EXPERIENCES OF MATHEMATICS INSTRUCTORS ON ADOPTING WEB2.0 TECHNOLOGIES IN ETHIOPIAN UNIVERSITIES

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Abstract. Web2.0 technologies have brought a paradigm shift on the teaching and learning process globally by providing creative, interactive and collaborative learning landscapes. These technologies have the potential to eradicate all possible physical and mental barriers for learning and pave the way to keep oneself up-to-date through the access of open contents and remains connected with people of same interest to secure lifelong learning. In the context of Ethiopian universities, the endorsement of these technologies for mathematics classrooms is at its infant stage. Likewise, much research is not conducted on experiences of mathematics instructors on adopting these technologies for classroom instruction. As a result, this study was conducted to describe the status of mathematics instructors' awareness, experience, purposes and challenges on adopting Web2.0 technologies for supporting students' learning of mathematics in three purposefully selected public universities in Ethiopia. Descriptive survey research design was employed for the study. Questionnaire, interview and observation checklist were used as data collection tools. Thirty mathematics instructors involved as respondents who were selected randomly. The study revealed that the instructors are aware of the use and benefit of Web2.0 technologies. But, they largely use them for the purpose of social communication or personal enjoyment than instructional practices. They do not incorporate them in course design and as classroom teaching and learning facilities. Internal and external factors related to awareness, experience, purpose and challenges hindered the instructors from adopting these technologies. It is recommended that web2.0 technologies need to be extended into the actual classroom instruction, and there has to commitment to build better ICT infrastructures and access to Web2.0 technologies on these institutions. *Keywords:* Web2.0 technologies, mathematics instructors, connectivism, 21st century learning models

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Introduction

The advancement of internet technology has brought a paradigm shift on the teaching and learning landscape. Web 2.0 technologies are one of the key driving forces that changed the learning paradigms into self-directed and self-regulated platforms by avoiding the bureaucratic bottle neck of formal education. To meet the needs of all students and to design program that is responsive to the intellectual strengths, personal and communal interests of students, it is essential to integrate affordable and accessible educational technologies to the educational system. The important knowledge of today is not the knowledge in the elders, in the minds of expertise, or in books, rather is the knowledge in the internet because it is easily accessible and can be disseminated to the beneficiaries anywhere at any time whenever there is an internet access. New knowledge can be published, transmitted and stored in the internet in an interactive way. These days, web based mathematics courses and mathematical software are available. Digital skill, in addition to literacy and numeracy, is becoming a third basic skill in the goal of mandatory education (Thomas, 2011). The original version of World Wide Web (WWW), which was discovered by Berners-Lee in 1990's, is now termed as Web1.0 that transmits information to the end users through one-way path of communication. But the web technology is now transformed into more interactive and collaborative, and users are content producers (Mohammadyari, 2012). Web 2.0 technologies as advanced refer to the Web-based applications that allow virtual students to collaborate, communicate, and share information in a virtual or online learning environment (Abdoli-Sejzi et al., 2015). The 21st century teaching-learning model is peer-to-peer collaboration, community generated curriculum content, place of learning is anywhere, self-directed exploration and teamwork interaction. Objective of learning is life-long learning skills, learning tools are personal devices, learning outcomes are adaptations and growth (Rogers et al., 2007). Thus, Web2.0 technologies can be seen as opportunities that create the environment that provides the 21st century needs. So, using Web2.0 technologies in our education sector is indispensable to cope up with the dynamics of the global society.

Background of the study

The interactive features of Web 2.0 technologies have the potential to reach students at home, in their dorms, in between classes and work, and on the weekends (Sadaf et al., 2011). The advent of Web2.0 technologies have brought a tremendous transformation on the academic sector by enhancing students' engagement, participation, higher order thinking, social skill, self-directed learning, and lifelong learning (Yadav & Patwardhan, 2016). The Web2.0 technologies have shifted the learning platform to open contents, multiple teachers, learning everywhere and any time in 24/7.

