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Abstract

YouTube is among the popular platforms in social media in today's digital age. Along with this popularity and the pressure to integrate ICT in the curriculum, the myriad of benefits afforded by YouTube for the improvement of science education encourage science teachers to utilize it in the teaching-learning process. This investigation was then effected to generate an understanding of science teachers' means and motives in using YouTube in their respective classes. Following the principles of phenomenology, two themes vis-à-vis YouTube integration surfaced. "Spectatorial" pertains to the passive use in which science teachers' participation is limited to viewing purposes. Anent, the sub-themes "Teacher's resource: Learning purposes" and "Teaching resource: Teaching purposes" were derived. These two establish that teachers rely on YouTube respectively to clarify concepts in lessons they find challenging and to enhance their science instruction. Yet prior to usage especially inside the classroom, science teachers subject YouTube content to meticulous scrutiny with close consideration to factors related to psychological and pedagogical principles. This is to ensure appropriateness of the material. "Participatory" on the other hand concerns the role of teachers as co-creators of YouTube by means of uploading various science materials. These findings reveal how YouTube is utilized as well as underutilized in science education.

Keywords

YouTube, Spectatorial, Participatory, Science Education

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YouTube Integration in Science Classes: Understanding Its Roots, Ways and Selection Criteria

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YouTube is among the popular platforms in social media in today's digital age. Along with this popularity and the pressure to integrate ICT in the curriculum, the myriad of benefits afforded by YouTube for the improvement of science education encourage science teachers to utilize it in the teaching-learning process. This investigation was then effected to generate an understanding of science teachers' means and motives in using YouTube in their respective classes. Following the principles of phenomenology, two themes vis-à-vis YouTube integration surfaced. "Spectatorial" pertains to the passive use in which science teachers' participation is limited to viewing purposes. Anent, the sub-themes "Teacher's resource: Learning purposes" and "Teaching resource: Teaching purposes" were derived. These two establish that teachers rely on YouTube respectively to clarify concepts in lessons they find challenging and to enhance their science instruction. Yet prior to usage especially inside the classroom, science teachers subject YouTube content to meticulous scrutiny with close consideration to factors related to psychological and pedagogical principles. This is to ensure appropriateness of the material. "Participatory" on the other hand concerns the role of teachers as co-creators of YouTube by means of uploading various science materials. These findings reveal how YouTube is utilized as well as underutilized in science education. Keywords: YouTube, Spectatorial, Participatory, Science Education

To ensure student success in today's world, the K to 12 Science Curriculum was framed around the 21st century skills which include critical thinking and problem solving, communication and collaboration, information literacy, media literacy, Information, Communications and Technology (ICT) literacy, initiative and self-direction, productivity and accountability, and leadership and responsibility (Partnership for 21st Century Skills, 2011; Saavedra & Opfer, 2012). Accordingly, students need to acquire these skills not only to survive at present but also to flourish in the future. The implication of this to teachers must be underscored, and that is for them to equip themselves with 21st century skills such that they can efficiently design activities and materials effective for the acquisition and development of these skills.

Several researches assert that ICT could be tailored according to the constraints and opportunities arising from a particular lesson such that consequently, the acquisition of the aforementioned 21st century skills through the optimization of ICT is made possible (The First National ICT in Basic Education Congress, 2004; Tekbiyik & Akdeniz, 2010). Thus, ICT integration in science education is widely promoted by experts (Fluck, 2010).

Among the widely-used facets of ICT at present is the social media which is delivered by Web 2.0. García-Barriocanal, Sicilia, Sánchez-Alonso, and Lytras (2011) described Web 2.0 as a loosely defined set of Web application styles that foster a kind of media where consumer is more engaged, and usually active in creating and maintaining Internet contents. Thus, Web 2.0 applications have resulted in increased user participation and massive user-generated (or user-published) open multimedia content, some of which are potentially useful for education.

With its pervasiveness, social media has paved its way in science education. In various studies, social media has been reported to enhance the quality of science teaching and learning. Researchers associate this to the following attributes common to the different forms of social media: (a) increased interaction especially when adapting synchronous discussion, (b) quick feedback, (c) diverse audience, (d) flexibility, and (e) increased access to content (Penmann & Thalluri, 2014; Dunn, 2013; Huang, Wu, She, & Lin, 2014; Whittaker, Howarth, & Lymn, 2014; Scott, 2013; Battrawi & Muhtaseb, 2013; Zinger & Sinclair, 2013). The considerable number of researches provides substantial evidence of social media's uncontestable influence in the way scientific information is distributed be it in the formal or informal context. However, the unresolved issue regarding its absolute effectiveness has prompted academicians to propose frameworks that outline provisions so as to warrant a scholastically productive integration of social media in science education. These provisions revolve around the essentials in a traditional teaching-learning structure. Thalluri and Penmann (2015) enumerated the following components – goals and objectives, expectations, communication (Singh, 2013), engagement with course content, active participation, and learning environment. Matzat and Vrieling's (2016) proposition regarding self-regulated learning and its role in learning via social media is equally significant.

