The Use of Web 2.0 Tools and Students' Cognitive Engagement Among Tanzanian University Students

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Abstract - With the advent of information and communication technology, educators need to embrace technology tools to enhance critical and creative thinking. This study has aimed to investigate the actual use of Web 2.0 tools in learning among University students in Tanzania. The course has also explored the effects of the actual use of Web 2.0 tools on cognitive engagement. The Acceptance Model and Technological Affordances were used as the research framework. The study used a quantitative method. Data were obtained from 3 universities in Tanzania. The study applied a proportionate random sampling from the 3 selected universities. Descriptive statistics using mean scores and percentage, Post-hoc, and Multiple Regression Analysis were employed. The findings show a non-significant effect of Web 2.0 tools on student cognitive engagement even though the actual use is apparent. The implications of the study are discussed.

Keywords - Web 2.0, Cognitive engagement, 21st Century, higher learning institutions

I. INTRODUCTION

In this 21st century, nearly any occupation that pays more than the minimum income in Tanzania and elsewhere is designed for workers who understand how to resolve a variety of intellectual and technical problems. As such, universities need to prepare and produce learners who are capable of collaborating, thinking critically, and solving problems in their surroundings (Wagner, 2008). Hence, universities are vehicles towards developing holistic students for the progress and development of Tanzania as a prosperous nation. Students have to be exposed to traditional approaches in teaching and learning. They need to be skilful in terms of collaboration, communication, and problem-solving by embedding social-emotional and spiritual learning strategies (World Economic Forum, 2016). This is contrary to the existing model of teaching approaches employed in most universities in Tanzania, which is still based on a teacher-centred and lecture-oriented method. There are still minimal interactions between instructors and students. The traditional method seems to be more attractive to many instructors due to its simplicity (Moulali & Sasidhar, 2017).

A. Cognitive Engagement

Student cognitive engagement is among the most important phenomenon in the 21st-century learning strategies that raise the skills required in the contemporary global market. According to Williams (2015), both students and employers urge the universities in the 21st century to engage students cognitively in higher-order thinking, problem-solving, critical thinking, communication, collaborative skills so as to make students meet current global demands. Studies have shown that cognitive engagement involves self-regulated learning that leads to academic success (Deci & Ryan, 1995; Daniel, Wang & Berthelsen, 2016; Oxford, 2016). In this study, a cognitive approach becomes a preference for achieving 21st-century learning skills. In the Tanzanian context, cognitive engagement has not been studied convergently by including affective, behavioural, and emotional engagement aspects. The previous studies have deliberated the aforementioned elements separately. Thus, this present study focused on cognitive engagement as it is the dominant of behavioural and emotional engagement. Despite the importance of cognitive engagement as an indicator of academic success, it has not been studied extensively in the context of Web 2.0 tools applications. Thus, this study has further expanded the understanding of the use of the cognitive engagement approach among university students in Tanzania.

B. Actual Use of Web 2.0 tools

Patil and Surwade (2018) define Web 2.0 tools as technological gadgets that are used to enable people to communicate through technological applications. Web 2.0 tools refer to the Internet applications that enhance online learning by engaging minds collaboratively and creatively, which leads to the interdependence of ideas, individuals, and information networks, which ultimately results in knowledge creation (McLaughlin &Lee, 2008). Web 2.0 tools are defined as those digital tools that enable accessing and producing knowledge in ways that move beyond passive consumption to active construction (Beach, Hull & O'Brien, 2011). There are different types of Web 2.0 tools, such as (i) social network sites, namely Facebook and Twitter. These are online tools that enhance collaboration, information

sharing, communication, and interaction of learners and lecturers in teaching and learning activities. (ii) Media sharing, which include Moovly, YouTube, Google plus (+), Vimeo, Prezi (iii) Blogging like Blogspot.com, WordPress, Website editor, Mozello.com, Wix.com, Weebly.com, Moovly (iv) Online libraries like ProQuest, Google scholar (v) Content management such as learning management system (LMS) which includes Moodle and Blackboard.