The everlasting Plato's philosophy related to education, including: teaching is considered as moral duty of educators, learning stems from active and dialogical process of questioning and learning is lifelong endeavor in the wider context of learning society (Thomas, 2011) still remains valid in the digital age. The implementation of the web technology is growing from passive information consumption (Web1.0) to the more interactive and productive information sharing (Web2.0) to the evolving semantic web (Web3.0) that allows users to adapt and customize information (Hossain & Quinn, 2012). The Web2.0 technologies help individuals to publish and store multi-media information and can share with their correspondents (O'Reilly, 2007). The features of Web 2.0 technologies may help to make mathematics learning interesting, simple, accessible, faster and long lasting. In the context of static to dynamic, in an interactive mathematics program, technology can increase students' ability of achieving a variety of higher-order learning outcomes (Hossain & Quinn, 2012). These technologies can avoid physical barriers of learning by making students access the learning contents through these digital technologies to their preference of learning modalities. The main features of Web 2.0 technologies are that they empower the students to access, create, disseminate, and share information easily in a user friendly, open environment (An & Williams, 2010).

For effective and efficient use of Web2.0 technologies in facilitating the teaching and learning process, the case of the Ethiopian context needs to take in to great consideration teachers' awareness and experience of using these technologies, the infrastructures that enables to access these technologies, and the curriculum design, development and implementation. The effective implementation of these technologies can also alleviate the quality problem of the Ethiopian education system. Research results obtained by Echeng & Usoro (2016) revealed that improved learning experience with the use of Web 2.0 tools in higher education is positively related to perceived usefulness, perceived ease of use, prior knowledge, motivation to use, social factors, facilitating condition and performance expectancy.

Web2.0 technologies

Even though, Web2.0 has no clean definition and can be defined from different perspectives, it is a buzzword used to describe the collaborative and interactive feature of the new version of the web based educational technologies. Web2.0 technologies are powerful mediators between students and the world around them, and they may motivate students to continue learning outside the classroom. The Web2.0 applications hold profound potentials in education because of their open nature, ease of use and support for effective collaboration and communication. Especially, in the Ethiopian context, Facebook and YouTube are the most familiar and commonly used web2.0 technologies by students of all grade levels for social interaction and enjoyment. The utilization of Web2.0 is managed by individual academicians rather than being driven from national policy or even institutional policy levels (Hossain & Quinn, 2012).

` Numerous tools and applications are included under the label of Web2.0 Technologies (Hossain & Quinn, 2012). A comprehensive review by Bower (2016) resulted in identification of 212 Web 2.0 technologies which are suitable for learning and teaching purposes. These technologies enable to provide the learning contents in various modalities of learning and can help to cater the diversity of students' preference of learning style. The use of Web2.0 technologies can support innovative teaching methods and is associated with concepts like communities of practice, syndicated content, learning as a creative activity, peer-to-peer learning, creation of personal learning environments, and non-formal education (Tyagi, 2012). Web2.0 applications rely on user-generated content and interactivity (O'Reilly, 2007). Hence, Web2.0 technologies give power for students to manage and decide on their own learning. This means that students have control over the content and over the choices that they make in relation to what is preserved and what is discarded. Web2.0 technologies create an environment for the students to participate in the learning platform with collaboration, creativity, conversation, community and control (Hicks & Graber, 2010). Rogers et al. (2007), stated the evolution of learning models for 19th century, 20th century and 21st century as in the Table 1.

Web2.0 technologies represent not just a new generation of tools, but a significant shift in approaches to teaching and learning that challenge the very existence of formal educational institutions (Lee & McLoughlin, 2011). As different researches showed, move from traditional approach of instruction to web-based approach can have several advantages in Mathematics instruction (Barve

& Barve, 2012) and using Web2.0 technologies for Mathematics instruction enhance students engagement in learning (Drijvers, 2015).

Table 1. Learning models of 19th, 20th, and 21st centuries
(source: Rogers et al, 2007)

	19th Century	20th Century	21st Century
Teaching Style	Lecture	Lecture	Peer-to-peer (P2P) collaboration
Curriculum	Books, blackboard	Textbooks	Community generated Content
Location	One-room Schoolhouse	Classrooms	Anywhere
Interaction	Question and answer (Q&A)	Labs	Self-directed exploration, Teamwork
Objective	Survival	Employment	Lifelong learning skills
Tools	Blackboard	Labs	Personal devices
Result	Book learning	Memorized facts and Information	Adaptation, growth