Havlik (2014) identified the following sites that can be used in promoting science and digital literacy – Facebook, Twitter, YouTube, Feedly, Vine, Easel.ly, Google Docs, Pinterest, and WordPress. Others such as LinkedIn, Instagram, MySpace, Wikis, Flickr, and SlideShare should also be taken into account. Considering the plethora of social media, this paper focuses on the utility of YouTube in science education.

Basically, YouTube is a video sharing platform that allows users to upload user-created content onto a customized YouTube Channel. It also allows the users to view others' videos by providing a list from which they can choose. YouTube features comment threads on one's channel, user-managed videos, and a counter that allows one to keep track of who is watching the videos. YouTube provides HTMLs or URLs that allows users to embed videos in other websites (Lange, 2008; Burgess & Green, 2009).

With regards the use of YouTube in schools, most researches available are devoted to understanding the ways by which students exploit YouTube to facilitate learning. This may be related to YouTube's establishment in the mid-2000s (Burgess & Green, 2009). Deducing from Barry et al. (2016), majority of today's students belong to the "YouTube Generation" or "Generation Connected" (Gen C). Gen C, which consists of 80% Millennials, actively interact with social media and integrate it into their education experience. A significant number of researches corroborate YouTube's repertoire of academic relevance. The succeeding discourse dwells on students' usage of YouTube in different scientific disciplines.

YouTube is frequently used by students as a resource or a supplementary material. In the medical field, Barry et al. (2016) surveyed second year undergraduate medical and radiation therapy students regarding their use of online social media in relation to anatomy learning. The vast majority of students had employed web-based platforms to source information with 78% using YouTube as their primary source of anatomy-related video clips. Such is an indication of the usefulness of integrating social media into blended learning approaches in anatomy programs. In relation, the availability of such videos makes the study of anatomy still possible despite having no or limited access to specimens especially now that animal rights advocates and environmentalists discourage the utilization of animals in dissection activities. Following this line of thinking, YouTube can also be helpful in studying astronomy, marine biology, volcanology, and other sciences where an actual observation is essential but simply not possible due to limited resources or other factors.

Other than serving as a resource material, YouTube can also be used for authentic assessment. In a module on polymer chemistry, students were given the option to make a YouTube video instead of writing a magazine-style article.

> The students making videos (YouTube) found it much more enjoyable than those who wrote articles and also gained further educational benefits: developing public engagement and presentation skills, enhancing their creativity, and even becoming empowered as global educators in their own right. The highly interactive nature of YouTube, in which users can comment, provides the audience with a voice, and as such, an online chemical community (WeTube) begins to spontaneously emerge. (Smith, 2014)

Meanwhile, Liberatore, Marr, Herring, and Way (2013) chronicled how students created homework problems in selected science topics as part of a class project. The project has been successful at different parts of the semester and demonstrated learning of course concepts. Students using the YouTube homework problems for one section of material resulted in improved grades on a single exam problem in a heat transfer course when compared with students completing textbook homework problems covering the same material. Surveys of participating students showed that 88% of the students feel they learn from the student-written YouTube problems. Overall, a new method to develop homework problems can help faculty avoid using textbook problems repeatedly, whose solutions manuals are readily available on the Internet.

The above accounts indicate that YouTube not only benefits the viewer but also the video creator. The latter holds an even greater connotation when used with pre-service science teachers and teacher education institutions (TEIs). Kotluk and Kocakaya (2016) reported the potential of digital storytelling through YouTube as an efficacious tool in Physics instruction. Pre-service teachers were trained then tasked to create digital stories which were then shared in YouTube. The pre-service teachers perceived the generated materials to be effective in helping learners understand Physics topics such as photoelectric effect, general creativity, blackbody radiation, and Compton scattering, which are highly baffling for the learners due to their highly abstract concepts. Moreover, the pre-service teachers affirmed that the task allowed them more creativity in designing projects and assignments.

