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# **Measuring the digital competency of freshmen at a higher education institute**

*Submission Type: Completed Research*

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## **Abstract**

*This study profiles the digital literacy of the freshmen at a higher education institute in Fiji. An online survey was designed to gather data from 1595 students, which reduced to 867 after data cleaning. The objective of this research study is to evaluate the digital literacy status of freshmen at a higher education institute and evaluate if there is any correlation between their literacies and their overall digital literacy. The digital literacy competencies of the freshmen were evaluated by using a newly designed Digital Literacy Scale (DLS). For each student, the literacy score for each component of digital literacy identified for this study (media, information, technology, computer, visual, and communication literacy) and the overall digital literacy was calculated using the DLS. The results show that the freshmen were highly digitally literate. The Cronbach alpha test showed that the newly designed DLS was reliable and had a high internal consistency. A correlation analysis – Spearman's correlation was also carried out which indicated that the overall digital literacy of the students was dependent on the individual score for each of the component of the digital literacy identified in this study.*

**Keywords: Digital Literacy, higher education, Fiji, digital competency, correlation**

## **Introduction**

In this digital age, the use of technology and the Internet is blooming and is bringing many transformations that are influencing the lives of people. According to (Wearesocial Ltd, 2019) there are about 4.39 billion Internet users, 3.48 billion social media users 3.26 billion social media users using mobile phones around the globe in 2019, an increase of 9 per cent when compared to 2018. Since the growth of the Internet is evolving and the impact of digitisation is increasingly profound, the people of digital age invariably require appropriate skills and literacies about using these new tools and technologies. According to (Leahy & Dolan, 2010), even though the technology is accessible, if a person does not have the required skills and knowledge he/she cannot use it efficiently and safely. Today, this set of skills and knowledge is termed as digital literacy (Dios et al., 2016; Phuapan et al., 2016).

Paul Glister defined the term digital literacy as the ability to understand and use information in multiple formats from a wide range of sources presented via computers (Tai et al., 2017). The definition of digital literacy evolved with the growing use and incoming of new technologies. The authors (Chan et al., 2017; Sadaf & Johnson, 2017; Phuapan et al., 2016; Murray & Perez, 2014; Leahy & Dolan, 2016) define digital literacy as the ability to locate, organise, understand, evaluate and create information using the digital technologies and the Internet. In recent years, this term has gained a lot of attention and several competencies have been associated with digital literacy. This is because the accessibility and availability of data have increased, privacy and security issues have compounded and user-generated content has increased.

Since the use of technology has greatly influenced and affected the education and employability sectors, researchers and stakeholders have called for the integration of digital literacy with the education curriculum (Ukwoma & Iwundu, 2016). In doing this, the college and university students will be equipped with the necessary digital literacy skills and competencies; hence, they will be able to use the digital tools for a lifelong learning experience. The colleges and universities can play a vital role in ensuring the seamless integration of these tools so that the skills and abilities of the students can be updated as new technologies evolve.

Motivated by the above, this paper focuses on measuring the digital competencies of the freshmen at a higher education institute. Phuapan et al. (2016) define competency or competencies as a set of knowledge, skills and attitude that an individual must-have for a particular context- in this case, competency will refer to the set of knowledge, skills and attitude of individuals in using digital technologies. The digital competencies of the students were measured using a new digital literacy scale (DLS) which was designed and developed for this research study. A series of ICT competency-measuring scales as a reference, designed by previous researchers (Ge et al., 2018; Simons et al., 2017; Maderick et al., 2016) were used to develop the DLS.

Once, the digital competencies of freshmen were measured, consistency and reliability analysis were carried out for the DLS. The study also evaluated if there was any correlation between the different competencies of digital literacy and the overall literacy of the students. The measurement of digital competencies in this digital age is essential so that the student's digital literacy skills are known and then improved if needed through proper training. There is an improvement in citizen's capacity and enhancement of social networks and participation. In addition, knowing the digital competencies of the students will enable relevant authorities and educators to design and direct appropriate remediation tools that will enhance the digital competencies of the natives of this digital society.

