A Measurement Model of University Students' Self-reported Perceptions of Internet Use for Learning

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Abstract

With the increased popularity of the Internet for instructional purposes in the recent years, learners can now ably build a positive attitude towards its use in their learning activities through constant interaction with various information technologies. The purpose of this study was three-fold: to examine the extent to which students' self-reported perceptions of Internet use constituted meaningful and interpretable dimensions of the Internet use in learning construct; to test the construct adequacy in terms of its validity and reliability; and establish if the measurement model is an adequate measure of Internet use for learning across levels of internet knowledge. The sample consisted of 258 undergraduates from six faculties of Islamic University in Uganda. The data were collected using a self-reported 16-item questionnaire that measured undergraduate students' perceptions on Internet use for learning and analysed using Structural Equation Modeling and Confirmatory Factor Analysis with AMOS software version 22.0. The study findings reveal that students' Internet use for learning is a valid and reliable multidimensional construct with AVEs>0.5, shared variance <0.5 and composite and Cronbach Alpha >0.7; and the measurement is Internet knowledge-invariant with chi-square change p>05. The results supported and extended the results of previous work on students' perceptions about internet use for learning. The findings are useful for evidence-based decision making regarding the integration of internet applications in student learning activities, and in enhancing future research in the domain of Internet use and pedagogy.

Keywords: collaborative learning, learner engagement, measurement model, structural equation modeling

New and emerging information and communication technologies have greatly transformed higher education provision, hence the need to harness the potential of these developments for high quality higher education (European Commission, 2014). And one such technology is the Internet. The Internet is a network comprising thousands of computers all over the World, connected in a way that lets other computers and related devices access information and resources on them (Ramzan and Irfan, 2016; Aqil and Parvez, 2011). In terms of instructional uses, the internet provides affordances to supplement to traditional instructional methods, as well as serving as a platform for student learning, edutainment, and building social relationships (Zainudin, Din, & Marini, 2013). Thus the Internet can be described as one primary tool that helps learners in

accomplishing their learning tasks, research as well as a means to relieve stress levels. Internet helps the students in beneficial aspects like helping them to improve their enhancing communication skill levels, social interaction and scaling up their grades. This is possible because the Internet enables users unlimited access to sources of information and search engines, yet at the same time offering opportunities to consult with experts via discussion groups, and greater independence from specific times and places for information search. But to achieve this effectively there is urgent need to broaden our understanding of how such new technologies and pedagogical tools can be an integral part of higher education landscape.

The use of the Internet for instructional purposes has increased in popularity in the recent years (Ramzan & Irfan, 2016); and through constant interaction with such information technologies; learners are able to build a positive attitude towards its use in their learning activities. For example Web 2.0 technologies via the Internet have emerged as a promising instructional tool due to the ability to provide instant and timely information and promote student learning activities. Thus as a new means of accessing and facilitating information access, the internet has the potential to enable learners be in charge of their learning and perceive instructors as facilitators in their learning process (Kabilan and Rajab, 2010). A case in point, Palaigeorgiou and Grammatikopoulou (2016) found that Web 2.0 technologies enable learners to be active and motivated, learn collaboratively and continue to learn outside the school environment.

Wang (2007) categorizes Internet activities into seven groups: (1) Email exchange; (2) discussion groups; (3) bulletin boards; (4) real-time chat; (5) instant messaging; (6) Multi-player games; and (7) web pages. Given these activities, Internet use among learners offers immense benefits, and these include: (i) learner motivation; (ii) improved quality of learning; (iii) increased learner curiosity; (iv) improved learner competitiveness to achieve their learning goals; (v) easing and speeding the process of access to learning resources; (vi) keeping learners and faculty with up-to-date literature in the fields of study; and (vii) facilitating communication with experts across the globe (Wang, 2007; Sudiran, 2015). It's worth noting that Internet use among students is largely dependent on their perceptions, as it determines the importance they attach to the Internet to complete their academic tasks. Thus learners with positive perception towards internet use will tend to apply it in their learning tasks (Sudiran, 2015).