The actual use of Web 2.0 tools in Tanzania has introduced a new method of learning among students, which includes searching for references from the Internet and collaborative learning (Ngeze, 2017). Critical reviews on the relevant literature show that Web 2.0 tools have been used in facilitating learning in developing countries. For example, at Mzuzu University, Malawi by Chawinga and Zinn (2016) and Chawing (2017), in Ghana by Wilson and Boateng (2014), at Makerere University in Uganda by Okello-Obura and Ssekitto (2015). In the context of universities in Tanzania, Mtebe and Raisamo (2014), Lwoga and Komba (2015), Ngeze (2017) primarily focused on the use of Web 2.0 tools in learning. Additionally, their studies did not provide an adequate understanding of how best to integrate Web 2. 0 tools in learning to foster student cognitive engagement in universities in Tanzania. So, the present study attempts to gauge the gap by investigating the relationship between the actual use of Web 2.0 tools among students and their cognitive engagement.

C. Conceptual Framework and Hypotheses

Web 2.0 tools affordances are aligned with the technological pedagogical content knowledge (TPACK) model of Koehler and Mishra (2009). The model offers potential guidance for students to utilize technology in learning. Thus, when these tools are properly integrated into instructional methods based on this model, they are assumed (expected) to foster cognitive engagement among students in universities. Hence, Web 2.0 tools are applicable and flexible for modifying the traditional learning approach, which is teacher-centred to a learner-centred pedagogy, as advocated by Constructivist Theory. As learning can be enhanced through interactive and collaborative skills, learners will be in a good position of getting employment in the job market (Damoense, 2003; Williams, 2015).

D. Research Hypotheses

H_1: Using Web 2.0 tools in learning significantly affects student cognitive engagement.
H_2: Students' readiness to use Web 2.0 tools in learning significantly affects their cognitive engagement.
H_3: Practicing techno ethics of using Web 2.0 tools in learning significantly affects students' cognitive engagement.

E. Research Methodology

This study applied a quantitative method that used the survey technique by administering the questionnaires. The Survey technique determines and describes the way views

and perceptions of the respondents are towards a studied topic. It aimed at investigating the extent of university students' use of Web 2.0 tools, also to determine the effects of independent variables (actual use of Web 2.0 tools, readiness in using Web 2.0 tools in learning, and practising techno ethics of using Web 2.0 tools in learning) on the dependent variable (student cognitive engagement).

F. Sampling Procedure

Proportionate random sampling was employed for quantitative data to represent the diverse characteristics of the study population. This method helps to minimize errors and allows a smaller sample to be selected (Creswell, 2009). The samples were taken from 3 selected Tanzania universities.

G. Instruments and data collection

A set of questionnaires with 26 questions were partially adopted and constructed by the researcher and administered among 1000 undergraduate students from the selected universities in Tanzania to ensure they could be randomly picked. The researcher used 409 randomly picked responses from the returned questionnaires of 818. Sampling was based on proportionate random sampling to represent different characteristics of the intended population of this study. The questionnaire was developed and adopted based on the expert's recommendation and the literature. The demographic data collected comprised gender, age, year of study, ICT knowledge level, and the subject that integrated ICT the most. The independent variables for this study were the actual use of Web 2.0, readiness, and techno ethics. The dependent variable was cognitive engagement. A five-point Likert scale (1 = strongly disagree to 5 = strongly agree) was used.

H. Data Analysis Procedure

Statistical Program for Social Sciences (SPSS) was used to analyze the data. The demographic information of the respondents is provided through percentage and frequency. Descriptive statistics using mean scores and percentages were utilized to address Research Questions. Independent Sample T-test (to determine if there is a significant difference in each variable) and Descriptive analysis (percentage, mean and standard deviation), One-way ANOVA (to determine if there are any significant differences among 3 variables) and Multiple Regression Analysis (MRA) to predict the model.

I. Findings

This study intended to investigate the extent of use of Web 2.0 tools in learning, student academic readiness, and practising of techno ethics in using Web 2.0 tools in learning on student cognitive engagement. Multiple Regression Analysis (MRA) was employed for predicting student cognitive engagement.

Respondents' Demographic Information

		Frequency (n)	Percentage (%)
Gender	Male	272	67
	Female	137	34
Age	19-23	215	53
	24-28	163	50
	29 and above	30	7
Year of study	1st year	51	17
	2nd year	190	47
	3rd year	168	41
ICT knowledge	Beginner	98	24
	Intermediate	241	59
	Advanced	70	17
Subject integrating technology most	ICT related courses	213	52
	Non ICT courses	196	48

Note: Total respondents are 409

The ICT-related courses in this study are referred to as courses (e.g., Computer Science, Engineering) that offer skills related to the functions of information and communication technologies such as retrieving, assessing, storing, producing, presenting, and exchanging information by communicating and participating in collaborative networks via the Internet. The non-ICT-related courses are related to courses that do not offer ICT skills, which include social sciences like History, Political Sciences, Psychology, Linguistics, etc. (Herman, 1999 & Lemke, 2002).