However, Havlik (2014) cautioned that as forums like YouTube and Facebook become news generators, students need guidance on how to find accurate and reliable sources of scientific information. This does not replace the need for training on traditional forms of research; rather it is another layer of 21st century competencies. The ability to sift through excess news stories, differentiate fact from opinion, and organize and synthesize data to communicate scientific ideas are not skills learned by being an everyday user of social media. For most students, it must be taught. This crucial task is largely the responsibility of teachers. But the question that needs to be answered beforehand is "How acquainted are teachers with social media more specifically with YouTube?"

Moran, Seaman, and Tinti-Kane (2011) conducted a survey and found that next to Facebook, YouTube along with Twitter is popular among higher education faculty. Yet, in terms of professional use, YouTube is the leading platform. The popularity of YouTube in the academe can be associated to the fact that as users, teachers can upload videos of their lectures and demonstrations as evidenced by teachers' use of YouTube for online classes. Moreover, teachers can access videos of other users to support classroom learning. With respect to this, the quality or reliability of videos used as a learning material can somehow be assured as teachers themselves pre-select the videos. Considering teachers' role in addressing the issue of reliability, YouTube's provision for annotation can be useful. García-Barriocanal et al. (2011)

investigated the prospective of selecting existing content then using a non-intrusive solution, annotating these contents so that software applications can filter fragments that were previously marked as useful for particular learning needs. This solution fits in the philosophy of multiple metadata profiles, allows for expressing fine-grained learning needs, and leverages the growing mass of contents by reusing well-established domain ontologies.

Grounding on the uses of YouTube both implied and explicated in the foregoing discussions, this paper aims to identify the specific ways by which a select group of science teachers utilize YouTube whether in the actual class or otherwise. Also, the study will look into the circumstances that drive them to use YouTube and the factors that they consider in selecting YouTube videos that they use in the classroom. In summary, the study seeks to understand the lived experiences of the selected science teachers around YouTube use and its integration in the teaching-learning process.

The study will contribute to the discourse on the application of YouTube in the science classroom. Consequently, science teachers will be provided a basis from which they can derive their own strategies of amalgamating YouTube in their classes to enrich the teaching-learning process. In addition, it can provide for the initiation of formulating a criterion for assessing YouTube videos that could be used in science classes. As an offshoot, a proposal can be forwarded to YouTube and Google to establish a YouTube section specifically for academic purposes as in the case of the generic Google and the Google Scholar. Finally, on the part of curriculum developers and TEIs, the results can shed light on the vibrant evolution of education as affected by social media particularly YouTube.

Researcher's Background

The researcher is a science teacher who uses YouTube for both academic and entertainment purposes. Mostly the usage is passive rather than active as she only views and downloads YouTube materials but has never uploaded any. The materials usually accessed include science lecture podcasts, animations, simulations, live videos, and music videos. However, only the animations, simulations, and live videos are downloaded and shown in the classroom. Podcasts are viewed both for personal and academic benefits including the generation of a deeper understanding of advance topics in science (i.e., signal transduction pathway).

Teaching in an urban area allows for a stable internet connection. Moreover, the science high school where the researcher teaches offers free WiFi and access to the school's computer laboratory. As such, the teachers there are confident of giving tasks which require the use of the internet one of which is for students to independently view and analyze a specific YouTube material. The researcher is interested whether such is also the case in other schools especially those located in the suburbs. Moreover, the researcher seeks to understand how other science teachers integrate and maximize YouTube in their classes considering the platform's popularity and the profound influence of social media in today's education. The researcher believes that undertaking the said study will provide insights that can be used as bases in improving local teachers' social media and ICT integration in science classes.

Methods

Research Design

As the study is geared towards describing and understanding how and why the teacher respondents utilize YouTube in their science classes, phenomenology was employed in this study. Groenewald (2004) and Creswell (2006) distinguished the method as seeking to describe

the meaning that experiences hold for each respondent by asking subjects to describe their experiences as they perceive them. In this study, the experience or phenomenon of interest is the science teachers' employment and incorporation of YouTube in the teaching-learning process.

Bracketing will be executed as part of the design. Chan, Fung, and Chien (2013) emphasized that the adoption of this attitude is unique to the phenomenological approach. According to Carpenter, 2007 (as cited by Chan, Fung, & Chien, 2013), bracketing is a methodological device of phenomenological inquiry that requires deliberate putting aside one's own belief about the phenomenon under investigation or what one already knows about the subject prior to and throughout the phenomenological investigation. Ahern (1999, 2007, as cited by Chan, Fung, & Chien, 2013) described it is a means of demonstrating the validity of the data collection and analysis process. Therefore, it is crucial to put aside the repertoires of knowledge, beliefs, values and experiences in order to accurately describe participants' life experiences.