Theory of Connectivism

Connectivism, also called learning theory for the information age seeks to shed light on the nature and complexity of learning in the changing digitally dynamic and networked world. It is largely an integration of principles explored by chaos, network, and complexity and self-organisation theories (Duke, Harper and Johnston, 2010). As promoted by Siemens and Downes (2005), the theory postulates that learning takes place through connections within networks; using the concept of a network with nodes and connections to define learning i.e. (i)

Learners recognise and interpret patterns and are influenced by diversity of networks, strength of ties and their context; and (ii) Transfer of learning occurs by connecting to and adding nodes and growing personal networks.

The theory thus points out that : (a) diversity of opinions is the basis for learning and knowledge; (b) learning is a process of connection to information sources; (c) Learning may be found in non-human devices; (d) capacity to know more is more vital compared to what we currently know; (e) it's important to nurture and maintain connections needed to facilitate continued learning; (f) the ability to establish connections between fields, ideas, and concepts is a fundamental skill; and (h) accurate, up-to-date knowledge is the goal of Connectivist learning (Downes, 2005).

The Connectivist thus theory enables us understand how Internet technology and its associated applications (web browsers, email, wikis, online discussion forums, social networks, YouTube and many more) have created new opportunities for learning and sharing knowledge across the globe. Learning according to this theory can happen across peer networks that take place online; and the teacher simply guides learners to information and gives feedback to key issues as needed, with a learning community as a product of learning.

Internet Use for Learning

Internet use for students' research work

The use of World Wide Web (web) easily offers access to a wide range of online databases, online journals and other scholarly resources like instructional materials; improves the quality of instructions and increases learner productivity. Additionally, the Internet provides vast volumes of information, which makes it the ultimate reference library which allows for easy and cheap dissemination of information to learning groups (Ivwighreghweta and Igere, 2014). In a study by Aqil and Parvez (2011) on Internet use, it was found that about 51% of the students were accessing and using Internet to foster research work. For example the students used online journal via data bases like J-gateway, Science Direct, Taylor and Francis, NetLibrary and Ingenta Group information services. In another study by Ivwighreghweta and Igere (2014), participants reported viewing the internet as research tool and source of information. The above findings align closely with Arthur and Brafi (2013)whose assessment of Internet use in selected tertiary institutions in Ghana found that students were using this technology to access information and complete their assignments.

In addition, a study by Bankole (2012) among undergraduate students in a Nigerian University revealed several instructional uses of the Internet: downloading instructional materials and software, accessing reference materials, E-mail, research for homework, accessing lecture notes, access to content and communication tools such as discussion boards, real time interaction with peers, experts and instructors. Prabhavathi, Padmavathi and Visvavidyalayam (2013) in an Indian University found that up to 28% of the respondents used Internet to access e-resources, while 42% of the respondents used the Internet for searching

general research information. The above mentioned uses of the Internet are further strengthened by Sanni (2009) who reports that a significant relationship exists between internet use and student research work.

Internet use for students' collaborative learning

Collaborative learning is characterized by student interactions and connections with course content via a variety of Internet tools like social media which provides an opportunity for learners to expand their learning environment since only a small segment of student learning occurs within the confines of a classroom (Chen and Bryer, 2012). Given the fact that interaction with others is key to their learning, today's learners want to be part of a learning community as they collaborate, share, and exchange ideas (Hart, 2008). Thus the use of web-based tools like Moodle, Google apps, online graphic organizers, email and wikis foster rich online collaboration spaces for learner-to-learner and learner-to-instructor. Also, learner-to-expert communication and co-construction of knowledge can occur through sharing ideas and information in all forms including text, video, audio, and graphics across learning communities. Furthermore, the internet helps to enrich traditional classroom instruction by allowing learners to engage in active, contextually meaningful and self-directed learning activities; yet enabling them to reach instructors and mentors for clarifications regarding assignments and other learning tasks. Kabilan et al. s' (2010) finding that learners build learning communities by working collaboratively to construct knowledge is in agreement with other researchers who theorise that knowledge not only exists in individual minds but also in the discourse and interactions between individuals. These interactions then support learner active participation, which is an essential element in student learning (Hrastinski, 2009).