The researcher has received 818 feedbacks from 1000 questionnaires distributed. However, only 409 were used for the study. The majority of responses in this study are males (67%) as compared to females (34%). Male domination in education is still prominent in Tanzania since independence in 1961. Among the factors contributing to gender inequality includes lower enrolment rates of females, higher dropout rates, and early marriages (Zacharia, 2014). Regarding the age category, the highest category ranges between 19-23 years, with 215 (53%) respondents, followed by 24-28 years with 163 (50%) and 29 and above with 30 (7%) respondents, respectively. The majority of students' age ranges between 19 and 23.

The availability and accessibility of higher learning institutions allow opportunities for fresher students who have completed their advanced secondary school levels to continue immediately with higher education. Regarding the year of study, the largest number of respondents was found in the 2nd year 190 (47%), followed by 3rd year 168 (41%) and 1st year 51 (17%), respectively. The response rate from first-year students was low. This would be due to the lower intake rate as compared to the succeeding (subsequent) years.

As far as ICT knowledge is concerned, competency, as reflected by the respondents, showed that the majority are intermediate level 241 (59%), followed by beginner level 98 (24%) and advanced level 70 (17%), respectively. Only a few respondents rated themselves as possessing advanced skills of the ICT level. There is a possibility that the majority of students began learning ICT skills at a higher education level. In terms of subject/course that integrates technology most, ICT related courses/subjects are 213 (52%) and non-ICT courses/subjects are 196 (48%) correspondingly, which indicates a small difference. Both courses, whether ICT or non-ICT related, indicated that the students have integrated Internet resources in learning. In this 21st Century learning, Web 2.0 tools have been integrated widely into education, which has provided more opportunities for collaboration in learning (An & Williams, 2010).

II. RESULTS
Mean, standard deviation and percentage of agreement

	Mean	Std. Deviation	Strongly agree%	Agree %	I'm not sure%	Disagree%	Strongly disagree %
I give feedback on my friend's blog.	3.89	1.24	19.3	44.7	12.0	13.4	10.5
I am able to work together with my colleagues to accomplish assignments through Google Docs or Google Drive.	4.20	.92	42.8	43.8	5.4	6.6	1.5
I am able to share an educational video with my classmates via YouTube or Google plus (+).	3.89	1.05	30.8	44.5	9.5	12.0	2.2
I use Social networks (e.g., Facebook, Twitter) to extend and share ideas with my friends	4.49	.72	58.2	36.2	2.7	2.2	.7
I use the Learning Management System (LMS), e.g., Moodle or Blackboard, to create, share, or upload content.	3.67	1.14	24.9	40.8	16.4	12.5	5.4
I use blogs to share reflective or academic writing.	3.41	1.26	19.3	40.8	11.0	19.6	9.3
I create a website for the course/subject using Wix.com/Google sites/ online free Website templates.	2.83	1.28	11.2	24.4	16.6	31.1	16.6
I upload self-developed video hosting sites such as YouTube/Vimeo/Wix.com/other Websites.	3.23	1.31	17.8	34.2	12.7	23.2	12.0
I refer to resources from websites for research or writing assignments	4.39	.84	53.1	39.6	2.9	2.0	2.4
I use e-mail to send my documents/assignments to my lecturers/friends.	4.30	.93	50.9	37.9	4.2	4.6	2.4
I collaborate with friends to design graphics using online apps (e.g., Canvas)	3.33	1.29	21.0	32.0	15.2	22.2	9.5

Based on the quantitative findings, items 1 to 11, which address the use of Web 2.0 tools, have revealed overall agreement (>50%). The words denoting "give feedback in the blog" in item 1, "share educational video" in item 3, "work together" in item 2, "collaborate" in item 11, "use social networks" in item 4, "use e-mail" in item 10, "refer to resources from websites" in item 9, "use LMS" in item 5, "share and reflect" in item 6, "create websites" in item 7, "upload video" in item 8, are corresponding to the trend of technology usage among Tanzanian higher learning institutions. The students, with the support of the Universities, are moving ahead towards managing knowledge in terms of 21st-century education.

