

# Familiarity with Technology among First-Year Students in Rwandan Tertiary Education

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**Abstract:** The more the students get experienced with technologies, the more the need for tertiary education systems to adopt innovative pedagogical strategies for accommodating different learning needs. Depending on students' prior experience with computer-based tools, they may have different degrees of familiarity with new technologies. At University of Rwanda (UR), for example, the familiarity and experience with technology for incoming students is not clearly known. Universities need to understand this phenomenon for efficient education planning and management. Therefore, this study aims to understand the degree of familiarity with technology for first-year students at the University of Rwanda. Accessibility, ownership, usage and previous computer-based training are used in this study' conceptual framework as factors that determine the degree of familiarity with technology. Firstly, results indicate that the majority of participants are not familiar with technology and never had any previous exposure to eLearning systems. Secondly, regarding the digital tools, while smartphones are the most accessed, owned and used tools by respondents, they rarely or never used them for learning activities. Thirdly, findings portrayed a heterogeneous technology experience with a substantial variation of access, use, ownership and previous training on new technologies among the sample. Strategies for improving experience and confidence with technology, for first-year students, are recommended for this institution. This will prepare new students for early technology uptake and readiness while empowering them to develop appropriate competencies and skills for the digital age. Further studies in the area of experience with technology are also proposed.

**Keywords:** familiarity with technology, net generation, tertiary education, digital tools, digital skills, first-year students

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## 1. Introduction

Students' familiarity and experience of technology are different among first-year degree candidates in tertiary education due to several reasons (Kvavik 2005; Kennedy, Judd, Churchward, Gray and Krause 2008; Hargittai 2010; Thinyane 2010). Some factors of differences in ICT skills among students may include but not limited to early exposure to computers and other digital devices (Kennedy et al. 2008), the types of schools frequented before being admitted to universities, students' attitudes towards computers, students' degree of computer anxiety (Sun, Tsai, Finger, Chen and Yeh 2008), and the level of teachers' ICT competencies in previously attended primary and high schools.

Due to the advances in technology, computing became ubiquitous and today's young generation's life is embraced by the digital culture and environment with a remarkable increase in using computers and smartphones for different purposes. Scholars such as (Kennedy et al. 2008; Jones, Ramanau, Cross and Healing 2010) argue that the current generation of students are digital natives, though their skills are at different levels. The types of computer-based activities that students used to perform, contribute to the diversity of their skills. The same authors uphold that, since their childhood, these students were spending their most time using computers, mobile phones, and other available digital tools. By levels of experience with technology amongst students, this is described by the frequency of accessing and using digital devices. That means while students who were always using technology are strongly experienced, others who rarely got such an exposure have little or no experience with technology at all (Kvavik 2005; Oblinger and Oblinger 2005b; Kennedy et al. 2008; Bennet and Maton 2010; Thinyane 2010). Therefore, what can be noticed from the above literature is that it is broadly assumed that there is a diversity in technology experience among first-year students at universities.

From the education perspective, various e-learning platforms are being integrated to assist in education delivery (Hosein, Ramanau and Jones 2010). Hence, due to this trend, it has become a prerequisite to have a

certain degree of digital skills for learners and teachers in order to cope within the new learning environments (Ananiadou and Claro 2009; Hosein et al. 2010; Claro et al. 2012).

A particular level of familiarity with the current technology has a strong impact on students' attitude toward the use of new ICT tools available at universities (Kennedy et al. 2008; Mahmood 2009). Therefore, it is becoming more crucial for educators to know the level of incoming students' digital skills. This knowledge forms the base for informing policy-makers and the university planners to accommodate new students' learning needs by acquiring appropriate ICT infrastructure and providing a proper technical support to not only learners but also the faculty and administrators.

However, research on students' familiarity with technologies for first-year university students is still scarce especially in Rwanda and the East African region. This study aims to understand the level of familiarity with technology by first-year students in higher education considering the case of the University of Rwanda.

## **2. Study background**

Today, universities around the world are called to consider learners' categories of experience with technology when attempting to integrate information and communication technology (ICT) in pedagogical activities. A study by (Querios and de Villiers 2016) anticipated that universities, in developing countries particularly, should consider their students' perceptions, attitudes and situations before shifting to online learning. This means that there is a need to pave the way to accommodate both computer-savvy and underprivileged learners with low digital literacy in university policies.

As students are considered as the core stakeholders in the current advocated active learning or student-centered teaching approach (Richardson and Newby 2006; Beetham and Sharpe 2013), it is crucial to get a rich picture of their previous ICT experiences. Hence, universities' pedagogy and curricula must be systematically revised to meet different learning preferences (Oblinger and Oblinger 2005b; Owston 2007). In this regard, the knowledge about incoming students' experience with technology is paramount for faculty, administrators, and other educational stakeholders.

Most scholars that explored first-year students' familiarity and experience with technologies, focused on developed countries (Kennedy et al. 2008; Nagler and Ebner 2009; Hosein et al. 2010; Jones et al. 2010; Margaryan, Littlejohn and Vojt 2011; Ng 2012). In general, findings from these scholars reveal that although many students from the sampled countries are tech-savvy, their preferences and experience with technology are highly heterogeneous. This considerable variation is linked to the patterns of ownership, accessibility, and use of computer-based tools and Internet during students early age. Another study conducted in America by (Kvavik 2005) depicted also that, although the surveyed sample of students self-reported the highest levels of computer skills, their level of IT competency in support of learning and problem solving was found very low. This author recommended a change in the curricula so that necessary digital skills for learners to cope with the current technology can be acquired during their early exposure to the university's learning environment.

Some other few studies in Sub-Saharan Africa attempted to study on students' use of ICT for learning purposes ( Arif 2001; Ajiboye and Tella 2007; Czerniewicz and Brown 2009) and others for technology acceptance towards learning management systems (Abdel-Wahab 2008; Tagoe 2012). Nevertheless, their focus was not on IT experience of first-year university students. Another study that was interested in this category of students was conducted by (Thinyane 2010) to understand South African first-year students' use and experience with technology. This study portrayed a considerable variation in accessing and using technology before enrolling at university and mobile phones as the vastly accessible and mostly used digital tools. However, this study sample was only composed of South African students and thus, it is difficult to generalize these findings to many other developing countries in Africa, because the latter do not share the same technology trend with South African education systems.

Reading from the above literature, one can realize that there is a universal assumption that the current incoming students at a university have had a great exposure to digital tools. Unfortunately, this may not be the case especially in developing countries such as Rwanda. Although there are some government initiatives to introduce computers in primary and secondary schools in Rwanda, there has been no equal distribution in both public and private schools. Additionally, due to limited financial resources, only a small number students

can afford to buy smartphones and personal computers. Those are some of the reasons it could be assumed that several Rwandan incoming students get access to computers for the first time when they join the university. Thus, this has to be empirically validated.

Broadly, higher education systems from around the world are aspired by the integration of technology in the classroom (Kennedy et al. 2008; Thinyane 2010). Thus, this has to be aligned with the diversity of students' familiarity with technology and their digital skills. Particularly in Rwanda, understanding the incoming students' mixture of information literacy levels can enable the hosting universities to reduce the existing digital divide among students.

Noting that few empirical research has been done in Sub-Saharan Africa and probably none attempted to investigate the access and use of technology for incoming students at universities in Rwanda, a typical study can be important to provide a frame of reference in modernizing pedagogy through the integration of appropriate information technologies at this university or similar contexts. This study aim has been to empirically understand the familiarity with technology for first-year students at UR with the following research questions: (1) To what extent do first-year university students owned, accessed and used a range of digital tools? (2) What activities do these students perform with these digital tools? (3) Did these students get any previous computer-based training? (4) What is their level of confidence in using a range of digital tools?