Statement of the problem

Quality in the Ethiopian education system is criticized by different bodies that it has less capacity in producing skillful, critical and creative human power. The lesson delivery approach is largely chalk and board method. As a means to overcome this problem introducing an alternative instructional approach responsive to the intellectual development and suitable for the mind setup of our students is essential. The institutional readiness in capacity building and availability of skilled manpower in the process of integrating Web2.0 technologies in education in the context of Ethiopia is critically demanded. The Ethiopian public universities educational system is semester based and classroom is bounded as box server backed with a long bottle neck bureaucracy. Such a system may not give chance for lifelong learning and self-directed learning mechanisms. This may interfere with the flexibility and autonomy of learning of the students, as universities no longer control knowledge of students as they can access information anytime and anywhere using their portable electronic devices through the internet connection. Students do not have to rely on the library, instructors, or even textbooks to access knowledge that is related to their course work. These days, students' ability to connect to the reliable sources of knowledge is the important thing for continuous learning to occur and to getting connected to the relevant source of knowledge that can bring lifelong learning. So, the effective implementation of web2.0 technologies to enhance students' learning of mathematics in Ethiopian Universities is worth investigating. However, the status of instructors' awareness, their experience of implementing Web2.0 technologies and associated purpose, and the challenges they face in the Ethiopian higher education are not yet investigated. It is thus worth of investigation.

Theoretical framework

According to Hossain & Quinn (2012), the Web2.0 technologies are adopted for the classroom use based on the connectivism of cognition and learning.Web2.0 technologies create the landscape for student directed learning mode because they allow student to easily participate and contribute to the learning material (Echeng & Usoro, 2016). Active learning helps learners to develop ideas and this brings about meaningful learning. Wang et al. (2014), as cited in Kizito (2016), have developed a framework for creating and analyzing interaction and cognitive engagement in connectivist learning contexts. In this framework, the interaction occurs between other humans and network resources and is critical for connection building and network formulation. Learning occurs as the learner engages in different forms of network formation at the neural (cognitive), concept, and social levels (Siemens, 2005). The four levels of interactions, noted by Kizito (2016), are: operation interaction, way finding interaction, sense making interaction, and innovation interaction.

Interaction models		
Chen's(2004) model	Elements from Moore's (1993) and Anderson's (2003) model	Components from Wanq, Chen & Anderson's (2014) and Siemen's (2011) models
Concept interaction	Learner's new-old concept interaction	
Information interaction	Learner-teacher interaction Learner-learner interaction Learner-content interaction	
Operation interaction	Learner-interface interaction	

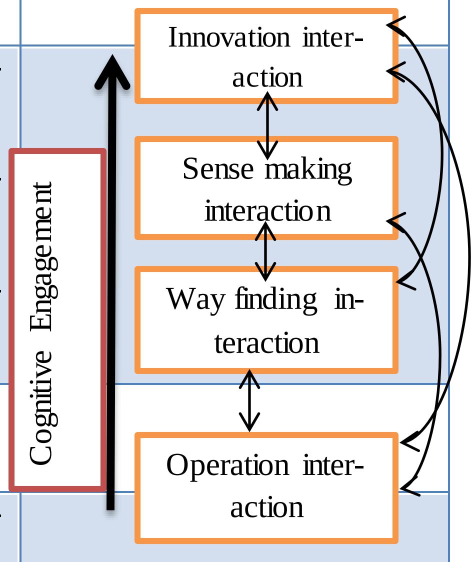

Figure 1. Framework for interaction and cognitive engagement in connectivist learning (Source: Kizito, 2016).

The evolutional stride indicates hierarchical modes of instructional interaction which consists of the following phases: an operational interactional phase in which the student interacts with the technology; an informational interactional phase whereby the learner links with information nodes located in human and non-human resources; and a concept interactional phase where old concepts become new concepts in a process of increasing levels of abstraction and meaningful learning.

In a connectivist learning context, each learner should be assisted by a facilitator, peers, experts, and non-human support mechanisms to create and maintain a personal learning network immersed in other networks. This could develop through the four phases of interactions namely operation, way finding, sense making and innovation, which are illustrated by Kizito (2016), as follows.

- In the operational interaction phase, the learner uses technological tools such as blogs, wikis and social networks to participate in learning.
- During the way finding phase, learners learn how to navigate the networking topography by identifying the right resource nodes (people or information).
- The sense making phase is a stage where learner–content and learner–group interactions occur at a deeper level.
- The highest level of cognitive interaction and engagement occurs at the innovation interaction stage when learners are able to create or modify artifacts, and engage deeply with others while reflecting on these artifacts.

