

CORRELATING PERFORMANCE AND DIGITAL LEARNING HABITS IN A HIGHER-EDUCATION INSTITUTION

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ABSTRACT – This paper describes the correlation between the digital learning habits of first-year students and their performance in university courses. The research was undertaken at an university in Johannesburg, South Africa. The institution recruits students based on their academic performance in high school. To incentivise students to enrol at the institution, they are offered a number of benefits, for example guaranteed acceptance for their programme of choice, merit bursaries, exemption from registration fees, and a R2000 voucher for books. . The research population comprised the entire cohort of students who were recruited (N = 317), representing 3% of the total enrolment of approximately 10500 first year students in 2016. ‘Total-sampling’ targeted all the students. We interrogated relevant literature to deconstruct the concept ‘digital learning habits’, and selected the following theoretical dimensions to be included in the instrument: pre-entry attributes (digital-device ownership, experience in using digital devices, and educational use of digital technologies), 21st Century skills, current use of digital devices for academic purposes, self-direction, and collaboration and connection. Using these dimensions, items were developed to which Likert-type responses were required. The instrument was developed using Google Forms and deployed online. An exploratory factor analysis (EFA) was performed on the data to determine the validity of the underlying dimensions, and seven factors were extracted. The Cronbach alpha measure of the dimensions was mostly found to be higher than 0.9. The correlation between the extracted factors and academic performance was computed using Pearson’s product-moment correlation coefficient. The results of the analyses showed weak or moderate correlations between the dimensions of the construct and performance, and only in one instance was a correlation significant at the 0.05-level. Some factors were negatively correlated with performance. The research shows that high-performing students in this context do not significantly use digital tools for learning, although they remained to be high performers. The limitation of the research is that data were not collected from students who were not beneficiaries of the incentives programme. In future research, it is recommended that the sampling base be expanded. Due to the reported benefits of learning with technology in the literature, it is recommended that design-based research methodologies be employed to develop a programme that will engender the use of digital learning habits.

Keywords: Digital learning habits; 21st Century Learning; Student performance

1. INTRODUCTION

Increasingly, universities are making use of online learning methodologies to support their academic offerings. Typically, this is referred to as *Blended Learning*. However, the proliferation of online learning at Higher Education Institutions (HEIs) raises some questions about the effect of ICTs on the academic performance of students. Firstly, the question arises whether students, especially in the South African context where many school leavers matriculate without digital skills, possess the necessary digital skills to maximise learning using that modality. Secondly, it needs to be noted that the literature is inconclusive about the extent to which the use of ICTs benefits learning. Higgins (2003) reviewed 200 reports on the effectiveness of digital technologies to improve learning performance. He reported that digital technologies have a modest effect on learning, especially when compared to other pedagogical interventions like study skills development, or the development of metacognitive skills. Conversely, Bilbao-Osorio & Pedró (2009) and Voogt, Knezek, Cox, Knezek and Ten Brummelhuis (2013) found that student performance can be advanced by digital technologies (2009).

A scan of the extant literature that specifically addressed the relationship between the use of DL and student performance, yielded the results displayed in Table 1:

Table 1: Previous research correlating the use of digital technology with performance

AUTHOR/s	TITLE	TOPIC
Youssef Dahmani (2008)	The Impact of ICT on Student Performance in Higher Education: Direct Effects, Indirect Effects and Organisational Change	“... to examine the relationship between the use of information and communication technologies (ICT) and student performance in higher education.”
Aristovnik (2012)	The Impact of ICT On Educational Performance and Its Efficiency In Selected EU And OECD Countries: A Non-Parametric Analysis	“... to review some previous research examining ICT efficiency and the impact of ICT on educational output/outcome as well as different conceptual and methodological issues related to performance measurement.”
Spiezia (2011)	Does Computer Use Increase Educational Achievements? Student-level Evidence from PISA	“... to assess whether the use of ICT has an impact on student performances as measured in the OECD Programme for International Student Assessment (PISA) 2006.”

The research problems that we explore in this paper is firstly to determine whether the pre-entry digital skills of the students can be correlated to their use of digital tools for learning, and secondly whether their use of digital tools can be related to their performance in the assessment tasks that they completed in the first semester.

2. LITERATURE REVIEW

In this section, we briefly describe the concepts *digital literacy*, *21st century learning*, and *digital learning habits*.

2.1 Digital Literacy and 21st Century Learning

The term Digital Literacy was first coined by Gilster (2007:1), who defined it as “the ability to understand and use information in multiple formats from a wide range of sources when it is presented via computers”. Subsequently, a number of authors attempted defining the terms, each adding further texture the understanding of the term. For example, the Digital Task Force to the American Library Association, elaborated on Gilster’s “use of information” by specifying that finding, evaluating, creating, and communicating information are other dimensions of DL. (Lyons, 2013). Sarkar (2012) and George (2015) emphasise that DL also refers to the multiplicity of “technological gear and resources”, and further states that these are used to also “generate, distribute, collect and administer” information. It is clear from the brief description of DL that the traditional understanding of “literacy” needs to be transcended and that literacy does not only refer to the passive ability to absorb and understand information. Lately, this view of literacy is recently best exemplified by the concept “21st Century Learning”.