### **3. Familiarity with Technology: A Conceptual Framework**

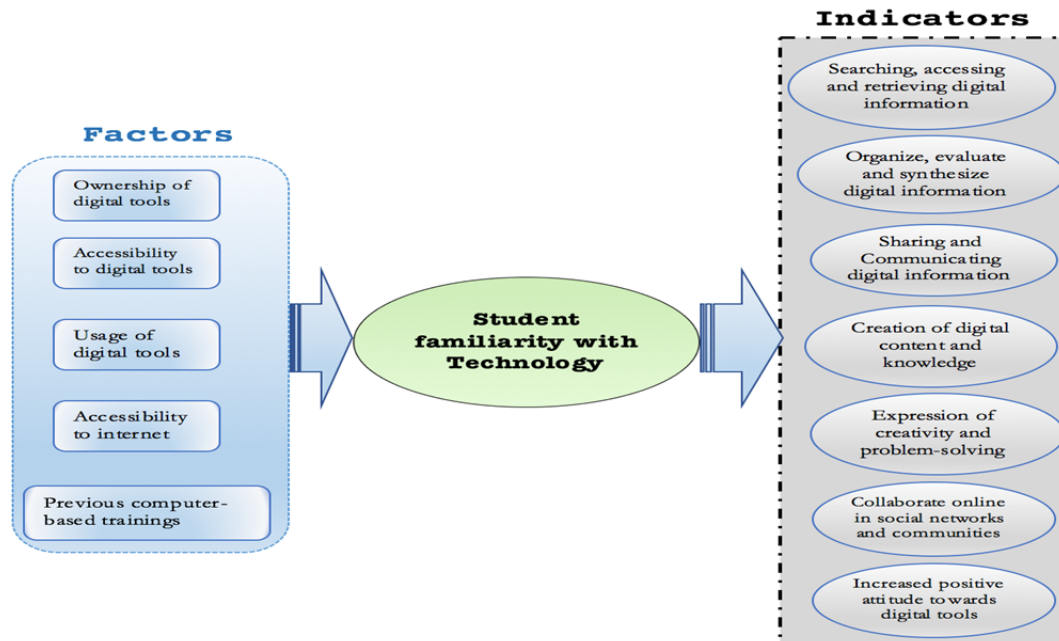
Today, teaching and learning are going either blended or fully digital. Familiarity with today's advances in technology has become a requirement for students in the current higher education settings. The degree of familiarity can be determined by the extent to which students are competent and able to use a range of existing digital tools and web-based platforms to perform different computer-based activities (Kennedy et al. 2008; Ng 2012). People become digitally literate when they have acquired a particular degree of the knowledge, attitudes, and skills that enable them to use the Internet and the associated set of technologies. Also, called digital natives are individuals who can easily understand the digital media and can manage digital information or work easily in a digital environment. As tertiary education systems are going digital, this implies that new students should be able to use different digital media tools and online learning management systems, search for online information, process digital data and be able to critically analyse data in a digital environment.

The concepts of familiarity with technology, digital competence, digital proficiency, technology confidence, digital ability and digital literacy are used interchangeably when measuring and assessing individual knowledge in regard to new technologies (Martin and Madigan 2006; Calvani, Cartelli, Fini and Ranieri 2009; Sefton-Green, Nixon and Erstad 2009; Ferrari, Punie and Redecker 2012; Littlejohn, Beetham and McGill 2012). A report by (Ferrari 2012) from the European Commission presented an inclusive definition of digital competence after reviewing a range of related frameworks and concepts. He then summarizes that:

..... Digital Competence is the set of knowledge, skills, attitudes (thus including abilities, strategies, values, and awareness) that are required when using ICT and digital media to perform tasks; solve problems; communicate; manage information; collaborate; create and share content; and build knowledge effectively, efficiently, appropriately, critically, creatively, autonomously, flexibly, ethically, reflectively for work, leisure, participation, learning, socializing, consuming, and empowerment. (Ferrari 2012, p. 43)

The overall consideration of these concepts is related to values, knowledge, and skills that determine an individual's experience or proficiency in a particular technology. Although most of the current incoming students at universities are commonly described as tech-savvy, internet-savvy or computer-savvy (Combes 2006; Bennet and Maton 2010), there is still no guarantee that they all have adequate skills to cope with the current digital learning environment (Kennedy et al. 2008; Helsper and Eynon 2010). In this study, students' familiarity with technology refers to the degree of experience and ability to use digital tools. These tools include but not limited to smartphones, computers, and tablets. The ability to use these digital tools and applications for manipulating digital information is also considered as an indicator of familiarity with technology. Thus, students with ownership, access, use and ability to efficiently deal with digital information can then be described as the Net Generation learners (Dorman 2000; Oblinger and Oblinger 2005a; Barnes,

Marateo and Ferris 2007). Other scholars such as (Tapscott 1998; Prensky 2006; Bennet and Maton 2010) describe them as socially inclusive learners. Therefore, by reviewing the above literature, a conceptual framework, to analyse students' familiarity and experience of technology, has been proposed as illustrated in figure 1.



**Figure 1:** A conceptual framework for student familiarity with technologies

The development of this analysis framework considered the existing literature related to digital natives and tech-savvy learners. This includes but is not limited to ICT competencies, digital skills, digital literacy, ICT proficiency, ubiquitous computing and experience with technology (Tapscott 1998; Oblinger and Oblinger 2005a; Kennedy et al. 2008; Ng 2012; Santos, Azevedo and Pedro 2013). This framework is first used to map some factors that affect familiarity with technologies for today's first-year students in tertiary educational institutions, irrespective of their study programs. In addition, some indicators for technology familiarity and experience are also proposed as a basis for analysing students' digital skills.

The framework is composed of two main clusters namely factors and competencies or indicators. The most identified relevant factors of student's familiarity with technology in the explored literature include ownership, accessibility and usage of digital tools, access and use of the Internet or web-based technologies; and previous computer-based training. These components are also considered as prerequisite and primary triggers for an individual to be familiar with a particular technology.

The second category includes various effects of being acquainted with technology. In other words, it encompasses a set of tech-savvy students' competencies (Oblinger and Oblinger 2005a; Feiertag and Berge 2008). These include capabilities to collaborate in online social networks and communities, to search, access and retrieve digital information, to organize, evaluate and synthesize digital information, to communicate or report information using digital tools, to create digital content and express creative knowledge and problem-solving skills using digital tools. More specifically, both factors and indicators that are used to conceptualize the framework are mostly related to the early exposure to technology by students before enrolling in higher education programmes. Both factors and indicators of the framework served as the basis to formulate the research questionnaire that was used in this study.

## 4. Research Method

### 4.1 Instrument and procedure

Due to the study limited time and the types of data to collect, a survey was used as a research strategy (Denscombe 2010) to gather factual information from students. With this strategy, web-based and paper-based questionnaires, with a mix of closed and open-ended questions (Denscombe 2010; Cohen, Manion and Morrison 2013) were developed and distributed to the sample of first-year students. Based on the survey instruments used by (Kennedy et al. 2008) and (Thinyane 2010), a questionnaire was developed to evaluate the degree of ownership, access use and previous experience with technology for first-year students. This instrument was composed of three main sections: participants' demographic information; ownership, access and use of computing tools and the Internet; and the level of confidence with technology and previous computer-based training to acquire digital skills.

