills are polished through face-to-face learning
	FED2	Face-to-face learning accommodates information literacy requirements
	FED3	Face-to-face learning is easier than learning management systems
	FED4	Face-to-face learning is better than learning management systems
Moodle Usage Disposition (MUD)	MUD1	Moodle is more easily accessible than other online resources
	MUD2	Moodle is an effective web server for information literacy
	MUD3	Moodle is more reliable than other online resources
	MUD4	Moodle enables the provision of an extensive amount of useful information
	MUD5	Moodle is used to overcome language, understanding, and communication gaps
Information Literacy Preference (IL)	IL1	Students and teachers prefer online resources
	IL2	Inauthentic websites are helpful for students and teachers
	IL3	Authentic websites are useful for students and teachers
	IL4	Students and teachers prefer published articles, journals, and books
	IL5	Online learning is more effective
	IL6	Information is essential for individuals' knowledge

**Table 1.** Item coding.

After the pilot study, a full-scale study was conducted, in which the participants were students, professors, and educational administrators. An online questionnaire was sent to the management of an academic institution in the Arabian Gulf region to assess the instruction methodology to improve students' information literacy skills. The language used in the survey was Arabic, and the questionnaire was translated into English for this article by a professional translator. A total of five hundred questionnaires were sent, and 398 of them were received with complete responses. The following criteria were used to filter questionnaires that were not appropriate for this study:

***Inclusion Criteria***

- People currently involved in the education system.
- Students, teachers, or members of an academic department.
- People who understand information literacy. A question was added in the survey about whether the participant was familiar with information literacy; if not, the participant was removed from the sample.

***Exclusion Criteria***

- People who were not involved in the education system.
- People who were not aware of online learning systems.
- Staff with no role in learning or teaching.



<b>Gender</b>	Frequency	Percent
Male	186	46.73
Female	212	53.27
Total	398	100

<b>Qualification</b>	Frequency	Percent
Undergraduate	181	45.48
Graduate	98	24.62
Masters	119	29.90
Total	398	100

<b>Designation</b>	Frequency	Percent
Student	216	54.27
Instructor	90	22.61
Administrator	92	23.12
Total	398	100

**Table 2.** Demographic information.

<b>Question</b>	<b>Agree</b>	<b>Neutral</b>	<b>Disagree</b>	<b>Don't Know</b>
<b>Face-to-face Education Disposition (FED)</b>				
FED1	46.8	22.8	21.3	9.1
FED2	10	74.5	14.2	1.3
FED3	1.5	12.8	75.8	9.9
FED4	32	30	26	12
<b>Information Literacy Preference (IL)</b>				
IL1	38.8	21.3	1.5	38.4
IL2	0.3	1	98.7	--
IL3	15	31	53.3	--
IL4	49.5	30	13.0	7.5
IL5	48	29.8	--	22.2
IL6	74	11.5	1.8	12.7

**Table 3.** Questionnaire response distribution for FED and IL.

<b>Question</b>	<b>Yes</b>	<b>No</b>
<b>Moodle Usage Disposition (MUD)</b>		
MUD1	65	35
MUD2	73.3	26.8
MUD3	67	33
MUD4	66	34
MUD5	63.7	36.3

**Table 4.** Responses to MUD.

The reliability statistics showed a high level of consistency for the pilot test because the Cronbach's alpha for the fifteen items was 0.901, which is above the recommended level of 0.7.<sup>36</sup> Cronbach's alpha is a widely used coefficient measuring the internal consistency of items as a unified group.<sup>37</sup>

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Based on the successful pilot study, a full-scale study was conducted. The demographic distribution for the full-scale study is shown in table 2 along with the mean and standard deviation of each demographic factor. The distribution of the questionnaire items for the full-scale study is shown in tables 3 and 4. Cronbach's alpha was used to determine the reliability of the constructed items for the full-scale study. The standard benchmark for the reliability value is a 0.7 threshold; however, the Cronbach's alpha for all constructed items was above the 0.7 standard value. Thus, this standard score revealed that all the items had appropriate and adequate reliability.<sup>38</sup>

## RESULTS

The research hypotheses were tested using structural equation modeling (SEM) with the analysis of momentum structures (AMOS) approach. SEM includes various statistical methods and computer algorithms that are used to assess latent variables along with observed variables. SEM also indicates the relationships among latent variables, showing the effects of the independent variables on the dependent variables.<sup>39</sup> One well-regarded SEM methodology is AMOS, which is a multivariate technique that can concurrently assess the relationships between latent variables and their corresponding indicators (measurement model), as well as the relationships among the model's variables.<sup>40</sup> Highly cited information systems and statistics guidelines were followed for the SEM to ensure the validity and reliability of data analysis.<sup>41</sup>