The kinds of learning that are required in the 21st century needs a paradigm shift from what traditional pedagogies espouse. Dede noted that “educational systems must transform their objectives, curricula, pedagogies, and assessments to help all students attain the sophisticated outcomes requisite for a prosperous, attractive lifestyle based on effective contributions in work and citizenship” (2007, p. 3).

In this paper, we selected one dimension of the 21st Century construct as it is defined by the P21.org organization (P21. Partnership for 21st century learning., 2015). We specifically focused on the dimension ‘learning and innovation skills’, which sets outcomes that aim to equip students to deal with an increasingly complex work and personal life. These skills, also known as the “4 C’s” include:

- Creativity and Innovation skills. Students need to have the ability to engender and refine solutions to various complex problems or tasks, and present the new ways which they have learned to solve such problem.

- **Critical Thinking and Problem Solving skills.** This refers to students' ability to not only analyze complex problems, but to investigate questions for which there are no obvious answers, evaluate different viewpoints, and draw present appropriate conclusions based on evidence and reasoning.
- **Communication skills.** Students are required to have the ability to shape their thoughts, information and results clearly using a variety of media, orally and on a variety of communication platforms - oral, written and non-verbal, in a variety of contexts; listen effectively to decode meaning, including knowledge, values, attitudes and intentions; and communicate for a variety of purposes (Pacific Policy Research Center, 2010).
- **Collaboration skills.** This refers to students' ability to work with others in order to solve problems, to accomplish certain goals and collectively assume responsibility for completing tasks.

In addition, in 21st Century Learning, Ravitz (2014) explains that the following skills are developed:

- **Self-Direction.** This refers to students taking responsibility for their learning by maximally using opportunities for learning, and to being able to self-assess their learning.
- **Global Connections.** This refers to students' ability to maintain an awareness and understanding of global, geographical and political issues, as well as developing an awareness of culture, language, history, and literature outside their local contexts. It further develops respect for individuals from diverse cultures, religions, ideologies, and lifestyles in an environment of openness and mutual respect (Pacific Policy Research Center, 2010).
- **Local Connections.** This refers to students' insight to apply what they have learned to their own contexts, as well as other local contexts and communities.
- **Using Technology as a tool for learning.** This refers to students' ability to channel their own learning by selecting appropriate information and communication technologies.

In our determination of the digital learning habits of the students, we explored their use of digital tools using the constructs associated with 21st Century learning as conceptual frame.

2.2. Digital learning habits

In a recent report commissioned by McGraw-Hill, 84% of the 3300 students surveyed believed that digital learning technology has positively impacted their education. 81% of these students believed that their learning efficiency has improved and that their performance improved as a consequence of digital learning technologies.

Mobile technologies are a key enabler of the changing digital learning habits of students. According to the 2015 Digital Trends in Higher Education report (<https://www.mheducation.com/blog/thought-leadership/four-reasons-why-digital-learning-will-surge-in-2016.html>), 85% of students report that they use mobile devices to study, 77% claim that adaptive technologies helped them to improve their performance, 62% say that technology supports them to be better prepared for classes, 80% believe that their employment prospects are improved as a consequence of technology, and 48% say that technology helps them to save time.

It is clear that there is an upsurge the use of digital technologies for learning. The institutional policies of the institution where this research was undertaken, strongly advocates for the use of digital technologies in teaching and learning, and it is therefore inevitable that the students who were the respondents in this research would be required to use these tools in the course of their learning. We were particularly interested in how they were using these tools, and whether this use could be correlated to their performance. Hence, we developed an survey instrument to determine this.

3. METHOD

The research project was conducted as survey, using a questionnaire as the primary research instrument. The target population comprised the entire cohort of students who were beneficiaries of an incentives campaign (N = 317) at an university in Johannesburg, South Africa, selected due to their good performance at school. The research population represents a mere 3% of the total enrolment of approximately 10500 first year students at the institution in 2016. 'Total-sampling' (also known as 'census-sampling') targeted each of the 317 students.

We interrogated relevant literature to deconstruct the concept 'digital learning habits', and selected the following theoretical dimensions to be included in the instrument: pre-entry attributes (digital-device ownership, experience in using digital devices, and educational use of digital technologies), 21st Century skills, current use of digital devices for academic purposes, self-direction, and collaboration and connection. Using these dimensions, items were developed to which Likert-type responses were required. The questionnaire was piloted among a sub-set of students, and some amendments were made. The instrument was developed using Google Forms and deployed online. Students were invited by email to complete the questionnaire. The response rate was 29.6% (n = 94). In addition, student performance in first-semester summative assessment tasks for each module were obtained from the institutional database systems.