An authorization for conducting this study was obtained from the Directorate of research and postgraduate studies at the university, prior to the administration of the questionnaire. Prior to distributing the questionnaire, it was tested and validated by four instructors with strong experience in educational technology and eLearning systems. Additionally, two lecturers with expertise in computer and systems sciences also reviewed it. All their comments and suggestions were highly considered in designing the final version of the questionnaire. Accordingly, the System Administrator at university assisted in creating and validating the web-based questionnaire version.

The data were collected during registration and orientation periods from September to October 2015. The online version of the questionnaire was created and its link was embedded in the university's online registration platform. Students were directed to the questionnaire link after the registration process is completed. Using two research assistants, paper-based questionnaires were also administered face-to-face to students via the academic registrar's offices at each college. In addition, with the assistance of Class representatives and Heads of Departments, the same questionnaire was distributed in classes of first-year students. Prior to launching the questionnaire, all participants were clearly informed through an introductory letter, that the participation in the research was voluntary and that the collected information will be kept confidential.

The collected valid data were analysed using two computer-based statistical packages (Muijs 2010). First, both paper-based and online data were entered in SPSS, a quantitative analysis software, before being analysed for determining the frequencies of students' ownership, access and use of technology; and their level of digital skills. Secondly, for data visualization, tables and figures were created using Microsoft Excel. This visualization was important to highlight the disparities and similarities of students' familiarity factors and indicators of their digital skills level as illustrated in the conceptual framework used for this study (See figure 1).

### 4.2 Participants

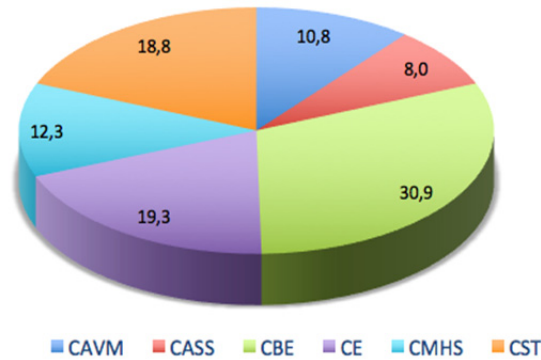
This study is limited to first-year students at University of Rwanda for the academic year 2015-2016. In total, a random sample of 576 students completed successfully the questionnaire used in this research. While 286 used the online questionnaire, 290 used a paper-based questionnaire. Among the total sample, 381 (66.14%) are males while 195 (33.85%) are females. The majority of participants' age is between 18 and 25 years old, which is equivalent to 526 students (91.3%). Students who participated in this study were from different previous study backgrounds. This information is presented in Table 1 in line with their secondary school majors.

**Table 1:** *Students' major categories*

	N/A	Non-STEM	STEM	TVET	Education	Total
Numbers	8	233	287	28	20	576
Percentage	1.4	40.5	49.8	4.9	3.5	100

As it can be observed from the Table 1, students that composed the sample for this study represented four main secondary school majors. The latter include (STEM) Science, Technology, Engineering and Medicine (40.5%), Non-STEM (49.8%), (TVET) Technical and Vocational Education Training (4.9%) and Education (3.5%). All the six colleges of the University of Rwanda are represented in the sample with the following proportions: College of Business and Economics (30.90%), College of Education (19.27%), College of Science and Technology (18.75%), College of Medicine and Health Sciences (12.33%), College of Agriculture and Veterinary Medicine (10.76%) and College of Arts and Social Sciences (7.99%). Figure 2 illustrates this distribution.

**Distribution of respondents by college (in percentage)**

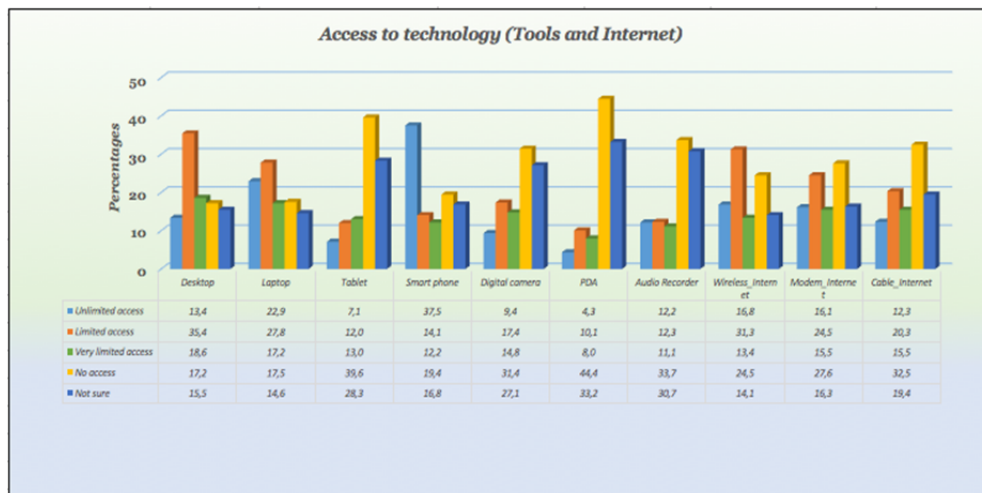


**Figure 2:** Respondents by college

## 5. Results

### 5.1 Access to digital tools

In line with the theoretical framework adopted for this study, respondents were asked to report about their access to a range of mostly available digital tools and the Internet. A unipolar rating scale was used from “Unlimited Access” to “No Access”. Those who have missing data for this variable of accessibility, were classified as “Not Sure”. In order to facilitate data interpretation for an easier understanding, respondents who reported having limited and very limited access to the proposed digital tools and Internet are categorized as “Limited Access”. Those who reported that they have no access and not sure are also combined to form one single category called “No Access”.



**Figure 3:** Students’ accessibility to technology

As it can be observed from Figure 3, the degree of access to both digital tools and the Internet is proportionally low among respondents. This is explained by the fact that the majority of respondents have a limited access (54%) and no access (32.7%) on desktop computers. The same situation is observed on laptop computers as (45%) of respondents have a limited access and (32.1%) have completely no access. Further analysis shows



also a high proportion of students with limited access (25% and 32.2%) and no access (67.9% and 58.5%) to tablet and digital Camera respectively. Not surprisingly, results indicate a slight increase of students with unlimited access (37.5%) to smartphones but still, the same data show that the remaining subsets have a limited or no access to mobile phones with a total of (62.5%) of respondents. Another observed trend is that smartphones are the highly accessed tools when compared with other proposed tools. In the same Figure 3, data indicate that the majority of respondents in this study do not have access to PDA (77.6%) and Audio Recorder (64.41%) respectively.

Nevertheless, on the accessibility to the Internet, related data indicate a similar trend as for digital tools in regard to the proposed types of the Internet access. For the wireless network, while 44.7% of respondents have a limited access and 38.6% with no access at all, only 16.8 % of the sample reported having unlimited access. Adding to that, only 12.3% of students reported having access to cable network while the rest of the sample have either limited (35.8%) or no access (51.9%) correspondingly. For the Internet modem, only 16.1% of respondents reported having unrestricted access while the majority of them have a very restricted (39.8%) or no access (43.92%) to this type of Internet network. Overall, the statistics reported in Figure 3 portray a significant heterogeneity among respondents' access to technology and a substantial number of students with limited or no access to the proposed digital tools and Internet.

### 5.2 Ownership of digital tools

In this study, respondents were also asked about which tools they own. Seven commonly computer-based tools that are especially used by students for different learning activities. The findings are presented in Figure 4.