### *Measurement and Structural Model*

The measurement model contained fifteen items for ascertaining the representation of three latent variables, including face-to-face education disposition, Moodle usage disposition, and information literacy preferences. Before we proceed to this analysis, the data need to show normality for us to be able to trust the robustness of this parametric SEM. Curran et al. suggested a skewness and kurtosis less than the absolute value of 2 and 7, respectively, to display the normality of the data.<sup>42</sup> All items' absolute values of skewness and kurtosis were less than the suggested cut off, showing a suitable level of normality for conducting SEM analysis. The overall measurement model showed a high level for the fit indices: GFI=0.99, AGFI=0.98, NFI=0.98, CMIN/DF=0.86, and RMR=0.39. All these fit indices show that the theoretical model fits well with the empirical data if they are above 0.95, except CMIN/DF and RMR, which do not follow this cut off. The CMIN/DF should be less than 3, while the RMR should be less than 0.5.<sup>43</sup>

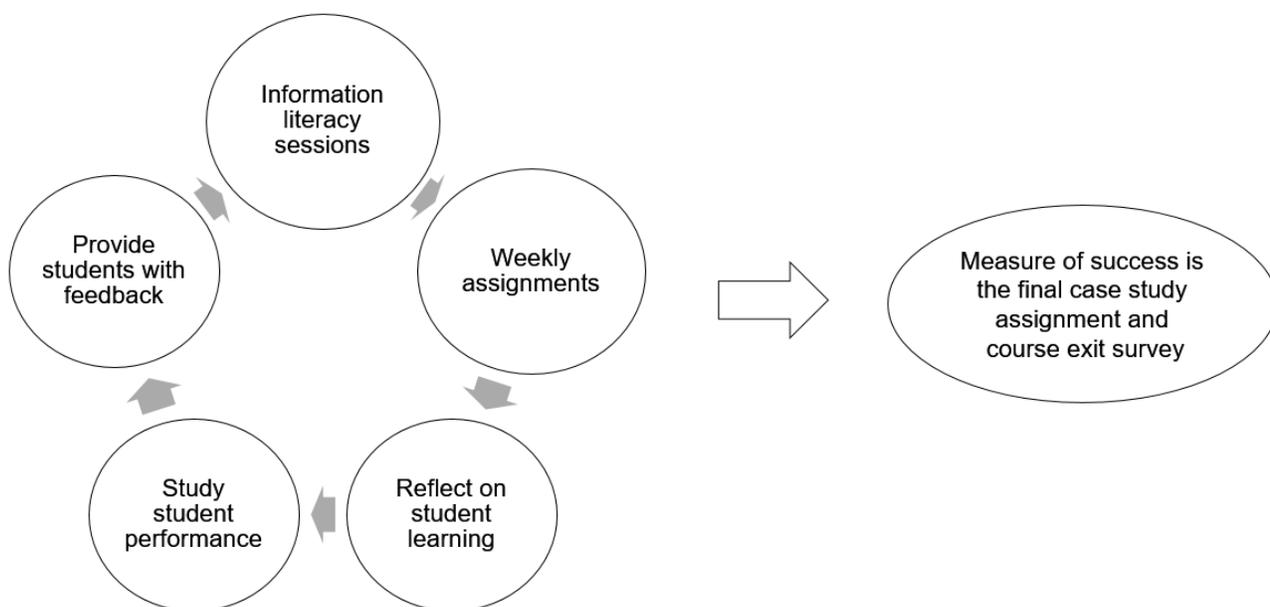
Table 5 shows all the items loaded on their corresponding latent variables higher than the suggested cut off (0.5). As shown in the table, IL6 was the only item that did not load clearly on its latent variable and, thus, it was dropped from further analysis.<sup>44</sup> An additional method to assess item loading was item loading significance, which was significant at the level of 0.001, indicating that all items loaded on their latent variables.<sup>45</sup> The indices of the measurement model suggested that the psychometric properties of this instrument can be preceded by the structural model.

Item	Estimate
Face-to-face Education Disposition (FED)	
FED4	0.71
FED3	0.52
FED2	0.66
FED1	0.89
Moodle Usage Disposition (MUD)	
MUD5	0.93
MUD4	0.92
MUD3	0.92
MUD2	0.73
MUD1	0.93
Information Literacy Preference Disposition (IL)	
IL6	0.32
IL5	0.91
IL4	0.72
IL3	0.86
IL2	0.81
IL1	0.83

**Table 5.** Item loadings.

The next step was to assess the structural model, which was used to evaluate the hypothesized relations between the dependent variables (face-to-face education disposition [FED] and Moodle usage disposition [MUD]) and independent variables (IL). Both education methods were tested in the hypotheses to identify the most suitable information literacy delivery mode for students. Both hypotheses were supported, which indicates that an individual method of information literacy delivery (either face-to-face instruction or LMS) is not preferred, and a different model can be suggested. Both hypotheses were supported at the level of 0.001 with an effect size for face-to-face education disposition of 0.32, which indicates a medium impact on information literacy preferences. Meanwhile, the Moodle usage disposition had an effect size of 0.70, which is considered a large effect size (Hair et al. 2010). Finally, the model's explanatory power of information literacy preferences was determined by  $R^2$ , which was high (0.85).