## **Literature Review**

The concept of digital literacy has been associated with varied terminologies. It is a broader concept that reflects the use of digital technology, communication tools and networks to access, manage, integrate, evaluate and create new knowledge to function effectively in this digital society. According to (Zhang & Zhu, 2016) digital literacy in the 21st-century skills that include an understanding of the evolving digital technology and the impact of these technologies to interact safely in this digital world. While (Leahy & Dolan, 2010) defined digital literacy as the skills needed for the information society, that is the use of electronic equipment for personal and social interactions and educational and business needs. Prior research conducted on digital literacy indicates that researchers have associated different types of literacies such as media literacy, information literacy, information communication technology literacy, communication literacy, reproductive literacy, visual literacy, Internet literacy and computer literacy. For this research study, we will adopt Covello's (2010) definition of digital literacy whereby he defined digital literacy as an umbrella consisting of six sub-components: media literacy, visual literacy, information literacy, communication literacy, computer literacy and technology literacy. Covello's definition of digital literacy was considered because his study had an educational setting similar to the setup of this research. His study was based on designing an educational testing service to measure the digital literacy skills of the students'.

The aforementioned components have slight differences and may overlap in terms of their meaning and abilities. According to (Ainura et al., 2018; Rizzi et al., 2014) media literacy can be defined as a set of skills that allows one to access, analyse and evaluate images sounds and messages and responsibly communicate it using media. Visual literacy is defined as a set of skills and knowledge that can be used to find, interpret and evaluate images (Matusiak et al., 2019; Arneson & Offerdahl, 2018). Information literacy has been defined by (Sorgo et al., 2017; Shiela & Bill, 2017) as the knowledge and skills required to allow an individual to navigate media and information-rich environments. The term communication literacy had been integrated with media literacy or information literacy. However, Covello (2010) has defined communication literacy on its own as the ability of learners to communicate effectively as individuals and work collaboratively in groups, using publishing technologies the Internet, as well as other electronic and telecommunication tools. Computer literacy can be defined as a set of skills and knowledge required to use the hardware and software components of a computer system and having the ability to manipulate and communicate information effectively (Olney et al., 2017; Kegal & Wieringa, 2016; Topkaya & kaya, 2014). According to (Ellis et al., 2016; Covello, 2010) technology literacy is having the necessary computer skills and the ability to use computers and other technology to improve learning, productivity, and performance. The definition of the components identified for this research brings out the digital competencies needed by the students to understand the use and impact of using digital technologies. The above components were used to design and develop the DLS and measure the digital competency of the students.

As an increased and deep proliferation of digital technology in the education sector, one of the important issues arising is the measurement of digital competencies. Research shows that some scales for the measurement of ICT literacy/computer literacy have been developed such as;

- i. a validated instrument developed by (Ge et al., 2018) to measure teachers ICT competency
- ii. the scale developed by (Muthupoltotage & Gardner, 2018) to measure digital literacy and self-regulated learning
- iii. an instrument developed by (Simons et al., 2017) to measure media literacy
- iv. an online survey developed by (Maderick et al., 2016) to measure digital competence
- v. an instrument developed by (Phuapan et al., 2016) to analyse digital literacy skills of Thai students

The aforementioned examples are attempts in the literature to develop digital literacy measurement tools. If we reflect literature, there has been only one validated DLS that has been developed by (Dios, Igartua, & Gonzalez, 2016). The authors developed a self – report questionnaire based on a Likert scale 1 to 5 on the five dimensions of digital literacy, which are technological skills, communication skills, information skills, critical skills and security skills. As new digital technologies are emerging, the term digital literacy has transformed and is expanding. Therefore, the above definition and dimensions of digital literacy need to be redefined. The authors of this paper have redefined digital literacy as an individual's ability to find and evaluate information, use this information effectively, create new content using this information and share and communicate this newly created information using appropriate digital technologies. The authors stipulate that the six components that have been used to design the new DLS for this study will give a broader perspective on the digital competencies of the students.