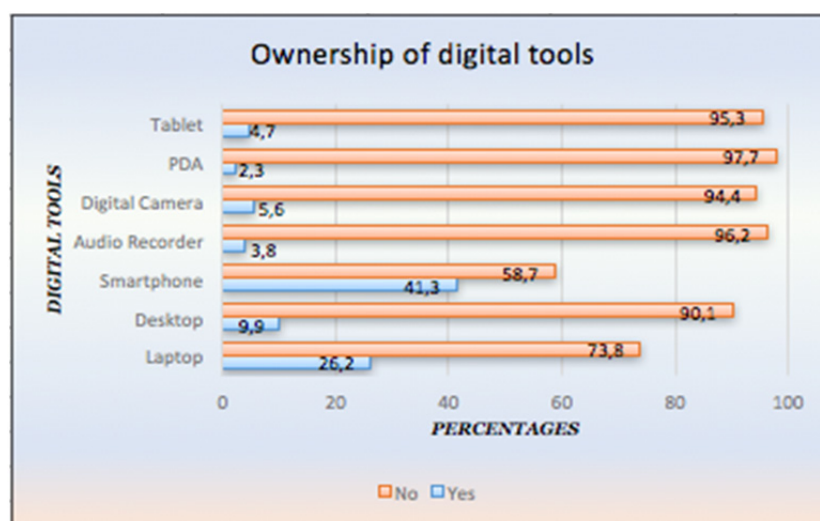


Figure 4: Ownership of Digital tools

As illustrated in Figure 4, smartphones are the most owned digital tools by 41.32% of respondents although still, a large proportion of them do not own this gadget (58.7%). Additional analysis shows that, while only 26.2% of respondents have their own laptops, the remaining six proposed digital tools are slightly owned by less than 10% of students who participated in this study.

### 5.3 Frequency of using digital tools

The access and ownership of digital tools and Internet do not necessarily mean that an individual is familiar with technology. Thus, the level of using these tools has a huge impact on the degree of familiarity with a range of technologies. This study was also interested in understanding how frequent students have been using digital tools. Participants were asked to rank their frequency of using digital tools as follow: Always, Sometimes, Often, Rarely and Never. Figure 5 presents the results of students' frequency of using the seven proposed digital tools in this study.

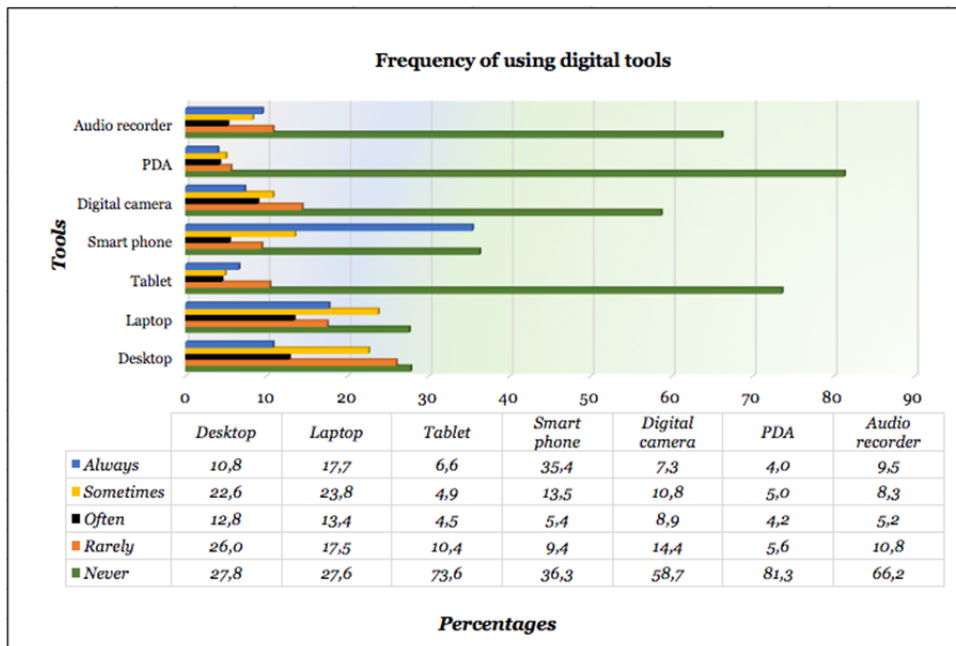


Figure 5: Frequency of using digital tools

As it can be seen from Figure 5, smartphones are the most frequently used tools by 35.4% of the surveyed students although this number is still not substantial. The same data show a slight number of students who frequently used desktops (10.8%) and laptops (17.7%). While respondents rarely (26%) or never (27.8%) used desktop computers, the same trend is also observed for laptop computers which were also rarely or never used by (17.5%) and (27.6%) correspondingly. Other tools such as tablets, audio recorders, digital cameras and PDAs record a very low frequency of usage which is less than 10% of study participants.

To sum up on this section, one can realize that the proportion of respondents who rarely or never used each of the proposed tools surpassed greatly the one for those who have been moderately and highly using these tools. Although not to a desirable degree, smartphones and laptops are reportedly the most frequently used tools by respondents.

#### 5.4 Students' activities using computer-based technologies

This study was also interested to know what students do with the proposed digital tools. Hence, participants were asked to indicate how often and which activities they performed offline using computing tools. The results are presented in Figure 6.

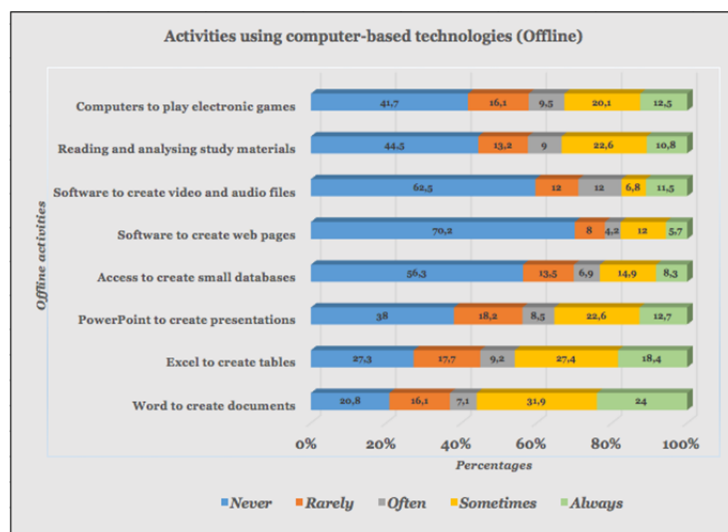


Figure 6: Activities using computer-based technologies



As visualized in Figure 6, the figures indicate that a small proportion of participants used the basic digital tools. For example, only 24% created documents most regularly using Microsoft word while Excel and PowerPoint tools were also used by (18.4%) and (12.7%) respectively to create tables and presentations. In addition, only (8.3%) used Access package to create small databases. For other proposed activities, the majority of students who participated in this study never created web pages (70.2%) and videos or audio files (62.5%). More alarming is that a substantial number of respondents (44.5%) never used computers for reading and analysing course materials.

### 5.5 Students' activities using mobile-based technologies

Having considered mobile phones as the important tools to increase familiarity and experience with technology, students' activities using a smartphone were further investigated. Participants were asked to indicate the activities they perform using smartphones. The findings for this section are presented in Figure 7.