The findings show the highest agreement of 94% with item 4 (I use Social networks (e.g., Facebook, Twitter) to extend and share ideas with my friends). This item was followed by item 9(I refer to resources from websites for research or writing assignments), which constituted an agreement of 93%. Item 10 (I use e-mail to send my documents/assignments to my lecturers/friends) has scored 89% of "agree and strongly agree). The way or method of knowledge delivery and sharing become concerns for the higher institutions among students in Tanzania. With reference to items 1 (64%), item 2 (87%), item 3 (75%), item 5 (66%), item 6 (60%), item 8 (52%), item 11 (53%) of the

agreement, the findings signify that the majority of the students use Web 2.0 tools in higher-order thinking activities.

Overall findings also show that the students have uncertainty (>10%) in the following items 1(I give feedback in my friend's blog), 5(I use a Learning management system (LMS), e.g., Moodle or Blackboard, to create, share or upload content), 6(I use blogs to share reflective or academic writing), 7(I create a website for the course/subject using Wix.com/Google sites/ online free Website templates), 8(I upload self-developed video hosting sites such as YouTube/Vimeo/Wix.com/other Websites) and 11(I collaborate with friends to design graphics using online apps (e.g., canvas). This indicates that few students are not certain about responding to the questions. In other words, the questions are not clear to them. So, there is a need to probe further in the interviews.

However, items 4, 9, and 10 suggest that students also use Web 2.0 tools, i.e., Facebook, Twitter, e-mail, and online resources, as common tools for communication. (See Table 4.8). In other words, Tanzanian students are ready for the new challenge in building a knowledge society.

Effects of Using Web 2.0 Tools on Cognitive Engagement in Learning

Model summary				
Model	**R**	**R^2**	**Adjusted R^2**	**Std Error of the Estimate**
1	.462	.213	.207	.40147

In order to understand the relationships based on the effects of using Web 2.0 tools, techno ethics, and students' readiness as they affect cognitive engagement, the model has to be verified using MRA. Thus, mean scores were computed to represent each construct. ANOVA is the prior results of MRA to verify the significance of the model. MRA Enter method was deployed to address the research question. In this model, the use of Web 2.0 tools, readiness, and practising of techno-ethics were independent variables, while student cognitive engagement was a dependent variable.

Based on the ANOVA results, R^2 = .213, which means that 21.3% of the variance in the data can be explained by the predictor variables. See the below model summary from the ANOVA in which three hypotheses were tested.

H$_{4a}$: Using Web 2.0 tools significantly affects students' cognitive engagement.

H$_{4b}$: Students' readiness in using Web 2.0 tools significantly affects students' cognitive engagement.

H$_{4c}$: Practicing techno ethics of using Web 2.0 tools in learning significantly affects students' cognitive engagement.

ANOVA results					
Model	**Sum of squares**	**Df**	**Mean square**	**F**	**Sig.**
1 Regression	17.682	3	5.894	36.568	.000
Residual	65.278	405	.161		
Total	82.960	408			

The results indicate that the model is significant F (3, 405) = 36.568, p = .000.
Coefficients

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std Error	Beta		
1(Constant)	2.631	.181		14.494	.000
Web2.0	.037	.042	.046	.878	.380
Ethic	.178	.041	.021	4.379	.000
Readiness	.230	.038	0305	5.973	.000

To determine the extent to which the individual predictor variables affect students' cognitive engagement, the researcher used the coefficient table. The results indicate that Techno ethics shows positive significant effect on the engagement (β = .178, P < .05), Students' readiness contributed significantly to the model (β = .230, p < .05), while the Use of Web 2. tools did not affect significantly on engagement (β = .037, P = .380). So, the final predictive model is explained by student cognitive engagement = 2.631 + (.178 techno ethics) + (.230 readiness). Thus, hypotheses H_1 is rejected, and H_2 and H_3 are accepted.

III. DISCUSSION AND CONCLUSION

This study has analyzed 3 hypotheses, notably, the effects of using Web 2.0 tools, practising techno-ethics, and students' readiness to use Web 2.0 tools on the students' cognitive engagement in learning. These hypotheses are:

H_1: Using Web 2.0 tools significantly affects student's cognitive engagement, which is not accepted;

H_2: Students' readiness in using Web 2.0 tools significantly affects students' cognitive engagement, which is accepted; and

H_3: Practicing techno -ethics of using Web 2.0 tools in learning significantly affects students' cognitive engagement, which is accepted. by this study.

