Research Article

Conceptual Understanding of Students Towards COVID-19 Pandemic: Basis for Inclusion in Science, Technology and Society (STS) Curriculum

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ABSTRACT

The study has utilized a multi-methodology research design with assessment tests and a structured interview guide as instruments in gathering the data. In class 2020, there are 72 students and 8 Teachers of Science, Technology and Society (STS) who served as participants in the study. The assessment test was validated by three experts, Science, Technology and Society teachers with sciences as specialization and a professional education teacher. There are two types of instruments were used to gather data, these are (a) an assessment test and (b) structured interview guide. The assessment test is compose of two parts (I) the traditional multiple choice assessment test that is composed of 20 questions and (II) close-ended essay which consists of five questions. The structured interview guide is composed of one question "In your perspective, should 'COVID-19 Pandemic' be included in a STS curriculum? Why?" The results of the study have concluded: level of understanding of the students based from the traditional and essay assessment tests are both fairly satisfactory; level of conceptual understanding based from the relationship between the assessment tests has moderate positive correlation; the perspectives of the teachers regarding the inclusion of COVID-19 Pandemic concept in the STS curriculum, seven themes have emerged. The themes focused on addressing COVID disparities experience across multiple dimension and use it for curriculum formulation and empowerment of STS literacy. The study has recommended; heighten and strengthen the students' conceptual understanding toward COVID 19 Pandemic through series of topics and teaching approaches; strategically include the concept of COVID-19 pandemic in the curriculum.

Keywords: *Conceptual Understanding COVID-19, Philippines, Science, Technology and Society Curriculum*

Introduction

According to Negash and Fura (2020), COVID-19 has been rapidly spreading around the globe, influencing many aspects of human life. Lamb (2020) explained that COVID-19 is a respiratory illness identified on December

2019. It is caused by SARS-CoV-2, a novel coronavirus (severe acute respiratory syndrome coronavirus 2. Severe diseases affect those over 65, as well as those with underlying medical conditions such as heart disease, diabetes and chronic lung disease. (World Health Organization, 2020). Given the severe consequences, a national and worldwide public health emergency has been proclaimed, and governments have taken exceptional steps to avoid contamination and restrict the pandemic. This has posed enormous problems and a disproportionate danger to the lives, relationships, and well-being of older persons (2020, Chee). COVID-19 is a fatal respiratory disease.

Despite widespread public health efforts, such as examining symptomatic patients and pushing for social distancing, COVID 19 continues to spread rapidly for months (Huff & Singh, 2020). Which has had an effect on almost every facet of society, including business, education, economics, religion, transportation, tourism, employment, entertainment, food security, and sports (Ananya, 2020). There are massive and wide-ranging repercussions. Whereas the pandemic's impact may vary by country, it will almost surely worsen global poverty and inequality, making the SDGs even more crucial (United Nations Development Programme, 2020).

The globe is in a critical situation. So far, the COVID-19 pandemic has claimed the lives of more than millions of people. Many lives and communities have been ruined by this disease. According to Asia Pacific Regional CSO Engagement Mechanism [APCRCEM] (2020), because of anti-people attitudes about science and technology, COVID-19 was born. These anti-people attitudes are found in an unfair patent system, the slashing of public health spending, and the rise of uncontrolled new frontiers that endanger people and the earth. Also, males, as well as those who were younger, less educated, and in physical labor, have lower level of knowledge in this concept and were less likely to engage in health preventive actions (Bates et al., 2021). So, significant intervention must be implemented. UNESCO (2021) underlined the importance of science in addressing social

and global challenges. People must understand and engage with science in order to make informed personal and professional choices. As a result, APRCREM (2020) asserts that science, technology, and innovation have all contributed to the resolution of this health catastrophe.

Additionally, United Nations Conference on Trade and Development (2020) also believes that science, technology, and innovation provides a 'guiding light to assist us in navigating and recovering from the COVID-19 pandemic.' The global scientific community must continue to contribute to the development of scientific and technological innovations not just to effectively battle the COVID-19 emergency, but to make a significant contribution to knowledge societies that coexist with nature and where individuals can live prosperous and fulfilling lives (APRCREM, 2020).

In relation to this, Jensen et al. (2020) emphasized that COVID-19 pandemic was a stark reminder of the need of scientific communication. To stop the virus from spreading, stakeholders must be able to properly communicate. The best method to fix the problem is to teach COVID-19 concepts (Modan, 2020). The pandemic's gap may be bridged if fundamental scientific concepts were widely disseminated (Rogayan & Dantic, 2021).