The emergence of Web2.0 technologies has reversed the dynamism into user-center platform for connecting, sharing, interacting, working and creating learning contents and materials. In the connected community, the concept of identity is shifting from the individual's interests to the communal goals (Thomas, 2011). Any single individual can independently connect with the others and contribute for the success of the communal goal of the community. So, in the digital age learning is taking place if a connection is made to the appropriate node of information. It is a fact that these days the individual has access to better and more modern technologies than that institutions or organizations can provide to him/her (Forrester, 2009). Instructors should scaffold their students to get connected to the reliable sources of knowledge related to their courses. Individuals can learn from their network through the Web2.0 technologies based on their interest and context more than what can they learn from seminars, workshops, conference, even some time, the normal classroom.

Objectives of the study

This study has the following specific objectives which have been investigated and provided with empirical and tangible evidences using reliable data sources: (1) to describe instructors' awareness on the potential uses of Web2.0 technologies to support students' learning of mathematics in Ethiopian Universities; (2) to investigate the experience of instructors in adopting the Web2.0 technologies as a means to promote students' learning of mathematics in Ethiopian Universities; (3) to identify mathematics instructors' purpose of using Web2.0 technologies in their day to day activities; (4) to identify the challenges Ethiopian mathematics instructors face to implement the full potential of Web2.0 technologies for supporting students' learning of mathematics courses.

Significance of the study

Web2.0 technologies can facilitate the teaching and learning process, knowledge in the web can be accessed anywhere at any time, and instruction supported with Web2.0 technologies can improve interaction and innovation.

Web2.0 technologies can eradicate the physical and mental barriers as well as bureaucratic bottle neck of the institutions for securing the lifelong learning goals.

Influence stakeholders, policy makers, government officials to give emphasize for adopting Web2.0 technologies for facilitating and managing the teaching and learning process.

Scope of the study

The research sites for this study were delimited to three Ethiopian Universities, namely Jigjiga University, Hawassa University and Dilla University.

Participants of this study are thirty (30) mathematics instructors from the three universities. The study intended to describe the status of awareness, experience, purpose and challenges of using Web2.0 technologies to facilitate the teaching and learning process of mathematics courses. Due to the small sample size of universities and instructors, it is difficult to generalize to the whole Ethiopian university and the entire mathematics instructors. It is only to describe the status of the considered university with respect to the implementation of Web2.0 technologies for facilitating the teaching and learning processes.

Research method and design

Method

A mixed research method (Creswell & Clark, 2007) was adopted to examine mathematics instructors' awareness on the potential use of Web2.0 technologies for facilitating students' learning of mathematics courses, and their experiences, purposes and challenges of using these technologies. This study used different but complementary data to validate and expand quantitative results with qualitative data. The results obtained from the structured questionnaire are triangulated by the results obtained from open ended questionnaires, semi-structured interviews and observation check lists.

Design

Descriptive survey research design (Best & Kahn, 2007) was employed to obtain empirical data on the awareness, experience, purpose and challenges of mathematics instructors in adopting Web2.0 technologies for facilitating the teaching and learning process at the selected Ethiopian Universities. This is so because descriptive survey study is the method of research which concerns itself with the present phenomena in terms of conditions, practices, beliefs, processes, relationships or trends invariably (Salaria, 2012) and descriptive survey research design is a scientific method which involves observing and describing the behavior of a subject without influencing it in any way.

Population, sample and sampling technique

For this study, the three universities were selected purposely. The purpose of selecting these different universities includes their different geographical locations, different infrastructures and different work experiences (generation). The target populations to which the results of this study present are the academic staffs in mathematics department at these three universities. Ten mathematics instructors from each university were selected for questionnaire. Furthermore, three mathematics instructors from each university were selected and interviewed.

Data collection instruments

The data collection instruments were mainly questionnaire, and observation checklist developed by the researchers by consulting the related literatures. All the data were collected through face to face administration of the instruments. The instructors' awareness, experience, purpose, and challenges on adopting Web2.0 technologies for supporting the students' learning of mathematics courses were measured by a 5 point Likert scale questionnaire that range from strongly disagree to strongly agree accompanied by open ended questions. The observation checklist consisted of items related to the availability, accessibility and affordance of utilities for the use of Web2.0 technologies.