Existing studies indicate that students use the internet as a collaborative learning tool; exchanging email with instructors and peers, conducting research for written assignments; and enabling learners to easily structure and eventually share their knowledge (Gagan and Rakesh, 2013). Moreover, many learners express greater satisfaction when instructors help them in using the Internet for classroom learning. Additionally, Internet applications enhance individual learning via e-mail instructional communication, improving learner skills in information search and retrieval; and conducting video-conferences with learners. For example Internet applications like chatting, email, online discussion tools enable learners to carryout meaningful learning tasks and to explore the world beyond their traditional classrooms (Geyer, 2009; Tekinarslan, 2009).

Internet use for Learner engagement

Learner engagement represents the time and energy a learner invests in an educationally purposeful activity (Kuh, Kinzie, Cruce, Shoup and Gonyea, 2007). This not only includes time spent interacting with their peers and instructors but also engagement in any active and collaborative learning activity. Internet use increases the quality and productivity of student learning as students are able to produce quality assignments and publications on time, and therefore the more

learners remain engaged in their work; the better they are likely to succeed (National Survey of Student Engagement, 2012). Internet tools like online discussion boards provide the opportunities for discussions after class, or from home, hence offering a much broader level of participation than the traditional class discussions; as well as enabling students with different learning styles, or who process information over time to have additional ways to participate. Internet use further enhances situated learning because learners are able to complete learning tasks Online while remaining in their own spaces and can easily contextualize learning; it helps learners in strengthening their interpersonal skills, enhance information-gathering and analysis skills; and, to improve questioning and problem-solving skills with the help of well-designed Internet-based activities (Nelson, 2008). Moreover, classroom learning can be enhanced by the presence of the Internet because it provides a variety of information related to the learning materials in form of text, images and sound (Sudiran, 2015). For example a study by Gialamas, Nikolopoulou, and Koutromanos (2013) revealed that over 65% of the students agreed that Internet use has the ability to increase their meaningful learning activities.

Statement of the Problem

The current generation of students in university education are those who have grown up in a technology-rich environment, communicating and interacting with multimedia in their daily lives via the Internet. With the penetration of the Internet into the classroom setting, it presents the potential to change the way learners and instructors gain access to and communicate information to support learning (Bankole, 2012). The Internet has been part of education for decades, with many educators acknowledging its importance in the classroom. The Internet is a robust technology with a number of valuable classrooms applications and uses (Thanuskodi, 2010). However, there is limited literature that exists to clearly categorize what learners actually do with the Internet in their learning activities. Whereas existing research reveals how internet is being used in higher education, evidence and information on the classifications of such uses is scarce. This study thus seeks to illuminate previous researches by characterising the underlying structure of internet usage for learning by students in higher education to allow for informed decision making.

Purpose of the Study

University education is learner-focused and it is therefore important to evaluate students' perceptions of how they utilise internet technologies into their learning activities to facilitate informed decision making by university management and instructors concerned. The purpose of this study was three-fold: to examine the extent to which undergraduate students' self-reported perceptions on Internet use constituted meaningful and interpretable dimensions of the Internet use in learning construct; to test the adequacy of the construct in terms of its validity and reliability; and establish if the measurement model is an adequate measure of Internet use for learning across levels of internet knowledge.

Research Questions

i. Is the undergraduate students' self-reported Internet use for learning a multidimensional construct interrelated factors which are Research work, Collaborative learning, and Learner engagement?
ii. Is the three-factor Internet use for learning questionnaire psychometrically sound in terms of reliability, convergent validity, and discriminant validity?
iii. Is the Internet use for learning questionnaire invariant across undergraduate students' levels of internet knowledge?