For it to happen, established scientific communication and curricular integration are required. Barbour (2020) argues that this helps students focus on what they're studying while stressing the value of what they're learning. By helping them understand how the news impacts their lives and the lives of their loved ones, we show them that what they learn in school matters beyond the classroom.

Having a developed conceptual understanding is utmost importance. It is where concepts can be approached dynamically. Individuals grasp information or learning then apply it across multiple domains. The goal of this research is to determine and analyze students' conceptual grasp of COVID-19 and to examine instructors' perspectives on the concept's incorporation in the Science, Technology and Society curriculum. The data would serve as basis for curriculum inclusion.

Theoretical Framework

According to Woolfolk (2011) that Social constructivism posits that learning occurs within groups of individuals. Those who participate in the activities and work of the group build knowledge in the process. So, the COVID 19 predicament lays a foundation where the experiences and interaction by the social subjects and variables have led to desperate learning and developing.

Based from CHED Memo No. 46 S. 2012, Article XIV Section 2 states "set up a comprehensive, appropriate, and well-coordinated educational system that meets the demands of the people and society at large." Science, Technology, and Society all play a critical part in devising a solution to the present dilemma, not only medically, but also socially and economically. It is the policies that will be devised in response to it that will be important, not just in post-COVID recovery plans, but also in the decade of action required to implement the 2030 Agenda for Sustainable Development (UNCTAD, 2020).
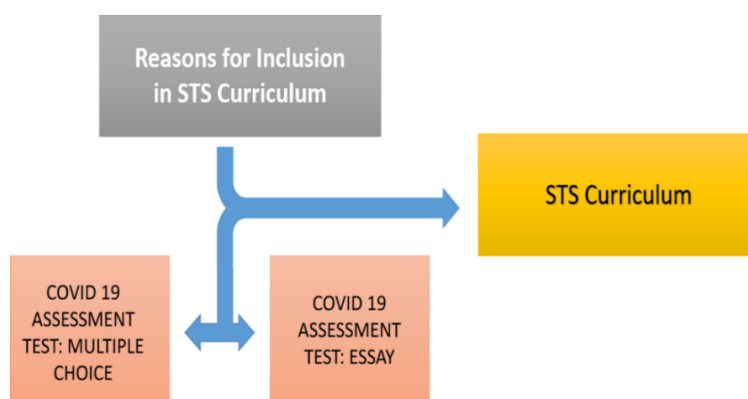

Figure 1. Conceptual Paradigm of the Study

The box 1 represents the scores of the students in COVID-19 Traditional Assessment Test. Another box represents the scores of the students in COVID-19 Close-Ended Essay Test. The two tests validate each other and measure the level of conceptual understanding of the students.

Methods

The study used a mixed methodology research design, with assessment tests and structured interview guides serving as the primary tools for data collection. The purpose of this research is to ascertain students' conceptual comprehension of the notion and teachers' viewpoints on its integration into education. The research used a thorough sampling strategy. 72 students and eight faculty members of a tertiary higher education acted as participants for class 2020. Three experts approved the assessment test: two Science, Technology, and Society teachers with a specialization in natural sciences and a professional education teacher. There two types of instrument was used to gather data, these are (a) assessment test and (b) structured interview guide. The assessment test is compose of two parts (I) the traditional assessment test or multiple choice test that is composed of 20 questions and (II) Close-Ended essay test which consist of 5 questions. The structured interview guide is composed one question "In your perspective, should 'COVID-19 Pandemic' should be included in a Science, Technology and Society curriculum? Why?"

Findings and Discussions
Student's Level of Understanding in the Traditional Assessment Test

The level of Understanding about COVID – 19 Pandemic by the students is reflected by the result of their traditional assessment test.

The traditional assessment test or multiple choice test was composed of Twenty (20) items. It was used in gathering information and identifying the strengths and weaknesses of students. It was administered to evaluate the level of understanding about COVID-19 Pandemic. Class scores were described using frequency distribution and percentages.

Table 1 shows the frequency and percentage distribution of the respondents scores in 20

items traditional assessment test given by the researcher. There are four (4) participants or 6% did not meet expectation. Fifty-one (51) participants or 71% of the class were Fairly Satisfactory. While, Seventeen (17) or 23% were satisfactory. The overall mean is 9.18 with an standard deviation of 2.68 and described as Fairly Satisfactory.

Table 2. Frequency and Percentage Distribution of Participants' Score in Traditional Assessment

SCORES	FREQUENCY	PERCENT	DESCRIPTIVE RATING
1.00 – 5.00	4	6	Did Not Meet Expectation
6.00-10.00	51	71	Fairly Satisfactory
11.00-15.00	17	23	Satisfactory
TOTAL	72	100	
Level of Understanding	SD = 2.68	Mean=9.18	Fairly Satisfactory

Student's Level of Understanding in the Essay Assessment Test

The level of Understanding about COVID – 19 Pandemic by the students is reflected by the result of their essay assessment test.