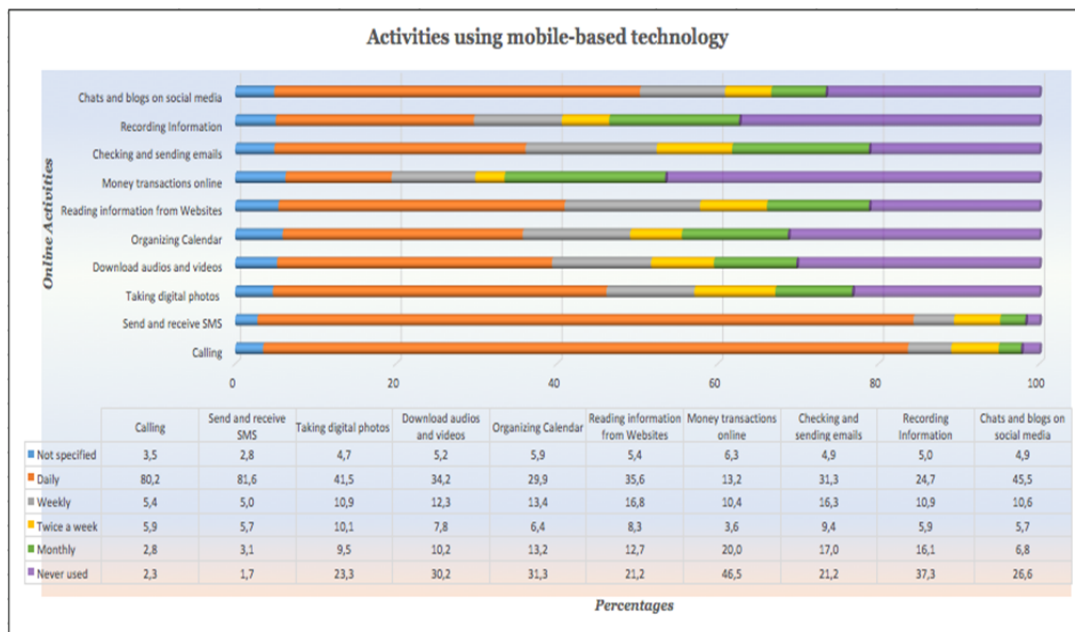


Figure 7: Activities using mobile-based technologies

As illustrated in Figure 7, the results indicate that respondents use mostly their smartphones for calling (80.2%) and texting messages (81.6%) on a daily basis. A substantial proportion of participants have been also using their phones daily for chatting and blogging (45.5%) and taking pictures (41.5%). On the other side, the data indicate that some important features offered by today's current technologies are still not yet used by respondents. For example, respondents never used their smartphones for online money transactions (46.5%), recording information (37.3%), organizing calendars (31.3%) and download audio/video files (30.2%). Another significant proportion (21.2%) of participants never used their mobiles phones to access and read information on websites, and exchanging emails.

### 5.6 Students' activities using web-based technologies

Like mobile-based technologies, using online-based tools has also an impact on the familiarity with technologies. For this reason, this study went further to describe the activities performed by students using web-based tools. The results are visualized in Figure 8.

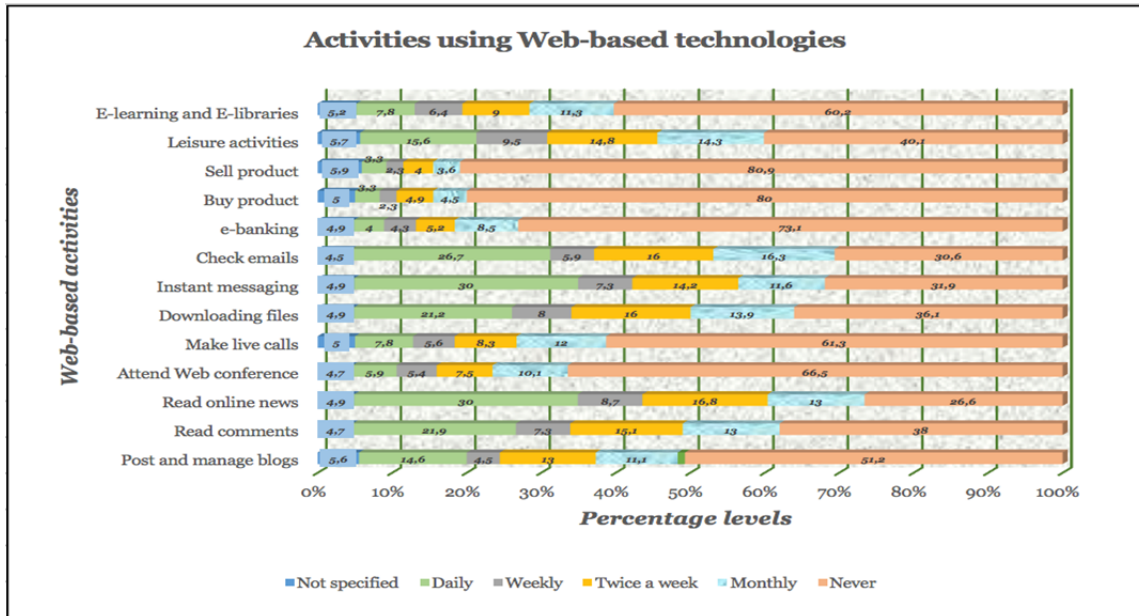


Figure 8: Activities using web-based technologies

As illustrated in Figure 8, more than 60% of students reported that they never used the web tools to attend online conferences and to make live calls. More to highlight is that a substantial proportion of respondents (60.2%) never used eLearning systems and E-libraries before registering at the University of Rwanda. Only a small subset of respondents (30%) used web-based tools to read online news (30%), send instant messages and to read and receive emails (26.7%) at least on a daily basis. But on the other hand, the majority of the sample reported having neither buy or sell products online (80.9% and 80%) and making online banking (73.1%). Overall, the figures in this section indicate that participants are not frequently involved in online web-based activities.

### 5.7 Students' self-confidence on the use of computer-based tools

Participants were asked to express their level of confidence vis-à-vis a range of nine digital tools. Figure 9 presents the results of respondents' self-reported degree of confidence which are ranked in scales from strongly confidence to no confidence.

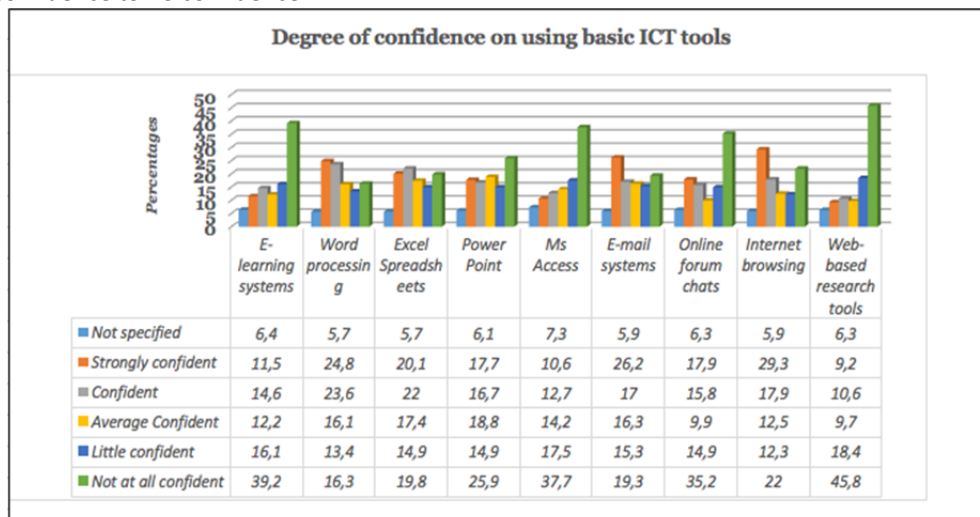


Figure 9: Degree of confidence on using computer-based technologies

As illustrated in Figure 9, many respondents reported that they have little or no confidence at all in using web-based research tools (64.2%) and eLearning systems (55.3%). While Internet has become an important tool for teaching and learning in universities, it is surprising to know from data in Figure 9 that only a small proportion of respondents are confident with eLearning systems (26.1%) and web-based research tools (19.8%).