Methodology

Sample

The sample consisted of 258 undergraduate students from six faculties at the Islamic University in Uganda, with students from Faculty of Education (Bachelors of Arts and Science Education) contributing the largest sample of about 45%, followed by Faculty of Arts and Social sciences (Bachelors of Mass communication and Social work) (19%) and Faculty of Management studies (Bachelors of Business studies and Public Administration) (16%). The faculties of Science, Law and Islamic studies trailed with 8%, 5% and 7% respectively. The sample was generally representative of the university student community at hand. This sample size was considered satisfactory to address the research and to fulfil the requirements for running a confirmatory factor analysis (CFA).

Instrument

For data collection, the study used a self-reported 16-item questionnaire measuring university students' Internet use for learning. The items were mainly derived from review of literature on internet use in education, and some were used in three previous related studies. Sixteen items representing the three hypothesized dimensions (Research work with 6 items, Collaborative online learning with 4 items and Learner engagement with 6 items) were used. Table 1 gives the details of the items used to measure each of the constructs. Students rated the levels of their knowledge of these items on 5 response categories, i.e. "Strongly Agree," "Agree," "Not Sure," "Strongly Disagree" and "Disagree".

Procedures of Data Analysis

The study first conducted dimensional analysis using Principal Axis Factoring (PAF) to explore the underlying structure of the responses. The Kaiser-Meyer-Olkin measure was .913. In addition, Bartlett's test of sphericity was significant ($\chi 2$ =2975.874, df =253, p = .000). These results suggested that factor analysis was appropriate and the sample size was sufficient for meaningful factorability.

Results

Underlying Structure of Students' Internet use for learning

Table 1 presents the descriptive statistics of the items included in the dimension reduction. Since the maximum possible score for each item is 5, the

mean score of almost all items appeared to fall far above the average hypothetical mean with the lowest mean score of 3.19 and the highest of 4.00.

Table 1
Internet use for learning dimensions and item statistics

Code	Dimensions/Sub construct	Alpha	Mean	SD	Factor Loading
	Learner engagement	**.886**			
Eng7	I can now participate in more learning activities with Internet use		3.50	.913	.630
Eng8	I easily critique and argue on ideas of interest with colleagues		3.19	.938	.700
Eng9	I easily share ideas and content with my peers		3.45	.907	.780
Eng10	Am able to search for content, create and share new knowledge		3.52	.882	.810
Eng11	Am able to complete my assignments on time using Internet		3.48	.822	.850
Eng12	I can submit my assignments on time online		3.54	.836	.780
	Research work	**.876**			
Res1	Internet helps me to identify a good research topic		3.95	.852	.690
Res 2	I use internet to get good literature		4.00	.627	.730
Res 3	Internet helps me to build theoretical/conceptual framework		3.83	.795	.800
Res 4	I have unlimited access to online journal and data bases		3.95	.811	.690
Res 5	Internet helps me to identify conference papers/articles		3.82	.891	.730
Res 6	I hope to share my research findings using the internet		3.69	.784	.810
	Collaborative Learning	**.820**			
Col15	I use Internet for real-time information sharing with peers		3.76	.781	.710
Col16	I use Internet to share messages		3.65	.748	.800
Col17	Internet use has enhanced my experiential learning using multimedia tools like graphics, videos, text, etc.		3.76	.712	.820
Col19	I use Internet to access course content		3.62	.721	.790

* Extracted from Principal Axis Factoring
Rotation method: Oblimin with Kaiser Normalization

This implies that the respondents reported having relatively high levels of Internet use for learning. Additionally, the value of Cronbach's alpha (internal

consistency index of the responses to the related items) was satisfactory. The minimum value of the reliability index was .820 and the maximum being .886, which exceeded the critical cut-score of .50 for a reliable measure of alpha (Hair, Black, Babin & Anderson, 2016; Pallant, 2007).

Principal Axis Factoring extracted five underlying factors, but only three of those whose factor loadings were significant (> .50) and with no cross-loadings were retained. This accounted for 53.7% of the total variance. The variance of the first dimension (Collaborative Learning) had the largest eigenvalue of 8.990, while the eigenvalues of the other two dimensions were 1.970 (Research work) and 1.379 (Learner engagement) respectively.