The essay assessment was composed of Five (5) items. It was used to validate the answer in the traditional assessment test of students. It was administered to evaluate the level of understanding about COVID-19 Pandemic. Class scores were described using frequency distribution and percentages.

Table 1 shows the frequency and percentage distribution of the respondents scores in 20 items traditional assessment test given by the researcher. There are sixteen (16) participants or 22% did not meet expectation. Forty-one (41) participants or 57% of the class were Fairly Satisfactory. While, Fifteen (15) or 21% were satisfactory. The overall mean is 8.26 with an standard deviation of 2.59 and described as Fairly Satisfactory.

Table 3. Frequency and Percentage Distribution of Participants' Score in Essay Assessment

SCORES	FREQUENCY	PERCENT	DESCRIPTIVE RATING
1.00 – 5.00	16	22	Did Not Meet Expectation
6.00-10.00	41	57	Fairly Satisfactory
11.00-15.00	15	21	Satisfactory
TOTAL	72	100	
Level of Understanding	SD = 2.59	Mean=8.26	Fairly Satisfactory

Level of Conceptual Understanding based from the Relationship between Traditional Assessment and Essay Assessment Test

Table 4. Relationship of Level of Conceptual Understanding between Traditional Assessment and Essay Assessment Test

		Traditional	Open-Ended
Traditional	Pearson Correlation	1	.515**
	Sig. (2-tailed)		.000
	N	72	72
Open-Ended	Pearson Correlation	.515**	1
	Sig. (2-tailed)	.000	
	N	72	72

The computed Pearson Correlation Coefficient is 0.515 that indicates moderately positive correlation between the traditional and essay assessment tests. It means that conceptual understanding base from the multiple choice test and essay test are just moderately correlated.

Perspectives towards the Inclusion of COVID 19 Pandemic in the Science, Technology and Society Curriculum

Table 5 shows the seven themes about the perspectives towards the inclusion of COVID 19 Pandemic in the Science, Technology and Society curriculum?

Theme 1. Emphasize Health Disparities on the COVID Crisis Experience

The country has gotten to this point because individuals lack adequate and proper knowledge about health issues like these. The present COVID-19 pandemic, according to PEC (2020), has affected us all and will continue to do so for some time. There is still a great deal of effort to be done to alleviate the global health inequities associated with Covid-19. That's why history lessons like the one on the health crises are important. Like the participant (P01) stated, "I think, yes. This COVID must be integrated in Science, Technology and Society curriculum, but should not only be limited to that. Probably it will be better to include health crisis in general and its implications to the society" Inequalities in health are often connected with inequalities in educational opportunity. People with less education are more prone to a wide range of health problems than those with higher education. People with higher levels of education are more likely to be able to receive and comprehend crucial health information and services, which will enable them to make the best possible health choices for themselves (Center for Disease Control, 2020).

Table 5. Perspectives towards the Inclusion of COVID 19 Pandemic in the Science, Technology and Society Curriculum

Theme	Sample Statement	Description
Emphasize Health Disparities on the COVID Crisis Experience	I think, yes. This COVID must be integrated in the Science, Technology and Society curriculum, but should not only be limited to that. Probably it will be better to include health crisis in general and its implications to the society. (P01)	It suggests that the curriculum address, analyze and use the data from the health disparities and implications brought by COVID experience.
Synthesize Possible Coping Strategies	Supposedly, yes. The Coping Strategies will probably be significant as of the topics. This is with anticipation that science and technology will play a significant role in man's wellness, especially with this experience. (P03)	It pertains that despite of all that experiences, use all those learning to formulate possible coping strategies relative to the Science and Technology.
Address Multiple Dimensions	Of course, it should be included. Today, I think concepts about COVID alone are already to public. So, need no to focus alone on COVID. Perhaps, better to refocus on the probabilities animal to human caused health crisis or overused/underused of science and technology caused by pandemic. (P07)	It highlights the need to address the problems rose and response conducted amidst pandemic towards the different dimensions of society.