The authors design a new DLS to measure the digital competencies of students and propose to have its case study at a higher education institute in the Pacific. Prior research has shown that the widespread use of digital technologies, Internet and their applications are evident amongst the educational and research communities (Reddy et al., 2020; Sharma et al., 2019a; Sharma et al., 2019b; Fehnker & Chaudhary, 2018; Ge et al., 2018; Chan et al., 2017; Chaudhary et al., 2017; Reddy et al., 2017; Sharma et al., 2017, Tai et al., 2017; Phuapan et al., 2016; Zhang & Zhu, 2016). However, there is little research done which focuses on measuring the digital competencies. This area of research is utmost important so that relevant interventions can be derived to improve the skills of individuals using digital technologies in the education sector (Chan et al., 2017; Simons et al., 2017). The skills of individuals need to be improved so that maximum benefits can be reaped from the use of these new technologies, there are higher retention and lower attrition rates at the university level and the graduates are prepared to face the challenges that they may face at the digital work environment (Ellis et la., 2016). The development and the use of digital technology particularly in the education sector in the country is exponentially growing, and the higher education institutes have successfully adopted and integrated technology into their teaching and learning processes (Reddy et al., 2020; Sharma et al., 2019b; Reddy et al., 2017; Sharma et al., 2017). This proliferation of technological advancements now demands the populations to be responsible digital citizens and hence arises the need to know the digital competencies of the individuals. Since there is, no baseline research done in regards to measuring digital literacy competencies for freshmen, the authors were motivated to conduct this study beginning with the digital natives or the Net Generation users, and select a higher education institute in the Pacific as the case study.

## **Research Objectives**

The specific objectives of this study are as follows:

- i. measure the individual digital literacy competencies of freshmen at a higher education institute
- ii. measure the overall digital literacy status of freshmen at a higher education institute
- iii. evaluate the correlation between the digital literacy competencies and the overall digital literacy

## **Methodology**

For this study, a quantitative research design was used to collect data from the freshmen enrolled in a higher education institution in Fiji - The University of the South Pacific. A survey methodology was used whereby a unipolar Likert scale 1-5 questionnaire was used to collect the data. A total of 1595 participants were part of the survey, out of which 867 completed the survey. The digital literacy competencies were calculated for each component of digital literacy identified for this study; media literacy, communication literacy, visual literacy, technology literacy, computer literacy and information literacy. Each component had a set of items, which were in the Likert scale format. A newly designed and developed DLS was used to measure the digital competencies of the students. The scale was developed in a manner that it calculated the score for each item for each of the components of digital literacy, which was then used to calculate the overall digital literacy competency of the students.

**The digital literacy scale**

As mentioned in the previous section, Covello’s study in 2010 was used as a reference to come up with a digital literacy scale for this study. The six items/components/literacies associated with digital literacy in this study were adopted from Covello (2010); however, the authors have redefined the six components of digital literacy as such:

- i. *Information Literacy*- using digital technology to find, locate, analyse and synthesise resources, evaluating the credibility of these resources appropriate citation techniques, abiding the legal and ethical issues surrounding the use of these resources and formulating research questions in an accurate, effective and efficient manner.
- ii. *Computer Literacy*- an understanding of how to use computers, digital technologies and their applications for practical use.
- iii. *Media Literacy*- having the ability to use digital technologies to access, analyse, evaluate and communicate information in a variety of digital platforms.
- iv. *Communication Literacy* – using digital technologies to communicate effectively as individuals and work collaboratively in groups, using publishing technologies, the Internet and Web 2.0 tools and technologies.
- v. *Visual Literacy* – having the ability to use digital technology to ‘read,’ interpret, and understand the information presented in pictorial or graphic images communicate this information and convert the information into visual representations.
- vi. *Technological Literacy* – having the ability to use digital technology to improve learning, productivity and performance.

For each of the literacies, a set of questions was designed after referring to previous studies conducted on media, visual, information, communication, computer and technology literacy. From the scores for each literacy, the total score for digital literacy was calculated and the participants were categorized into their relevant levels using the DLS. Table 1 shows the levels of DLS with their descriptions.

**Table 1: The levels in the digital literacy scale with their description**

| Levels | Description      |
|--------|------------------|
| L1     | No Understanding |

|    |                    |
|----|--------------------|
| L2 | Very Low           |
| L3 | Low                |
| L4 | Average            |
| L5 | High               |
| L6 | Very high (Expert) |

For analysis, the Statistical Package for the Social Sciences- SPSS software was used to carry out the reliability and validity tests. The correlation analysis was done to see if there were any possible connections between the variables. For this study, since the variables were ordinal the Spearman’s correlation analysis was used to see if there was any relationship between the individual components of digital literacy and the overall digital literacy competency of the students.

