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Utilization Of Media Technologies and Web 2.0 Tools in Teaching Science Among DOST-STAR Teachers

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Abstract

Twenty-first century education defines instruction in the context of technologies utilization. This study was conducted to explore the scope of utilization of media technologies and Web2.0 tools using a pre-validated and pilot-tested three-part questionnaire as the main instrument to 69 purposive and conveniently selected teacher-recipients in schools of Region-implementers of the Department of Science and Technology Project Science Teacher Academy for the Regions (DOST-STAR): I, III, IVA, NCR, V, VI,VII, IX, and X to determine the demographic profiles of the respondents, identify the media technologies and Web 2.0 tools utilized in science instruction, determine the media utilization of Web 2.0 tools in teaching science and make intervention design to enhance utilization of media technologies and Web 2.0 tools in teaching Science.

Findings show that most of the DOST-STAR teacher-respondents have been teaching at the Junior High School level for less than 10 years, with preservice Science specialization and are master's degree holders. Media technologies of personal computer or laptop for science instructions have been widely utilized with the Web 2.0 tools as mirroring devices, Office tools, Messenger micro blogging, and portable data file (PDF) for media utilization on learning management, online assessment, and open resources with application of structure, media richness and transactional distance learning.

In conclusion, media utilization with application of web 2.0 tools capacitates science teachers in their practice. Intervention designs integrating media utilization of Web 2.0 tools in science instruction could further enhance capacity-building facilitation.

Keywords: media technologies, Web 2.0 Tools, media utilization, science teaching

Introduction

Twenty-first-century education is characterized by evolving teaching and learning processes. These educational evolutions define learning in the context of success in work and life among learners. A strong academic foundation, applied literacies, and broader competencies are considered essential for success. Twenty-first-century learners need to have foundational knowledge, critical skills, and advanced competencies to meet real-world challenges. Effective teaching and learning are impossible nowadays without the utilization of varied techniques supported by modern ICTs and innovations of the so-called 'digital' pedagogy. Within a high-tech information-educational environment, multimedia is

one of the powerful tools that assist teachers to reinforce their professional capacity and helps students to realize their educational goals (Andresen, 2013). This requirement in learning is being addressed by the emergent technologies of the century, which are recognized by the learners as significant in their access to information needed in their school tasks. In modern society, where computers and Net technologies are becoming indispensable, the training technologies are found to be deployed altogether sectors: schools, colleges, universities, and industries. The emergence of the knowledge and educational content industry, the emergence of virtual campuses of learning, the availability of new learning and training tools, and the deployment of such tools to satisfy the various needs of learners have greatly influenced education and training systems. Students must find their own individual access to the fast-changing world and therefore they need a huge pool of appropriate individualized strategies, which will foster their active and critical learning. In response, learners adapt to the new wave of technological innovations by equipping themselves with gadgets such as smartphones, iPad, or tablets. These technologies however, as pointed out in a study by APS Group Scotland (2015) serve as one of the competing factors from developing interest to the concepts being taught in school. The teacher's role often changes from being an authority, or the primary source of knowledge, to being also a facilitator or conductor of the learning process instruction among teachers was often restricted by the established and defined function of the technology. Studies on the utilization of technologies and the linked web tools in classroom instruction in science for purposes of expansive learning were rather limited. It cannot be denied that teachers must exert extra effort than their students in the use of technology for educational purposes. Staines & Lauchs (2013) emphasized this difference by using the terms "digital natives" and "digital residents" for 21st-century learners while teachers are referred to as "digital immigrants", "digital visitors" and lacking "digital wisdom". According to the study conducted by UNESCO Institute for Information Technologies in Education (Karahan, 2015) teachers applying media technology into the classroom need different types of competencies. The first is general pedagogical competencies. The student-centered approach plays an important role. Second is media technology literacy to teach a foreign language, the teacher needs to be fluent with respect to that language. For example, the teacher of English must be fluent in English. In the same way, the teacher needs to be fluent in media technology use. For example, he/she needs to know where and how to find materials on the web, how to use it for different subjects for teaching and learning purposes, how to present educational content by means of multimedia, and the way to use multimedia products and online services in education. These competencies include a general understanding of central functions, uses, and methods in general computer use. Such competencies are also needed for being able to discuss multimedia issues in schools and ICT pedagogical competence. More so, most educational systems are poorly equipped to fulfill 21st-century needs. Goldman & Pelligrino (2015) stressed that this challenge in education was due to the persistence of outmoded perspectives on learning and designs and the utilization of instruction and assessments.