Validity and reliability of the research instruments

Before the actual research had been conducted, panel of experts, colleagues, and related literatures were consulted to ensure the different features of validity of the instruments. A pilot test was also conducted on some randomly selected instructors who were not included in the final study to measure reliability (internal consistency) of the instruments. To estimate the internal consistency reliability of the scaled items, Cronbach's alpha coefficient was calculated.

Table 2. Reliability of data collection tools

Item	Number of Items	Cronbach's Alpha
Awareness	16	.71
Experience	13	.78
Purpose	6	.56
Challenge	10	.72

Table 2 shows Cronbach's alpha coefficients of Awareness, Experience, Purpose, and Challenge. In the ideal situation, the accepted Cronbach alpha coefficient of a scale is required to be greater than .7 (Pallant, 2005). For the scales of purpose, the mean inter-item correlation was calculated since the Cronbach's alpha values are quite sensitive to the number of items in the scale and obtained to have the value in the interval .2-.55 that is in the recommended optimal range (Briggs & Cheek, 1986).

Method of data analysis

Descriptive statistics is used to organize, analyze, summarize and discuss the collected data. The data were analyzed using SPSS 20 statistical software package. Qualitative discussion is provided for the data obtained from the observation checklist and open ended questions. The scaled data were analyzed by using percentage and frequency. The qualitative data were described using texts and these were used to triangulate the results obtained from the quantitative data. Brief discussions and interpretations are given for the obtained results. Based on the results obtained insightful conclusions and recommendations are forwarded.

Ethical issues

After the participants had been selected randomly with probability sampling technique, they were requested to ensure their consent if they were volunteers to participate in this study and the anonymity of the volunteers was kept confidentially.

Results and discussion

The data are organized, presented and analyzed in tabular form followed by discussions and interpretations. These are presented hereunder.

Table 3. Demography of the research participants (N = 30)

Variable	Category	Frequency (*f*)	Percentage (%)
Gender	Male	26	86.3
	Female	4	13.3
Age	25-35	18	60
	36-46	9	30
	Above 47	3	10
Academic status	Graduate Assistant-II	1	3.3
	Graduate Assistant-III	1	3.3
	Lecturer	27	90
	Others	1	3.3
Work experience	Below 5	6	20
	5-10	8	26.7
	10-15	11	36.7
	Above 15	5	16.7

Table 3 presents background information of the participants of the study. Most of mathematics instructors are male (86.3%), their age is dominantly in the range of 25-35(60%). Mathematics instructors are youngsters. Web2.0 technologies and these mathematics instructors are eligible compatriots that belong to the 21st century digital technology and digital technology literate generation, respectively.

Table 4. Mathematics instructor's awareness on the potential use of Web2.0 technologies for mathematics instruction (N= 30)

Item	SD		D		N		A		SA	
I am aware of Web2.0 for:	f	%	f	%	f	%	f	%	f	%
▸ the educational value	2	6.7	5	16.7	4	13.3	14	46.7	5	16.7
▸ addressing students' diversity	1	3.3	1	3.3	2	6.7	22	73.3	4	13.3
▸ engaging students in learning	1	3.3	1	3.3	1	3.3	23	76.7	4	13.3
▸ creativity and innovation	0	0	1	3.3	3	10.0	19	63.3	7	23.3
▸ effective feedback	1	3.3	3	10.0	5	16.7	16	53.3	5	16.7
▸ scaffolding students' learning	0	0	3	10	6	20	19	63	2	6.7
▸ user friendliness	0	0	3	10	6	20	19	63.3	2	6.7
▸ avoiding time constraint.	0	0	3	10	6	20	16	53.3	5	16.7

SD= Strongly Disagree, D = Disagree, N = Neutral, A = Agree, SA = Strongly Agree

A large number of mathematics instructors (63.4%), are aware of on the potential use of Web2.0 technology for mounting educational value, and for addressing students' diversity (86.6%). Engaging students on their learning (90%) and supporting students' creativity and innovation in their learning (86.6%) are worth mentioning. Instructors are also aware of on the potential use of Web2.0 technologies for effective and timely feedback (70%) on learning progress through students' portfolio and records on the learning platform that is useful to scaffold students learning supported by 69.7% because instructors can reach their students anywhere at any time whenever there is an internet access. It is also noted that Web2.0 technologies are useful for avoiding time constrains (70%) since these technologies are not confined to classroom and school days. Albeit these, the instructors are also aware on the user friendly nature of Web2.0 technologies (69.7%) because these technologies do not need advanced computer programming skills of the end users. It was also noted from the open ended questionnaire that some mathematics instructors are familiar with auto-wave lesson planning. One respondent explained that auto-wave lesson is prepared by instructors and uploaded in computer lab center for students. It is audio-visual;

students can easily visualize abstract concepts like 3-D graphics which we are not easy to display in a blackboard.