**Validation of the newly designed and developed digital literacy scale**

An exploratory factor analysis (EFA) was used to validate the newly designed digital literacy scale. According to (Chan & Idiris, 2017; Ustundang et al., 2017; Tondeur et al., 2017), EFA analysis is the most effective analysis for validating scales which are in the early stages of research. It identifies the underlying dimensions of the observed variables. For this study, the EFAs that were carried out were the Kaiser-Meyer-Olkin (KMO) and Bartlett’s Test of Sphericity (Samuels, 2017; Yong & Pearce, 2013). For both the tests, the values yielded were higher than 0.85 therefore, the sample was adequate and valid. Furthermore, the results from the EFA showed that the newly designed and developed Digital Literacy Scale was valid and reliable.

**Results**

From a simple, excel analysis with a sample size of 867, the digital literacy of the freshmen stands as such:

**Table 2: DLS score of freshmen**

| Levels | Overall Digital Literacy (number of participants) |
|--------|---|
| L1     | 0   |
| L2     | 6   |
| L3     | 40  |
| L4     | 185   |
| L5     | 379   |
| L6     | 257   |

Table 2 shows that the DLS score of the freshmen mainly falls in Level 4 and above. This means that the digital literacy skills of the freshmen are good to excellent. According to (Tavakol & Dennick, 2011) validity and reliability are the two fundamentals elements in the evaluation of a measuring instrument and the reliability of an instrument is closely associated with its validity. A Cronbach alpha test is the

most valuable for indicating a scale’s reliability. Therefore, a Cronbach’s alpha test was carried out in SPSS to measure the reliability and internal consistency of the scale used to measure the digital literacy competencies of the students. The Cronbach’s alpha result comes to 0.948 for the seven items on the scale.

The scale is given in (StatisticsHowTo, 2019) states that the alpha value > 0.7 is acceptable, the alpha value between 0.8 and 0.9 is good and anything above 0.9 is excellent. From the results obtained in this study, since the alpha value is 0.948, it can be concluded that the items in the scale have high internal consistency and reliability. A higher value of alpha also means that the items in the scale are highly correlated.

The mean and the standard deviation for the items were also calculated. The mean was calculated to find out the average scores of the participants. The results are shown in Table 3.

**Table 3: Mean and Standard Deviation for each item**

| <b>Variables</b>              | <b>Mean</b> | <b>Standard Deviation</b> |
|-------------------------------|-------------|---------------------------|
| <b>Overall Literacy</b>       | <b>4.97</b> | <b>0.87</b>               |
| <b>Media Literacy</b>         | <b>7.82</b> | <b>1.554</b>              |
| <b>Communication Literacy</b> | <b>7.65</b> | <b>1.594</b>              |
| <b>Visual Literacy</b>        | <b>7.45</b> | <b>1.834</b>              |
| <b>Information Literacy</b>   | <b>7.74</b> | <b>1.627</b>              |
| <b>Technology Literacy</b>    | <b>7.53</b> | <b>1.769</b>              |
| <b>Computer Literacy</b>      | <b>7.32</b> | <b>1.434</b>              |

As shown in Table 3 the mean for Overall Literacy is 4.97, this means from the sample the overall literacy of the participants falls around Level 5. It can be concluded that those students who completed the survey can be assumed to have a level of digital literacy. Since the adaptation of technology at the USP has been existent for many years and visibly integrated into its teaching and learning, the student’s use of technology from the very beginning of their university life (Reddy et al., 2016; Sharma et al., 2015; Sharma & Reddy, 2015). However, students still miss some aspects of the skills and knowledge of digital literacy, which is captured in Table 2 that shows students falling in levels 2-4. In addition to this, a micro-level analysis was conducted to see to which items students’ response were weak. The results were as such:

- i. for media literacy, there were 13 items, and according to the responses, 3 out of 13 items had weaker responses. These items tested the students for their ability to create pdf documents, understanding intellectual property rights and navigating through hyperlinks.
- ii. for communication literacy, there were 5 items and students had a low understanding in 3 out of 5 items. These items tested the students for the ability to use digital platforms, use OER s and the use of publication technologies.
- iii. for information literacy, there were 11 items, and the students had average to a high and very high level of understanding on all the items.
- iv. for visual literacy, there were 13 items. The students had average to a high and very high level of understanding on all the items.
- v. for technology literacy, there were 12 items, and the students had average to a high and very high level of understanding on all the items.