Settings and Participants

Purposive sampling was utilized in identifying the potential subjects who are all junior high school science teachers in Benguet. They were contacted online and invited to participate in the study but only three (3) responded and signified interest in participating in the study. A letter containing a brief description of the purpose and nature of the study was given to these science teachers who have also indicated themselves to be fairly knowledgeable of YouTube.

To ensure that the study adheres to ethical practices, the research procedures were meticulously evaluated by professors knowledgeable and experienced in qualitative research. The interview guide was also scrutinized to ensure that it is free from bias, offensive statements, and others factors which may be detrimental to the respondents. This was done prior to the conduct of the interviews.

Ethical Considerations

Before and during the interview, McNamara's (2009, as cited by Turner, 2010) eight principles to the preparation stage of interviewing were considered before proceeding into the inquiry part. Thus, the interview was conducted at the respondents' most convenient time in a quiet and conducive place of the respondents' choosing. The researcher reiterated the purpose and nature of the study. The respondents were also assured of their anonymity and the confidentiality of the information they will provide. Furthermore, the researcher explained the format of the interview, indicated how long the interview usually takes, informed the respondents how to get in touch later if they want to, and asked them if they have any questions before starting with the interview. Finally, the researcher emphasized that their participation in the study is determined by the extent of their willingness hence they can decline to answer any question or even terminate the interview should they feel the need to do so.

Data Gathering Procedure

Moustakas (1994) stressed that in phenomenological researches, descriptions of experiences are obtained through first-person accounts in informal and formal conversations and interviews (Englander, 2012). Thus, in order to "explicate the meaning, structure, and essence of the lived experiences" (Christensen, Johnson, & Turner, 2010 as cited by Simon & Goes, 2011, ¶1) of the science teacher respondents, the interview was chosen as the mode of data gathering.

An unstructured interview was conducted with each respondent. In this type of interview, the respondent is allowed and even encouraged to freely express his thoughts and experiences on the subject even without waiting to be probed by the interviewer (Calderon & Gonzales, 2008). Such freedom is essential as it allows the researcher to gather comprehensive descriptions of the teachers' experiences in using YouTube in their science classes. According to Moustakas (1994), a comprehensive description provides the basis for a reflective structural analysis to portray the essences of the experience.

An interview guide was prepared beforehand. The interview guide was chosen over the interview schedule to allow for flexibility on the part of the researcher which in turn corresponds to the flexible nature of an unstructured interview. The interview guide contained items related to the research problems. The items are based from various literatures about the use of social media especially YouTube in science education. Responses were recorded using a digital recorder and via note taking. The interview was conducted in a manner described in literatures with close consideration to Kennedy's (2006) four important facts of human social interactions that influence what people are likely to say to the interviewer. These four facts are: (1) Research questions are not the same as interview questions; (2) People's espoused theories differ from their theories-in-use; (3) Interviews are social occasions; and (4) Testimony by itself is relatively weak form of evidence.

The recording and transcription of the responses were managed by the researcher herself to ensure utmost confidentiality.

Data Management and Analysis

The recording was transcribed word per word. The transcriptions were checked for transcription errors by reading while listening to the recordings. Subsequently, the researcher proceeded to what Moustakas calls as horizonalization wherein the researcher goes through the interview transcriptions and highlight "significant statements," that postulate a conception of how the participants experienced the phenomenon (Creswell, 2006). The researcher then developed clusters of meaning from these significant statements into themes. These significant statements and themes were then utilized to write a description of what the participants experienced (textural description) and also to write a description of the context or setting that influenced how the participants experienced the phenomenon, called imaginative variation or structural description. From the structural and textural descriptions, the researcher then wrote a composite description that presents the "essence" of the phenomenon, called the essential, invariant structure (or essence). Primarily, this passage focuses on the common experiences of the participants.

The transcript files were printed from which respondents' verbatim statements, extracted significant statements, and generated themes were read to the respondents for validation. This is also to allow for the possibility of revealing new data from the participants (Basatan et al., 2010) and for ensuring that no misinterpretation of their views and comments takes place (Simon & Goes, 2011).

Findings

After a thorough evaluation of the transcriptions, two themes were identified regarding the manner by which science teachers use YouTube: (1) spectatorial and (2) participatory. Under spectatorial, two sub-themes emerged namely (a) teacher's resource and (b) teaching resource.