Research has examined the impact of media technology in science learning contexts. Media technology is any hardware, software, or tool that's wont to compose, create, produce, deliver and manage media including audio, video, images, information, interactive media, video games, virtual reality, and augmented reality environments. Modern media comes in many various formats, including medium (books, magazines, newspapers), television, movies, video games, music, cell phones, various sorts of

software, and the Internet. Each type of media involves contents, and a device or object through which thae content is delivered.

Among others, media is used to improve science attitudes and engagement (Wilson, 2012) or ecological and environmental awareness (Karahan, 2015) ; (Robelia, 2011). Other studies have examined the ways in which media can facilitate creative thinking. For example, Smith (2014) reported on the impact of providing undergraduate chemistry students with the chance to form a YouTube video to speak their understanding of a chemistry concept. Students were enthusiastic about the process of generating the video, which helped develop creativity and communication skills (Nielsen, 2017). The research found that students were more explicit in articulating their reasoning while playing physics-focused digital games when they interacted in an online forum when compared to face-to-face (Van Eaton, 2015). Thus, some studies have examined contexts or learning activities. The interest is wider and research (Van Eaton, 2015) on how social media are applied to the field of science education where little and about how students use social media resources to support their science learning. This gap, however, is seemingly becoming narrow as the internet is now widely available which fuels an increasing interest in self-directed, curiosity-based learning for both teachers and students. Literacy has been expanded to encompass understanding digital tools and information applied to both learners and teachers. Teachers now have access to innovative tools to enhance their curriculum to increase students' participation and expand their potential in the classroom settings. The question is, what are this technology available in the classroom and how are these technologies are applied to collaborate, interact and reach digital learners? In the Philippine context, teachers' access to these innovative technological applications generally, was not a concern. The challenge is how to utilize these accessible tools so that instruction could be delivered, and learning could take place despite of social, cultural, and economic circumstance, particularly in the DepEd public school setting where there are existing difficulties in the availability of teaching media platform. A teaching media platform primarily delivers instructional content, but sometimes allows feedback, discussion or sharing. This technology becomes expansive when the media platform was utilized beyond its defined common function, and thus caters to extensive and wide variety of instructional needs. Web 2.0 tools are web-based sites and applications which can be accessed online or offline allowing information creation, sharing, collaboration and communication among users. Teachers may consider expansion of the use of available devices to cope with the technological limitations and encourage students' interests and engagement in the learning process. Working on the context of exploring instructional potentials of the existing and emergent online and offline web-based tools within social, cultural, and economic limitations of DepEd public school system in the country through utilization of media technologies, of which established teaching modalities in Web 2.0 Tools and designed intervention program in science instruction may address current education challenges, this study was conducted.

This study was conducted to explore the scope of utilization of expansive technologies in relation to Web 2.0 tools in science instruction among DOST-STAR Teachers. Specifically, this study pursued to identify the media technologies utilized in science instruction and the Web 2.0 tools associated in the utilization of media technologies in teaching science; and determine the teaching modalities of Web 2.0 tools utilizing media technologies in science instruction among these teachers.