- vi. for computer literacy, there were six items and 3 items had weaker responses. These items tested the students for their ability to use the google search engine, creating and using email accounts and resolving basic technical equipment problems.

The results above can be as a guideline while designing appropriate interventions. The interventions can focus more on the weaker areas of the students gathered from the results.

A Spearman correlation is often used to evaluate relationships between the items. For this study, the Spearman’s correlation analysis was used to evaluate the relationship between the variables. The results are shown in Table 4:

**Table 4: Spearman’s correlation between the items in the scale**

| Variables              | Overall Literacy | Media Literacy | Communication Literacy | Visual Literacy | Information Literacy | Technology Literacy | Computer Literacy |
|------------------------|------------------|----------------|------------------------|-----------------|----------------------|---------------------|-------------------|
| Overall Literacy       | 1.000            |                |                        |                 |                      |                     |                   |
| Media Literacy         | 0.834            | 1.000          |                        |                 |                      |                     |                   |
| Communication Literacy | 0.795            | 0.727          | 1.000                  |                 |                      |                     |                   |
| Visual Literacy        | 0.859            | 0.735          | 0.719                  | 1.000           |                      |                     |                   |
| Information Literacy   | 0.863            | 0.787          | 0.767                  | 0.819           | 1.000                |                     |                   |
| Technology Literacy    | 0.855            | 0.733          | 0.698                  | 0.8             | 0.793                | 1.000               |                   |
| Computer Literacy      | 0.792            | 0.698          | 0.626                  | 0.722           | 0.749                | 0.735               | 1.000             |

Table 4 shows that the correlation values are almost 0.8 to 1.0, which is a very strong correlation between the items in the scale as described by (statstutor, 2019). It can be concluded that as the values for each component of digital literacy increases the overall score for digital literacy of the students also increases. This is because individual literacies have a strong positive correlation with the overall literacy.

**Limitations**

There are two major limitations in this study that could be addressed in future research. The first one is getting a more heterogeneous sample so that results could be compared. It will be interesting to note whether the results are similar or different from this study. Additionally, conducting the survey as students enroll and before they start with their learning for the semester. Doing this will ensure that the students attempt the survey before they begin their digital learning journey. The aim of this survey is to yield raw scores of the freshmen.

## Conclusion

This research paper shows an initial status of digital literacy amongst the freshmen at a regional university in the South Pacific with the main campus situated in Fiji. Based on the analysis of this study, the freshmen at the USP had high levels of digital literacy- 73% of the students making it to levels 5 and 6. This can be possible since today's generation is accustomed to using the new digital technology, the Internet and the concepts associated with it. Also, since the USP is known to be the ICT drivers in the education sector in the South Pacific region (Sharma et al., 2018; Sharma et al., 2019a; Sharma et al., 2019b), implementing ICT into their teaching, learning and delivery modes, the students have been taught how to leverage their learning using the ICTs. While the sample of students comprised of freshmen only, surveying in semester 2 already had this cohort a head start of about 6 months into university life and accustomed to the use of digital tools and technologies.

This study shows that there is a strong relationship between the individual literacies and the overall digital literacy as there was a strong positive correlation obtained from the Spearman's test. This means that if a student improves any of the items or literacies the overall digital literacy of the students will also improve. Although there are more students on levels 5 and 6, the students still lacked some skills of the digital literacy defined for this study. This means that the students lacked one of these literacies; media, visual, information, communication, computer or technology literacy depending on individual student's capabilities of using the digital technologies. The calculated mean showed that the participants had an average literacy of five, meaning that the freshmen were highly digitally literate. Another test carried out for this study was the Cronbach alpha test that had a result of 0.948, proving that the newly designed DLS used for this study had a high internal consistency and reliability. The DLS used for this study has redefined digital literacy through the association of the six components; media literacy, visual literacy, information literacy, communication literacy, computer literacy and technology literacy. The aforementioned components seem to be most appropriate for an educational setting and give a broader perspective on the digital literacy of the students.

The concept of digital literacy will continue to evolve with the growing use of digital technologies; hence, individuals need to attain the appropriate skills for their survival in this digital society. Therefore, it is recommended that the individual literacies identified in this study should be made aware to the people so that they can also be trained to use the new technologies of this digital society. This study also suggests that students need to be aware of the different literacies associated with digital literacy so that effective and efficient use of the new digital tools and technologies can be carried out.

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