DOES IT MATTER IF A FIRST YEAR PROGRAMMING STUDENT IS DIGITALLY LITERATE? THE EFFECT OF DIGITAL LITERACY ON A STUDENT'S PERFORMANCE IN COMPUTER PROGRAMMING

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Abstract

Information Technology is an increasing part of our everyday lives, and it is not uncommon to see students at a university walking around with smartphones, iPad's and laptops. These days', students are perceived to be digitally literate when starting their first year of studies. This, however, may not necessarily be true. This study is twofold: firstly, we examine the digital literacy level of the first year students at a South African university who are enrolled for a computer programming course; and secondly, we determine whether these students' digital literacy level has an impact on their programming ability. A quantitative approach was taken with a closed ended questionnaire used to collect data. The data that were collected were (a) analysed according to the students' access to and use of technology and (b) brought in relation to the students' final mark for their computer programming module. The results showed that there was a significant but weak positive correlation between (a) a student's computer experience and (b) use of common applications and their computer programming mark. However, the other four factors of use identified do not correlate significantly.

Keywords: digital literacy; computer programming; access to technology; use of technology; first year students

Introduction

People who embrace information and communication technologies (ICT), in particular the use of mobile phones and social media technology, possess a certain level of digital literacy. Digital literacy can be defined as "the interest, attitude and ability of individuals to appropriately use digital technology and communication tools to access, manage, integrate, analyze and evaluate information, construct new knowledge, create and communicate with others in order to participate effectively in society" (British Columbia Ministry of Education, 2013, para.3). People who are digitally literate are able to use desktop computers, laptops and mobile technologies for texting, searching the Internet, and downloading music and video files. They are part of online communities and able to use social media networks such as Facebook and twitter to communicate with friends and families as well as access services (Ng, 2012).

Digital literacy has several dimensions to it (Ng, 2012), namely; technical, cognitive and social-emotional. In the *technical dimension*, people have the

technical and operational skills to use technology to either learn or to perform their everyday life tasks (Host'ovecky & Stubna, 2012). A digitally literate person would be able to operate technologies such as downloading files, understanding storage, installing software, etc. An example of a technical dimension would be connecting a computer to a printer. The *cognitive dimension* is associated with a person's ability to think critically, essential in computer programming. A digitally literate person would, for example, be able to evaluate and select appropriate software programs to learn with or to do a specific task. The *social-emotional dimension* of digital literacy focuses on people who use technology simply to socialize with others through the use of the Internet. They purely use digital technology to interact/communicate with other individuals through applications such as Facebook, Skype, MXIT, WhatsApp, Instagram, etc. (Paolini, Fiore, Contursi, & Bramani, 2006). Therefore, being digitally literate requires the development of a set of key skills that are technical, cognitive and social-emotional.

It is thus presumed that students when entering an Information Technology course at a tertiary institution know how to work with a computer and to surf on the Internet (Verhoeven, Heerwegh, & De Wit, 2010). In South Africa where this study was conducted, research suggests that this assumption may not be accurate (Thinyane, 2010). In 2013 the *Daily Maverick* (Davis, 2013) reported that out of 25 000 South African schools, 19,037 did not have a computer centre (76%). South Africa also has a relatively high proportion of households with no access to a computer (79%) (Statistics South Africa, 2012). Tertiary institutions today comprise a diverse student presence with a wide variety of digital literacy capabilities.

Context of the Study

This study is twofold: firstly, we examine the digital literacy level of the first year students studying the National Diploma Business Information Technology at the University of Johannesburg for the year 2014; and secondly, we determine whether these students' digital literacy level has an impact on their programming ability. A quantitative approach was taken with a closed ended questionnaire used to collect data from 116 first year computer programming students studying the National Diploma Business Information Technology at the University of Johannesburg. The data that were collected were (a) analysed according to the students' computer experience and use of technology and (b) brought in relation to the students' final mark for their computer programming module for semester 1.

Data Gathering Methods

Ethics approval for the research was obtained prior to the administration of the research instrument, which consisted of a questionnaire. The questionnaire was approved by a statistician at the University of Johannesburg and piloted on a group of 5 computer programming students. The questionnaire was administered in the first week of lectures for the year 2014. The first section of the questionnaire consisted of basic demographical questions, and the second section related to the students experience with and use of technology.

In order to determine how much computer experience a student had, they were asked about their experience with computers as shown in Table 1.

Table 1

How Much Experience Do You Have with Computers?

1. I used computers for the first time at university
2. 1 to 2 years
3. Since High School days
4. Since Primary School days
5. I used computers before I even started school

The questions in the second section were adopted from Kennedy, Judd, Churchward, Gray, & Krause (2008). There was a common set of a 5-point scale of AN=almost never true for me; S=sometimes true for me; HT=true for me about half of the time; O=often true for me; AA = almost always true for me; NA=I cannot respond to the statement/I don't understand the statement. The statements are shown in Table 2.