Theme 1: Spectatorial

This theme emerged from the predominant passive use of YouTube which is limited to viewing purposes. This theme is subdivided further into two sub-themes: *teacher's resource* and *teaching resource.*

Teacher's Resource: Learning Benefit

The science teachers revealed that while they use YouTube in teaching their subjects, their usage is not always necessarily within the classroom. The teachers narrated instances in which they resorted to YouTube to clarify concepts in their lessons. One teacher stated "I use it as a reference especially with lessons in which I myself am confused." Most of the time these lessons are under the areas which are outside of their fields of specialization albeit they also view YouTube contents related to their own fields of specialization. For instance, the teacher who is a Physics major enumerated biology processes such as circulation and photosynthesis as the prime subject of the YouTube contents he watches. He also cited the Physics-related YouTube contents he views including those concerning modern physics such as time dilation. The teachers mentioned using YouTube for this purpose complementary with using the web and various reference books.

Teaching Resource: Teaching Benefit

Motivation, discussion, demonstration, and augmentation are the four ways in which the science teachers employ YouTube as a teaching resource. In other words, materials obtained from YouTube are used as an instructional material.

One teacher cited the use of songs in the motivation proper of the lesson. Music videos and lyric videos related to the day's lesson are downloaded then shown to the class. For other types of YouTube materials employed to arouse students' interest, these typically last from 1-5 minutes.

The following statements reveal how YouTube is used in the motivation proper.

> I use songs as motivation for the lesson. I do this by downloading music and lyric videos related to our lesson for the day then showing them in class. *Minsan naman, ginagamit ko yung songs sa generalization part.* (Translation: At other times, I use songs in the generalization part).

> Before the discussion, I show them short video clips, *mga* 1-5 minutes. (Translation: About 1-5 minutes).

All three science teachers reported downloading videos and animations to be used in the lesson proper. According to one teacher, this is done "when the teacher can't explain the concepts well especially if it's not her specialization." In line with this, another teacher narrated "when I was simply discussing, the students seemed to be wondering what I was talking about and most of them have a negative attitude towards the topic because according to them, the lesson seems to be abstract." The same teacher disclosed using YouTube for convenience that is to *"reduce effort kasi yung video nandon' na mismo yung karamihan ng sasabihin mo at may illustrations na rin… and yung mga kagaya ko na visual learners, mas makakaintindi* [when used in conjunction with] *the chalk-talk method."* (Translation: To reduce effort because the video already contains what's in your lecture. Moreover, it also contains illustrations. Visual learners like me can understand better. This is when it's used in conjunction with the

chalk-talk method.) This was supplemented by another teacher citing the "observed short attention span of students – especially in Grade 7 – when the teacher is discussing."

All three science teachers also reported exploiting YouTube for the demonstration of experiments or processes that cannot be done inside the classroom primarily due to the lack of resources. For instance, one teacher reported resorting to YouTube to demonstrate chemical reactions because they do not have the necessary chemicals in their school. Another teacher cited the lack of the learner's material (module) specifically for Grade 9.

For these three uses, there were two ways of showing the videos noted namely continuous playing and play-pause. Two teachers practice continuous playing in order to avoid disrupting students' concentration. Discussion and video analysis follow. Meanwhile, one teacher adopts pause-play method in order to allow immediate clarification and emphasis on a specific part of the material.

Lastly, augmentation is accomplished by providing the URL of a particular YouTube material to students so that they can access it at home or during their free time. Among the YouTube uses under the *Teaching Resource,* augmentation is the only instance where usage is done outside the classroom.

Regardless of the manner of use, YouTube materials are evaluated by the teachers in terms of duration, accuracy/correctness, clarity, visual appeal, and sense of familiarity. The teachers prefer YouTube materials with duration under 30 minutes to prevent the students from getting bored. The teachers also see to it that the contents are correct or "go with other resources." As for clarity, one teacher emphasized that the material "should make the topic simpler" otherwise the students will become more confused. Other teachers mentioned accent because accordingly there are instances when students cannot understand the audio because of the accent. To address this predicament, one teacher cited that "videos with subtitles are needed for some students." Teachers also look into the appeal of the material that it is it should be "catchy" and uses complementary colors ("colors are simple, not so colorful"). Regarding sense of familiarity, one teacher expressed her preference for materials that have features which are popular among students. These can be in the form of famous cartoon characters (i.e., Dora – The Explorer) and well-known songs used as background tune or music.