Research Design

This study used descriptive-evaluative and comparative methods of research. The data collection of the study had utilized a descriptive-evaluative method in which an online questionnaire as the main instrument was given to a purposively selected group of respondents without any result baselines to compare with. With this method, the study primarily focused on identifying the media technologies and web 2.0 tools utilized in science instruction among teacher-recipients of DOST-STAR Project and the resulting teaching modalities in science instruction due to media technologies utilization with the application of the web 2.0 tools. Further, descriptive-evaluative method together with comparative method, allowed definition of characteristics of the respondents using open-ended questions drawing conclusions about them, measuring data trends on Media technologies utilization with 2.0 applications in science instruction with descriptive statistical capabilities among selected secondary DepEd Science teachers through in-depth analysis of qualitative data.

Respondents of the Study

The respondents of the study were the secondary school Science teachers from different schools in the regions who were recipients of the DOST-STAR Project. The sample was selected purposively by convenience sampling through key persons per region implementing DOST-STAR Project consisted of 69 teachers. This population of science teachers were specifically selected as respondents of the study as they were the recipients of series of in-service trainings in 3-year span on the use of varied 21st century pedagogies and technological tools in science classroom under the Science Teacher Academy for the Regions (STAR) Project of the Department of Science and Technology- Science Education Institute in identified regions (Region I, III, V, VI, X and NCR) in the Philippines, and hence were equipped to select and utilize technological tools in Science classrooms. More than half (56.41%) of the respondents were teachers in junior high school and were from Luzon island. Mindanao island has the least number of respondents at about nine percent.

Method

The research process was divided into four stages. The first stage involved analysis and synthesis of documents and research studies related to media learning and technology utilization in science classroom. The second stage was designing and developing the questionnaires with regard to media technologies utilization and Web 2.0 tools in science instruction. The designed questionnaire was then validated by the ten DOST-STAR key persons in identified regions. The third stage was data collection process using the questionnaire through an online platform to determine the demographical profile of teachers included in the study; identify the media technologies utilized in science instruction; identify the Web 2.0 tools associated in the utilization of media technologies in teaching science; and determine the teaching modalities of Web 2.0 tools utilizing media technologies in science instruction among DOST-STAR teachers. Validation of responses was conducted through online discussion with key persons per region. The fourth stage was the development of intervention program for teachers to enhance utilization of media technologies in applying Web 2.0 tools in science instruction.

Instrumentation

The instrument used to gather the needed data in this survey research was an online questionnaire composed of three parts with 11 open-ended questions requiring short answers. Part I focused on the

profile of the respondents including some personal information: email address, name, school, region, sex, area of specialization, subjects handled, number of years in teaching, and highest educational attainment. Part II focused on the data identifying media technologies utilization in science classroom. Part III focused on Web 2.0 tools application in science lesson development. The instrument undergone control validation from three experts and piloted to ten key persons in the project STAR.

Analysis of Data

Upon completion of the survey, responses were sorted and categorized using a web-based application downloading the data in a comma separated values (csv). The data was converted into an excel or spreadsheet format for coding, categorizing and analysis using a web-based statistical software. The collected data from the online questionnaire were presented in categorical tables. Most of the data collected were categorical hence frequency distribution and percentage were utilized in specific parameters.

Results and Discussion

More than half (65.2 percent) of the respondents were female. Among DOST-STAR teachers who participated in the study, there are about twice as more females than males. Seven specializations were observed among respondents. These specializations were earned in their preservice education. Ninety percent of the respondents were Science specialists. Among the respondents, there was one Science teacher who specialized in Financial Management and Accounting, three in English and three in Mathematics. About half of the respondents at 49.3% were Biology specialists while only one respondent specialized in Chemistry. Most of the respondents at 71% were teaching Science for less than ten years of which 55% of it have been teaching for less than five years. 29% of the respondents have been teaching Science for more than 20 years. Among the respondents, there are younger and novice Science teachers than those who were seasoned by age. More than half (55.1%) of the respondents were master's degree holders. About three percent have a Diploma degree; and 30% have their bachelor's degree. Eight have finished their doctorate.