Based on the results displayed above, it can be concluded that mathematics instructors, at the considered three universities, are aware of the potential use of Web2.0 technologies to supporting students' mathematics learning.

Table 5. Experiences of mathematics instructors in adopting Web2.0 technologies for supporting students' learning (N= 30)

Item	SD		D		N		A		SA	
I have the experience of adopting Web2.0 technologies on:	f	%	f	%	f	%	f	%	f	%
▸ sharing contents to others	5	16.7	12	40	6	20	5	16.7	2	6.7
▸ reading contents	0	0	16	53.3	1	3.3	10	33.3	3	10.0
▸ commenting other's contents	3	10	7	23.3	9	30.0	8	26.7	3	10.0
▸ interaction with students	5	16.7	10	33.3	8	26.7	6	20	1	3.3
▸ collaboration with fellow scholars	3	10	4	13.3	8	26.7	13	43.3	2	6.7
▸ assessment and grade submission	1	3.3	8	26.7	6	20.0	10	33.3	5	16.7
▸ handling mathematics classroom	6	20	13	43.3	10	33.3	1	3.3	0	0

Small number of mathematics instructors (23.4%) has the experience of adopting Web2.0 technologies for creating and sharing mathematics learning contents to others. Significant number of mathematics instructors (53.3%) do not use Web2.0 technologies for reading mathematics contents. 36.7% of mathematics instructors have the experience of adopting Web2.0 technologies for commenting other's contents while considerable number of them (33.3%) do not have the experience. Though Web2.0 technologies are sufficiently accessible only 23.3% are using Web2.0 technologies for interacting with their students during the teaching and learning process of mathematics courses. But, about

50% of them have the experience of using Web2.0 technologies for collaborating with fellow scholars and co-lecturer for facilitating the teaching and learning process of mathematics course. As it can be observed in table 5, half of the participants (50%) claimed to have the experience of using Web2.0 technologies for assessment and grade submission. But, almost all of the participants (96.3%) have never incorporated web2.0 technologies in their mathematics classroom. Beyond these, the results obtained from the open ended questionnaire indicate that mathematics instructors use you-tube and Facebook more frequently. The instructors indicated that they are using off line mathematics soft wares, like, MATHLAB, FORTRAN, PYTHON, C^{++}, etc., for teaching mathematics. However, these kinds of software are not part of their course design and they do not use in the formal classroom for supporting the teaching and learning process.

From Tables 4 and 5, it can be seen that mathematics instructors have a good awareness on the potential use of Web2.0 technologies for supporting students' learning of mathematics courses, but not in practice. These indicate that there must be some barriers that prevent the instructors from implementing Web2.0 technologies for facilitating students' learning. Birhanu (2012) reported that despite general enthusiasm and believes in the benefits of ICT for transforming education in Ethiopian Universities, instructors' lack of relevant preparation, either as pre-service or in-service, are a primary barrier to instructors' readiness and confidence in using ICT.

The purpose Web2.0 technologies are used varies for different people and interest groups. In this regard about 66.6% of the mathematics instructors use Web2.0 technologies for enjoyment while a few of them 13.4% use Web2.0 technologies for instruction. Gebremedhin & Fenta (2015) explained that most of the teachers are using the connection for social networks and entertainments rather than academic purpose. Significant number of the participants (83.3%) use Web2.0 technologies for communication purpose. In spite of this use of Web2.0 technologies for communication only 56.6% use Web2.0 technologies for collaboration with others who have similar interest. Most of the instructors

(40%) do not use Web2.0 technologies for creating virtual space, and considerable number of the participants (36.7%) could not determine their stance on their use of Web2.0 technologies for creating virtual space. Only a few of them (23.3%) are using Web2.0 technologies for creating virtual space. These results manifest that most of the mathematics instructors use Web2.0 technologies either for enjoyment or communication purpose than instructional.