Based on the previous analysis, it can be said that an individual method of information literacy delivery is insufficient in developing countries. Thus, a different model for information literacy was developed (figure 1), which had an impact on students' related competencies.



**Figure 1.** Information Literacy Intervention Model.

As shown in figure 1, the model includes conducting weekly information literacy sessions that focus on educating students about technological literacy, information ethics, online library skills, and critical literacy. After each session is concluded, the instructor creates weekly assignments using an LMS that tests the students' information literacy abilities regarding the subject material. The instructor follows up regarding the students' overall performance and fills any identified gaps in subsequent information literacy sessions and assignments. The instructor studies the students' performance after one month and provides feedback to students. Finally, a "real case project assignment" is used to teach students to solve real problems using the skills they learn. The instructor can further extend reflection on the process of assigning "real case project" grades by creating a course exit survey that asks students about their acquired level of information literacy skills.

### LONGITUDINAL CASE STUDY

A small technical university in the Arabian Gulf region faces difficulties in providing adequate library resources to its students because of its limited capabilities. The university has about 4,500 students and five hundred employees. The university library and information technology department shortage in adequate staff and resources, resulting in an insufficient support for student learning. This has caused lack of student information literacy education, which is evident in the submission of student assignments. For example, students are not accustomed to citing materials that were used in their assessments. Thus, these undergraduates are viewed suspiciously by their educators when using online materials. Not knowing how to paraphrase then cite relevant online materials causes missing learning opportunities for students. Information literacy is a skill that should be considered for all technology-related courses.<sup>46</sup> The outcomes of this course will be used to improve the education of students and place the power of learning in their hands.<sup>47</sup> Therefore, the objective of this case study is to determine the influence of information literacy practices in improving student performance in solving organizational problems, especially when technology and library resources are scarce. This longitudinal case

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study was conducted in two semesters: the first was conducted traditionally without the use of an information literacy intervention model, whereas in the second semester, the intervention model was introduced. Finally, the performance and opinions of students for the two semesters were compared using a case study assignment and course exit survey.

The information literacy intervention model was implemented by providing a series of practical tutorials at the beginning of the semester showing students how to use information from the internet. Then, the students applied the information and used information literacy skills to solve weekly assessments for an enterprise-architecture (EA) course. This course is taught under the information systems program at a private university. Students enrolling in the course are in their second year or higher. The information literacy assessments require students to search for reliable sources of information and cite and reference them. This forces them into the habit of critically examining sources of information, and grasping, analyzing, and using these sources to solve problems. The information literacy technology pedagogical method was followed to improve students' knowledge of methods of learning.<sup>48</sup>

The students were educated through a series of classes on how to use the university's databases, e-books, and internet resources to solve real-life organizational problems and to apply concepts in different situations, as shown in figure 1. The students were given ten small assessments from the Moodle LMS, where a concept taught in the class needed to be applied after students searched for it and learned more about it from different sources. This included looking in the correct places for reliable resources, online scholarly databases, and online videos that could be of use. Then, students were taught how to critically examine resources and determine which of these could be reliable. For example, students were shown that highly cited papers were more reliable than less cited papers and that online videos from professional organizations (e.g., IBM or Gartner) were more reliable than personal videos. Students were also taught how to use in-text citations and how to create reference lists.

In the last quarter of the semester, a case study assignment was provided with real-life problems that students were required to solve using different sources, including the internet. The performance of semester-1 students (no intervention was conducted) was compared with that of semester-2 students (information literacy intervention was conducted) taking the same course. An improvement in grades was considered a successful indicator. The comparison point was a major project that required students to solve real-life organizational problems and required greater information literacy.

Some of the EA concepts taught in the class required practice to apply them. For example, the as-is organizational modeling that is needed before implementing EA would be difficult to understand unless students actually conducted modeling on selected organizations. This enabled students to understand how they related to the real world. The concepts that were focused on were related to business tools in information systems (e.g., business process management and requirement elicitation) that are widely used for analysis within organizations. The theory behind these tools was explained in class; applying these theories required students to search many sources of information, including online books and research databases. Students were unaware of these resources until the instructors explained their availability on the internet and in the library. The students were provided with regular information literacy sessions to improve their skills in this aspect. They were shown how to search; for instance, if they could not find a specific term, they

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could look for synonyms. They were instructed on how to use search engines and research databases and were shown the relevant electronic journals and books that can aid in solving weekly assessments. The usage of internet multimedia is also important in education.<sup>49</sup> The students were shown relevant YouTube channels (e.g., by Harvard and Khan Academy) and relevant massive online open courses (e.g., free courses on Coursera.com and Udemy.com). Weekly tests required students to use these resources to solve the assessment problems.