In a general view, the data about first-year students' confidence in using computer-based tools are not significantly substantial at least for the considered sample, while most of the proposed range of digital tools are much used for learning in higher education.

### 5.8 Previous computer training

Having been previously offered some training, either on basics or advanced computer applications contribute enormously to an individual's degree of familiarity and confidence with technologies. This study went further to investigate this factor from respondents. Results for this section are clustered in colleges for which students have been registering in.

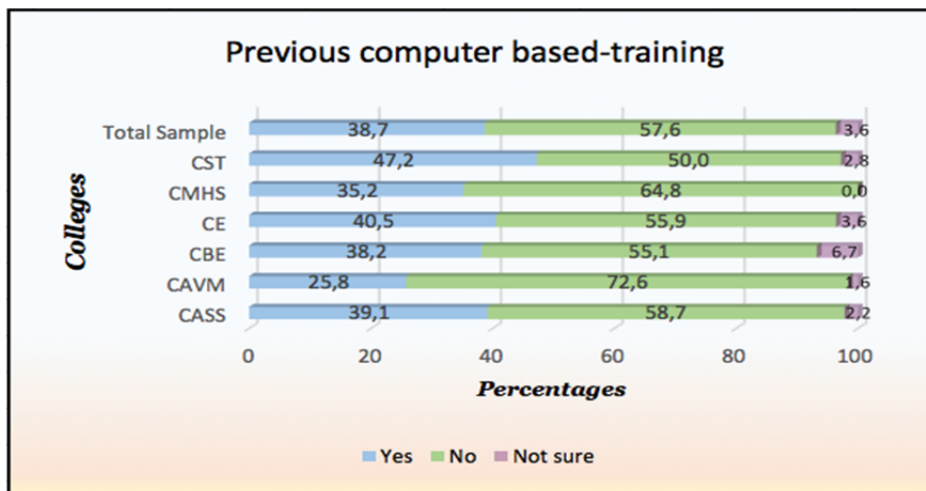


Figure 10: Previous computer-based training

As illustrated in Figure 10, the majority (57.6%) of the first-year students considered in this study never got any training on computer applications. When you observe these data by college, the figures of those who never got a training continue to be considerably higher, more especially for the College of Agriculture and Veterinary Medicine (72.6%) and the College of Medicine and Health Sciences (64.8%) respectively. This means that a considerable number of first-year students at this university do not have adequate digital skills and competencies as proposed by the conceptual framework used for this study.

### 5.9 Previous experience with E-learning systems

Another interest of this study was to assess the first-year students' previous experience with an online learning environment. Respondents were asked to rate the degree of difficulty or stress-free for some eLearning systems that they previously used. To analyse this experience, students have been clustered in their respective majors at secondary schools. The findings regarding this question are presented in Figure 11.

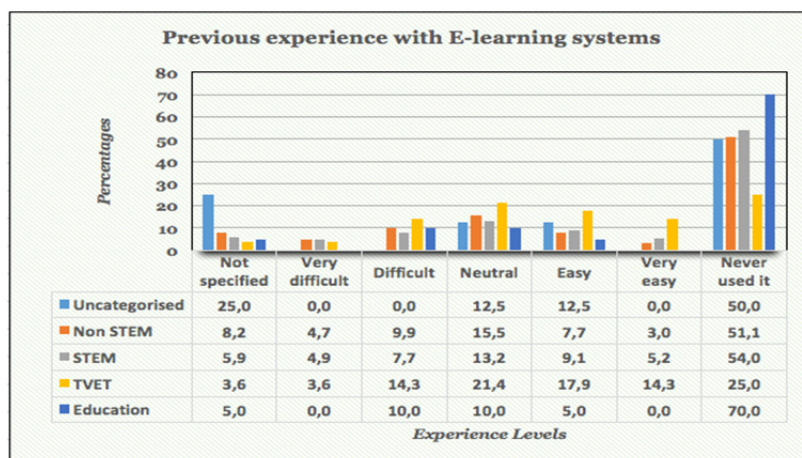


Figure 11: Students prior experience with eLearning systems

As illustrated in Figure 10, it indicated that a substantial proportion of respondents from education (70%) and STEM (54%) never used eLearning systems for educational purpose. Therefore, for those subsets, it is not possible to know their experience with the online learning environment as they never had such an exposure.

The findings show also that students with difficulties in using eLearning platforms are relatively higher than those who found it easy across all secondary school majors. But in the overall, the variation among the surveyed sample on how difficult and easy they find using eLearning platforms is relatively small. This means that the figures are less than and close to 20% for all students' major categories.

## 6. Discussion

As described in the introduction and background of this paper, the knowledge about students' familiarity with technology in Rwanda and similar contexts was still limited. Thus, this study revealed empirically the level of first-year university students' experience with technology and the extent to which they can use ICT for learning purposes. According to the conceptual framework used for this study (Figure 1) accessibility, ownership, usage and previous experience with digital tools and Internet were used as four main factors that can determine the degree of an individual's familiarity with a particular technology. By taking into consideration the statistical data presented in Section 5, important findings in line with these factors are observable.

Starting with technology access, the findings presented in Figure 3 indicate that a substantial number of first-year students had a limited or even no access to a number of digital tools such as desktops, laptops, tablets, and smartphones. The same situation was also noticed for students with limited or no access to the Internet. Therefore, with these findings, differences in access to technology among the first-year students are noticed from at least the investigated sample. By investigating the ownership of digital tools, it was also revealed (See Figure 4) that the majority of first-year students at University of Rwanda do not own any of the proposed digital tools. Hence, this study coincides with the scholars such as (Thinyane 2010) and (Kennedy et al. 2008) who concluded that there is a diversity among first-year students' degree of technology access in their respective study samples.

These findings can serve as a basis for developing a policy and mechanisms for "Bring Your Own Device" program. This is also in line with the work of (Afreem 2014) who portrayed that owned devices are much used at universities for educational purposes by students. This is also a program which is hugely supported by the Government of Rwanda.

Regarding the use of technology, while the results indicate that some students are somehow at a slightly increased level of using digital tools and Internet (See Figure 6), it is important to note that even most activities they perform are not related to the learning purposes (See Figure 6 and 8). Therefore, the results of this study concur with the assumption of (Van Dijk and Hacker 2003) about the appearance of "usage gap" between individuals who use digital tools and Internet for education purpose on one hand, and those who use them just for entertainment. As discussed in the previous section, the majority of surveyed students have rarely or never used computer-based tools for online learning (See Figure 6 and 8), reading and analysing study materials (See Figure 6), and web-based research tools (See Figure 9). This overlap with the work of (Kvavik 2005) who also claimed that the high levels of access and use of computing tools, and the students' digital skills do not certainly translate into their preferences of using technology for educational activities.

To understand the students' experience with technology, we, first of all, analysed their previous computer-based training. Results show that still the majority of surveyed students for each college (See Figure 10) never had any ICT related training. However, this entails that their level of digital skills and competencies, as proposed by the conceptual framework used for this study, is problematic. Secondly, to highlight more on this, further analysis of their self-reported degree of confidence show also that their level of experience with technology is low, as portrayed by a substantial number of students (See Figure 9) who reported that they have very little or no confidence for a number of technologies.

After that, by investigating the students' previous experience with eLearning systems, results indicated also that the majority of the sample (See Figure 11) never had any previous experience with online learning platforms. Thus, the students' previous little exposure to eLearning based-tools brings us to hypothesize that their level of knowledge towards these tools, as one of the indicators of familiarity with technology (See Figure

1), is very low. That is because the more you use a particular tool, the more you become familiar with it and this has not been the case for at least the sample used in this study.