Theme 2: Participatory

This theme was derived from the incidence of using YouTube as a platform for showcasing students' outputs such as "videos of their experiments and group/individual song compositions." One teacher reported doing this to allow others whether inside or outside of the school to have a glimpse of students' undertakings. Interestingly, no teacher has ever uploaded his or her own material. One teacher was even emphatic saying "no, never… Impossible!" All three alluded to the "lack of confidence" as the main reason for not sharing any of their own material in YouTube. One teacher also identified "feeling conscious of my accent" which incidentally is a factor affecting the preference for videos uploaded by native speakers over those produced by non-native speakers including Filipinos. She however clarified that she also uses materials uploaded by Filipinos but only those in Filipino language such as documentaries.

Discussion

The two themes that were derived from the subjects' responses spring from the fact that there are two types of video services available online. According to Buzzetto-More (2014), these are (1) video viewing services that allow users to view videos, and (2) video sharing services that allow individuals to upload videos and share them with others for commentary. YouTube features both services. From these, two types of users can be identified – those whose

participation is limited to purely spectatorial and those viewers who also actively share their own materials online. Apparently, more science teachers are inclined to being merely viewers whereas fewer seize the opportunity to become co-creators by refusing to upload self-generated materials. From personal experience, it is actually noticeable that most science-related YouTube contents that can be used as a teaching-learning resource are of Western origin. These contents include videotaped lectures of teachers known as vidcasts or podcasts which are accessible to both online and in-class learners. Burke, Snyder and Rager (2009) pointed that this allows teachers to greatly expand their educational audiences even to international locations. In the study of Gustafsson (2013), it was found that Physics materials in YouTube were dominated by this type. Yet it's also noteworthy that while there are also YouTube teaching-learning resources from the Philippines that can be used in science classes, there is a scarcity in terms of vid/podcasts from Filipino science teachers. This is despite the fact that the rudiments for making and uploading a video are generally accessible to teachers. *Developing Online Teaching Skill* (2011) enumerated these requirements: (1) a device which can be used to shoot a video in the suitable format such as most digital cameras, all digital camcorders, various webcams, and even some mobile phones, (2) a direct connection between the recording device and computer, (3) a relatively fast Internet connection, and (4) a YouTube account. Whilst the accent of a non-native speaker and lack of confidence were cited by the respondents, it would be interesting to conduct a separate investigation on the underlying causes of Filipino science teachers' reluctance in uploading their own teaching materials in YouTube.

Outwardly, science teachers do not have as much apprehension in requiring their students to upload videos of their creativity tasks such as experiments as well as compositions related to the lesson. Gustafsson (2013) chronicled the prevalence of similar videos in Physics featuring active and willing students with their projects and demonstrations. He then noted the likelihood that the students were instructed by their teachers to do these video recordings as a part of assignments in a course and then to upload the clips or as part of the assessment of the students. Incidentally, such tasks are a means of overshadowing the "sit and get" or the "sit and be told" (Gauntlett, 2011) type of learning which revolves around transmissionism. By allowing students to work on tasks that will eventually be shown in a global platform, they become motivated to express their own creativity. Also, their roles shift from passive recipients to active co-creators of knowledge. Moreover, Gustafsson (2013) indicated that student-generated videos can be used to inspire learners before starting a project. In addition, they could provide ideas for possible projects, as well as ideas for how to realize them and how to present them. Evidently, the participatory element of YouTube is pedagogically beneficial when aptly taken advantage of.

When teachers require students to upload their videos, they should warrant protection of students' privacy to be safe and avoid complications in the future legal or otherwise. This is especially true for levels where students are still minors. According to the *Developing Online Teaching Skill* (2011), this can be accomplished by changing the settings to protect their privacy and establishing a secure YouTube channel just for the class.

As viewers, science teachers use YouTube in two ways. One is for their learning benefit (teacher's resource) and the other is for their teaching benefit (teaching resource).