It was observed that most respondents (98.55 percent) have utilized laptops or personal computers in science instruction. Use of projectors followed next by 78.26% of the respondents. More than a half (65.22 percent) utilized their own mobile phones and iPads in teaching. Only 52.17 percent have utilized television, 40. 58 percent used simulation models and sound systems. Laser pointer was also utilized by 28.99 percent and less than 10 percent utilized Overhead projectors, mirroring device, Chromebook, and Virtual reality Devices. The primary use of these tools was fundamentally for office functions, entertainment, and information and communication. In classroom instruction however, implementing the concept of BYOD- Bring Your Own Device (Sangani, 2013), these tools were mostly used. Most of the respondents utilized computers and laptops in science instruction. Moreover, there were respondents who have used iPads, cellphones, and tablets in teaching science. This media utilization of iPad, cellphones and tablets have been noted even before and have replaced the laptop due to their smaller size, lighter weight, and longer battery life (APS Group Scotland, 2015; Kuznekoff, 2013; Poore, 2015). These devices were classified as media technologies to emphasize that these were used beyond their established common use. Further, cellphones, iPads, PCs, simulation models, and television have been utilized mostly for lesson preparations and assessments, learning management, group collaboration,

mirroring or casting, output generation and resource materials (Street, 2017). Along with sound systems and projectors, these technologies were significantly utilized in science instruction among respondents.

This media utilization in instruction in general was also observed in other countries. Access to computers in public schools worldwide has increased manifold in the last thirty years. In the United States alone, there was only 0.008 computer per student ratio in 1984. In 1998, there was 0.15 computers per student and only half of these computers had internet access. The most recent data available from the NCES, is in 2008, in which there is 0.32 computer per student and essentially all computers have Internet access (Bulman & Fairlie, 2015). Several studies have reported this media utilization of technologies in the classroom. Street (2017) had pointed out some benefits of laptops in the classroom in improving student learning. Laptop, personal computers, LCD projectors and cellphones have invaded classroom instruction (Fisher, 2015; Bulman & Fairlie, 2015; Mohammed, 2016; Kuznekoff, 2013). In the study conducted by Shear (2010), it was reported that using television in the classrooms enabled students to create questions allowing them to understand what they have watched. LCD projectors commonly known as multimedia projectors were popular in lecture halls, offices, courtrooms and even in the medical domain (JMGO, 2018). Currently, multimedia projectors have becomes essentially integrated in the classroom making learning more long-lasting than the use of traditional textbooks (Amin et al., 2018). A study conducted by Kuznekoff (2013) showed the positive impact of using mobile phones, tablets, and iPad in classroom instruction. This entails that the use of these technologies have Media from their main utility to instruction facilitation.

Web 2.0 tools are a variety of web-based sites and applications, that allow information creation, online sharing. Collaboration and communication among users. This may be in the form of applications that can be delivered synchronously or asynchronously (Johnson, 2007; Cao, 2009). Microsoft office tools were on top of the list and were used mostly by 92.75% of the respondents. Messenger social network tool ranks second as it was utilized mostly by 59.42% of the respondents. The use of portable data file (pdf) for worksheets, online submissions and videoclips were among the most utilized in Science classroom. Combined responses on the Media use of messenger, Facebook, and other online and offline platforms in science instruction were manifestations of the importance of media utilization of Web 2.0 tools in science classrooms. The full potential and the innovative communication models of Web 2.0 tools in education, particularly the combination of the Open Access/Open Data paradigm was already established (Licia, 2013). Most of the respondents have utilized the Web2.0 tools in hybrid teaching modality mostly on learning and project management instead of just serving as office tools in science classroom lesson development and assessment. Hybrid teaching modality, a combination of offline and online technologies was the most utilized form of Media utilization of web 2.0 tools among science teachers in their classroom. This teaching modality was also observed in using spreadsheets, PowerPoint, and database tools (Walcott, 2011) in data processing, encoding, and computing. Utilization of Messenger, pdf, and Facebook in extending lessons was also done in hybrid modality.