With regard to the actual use of Web 2.0 tools, the university students of Tanzanian are engaged in using Web 2.0 tools in learning activities. They use them to get feedback, work together to accomplish assignments, collaborate, share videos and ideas, cite and authenticate references from websites.

In general, the findings of this present study have shown that Tanzanian students use (actual use) Web 2.0 tools in learning. The findings have also proven the importance of providing prior training towards students' readiness to embrace technology. This is supported by the TPACK Model as solidifying knowledge with both lecturers and students. Knowledgeable lecturers can choose appropriate technologies for learners learning. On the other hand, knowledge can support learners in using technologies in learning. Hence, the government, through the Ministry of Education, Science, Technology, and Vocational Training, should introduce a policy about using technology in universities in Tanzania.

Tanzanian students of higher learning institutions seem to be interacting deeply with content in learning as related to items of cognitive engagement (>90%). Their responses rated between 90.2% and 96.3% of agreement (trying to understand the material better; figuring out how the information might be useful; trying to connect new knowledge with past experiences; making examples to comprehend concepts, and deciding what to learn).

Thus, the results indicate that the Use of Web2 tools did not have a significant effect on engagement (β = .037, P = .380); Students' readiness contributed significantly to the model (β = .230, p < .05), and Techno-ethics showed positive significant effect on the engagement (β = .178, P < .05). Students' readiness and Techno ethics are contributing to the means to predict students' cognitive engagement. The strongest contribution in explaining students' cognitive engagement is Students' readiness (β = .230, p < .05) and it is followed by Techno-ethics (β = .178, P < .05). The results have suggested that when students are ready to use web 2.0 tools and, at the same time, they are ethical in using Web 2.0, there is a possibility that such students will be cognitively engaged. In other words, students who are either intrinsically or extrinsically motivated and ready to use these learning affordances by observing techno-ethics have a higher degree of cognitive engagement; hence they have more concentration in learning.

Despite the finding that the use of Web 2.0 tools is not significant, it is still needed in this model. According to Hair et al. (2010), each predictor has a unique contribution to the multivariate model as there is collinearity with other predictors. Thus, the researcher has not discarded the usage of the Web 2.0 tool. The potential of using Web 2.0 tools in learning has been supported by other findings. Sumuer (2018), in Turkey, found that the use of Web 2.0 tools significantly influences students' cognitive engagement. Similarly, Den Exter, Rowe, Boyd, and Lloyd (2012) in Australia found that these tools engage students with learning activities. Social networks enable students' interaction in learning. They also enhance students by promoting critical thinking, constructing knowledge collaboratively, and helping students to generate their own knowledge. Thus, despite the construct of Web 2.0 tools used in this present study, it has been found to be not visible enough and strong enough as a factor to predict student

engagement. It shows association or relationships with other predictors.

This study has implications for expanding Davis' technology acceptance model (TAM). The basics and foundation of this model indicate that the external variable has influenced the perceived ease of use and perceived usefulness. Knowledge and skills of ICT play an important role in forecasting the PEOU and PU. Hence, it should be expanded among the external factors of the model. Enjoyment stimulates a user towards the acceptance of using technology. As a result, the users will express their intention to use the technology, hence influencing their actual use. This model has anticipated not only the intention to use and perceived usefulness with the actual use but also their impact on cognitive engagement. Hence, TAM has been expanded to include knowledge and skills of ICT and indirectly influences cognitive engagement.

This study is also very useful for universities to meet the demands of 21st-century skills by introducing the use of Web 2.0 tools in learning, which are applicable for critical thinking, creativity, communication, collaboration, and problem-solving, as they are relevant for employment in the 21st-century society. This will help the government to generate qualified human talents as resources, which will boost the development of the country.

This study allows other researchers to employ the instruments of this study and cross-validate it in a diverse setting. The conceptual framework for this study serves as a reference for scholars and researchers in the related field in their attempt to develop a more conducive learning environment using Web 2.0 tools. As such, policymakers through the Ministry of Education will be able to restructure and reshape the curriculum to cope with 21st-century demands.

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