Thus in order to test the validity of the Internet use for learning measure, the study made use of confirmatory factor analysis (CFA). The results of the estimated measurement model clearly show that the three-factor structure of Internet use for learning was adequate and representative of the data. Figure 1 shows that the goodness-of-fit of the model was satisfactory, with the relative Chi-square = 2.348; RMSEA = .072; CFI = .941.

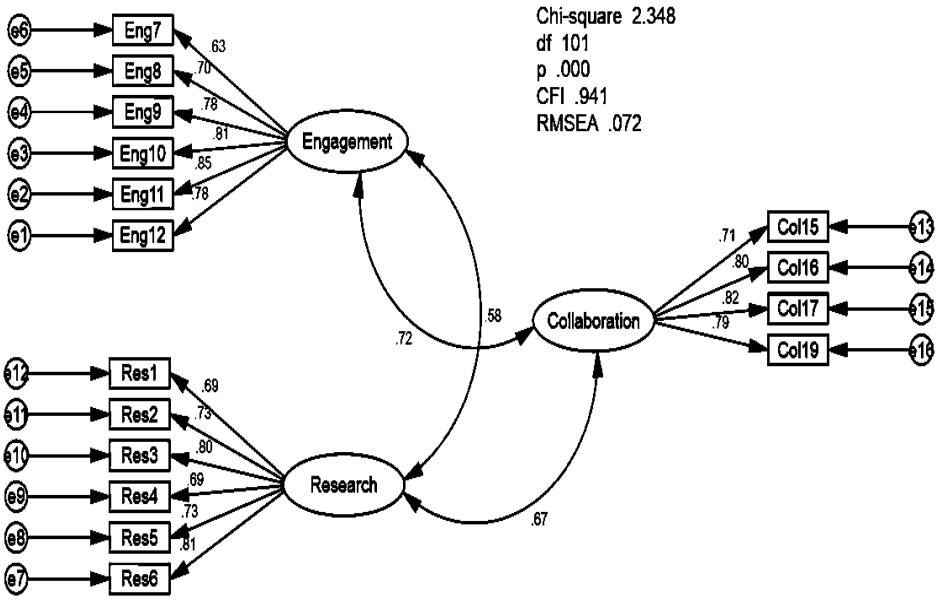

Figure 1: Results of the three-factor measurement model

The psychometric of the three-factor Internet use for learning questionnaire

The results obtained confirm the psychometric properties of the Internet use for learning instrument regarding its convergent validity and discriminant validity (Table 2). The statistics along the diagonal, which shows the average amount of variation (AVE) that a construct is able to explain through its indicators, is evidence of convergent validity of the measurement. Given the fact

that the value of the AVE of each construct was larger than the threshold of 0.5, indicates evidence of convergent validity.

In addition, the measure of Internet use for learning satisfied the properties of discriminant validity since most of the AVEs were larger than the values of the corresponding shared variances (values above the diagonal). Moreover, the moderate inter-factor correlations indicated that Internet use for learning was a multidimensional construct with distinct but inter-related dimensions. Lastly, the data indicated that the composite reliability of each construct was adequate ranging between .861 (Collaboration) and .891 (Engagement).

Table 2
Inter-factor correlations, shared variance, average variance extracted, and construct reliability among the constructs of Internet use for learning

Construct / Dimension	**1**	**2**	**3**
Engagement	.580	.34	.52
Research	.58	.552	.45
Collaboration	.72	.67	.610
Composite Reliability	.891	.880	.861

Note. Indicated along the diagonals are the average variance extracted (AVEs) of each sub-construct; below the diagonal is the correlation matrix; and above the diagonal is the shared variance matrix.

Factorial invariance of Internet use for learning across levels of internet

The third objective of this study was to assess the factorial invariance of Internet use across levels of Internet knowledge The Chi-square produced by the constrained measurement model was compared against the baseline value if there was any statistically significant difference.