Learning is mainly the process through which we become the social human beings we are, and it takes place through a diversity of media, strategies, and processes, of which interactive program is just one. Using these media and technologies, we internalize data and knowledge available in the external world to construct our own understandings. Utilization of Media technologies with Web 2.0 tools application

have enhanced teaching modalities in science instruction by adapting hybrid platforms through trainings and professional development programs designed for the utilization of media technology applying platforms, programs, interactive applications that the younger generation of science teachers who are mostly digital natives may adopts since media technologies utilization with Web 2.0 tools mostly in learning and project management media utilization were applied in different modalities of teaching. The benefit for students of incremental improvements can only be marginal. Indeed, the value added of students' learning of such incremental changes in teaching cannot be brought through the actions of individual teachers themselves. They must come about through major and organizational and structural change in the educational institutions. This is only possible when administrators face up new policies in the provision of compulsory in service trainings and monitoring of teachers as the Theories on Media Learning, Media Richness and Transactional Distance have supported the findings and conclusions of the study.

On the basis of these findings and conclusions drawn from the study, the following recommendations are given: inclusion of cooperative group learning using synchronous media technology, lateral-thinking collaborative learning using asynchronous media technology, hypothesis testing in a collaborative synchronous manner, and experiential learning in cooperative synchronous media technology and about multiple-media technology use in teaching and learning should also be taken into account since the utilization of the these technology still depends on the appreciation and performance of students as the recipients of learning in the digital era. As this study was limited to confidentiality in which respondents may have provided filtered responses and on the sample representation of the population due to randomness, more methods of research and inclusion of more respondents may be conducted. It may include those teachers on non -cities. The needs for lifelong learning, just-in-time training, and retraining led to the development of widely accessible and reusable digital multimedia content and learning repositories.

Appendix

Questionnaire on the Teachers' Utilization of Media Technology tools for Web2.0 technologies

Premise

The purpose of this survey is to explore ways of utilizing media technology tools in the classroom among teachers in the Science Teachers Academy for instruction and assessing learning, and the current instructional applications of Web 2.0 technologies in the classroom among teachers. The survey intends also to explore the categories of applying Web 2.0 technologies tools in teaching and assessing activities. For this study, the operational definition of Web2.0 technologies include an increased emphasis on online experience such as learning management system, video conferencing, open access resources, lecture capture, gaming, and simulations. This study proposes a concept of the term Web2.0 technologies for variety of generic programs, platforms and applications accessed online or offline which facilitate learning and assessment.

The questionnaire is divided in 3 sections:

1. Personal information
2. Media Technology tools and their usage classroom activities

3. Web 2.0 technologies in teaching and Assessment activities and its modalities

Section 1: Personal information
1.1 Email Address
1.2 Name
1.3 School
1.4 Region
1.5 Sex
1.6 Area of Specialization
1.7. Subject Handled
1.8 Number of years in Teaching
1.9. Post Graduate Studies

Section 2: Media Technology tools
2.1 What technology tools are utilized in your classes?

Section 3. Web2.0 technologies in science instruction
3.1 What other options do you use in assessing learning in your classes?

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The author is serving the Department of Education as Master Teacher II at Camarines Sur National High School in Naga City where he handles Sciences and Research subjects for secondary school students. He is one of the awarded DOST-STAR Teachers in the Philippines in 2018 and have received more awards including the 2019 DepEd ICT Achievers Award; the 2020 Exemplary Employee in Division Award; the 2021Ambassador Cabangon-Chua Gintong Parangal para sa Edukasyon for his outstanding commitment to the implementation of the value of hardwork and discipline; and the 2021 Dangal ng Bayan Regional Winner awarded by the Civil Service Commission during the Search for Outstanding Government Workers.

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