In general, the overall results denote a lack of a uniformity for the surveyed students in terms of digital capability and a significant variation in student's degree of familiarity and experience with the current technology. This is explained by the fact that there is a substantial variation in their levels of performing different activities online. Therefore, although not at the same level, first-year student's heterogeneity has been observed in access, use, ownership and previous experience with technology. In contrast, while a study conducted by (Kennedy et al. 2008; Jones et al. 2010; Thinyane 2010) revealed that it is a little minority of their sample that does not substantially use technology, instead in this current study, it is the majority of first-year students that rarely or never used technology.

Therefore, there is a high ratio of digital divide among incoming first-year students in Rwandan higher education with regard to ownership, access, and use of digital tools and Internet. This situation may be seen from geographical and social-economic dimensions as also revealed by ( Hindman 2000; Warschauer 2004; Ching, Basham and Jang 2005). While the universal assumption in the literature conveys that the current students are denoted as "Net Generation or Dot.Coms" (Barnes et al. 2007; Shaw and Fairhurst 2008), this study results contrast this perception at least for the first-year students in Rwandan tertiary education context and probably the similar milieus across the world. Although the surveyed students in this study are born in the digital era (after 1980) when the Internet and World Wide Web was thriving (Tapscott 1998), the results for this study indicated that their degree of computer-based technologies does not qualify them as tech-savvies. Therefore, this study agrees with other scholars such as (Kennedy et al. 2008; Jones et al. 2010; Thinyane 2010) who claimed that the Prensky's concept of digital natives or net-generation students could not be universally generalized. Undoubtedly, referring to this study results, it is realized that adhering to the Net Generation students, does not necessarily imply that someone has adequate knowledge for using available digital technologies for learning purposes in the current digitalized tertiary education context.

## **7. Conclusion**

This study aimed to understand the degree of familiarity with technologies for the new incoming students at the University of Rwanda. Factors of previous experience, ownership, access to and use of technology were used as determinants of familiarity with technology.

The study revealed that the majority of incoming first-year students at University of Rwanda are not tech-savvy and they are at different levels of technology readiness. This means that only very few incoming students at the University of Rwanda can search and retrieve digital information, evaluate and synthesize soft data, and share and collaborate in a digital learning environment of the current higher education systems. With their low degree of accessibility, ownership, usage and previous experience with technology (as indicated by the study results), it can be difficult for them to use a range of digital tools. This slight or lack of exposure to computer-based tools by the surveyed sample can predict that the degree of using available online learning resources at UR by first-year students is more likely to be undesirable.

Therefore, this is an early warning to teachers and educational planners in Rwandan tertiary education to revisit the institutional curriculum in order to accommodate these students' needs, especially for better learning in a digital environment. More especially, course designs should be aligned with this lack of homogeneity in students' familiarity with technology in order to effectively accommodate their differences. There is a need for change in curriculum reform in order to take into consideration the diversities of the Net Generation students (Beyers 2009) at University of Rwanda and similar contexts in the region. While this university continues to shift the majority of courses/modules from traditional to the online learning environment, this study can serve as a reference for improving first-year students' digital literacy and meeting their learning preferences.

Finally, in order for those new students to cope within the current university's digital learning environment, the university has a big challenge to bridge the gap among them by increasing access to computer labs and Internet. Although the Government of Rwanda has initiated the laptop ownership project by all new university students, this study shows that access and ownership of these tools are not the only factors to assess student's familiarity with technology. Instead, teaching approaches that involve the integration of computer-supported



collaborative learning activities (Stahl, Anderson and Suthers 2006; Owston 2007) should be put in place at the early stages for first-year students classes. That means, teaching with technology at UR should be aligned with first year students' degree of access to, ownership and experience with digital tools. For example, in order to increase their familiarity with technology, students have to be introduced to a range of available educational technologies, such as online learning forums and blogs, electronic libraries and other online learning management systems, at the early start of their university course activities. This alignment will allow students to develop digital high order thinking skills that enable them to process computer-based information and easily collaborate online.

As results indicated an increased proportion of access, ownership, and use of smartphones, compared to other tools, the university should emphasize designing courses that are also compatible with mobile phones, provided that there is increased, free Internet access for students at the campus. The same recommendation of introducing mobile based-learning technology was also put out by (Thinyane 2010).

In this study, the continuing university students were not considered and thus, further research should follow this category chronologically to evaluate their technology uptake by the time they will have completed their study programmes. Other studies could go further to investigate the university teachers' degree of familiarity and experiences with a range of common educational technologies that support teaching and learning activities by considering the University of Rwanda or comparing them with other universities in the region.

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## References

- Abdel-wahab, A. G., 2008. Modeling students' intention to adopt e-learning: a case from Egypt. *The Electronic Journal of Information Systems in Developing Countries*, vol. 34, no. 1, pp. 1-13.
- Afreen, R., 2014. Bring your own device (BYOD) in higher education: opportunities and challenges. *International Journal of Emerging Trends & Technology in Computer Science*, vol. 3, no. 23, pp. 233-236.
- Ajiboye, J. O. and Tella, A., 2007. University undergraduate students' information seeking behaviour: implications for quality in higher education in Africa. *The Turkish Online Journal of Educational Technology*, vol. 6, no. 1, pp. 40-52.
- Ananiadou, K. and Claro, M., 2009. *21st Century Skills and Competences for New Millennium Learners in OECD Countries*, no. 41. *OECD Education Working Papers*. OECD Publishing.
- Arif, A. A., 2001. Learning from the web: are students ready or not? *Educational Technology & Society*, vol. 4, no. 4, pp. 32-38.
- Barnes, K., Marateo, R. C. and Ferris, S. P., 2007. Teaching and learning with the net generation. *Innovate: Journal of Online Education*, vol. 3, no. 4, pp. 1-10.
- Beetham, H. and Sharpe, R., 2013. *Rethinking pedagogy for a digital age: designing for 21st century learning*. Routledge.
- Bennet, S. J. and Maton, K. A., 2010. Beyond the "digital natives" debate: towards a more nuanced understanding of students' technology experiences. *Journal of Computer Assisted Learning*, vol. 26, no. 5, pp. 321-331.
- Beyers, R. N., 2009. A five dimensional model for educating the net generation. *Educational Technology & Society*, vol. 12, no. 4, pp. 218-227.
- Calvani, A., Cartelli, A., Fini, A. and Ranieri, M., 2009. Models and instruments for assessing digital competence at school. *Journal of E-Learning and Knowledge Society*, vol. 4, no. 3, pp. 183-193.
- Ching, C. C., Basham, J. D. and Jang, E., 2005. The legacy of the digital divide gender, socioeconomic status, and early exposure as predictors of full-spectrum technology use among young adults. *Urban Education*, vol. 40, no. 4, pp. 394-411.
- Claro, M., Preiss, D., San Martín, E., Jara, I., Hinostroza, J. E., Valenzuela, S. and Nussbaum, M., 2012. Assessment of 21st century ICT skills in Chile: test design and results from high school level students. *Computers & Education*, vol. 59, no. 3, pp. 1042-1053.
- Cohen, L., Manion, L. and Morrison, K., 2013. *Research methods in education*. 6th ed. New York: Routledge.
- Combes, B., 2006. Techno savvy or techno oriented: who are the net generation? In: C. KHOO, D. SINGH and A. S. CHAUDHRY, eds., *Asia-Pacific Conference on Library & Information Education & Practice 2006. A-LIEP 2006*, pp. 401-408. Singapore: A-LIEP, 3-6 April 2006.
- Czerniewicz, L. and Brown, C., 2009. A study of the relationship between institutional policy, organisational culture and e-learning use in four South African universities. *Computers & Education*, vol. 53, no. 1, pp. 121-131. [Date viewed] Available from: <http://doi.org/10.1016/j.compedu.2009.01.006>
- Denscombe, M., 2010. *The Good Research Guide: for small-scale social research*. London: McGraw Hill.