Science teachers are expected to be competent in their respective fields thus they should exhaust all means to provide quality and accurate science instruction. Because science is an organized body of knowledge covering general truths or the operation of general laws, accuracy of information is highly emphasized in science teaching. It is then a prerequisite for science teachers to establish a sound understanding of science concepts so that they can communicate correct information about the subject matter. Otherwise, they risk causing misinformation among students. This exacerbates the reported prevalence of students' tendency to generate misconceptions as a result of the inherent technicality and theoretical nature of science. In

relation to these characteristics of science, multimedia available in YouTube in the form of animations, demonstrations, and podcasts of experts are a great aid for teachers who themselves find certain science topics a challenge. Animations and demonstrations help in translating abstract concepts into a visual form whereas podcasts facilitate teachers' attempt of comprehending the subject matter by providing an alternative source of information apart from the conventional reading materials. It may also provide a direct access to scientists who could provide an extensive elucidation on the matter. What's more to this is that teachers can show these materials to their students provided that they are deemed appropriate for the level of the students. In fact, this manner of using YouTube constitutes the larger portion by which the website is integrated in science classes. It must be noted however that in areas where there is slow internet connection, teachers typically download the material and show them in class. Regardless, several studies (as cited by Buzzetto-More, 2014) uphold the multifarious benefits afforded by YouTube depending on how it is used in the teaching-learning process.

Buzzetto-More (2014) cited YouTube's effectiveness in capturing students' attention, making learning more interesting and enhancing the overall learning process. This supports the science teachers' use of YouTube for motivating their students. As for the use of YouTube in the discussion proper and for demonstration purposes, VanderArk and Schneider (2013) elucidated on the macro benefit of digital learning which is providing support for deeper learning. Figure 1 shows the components of deeper learning that are enriched with the use of digital technology.

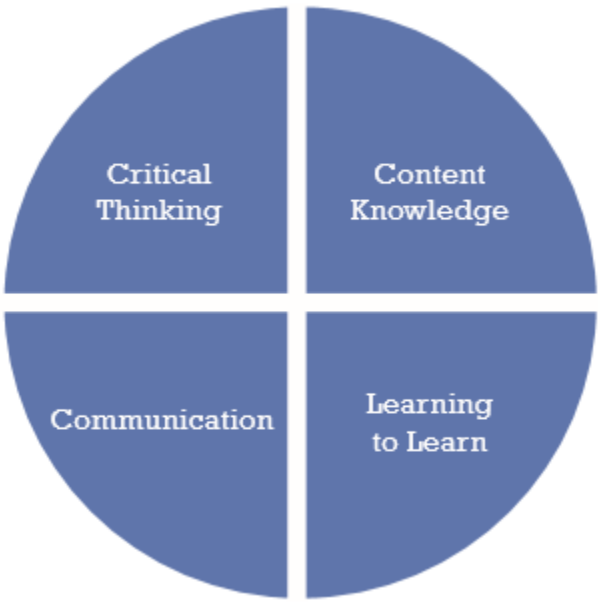

Figure 1: Components of Deeper Learning Components
from the Hewlett Foundation (VanderArk & Schneider, 2013)

This macro benefit is substantiated by the following advantages of YouTube integration as quoted by Buzzetto-More (2014): help students engage more deeply with subject matter, recall the information learned longer, expand access to information, promote critical thinking, foster active and flexible learning environment, support analytical discourse and multiple approaches to reasoning, provide memory cues so as to support conceptualization through visualization, and increase depth of understanding.

Conveniently, videos can be incorporated into assignments, quizzes, and tutorials (Snelson, 2010). In addition, they can be used to support independent learning and assist in

tutoring (Berk, 2009; Kelly, Lyng, McGrath, & Cannon, 2009). This validates science teachers' practice of giving YouTube URLs to students for them to look up at home.

It is however imperative that teachers perform a careful selection of materials for these benefits to materialize. Similar to the characteristics of YouTube materials scrutinized by the respondents, video characteristics, attractiveness and clarity were also acknowledged by Alhamami (2013) albeit in the context of language learning. But of all the factors that determine whether a particular YouTube content merits consideration for classroom viewing, correctness of content is of prime importance. When a viewer enters keywords in YouTube, a selection of materials corresponding to the keywords appears. The selection is a mixture of contents uploaded by users because any user with a YouTube account whether a student, teacher, expert, enthusiast, or organization can upload his/her own material. This ease of using video-sharing websites results in the accuracy and credibility of the materials as a significant limiting factor as emphasized by Burke et al. (2009). Hence contents of these materials must be thoroughly examined to determine whether they conform to widely accepted scientific truths. For this reason, it is important that science teachers consult other references especially when they are using YouTube to be clarified on a particular subject matter.

Because inspection of materials must be done by the teachers themselves, it can be time consuming as each potential material must be viewed and analyzed in terms of all the aforementioned factors. In addition, time spent evaluating the videos can be prolonged especially when teachers do not have a particular video in mind. Burke et al. (2009) suggest increasing efficiency in doing a search by entering relevant key descriptive terms and spending time searching like-topics and user-personalized YouTube pages with similar content.