Table 2

Statements Investigating Students' Use of Technology Before Enrolling at University

Use of Technology Before You Enrolled at University
1. I used a computer in the home where I grew up
2. I used the Internet in the home where I grew up
3. I used a computer in the computer centre at school
4. I used the Internet on a computer at school
5. I used Internet Messaging (IM) like Yahoo/Windows Messenger or Mxit
6. I used search engines to search for information
7. I used the web for playing games
8. I accessed educational websites to learn more about my subjects
9. I used the web for banking, online ticketing, and other similar services
10. I used a web-based email account to send or receive email
11. I used the web to make phone calls (e.g. Skype)
12. I made use of cloud-based services like Google Drive, or Drop Box
13. I used a gaming console like Xbox, Playstation or Wii when I grew up
14. I used tools like MS Word, MS Excel or MS Publisher
15. I used computer-based music players (e.g. Winamp, Media Player, etc)
16. My teachers made use of computers to create learning materials
17. I used computers during classes to learn in my subjects
18. My teachers required that I use a computer for homework
19. I made use of Torrent services
20. I built websites
21. I had my own blog
22. I tried to have the latest version of a software programme
23. I tried to have the best hardware that I could afford

Data Analysis and Results

SPSS software was used to analyse the quantitative data. In order to determine how much computer experience students had, their answers to the questions in Table 1 were compared to their programming marks. The results show that there was a significant but weak positive correlation with a student's computer experience and programming mark, $r = .221$, $n = 114$, $p<0.05$. Interestingly, 16% of students used a computer for the first time at university and 15% only had 1 to 2 years' experience before embarking on their studies.

Table 3

Student's Computer Experience

How Much Experience Do You Have With Computers?		Frequency	Valid Percent
Valid	I used computers for the first time at university	19	16.7
	1 to 2 years	18	15.8
	Since High School days	24	21.1
	Since Primary School days	38	33.3
	I used computers before I even started school	15	13.2
	Total	114	100.0
Missing	System	2	
Total		116	

The students were then asked to indicate how often they used certain forms of technology by answering 23 related statements on a Likert scale as shown in Table 2. In order to reduce the 23 statements, five factors were identified. Factor 1 grouped commonly used applications such as MS Word, playing music, software, hardware and IM. Factor 2 grouped educational related uses such as Internet at school, computers at school, accessing of teachers' learning materials, and access in the classroom. Factor 3 grouped less common uses such as Skype, torrents, cloud-based services and banking. Factor 4 grouped web-based uses such as email, search engines, and educational websites and Factor 5 grouped creative uses such as having own blogs, building websites and playing games (see Table 4).

Table 4

Computer Use Factors

Computer Use Factor	Uses
Factor 1: Commonly used applications	in home, MS Word, music playing, gaming console, latest software, best hardware, IM
Factor 2: Education-related uses	Internet at school, computer at school, teachers learning materials, during classes to learn subjects
Factor 3: Less common uses	cloud-based services, teachers required use for homework, banking, torrent, skype
Factor 4: Web-based uses	email, search engines, educational websites
Factor 5: Creative uses	own blog, building websites, playing games

The results show that there was a significant but weak positive correlation with Factor 1 (commonly used applications) and the student's programming mark (see Table 5).

Table 5

Correlations

Correlations		
Factors		**Development Software Exam Mark**
Q20 How much experience do you have with computers?	Pearson Correlation	.221
	Sig. (2-tailed)	.018
	N	114
Computer use factor1: Common uses: in home, MS Word, music playing, gaming console, latest software, best hardware, IM	Pearson Correlation	.218
	Sig. (2-tailed)	.019
	N	115
Computer use factor 2: School use: internet at school, computer at school, teachers learning materials, during classes to learn subjects	Pearson Correlation	.099
	Sig. (2-tailed)	.293
	N	115
Computer use factor 3: Rarer uses: cloud-based services, teachers required use for homework, banking, Torrent, Skype	Pearson Correlation	.051
	Sig. (2-tailed)	.588
	N	115
Computer use factor 4: Web-based uses: email, search engines, educational websites	Pearson Correlation	.175
	Sig. (2-tailed)	.062
	N	115
Computer use factor 5: Creative use: own blog, building websites, playing games	Pearson Correlation	.141
	Sig. (2-tailed)	.135
	N	113

The other four factors of use do not correlate significantly. Interestingly, the statement "playing music" has the highest correlation with a student's programming mark (p=.000) as shown in Table 6.

Table 6

Q2.15 I Used Computer-Based Music Players Correlated with Computer Programming Mark.

Q2.15 I used computer-based music players (e.g., Winamp, Media Player, etc)	Pearson Correlation	.357
	Sig. (2-tailed)	.000
	N	113

Conclusions

In South Africa, we are becoming more digitally literate as technology evolves. This research has shown that the majority of students that choose to study the National Diploma Business Information Technology at the University of Johannesburg, have already had some level of interaction with

technology. The results showed that there was a significant but weak positive correlation between (a) a student's computer experience and (b) use of common applications and the student's computer programming mark. However, the other four factors of use identified do not correlate significantly.

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