Table 3
Results of the levels of internet knowledge -invariant analysis

	Unconstrained	**Constrained**	**Change**
Chi-Square	623.264	643.733	20.50
Degree of freedom	303	329	26
CFI	.871	.873	.002
RMSEA	.064	.061	.003

The invariance test across the beginner, intermediate and advanced groups revealed a statistically insignificant change in the Chi-square value, χ^2

(df=26) = 20.50, p>.05; implying that the increase in Chi-square values from the baseline to a constrained model still produced a good model. Additionally, the CFI changed by merely .002 and the RMSEA value was changed by a mere .003.

Table 4
Summary of Results

	Statement
RQ1	Undergraduate students' self-reported Internet use for learning is a multidimensional construct with interrelated factors, which are Research work, Collaborative learning, and Learner engagement.
RQ2	The three-factor Internet use for learning questionnaire is psychometrically sound in terms of reliability, convergent validity, and discriminant validity.
RQ3	The Internet use for learning questionnaire invariant across undergraduate students' levels of internet knowledge

Discussion

This study extended previous findings on students' Internet use for learning and as such enhanced our knowledge with regard to the Internet use for learning construct by confirming the multidimensional nature of the Internet use for learning construct. In term of Total Variance Explained (TVE), the dimension of learner collaboration demonstrated over 70% of self-reported perceptions with Internet use for learning. The learner engagement and research work dimensions had TVE of 64% and 62% respectively. This is in agreement with the categorizations of internet use by Wang (2007); Aqil and Parvez (2011) and Sudiran (2015) and Secondly, this study sought to assess the reliability and validity of the three Internet use for learning dimensions. The scores for sub-construct indicated satisfactory levels of internal consistency, with reliability indexes ranging between α= (.820) and α= (.886). The analysis results also supported the convergent and discriminant validity of the Internet use for learning questionnaire. Moreover, the AVE of each sub-construct exceeded the required threshold and yet with satisfactory inter-correlations among the dimensions of Internet use for learning. This study was also able to indicate that the 16-item questionnaire functions well in measuring undergraduates' responses to Internet use for learning. Thus the questionnaire adequately explained the meaning and variability of a three-dimension structure among students of Islamic University in Uganda

Lastly, the study examined the validity of student responses across levels of Internet knowledge. The results of multiple group Confirmatory Factor Analysis revealed that the measurement of Internet use for learning varied across levels of Internet knowledge (Beginner, intermediate and advanced). The results suggest that Internet use for learning did not vary significantly across levels of Internet knowledge. Hence, it can be deduced that level of Internet knowledge was not a moderating variable given its lack of interaction with the underlying

dimensions to affect learner responses to the Internet use for learning instrument. The findings thus far suggest that the measurement of Internet use for learning is applicable to beginners, intermediate users or advanced users of the Internet.

Conclusion and Recommendations

One of the practical contributions of this study to pedagogy is the importance of the 23-item Internet use for learning questionnaire is a satisfactory tool that is useful of undergraduate students' use of Internet tools for learning activities. Programme instructors and university management can utilise this tool to make an assessment of how well investment in Internet connect can be aligned with student learning activities and hence improved student performance and institutional competitiveness. Specifically, the assessment of undergraduates' self-reported perceptions to the three sub-constructs of collaborative learning, research work and learner engagement will enable faculty and students make better use of the Internet and its related tools and applications for enhanced teaching and learning processes.

Despite the significance of the findings, the study has a number of limitations. First, the sample for this study was a homogeneous group of undergraduate students from just one university. As such results may significantly differ with students in other higher education institutions and levels. Thus future studies covering heterogeneous samples would provide better comparisons across Internet users. Lastly, this study did not examine any likely causal relationship student Internet use and achievement or even learning satisfaction for that matter. Further research is therefore necessary to clearly link student Internet use and learning outcomes for better technology investment choices.

In summary, the study has enhanced our understanding with regard to the students' use of the Internet in their learning activities. The data got from this study is therefore important in guiding pedagogical interventions involving Internet technologies in higher education, necessary for producing a competent workforce for the 21st knowledge economy.

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