An important outcome of this intervention was an improvement in students' abilities to use different digital resources. This was evident in semester-2 students' usage of suitable reference lists and in-text citations, as compared to a lack of such usage by semester-1 students. An additional measure was the higher average score the students indicated in semester 2 (4.15/5), in comparison to semester 1 (3.2/5), for one of the items in the course exit survey relevant to information literacy: "Illustrate responsibility for one's own learning."

The students were continually taught that information literacy grants a power that comes with responsibility, and no incidents of plagiarism were reported during the semester in which the intervention was conducted. Referencing became a habit with weekly information literacy assessments. The students' grades in the final project were better than in the previous academic semester. The average grade for the project for semester 1 was 15.5/20, while that for semester 2 was 17/20. The difference between the grades for semester-1 and semester-2 projects was statistically significant at the level of 0.10, indicating significant differences in the students' grades between the two semesters. The students could use digital library databases, and some were interested in using external online books. It became habitual for students to use in-text citations, and their references became diversified. Some students, however, struggled at times with the limited usage of suitable references in only some paragraphs. This feedback was delivered to students so that they could address this issue in other courses.

## **DISCUSSION AND CONCLUSION**

This study was conducted to investigate the most effective mode of information literacy delivery. The study focused on smaller universities because they do not have adequate library facilities and technological capabilities to provide students with sufficient information literacy competencies during course delivery. A survey was conducted to determine the most suitable form of information literacy delivery. The survey determined that Moodle and face-to-face methods were both favored regarding information literacy. Thus, the information literacy intervention model was developed and tested in a case study, so that students' performance would improve. The results of this study have shown that the combination of technology and information literacy instruction is an effective method to improve student skills in using digital resources in seeking knowledge. It was found that both face-to-face learning and the use of an LMS increase student performance in assessments that require information literacy. Face-to-face learning is required in order to explain information literacy concepts, while the LMS is used to disseminate the necessary digital resources and in creating assessment modules. Thus, the arrangement of both theory and practice in information literacy resulted in better understanding and implementation in knowledge seeking and problem-solving related to information systems. The inclusion of information literacy instruction along with the use of LMS for information literacy assessments within information systems courses has reduced the pressure on libraries that lack technological resources (such as PCs) and qualified staff.



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The results with regard to this study's hypotheses are in agreement with those of previous studies.<sup>50</sup> Hypothesis 1, which posited that there would be a positive significant influence on information literacy disposition, is congruent with the research of Churkovich and Oughtred.<sup>51</sup> Their research focused on student information literacy skill development using library facilities instead of faculty, which is a different approach than the approach followed in the present study. However, both the present study and the study of Churkovich and Oughtred found that using face-to-face instruction leads to improved student performance. Hypothesis 2, which posited a positive impact on information literacy disposition, correlates with the research of Anderson and May.<sup>52</sup> They found that using an LMS is more effective than face-to-face instruction for information literacy instruction. Similar to Churkovich and Oughtred (and in contrast to the present study), Anderson and May relied on librarians to deliver information literacy instruction online. However, Anderson and May also relied on faculty staff in addition to librarians.

There are two noteworthy outcomes of the first study. First, the questionnaire measurement model showed that the development of this instrument was successful and that the items and their latent variables can be used in further studies. Second, the results regarding the structural model indicated that both face-to-face instruction and Moodle use influenced information literacy preferences. Other studies have supported these results. The results of Peter et al. (2015) agree with the finding of the present study that the combination of face-to-face instruction and LMS use leads to improved student performance.<sup>53</sup> Peter et al. (2015), based on psychology students, focused on the time-efficiency of the delivery of information literacy instruction; in contrast, the present study considers information literacy skill development as a progressive, long-term process.

The information literacy intervention model is not only a learning medium but an interactive method of teaching that adapts to student learning patterns. The primary limitations of the study were the nature of the sample, the exclusion of some potentially relevant variables, and the simplification of the study's findings. The sample was limited to students, professors, and people who were aware of the learning programs; it is highly possible that they were more familiar with such technological innovations than the general population.

Future studies could retest the hypothesis of the study in a comprehensive manner and impose more control on the respondents. The interaction between people while visiting a site is itself an activity worthy of examination, but it must be either controlled or measured for us to understand the role it plays in shaping attitudes and behaviors. Future studies can apply the developed theoretical model in different settings to determine its interaction with other variables in the information systems field. A quantitative instrument can be developed based on the information literacy intervention model. Alternatively, this model can be applied with qualitative interviews in future studies to develop theoretical themes based on instructors' and students' responses.

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