An exploratory factor analysis (EFA) was performed on the data to determine the validity of the underlying dimensions. The correlation matrix showed the majority of the coefficients to be larger than .3 in magnitude, suggesting that the EFA would be appropriate. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) was .729, well above the commonly accepted value of .6, and Bartlett's test of sphericity was significant ($\chi^2 = 792.59$ (276), $p < .000$). Using Principal Axis Factoring as extraction method, and after examining the scree plot, seven factors were extracted. The Cronbach alpha measure was used to assess the internal validity of the dimensions, and was mostly found to be higher than 0.9. The correlation between each of the extracted factors and academic performance, calculated as the final average for all assessments, was computed using Pearson's product-moment correlation coefficient. In the correlational analysis, the mean performance of students was considered as the dependent variable (DV), and the various dimensions of 21st Century Learning were independent variables (IVs).

4. RESULTS

In this section, we briefly provide relevant descriptive and correlational results.

4.1 Student performance

The mean performance of all students (N=94) across all modules was 70.09% (SD= 11.31). This relatively high performance is aligned with the primary characteristic of the research population: students maintained the high performance that characterised their school years.

4.2 Dimensions of 21st Century Learning

Each of the dimensions of 21st Century Learning were represented by a number of items that measured student responses on a Likert-type scale ranging from 'Not true for me at all' to 'Very true for me'. No neutral option was given, and the midpoint for the scale lay between "somewhat untrue for me" and "somewhat true for me". Table 2 gives the results of this analysis.

Table 2: Descriptive statistics for 21st Century Learning

Dimension / Computed variables	N	Mean	Median	Std Deviation
Communication	94	3.18	3	1.24
Creativity	94	2.86	2.6	1.37
Self-direction	86	3.22	3.16	1.31
Global Connections	82	3.82	4	1.53
Local Connections	92	3.54	3.5	1.42

The results of the analysis show that the respondent students used digital tools in a very limited way in terms of the 21st Century Learning framework.

4.3 Correlational analysis: pre-entry attributes and performance

An exploratory factor analysis for the pre-entry attributes of the students yielded 9 factors. A Pearson product-moment correlation coefficient was computed to assess the relationship between each of the extracted factors and performance in Semester 1. The results of the analysis are given in Table 3.

Table 3: Correlational analysis: pre-entry attributes and performance

Factor	N	Cronbach alpha	Pearson's Correlation	Sig (2-tailed)
Factor 1: Experience using ICTs.	77	.810	.192	0.78
Factor 2: Experience using ICTs. Using cell phones	75	.707	-.073	.524
Factor 3: Experience using web services. BBM, Google search, web mail, WhatsApp, Messenger	78	.794	.143	.193
Factor 4: Experience using web services. Google groups, WeChat.	80	.721	-.309	.005
Factor 5: Experience using web services: factor 3: Instagram, Twitter, Facebook	80	.687	-.129	.239
Factor 6: Before entering university: Use educational websites, Internet at School, Computers at school.	85	.817	.041	.713
Factor 7: Before entering university. Built own web sites, want latest hardware, used torrent services, wanted latest software	83	.894	-.124	.260
Factor 8: Before entering university. Used gaming consoles; computer Home; use web financial services	84	.791	.205	.060
Factor 9: Maintained blog; web games; web for phone calls	84	.775	-.116	.290

It is clear from the data that the pre-entry attributes of the students could not be correlated with their performance. Only factor 4 ($r = .309$, $N = 80$, $p = .005$) had a moderate negative significant correlation with the performance of students.

4.4 Correlational analysis: digital learning habits and performance

An exploratory factor analysis of the items determining the digital learning habits of the students yielded 7 factors. A Pearson product-moment correlation coefficient was computed to assess the relationship between each of the extracted factors and performance in Semester 1. The results of the data are given in Table 4.

Table 4: Correlational analysis: digital learning habits and performance

Factor	N	Cronbach alpha	Pearson's Correlation	Sig (2-tailed)
Factor 1: Annotate & combine digital resources, integrate tools, search during classes, cloud services.	85	.797	.085	.442
Factor 2: Record, analyse, blog, maintain online ID.	85	.745	-.170	.120
Factor 3: Blackboard, , convert paper to electr media.	85	.614	.041	.708
Factor 4: Use social media, online videos.	85	.742	-.199	.068
Factor 5: Use online tools to establish credibility.	85	.614	.624	.624
Factor 6: Online communities, use digital mind-maps.	85	.723	-.166	.129
Factor 7: specific tools, self-direction & creativity.	83	.954	-.019	.865

It is clear from the data that the factors for digital learning habits could not be correlated with the performance of the students.

5. CONCLUSIONS

The findings of this study aligns with extant knowledge that the use of ICTs for learning have limited or no influence on performance. In this case, we have shown that this is certainly true for the sub-group high-performing students. We could find no positive, significant correlations between the variables. The results also showed that although this sub-group of students' 21st century digital skills were well established, it was not necessarily so that they were using these skills for learning. This study contributes to the body of knowledge relating to use of digital technologies for learning in higher education. It also may influence the practice of online learning design, as it appears the course designs do not require students to use dimensions of 21st Century Learning during learning design, and it stands to reason that there would be limited correlational relationships between the digital learning habits of students and their performance.

The limitation of the research is that data were not collected from students who were not beneficiaries of the incentives programme. In future research, it is recommended that the sampling base be expanded. Due to the reported benefits of learning with technology in the literature, it is recommended that design-based research methodologies be employed to develop a programme that will engender the use of digital learning habits.

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