- Dorman, S. M., 2000. Implications of growing up digital. Review of Tapscott's Growing up digital. *The Journal of School Health*, vol. 70, no. 10, pp. 420-422.
- Feiertag, J. and Berge, Z. L., 2008. Training Generation N: how educators should approach the net generation. *Education+ Training*, vol. 50, no. 6, pp. 457-464.
- Ferrari, A., 2012. *Digital Competence in practice: An analysis of frameworks*. Sevilla: JRC IPTS.
- Ferrari, A., Punie, Y. and Redecker, C., 2012. Understanding digital competence in the 21st century: an analysis of current frameworks, pp. 79-92. Springer, Berlin, Heidelberg. [ ] Available from: [http://doi.org/10.1007/978-3-642-33263-0\\_7](http://doi.org/10.1007/978-3-642-33263-0_7)
- Hargittai, E., 2010. Digital Natives? Variation in Internet Skills and Uses among Members of the "Net Generation." *Sociological Inquiry*, vol. 80, no. 1, pp. 92-113. [ ] Available from: <http://doi.org/10.1111/j.1475-682X.2009.00317.x>
- Helsper, E. J. and Eynon, R., 2010. Digital natives: where is the evidence? *British Educational Research Journal*, vol. 36, no. 3, pp. 503-520.
- Hindman, D. B., 2000. The rural-urban digital divide. *Journalism & Mass Communication Quarterly*, vol. 77, no. 3, pp. 549-560.
- Hosein, A., Ramanau, R. and Jones, C., 2010. Learning and living technologies: a longitudinal study of first-year students' frequency and competence in the use of ICT. *Learning, Media and Technology*, vol. 35, no. 4, pp. 403-418.
- Jones, C., Ramanau, R., Cross, S. and Healing, G., 2010. Net generation or digital natives: Is there a distinct new generation entering university? *Computers & Education*, vol. 54, no. 3, pp. 722-732.
- Kennedy, G. E., Judd, T. S., Churchward, A., Gray, K. and Krause, K.-L., 2008. First year students' experiences with technology: Are they really digital natives? *Australasian Journal of Educational Technology*, vol. 24, no. 1, pp. 108-122. [Date viewed] Available from: <http://doi.org/10.14742/ajet.1233>
- Kvavik, R., 2005. Convenience, communication, and control: How students use technology. In D. Oblinger and J. Oblinger, Eds., *Educating the Net Generation*, p. 7.1-7.20. EDUCAUSE.
- Littlejohn, A., Beetham, H. and McGill, L., 2012. Learning at the digital frontier: a review of digital literacies in theory and practice. *Journal of Computer Assisted Learning*, vol. 28, no. 6, pp. 547-556.
- Mahmood, K., 2009. Gender, subject and degree differences in university students' access, use and attitudes toward information and communication technology (ICT). *International Journal of Education and Development Using Information and Communication Technology*, vol. 5, no. 3, pp. 1-11.
- Margaryan, A., Littlejohn, A. and Vojt, G., 2011. Are digital natives a myth or reality? University students' use of digital technologies. *Computers & Education*, vol. 56, no. 2, pp. 429-440.
- Martin, A. and Madigan, D., 2006. *Digital literacies for learning*. Facet Publishing.
- Muijs, D., 2010. *Doing quantitative research in education with SPSS*. London: Sage.
- Nagler, A. and Ebner, M., 2009. Is Your University Ready For the Ne(x)t-Generation? In G. SIEMENS and C. FULFORD, Eds., *EdMedia: World Conference on Educational Media and Technology 2009*, pp. 4344-4351. Association for the Advancement of Computing in Education (AACE).
- Ng, W., 2012. Can we teach digital natives digital literacy? *Computers & Education*, vol. 59, no. 3, pp. 1065-1078.
- Oblinger, D. and Oblinger, J., 2005a. Is it age or IT: First steps toward understanding the net generation. *Educating the Net Generation*, vol. 2, no. 1-2, p. 20.
- Oblinger, D. and Oblinger, J., 2005b. Is it age or IT: first steps toward understanding the net generation. In: D. Oblinger and J. Oblinger, eds. *Educating the Net Generation*. EDUCAUSE.
- Owston, R., 2007. Contextual factors that sustain innovative pedagogical practice using technology: An international study. *Journal of Educational Change*, vol. 8, no. 1, 61-77.
- Prensky, M., 2006. *Don't bother me Mom—I'm learning*. Minneapolis: Paragon House Publishers.
- Querios, D. R. and De villiers, M. R., 2016. Online Learning in a South African Higher Education Institution: Determining the Right Connections for the Student. *The International Review of Research in Open and Distributed Learning*, vol. 17, no. 5, pp. 165-185.
- Richardson, J. C. and Newby, T., 2006. The Role of Students' Cognitive Engagement in Online Learning. *American Journal of Distance Education*, vol. 20, no. 1, pp. 23-37. [date viewed] Available from: [http://doi.org/10.1207/s15389286ajde2001\\_3](http://doi.org/10.1207/s15389286ajde2001_3)
- Rogers, C. R., 1983. *Freedom to Learn for the 80's*. Columbus: Charles E. Merrill Publishing Co.
- Santos, R., Azevedo, J. and Pedro, L., 2013. Digital Divide in Higher Education Students' Digital Literacy. In S. Kurbanoğlu, E. Grassian, D. Mizrahi, R. Catts and S. Špiranec, Eds., *Worldwide Commonalities and Challenges in Information Literacy Research and Practice* (ECIL 2013.), pp. 178-183. Springer, Cham.
- Sefton-Green, J., Nixon, H. and Erstad, O., 2009. Reviewing approaches and perspectives on "digital literacy." *Pedagogies: An International Journal*, vol. 4, no. 2, 107-125.
- Shaw, S. and Fairhurst, D., 2008. Engaging a new generation of graduates. *Education + Training*, vol. 50, no. 5, pp. 366-378. Available from: <http://doi.org/10.1108/00400910810889057>
- Stahl, G., Anderson, T. and Suthers, D., 2006. Computer-assisted collaborative learning: An historical perspective. In R. K. Sawyer, Ed., *Cambridge handbook of the learning sciences*. New York: Cambridge University Press.
- Sun, P. C., Tsai, R. J., Finger, G., Chen, Y. Y. and Yeh, D., 2008. What drives a successful e-Learning? An empirical investigation of the critical factors influencing learner satisfaction. *Computers & Education*, vol. 50, no. 4, pp. 1183-1202.

- Tagoe, M., 2012. Students' perceptions on incorporating e-learning into teaching and learning at the University of Ghana. *International Journal of Education and Development Using Information and Communication Technology*, vol. 8, no. 1, pp. 91-103.
- Tapscott, D., 1998. *Growing up digital: the rise of the net generation*. New York: McGraw-Hill.
- Thinyane, H., 2010. Are digital natives a world-wide phenomenon? An investigation into South African first year students' use and experience with technology. *Computers & Education*, vol. 55, no. 1, pp. 406-414. [Date viewed] Available from: <http://doi.org/10.1016/j.compedu.2010.02.005>
- Van Dijk, J. and Hacker, K., 2003. The digital divide as a complex and dynamic phenomenon. *The Information Society*, vol. 19, no. 4, pp. 315-326.
- Warschauer, M., 2004. *Technology and social inclusion: Rethinking the digital divide*. MIT press.