Table 6. The purposes that mathematics instructors use Web2.0 technologies (N= 30)

Item	SD		D		N		A		SA	
I use Web2.0 technologies for the purpose of:	f	%	F	%	F	%	f	%	f	%
Enjoyment	3	10	4	13.3	3	10	16	53.3	4	13.3
Communication	1	3.3	2	6.7	2	6.7	19	63.3	6	20.0
Instruction	14	46.7	7	23.3	5	16.7	2	6.7	2	6.7
Collaboration	2	6.7	5	16.7	6	20	16	53.3	1	3.3
Virtual Space	1	3.3	11	36.7	11	36.7	6	20.0	1	3.3
Generating income	10	33.3	12	40.0	5	16.7	3	10	0	0

The results in Table 7 depict that about 43.4% of the mathematics instructors have lack of access to affordable Web2.0 technologies while 33.4% of them do not lack this for implementation. Lack of effective technical support (53.3%), lack of staff training workshops (80%), lack of strategic direction and leadership (73.4%), lack of policies to use Web2.0 technology (70%), lack of design skills (53.3%), lack of skills to implement Web2.0 technologies (63.4%), and poor infrastructures (56.7%) are the challenges the mathematics instructors experienced in the practical implementation of Web2.0 technologies for teaching and learning.

Table 7. Challenges experienced by mathematics instructors in using Web2.0 technologies in the teaching and learning process (N= 30)

Item I lack:	SD f	SD %	D f	D %	N f	N %	A f	A %	SA f	SA %
access to Web2.0 technology	2	6.7	8	26.7	7	23.3	11	36.7	2	6.7
effective technical support	0	0	4	13.3	10	33.3	13	43.3	3	10
staff training workshops	0	0	2	6.7	4	13.3	16	53.3	8	26.7
strategic direction	0	0	1	3.3	7	23.3	14	46.7	8	26.7
policies for Web2.0 technology	0	0	2	6.7	7	23.3	18	60	3	10
design skills	1	3.3	4	13.3	9	30	15	50	1	3.3
skills for Web2.0 technologies	3	10	3	10	5	16.7	14	46.7	5	16.7
suitable infrastructure	4	13.3	3	10	6	20	12	40	5	16.7

Apart from these reported challenges, there are more issues such as supply of laptops, desktops, and internet cables, and overall connectivity in those universities. Observation revealed that the ratios of lap top, desktop, internet cable to instructor is not one to one except in Hawassa University. Even though there is no ample supply of technological devices, Jigjiga University has a wireless internet access that covers a wide range of area better than the other two universities. The computer lap centers and the learning classrooms have no internet connections, except for Hawassa University. Mathematics instructors in Hawassa University are attempting to integrate Web2.0 technologies for facilitating the teaching and learning. All the three universities have erratic electric power supply. The departments in the three universities have no any online mathematics course. The universities have no well-framed policies governing for the usage of Web2.0 technologies for teaching and learning. Students from rural background have no good computer skill.

From the discussions above one can see that the use of Web2.0 technologies is subjected to both internal and external factors. In their study Gebremedhin & Fenta (2015) revealed that teachers fail to use hardware and software in the teaching and learning process due to lack of resources, and absence of technical support services which is more external. Research results obtained by Sadaf et al. (2011) suggest that pre-service teachers' attitude and their perceived usefulness of Web 2.0 technologies are strong indicators of their intention to use Web 2.0 technologies which is internal. However, to reduce the effect of, or remove, internal factors (belief, attitude, self-confidence, etc.) it requires a more significant, difficult and long process compared to external factors (Kul & Çelik, 2018). Mitigating the external factors, including issuance of policies and guidelines can help resolve some of the internal factors and lay the foundation for the use of Web2.0 technologies that should not be underemphasized given the future students are getting into the technological citizenship.

Conclusion and recommendation

Based on the findings and discussion provided above the following conclusion and recommendations are drawn.

Introducing web technologies help to reach students all through and enhance the quality of education. Unless we digitize our educational system and practices, it will be very challenging to provide quality education for our students. The current study shows us that the adoption of Web2.0 technologies for supporting students' learning of mathematics is at its early stage and its use minimal. Students have no the opportunity to access the ubiquitous knowledge of the 21st century and the main sources of knowledge for them are the outdated books from the library and their course instructors. As a result, we recommend that the web2.0 technologies need to be extended into the actual classroom instruction, and there has to commitment to build better ICT infrastructures and access to Web2.0 technologies.

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