Other than intelligent selection, teacher competence is also a significant factor for YouTube integration to be effective. This also applies to any other digital media used in the teaching-learning process. While teachers admit to exploiting YouTube for lessons they do not feel confident or comfortable of tackling, the entire burden of fostering learning among students must not be ascribed to the material. It is unfortunate to note that some teachers settle to the idea of using digital media as their "substitute." Even when the selected YouTube content is commendable in terms of the different parameters mentioned earlier, the scholarly processing that is expected after exposure to the material presents immense possibilities for deeper learning. It significantly reinforces the learning gleaned from the material. Needless to say, it entails competence on the part of the teacher.

Meanwhile, reviewing the aforementioned ways on how science teachers incorporate YouTube in their field reveals an underutilization of the platform. Exploring literature on creativity vis-à-vis science education and YouTube can furnish insights regarding the optimization the instructional potential of YouTube. For instance, teachers may derive ideas from Rotheram's (2014) Teaching, Learning, Creativity (TLC) model for science which incorporates various strategies and creative activities pertinent to science instruction. Science teachers may also learn from examining Veritasium which is one of the largest science education channels on YouTube created by Derek Muller, an expert in both physics and education. Henriksen and Hoelting (2016) attributed its success to Muller's ability to anticipate future technologies, communicate and educate in compelling ways, adapt lessons for a new medium, and distribute them to a broader audience that truly defines his expertise. Benchmarking on these, science teachers must continuously seek and practice innovative and creative ways for the improvement of their craft which in turn is fundamental in today's digitally-influenced education and society.

Conclusion

In order to understand how and why science teachers in the province of Benguet, Philippines utilize YouTube vis-à-vis science instruction, this study was conducted. It must be noted that the findings were derived from three (3) respondents who agreed to participate in the study. Data were gathered mainly through an unstructured interview with each of the respondents.

The investigation successfully revealed the practices as well as the motives and considerations of science teachers in integrating YouTube in their classes. The science teachers who participated in the study utilize YouTube for improving their mastery of a particular subject matter and show YouTube contents to students as part of their strategy and as instructional material. These two constitute the inactive application of YouTube where the role of the teacher and consequently the students is limited to mere spectators. In contrast, teachers can adopt a more dynamic participation in YouTube by uploading materials and thus co-creating YouTube's library of contents. These findings may however be true for a select group of science teachers and may not reflect the experiences of all science teachers in the same situation. Nevertheless, several primary as well as secondary points were mooted in this study thus the researcher encourages further investigation on these areas.

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Appendix

Repertory Grid

Questions	Categorized Significant Statements	Emerging Themes
As a science teacher, in what ways do you participate in YouTube?		Spectatorial:
	I use it as a reference especially with lessons in which I myself am confused… mostly *yung hindi ko major* [that which is my major/field of specialization].	Teacher's Resource: Learning Benefit
	I use it for reference also.	
	I participate in YouTube by using it as a resource especially when I need to see demonstrations or processes.	
	I download videos related to my lesson.	Teaching Resource: Teaching Benefit
	Songs related to the topic were used in the motivation part.	*Motivation
	I use videos to give them ideas	
	When the teacher can't explain the concepts well especially if it's not her specialization, YouTube helps a lot!	**Discussion
	When I was simply discussing, the students seemed to be wondering what I was talking about and most of them have a negative attitude towards the topic because according to them, the lesson seems to be abstract.	
	Reduce effort kasi yung video nandon' na mismo yung karamihan ng sasabihin mo at may illustrations na rin… and yung mga kagaya ko na visual learners, mas makakaintindi kung ano… *with the chalk-talk method.*	
	Observed short attention span of students… especially in Grade 7… when the teacher is discussing.	
	In some case, like historical events, YouTube is needed	
	Usually, if materials are not available in an activity	***Demonstration
	In earth science, particularly earthquake and volcano	
	Hard up in actual demonstrations… for instance chemical reactions due to lack of materials	
	Kung kulang ang materials or kung walang or kulang ang books … sa Grade 9. [When the materials are not sufficient or when there are no or not enough books … in Grade 9].	
	You can just give the site where they can watch the events. Give them questions, then reporting, reflections will follow	****Augmentation
	I refer videos from YT to my students for them to watch at home	
Do you upload multimedia in YouTube? If yes, describe the contents of the material.	Yes, these are works of students – videos of experiments, group/individual song composition	Participatory
	No, never… I mean, impossible!	

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