Theme	Sample Statement	Description
Conduct Curriculum Review	This is more of the issue of relevance. So, it follows that all curricula not just STS must be made relevant and responsive. So, no one had though of this health crisis to happen. With that, it calls for a curriculum review. Just in the field of Social Science, social economics and even political implications should now be integrated. (P06)	It recommends to conduct a curriculum review were COVID data and information may subject to scrutiny and include to educational formal curriculum.
Establish Science Communication	It should be included in the STS subject. Aside from the health aspects of COVID 19 that greatly affects the society. The curriculum must also focus on developing and establishing stronger science communication. Because of its great weakness among all the stakeholders, it obviously manifested as the crisis got worse. (P01)	This focuses on bridging the gap between science and the public by disseminating and explaining fundamental and understandable science concepts.
Empower Scientific, technological and societal Literacy	Yes, it should be included. Because, when the COVID-19 hit, all of us we're unprepared. Not just with the medical sectors, but in all sectors like the education, tourism, market, food, financial, science, employment and others. With this manifestations, I simply believe we obviously lack knowledge on STS. Because we have not used the most efficient ways, technology and sciences when approaching COVID-19. (P08)	It justifies the necessity to empower Scientific, technological and societal Literacy among the community to prevent such disasters in the future.
Study the COVID 19 implication.	Yes, it should be strategically included. The matter of COVID-19 crisis is huge burden towards the society. The rapid regress is significantly felt by everyone. Not just the medical aspects, but also to the others; economic distress, educational challenges, food crisis etc.; of the pandemic have made the stakeholders suffer massively. So, in the STS, the implications of COVID-19 crisis should be thoroughly studied. (P03)	It emphasized the thorough studying of COVID 19 implication towards society.

Theme 2. Synthesize Possible Coping Strategies

People's unique perspectives on COVID crisis situations and their particular areas of expertise might be pooled to provide a variety of potential coping mechanisms. When the COVID-19 epidemic struck Pakistan, Munawar & Choudhry (2020) found that health care providers used a variety of coping methods to deal with stress and worry. One participant's remark that stood out was this: "Supposedly, yes. The Coping Strategies will probably be significant as of the topics. This is with anticipation that science and technology will play a significant role in man's wellness, especially with this experience." Modern mobile and Internet-enabled technology was designed to make our lives

simpler by reducing the time it takes to do routine actions and increasing the speed at which we can access online resources (Davidson, 2018).

Theme 3. Address Multiple Dimensions

One participant's response was particularly noteworthy, "In my opinion, it's a yes. Because it is a great opportunity to see and analyze how politics greatly implicate, the supposedly, scientific matters. It seems the politics had played a huge role than science in approaching the COVID predicament." Protests overlook the fact that we must also address the underlying social and economic problems in our society (Burgess, 2020). As we emerge from lockdown, it is imperative that any environmental policy that has been pushed back gets back on its feet as rapidly as feasible. It is now more important than ever for us to establish sustainable systems that can help us avoid future pandemics or environmental disasters (Villela, 2020).

Theme 4. Conduct Curriculum Review

Among the responses, two participant's was especially significant, "This is more of the issue of relevance. So, it follows that all curricula not Science, Technology and Society must be made relevant and responsive. So, no one had thought of this health crisis to happen. With that, it calls for a curriculum review. Just in the field of Social Science, social economics and even political implications should now be integrated." And, "Yes, it should be considered in the curriculum. The administration had only focused too much on the health crisis. Though it is reasonable. But other dimensions like businesses, tourism, technology, etc have been subject of concern for far too low. I think, this should be historically reviewed and make recommendations for future references. So, it will be great opportunity if it is included in STS curriculum."

Theme 5. Establish Science Communication

According to the STRIDE (Science Training & Research to Inform Decisions) Program of Stony Brook University (2020) that scientists need to be given the appropriate instruments to convey their findings to the general public, fellow scientists, policymakers, and other stakeholders in society. It was also emphasize by a participant, "It should be included in the STS subject. Aside from the health aspects of COVID 19 that greatly affects the society. The curriculum must also focus on developing and establishing stronger science communication. Because of its great weakness among all the stakeholders, it obviously manifested as the crisis got worse." We must go beyond the technical specifics and appendices of raw data when it comes to science communication. Even a collection of pretty images is not enough (Gee, 2020).

Theme 6. Empower Scientific, Technological and Societal Literacy

Participants stated that the majority of us are Science, Technology and Society illiterate. It became especially apparent as the crisis approached. "Yes, it should be included. Because, when the COVID-19 hit, all of us we're unprepared. Not just with the medical sectors, but in all sectors like the education, tourism, market, food, financial, science, employment and others. With this manifestations, I simply believe we obviously lack knowledge on Science, Technology and Society. Because we have not used the most efficient ways, technology and sciences when approaching COVID-19." Additionally, "It seems that this should be included in the Science, Technology and Society curriculum. The scientific community has been closed to silence during this predicament. Aside from that, the education or knowledge of the people about the technicalities of the predicament is indeed weak. Because of that, we are currently facing a huge disaster." It was clearly justified by APRCEM (2020) saying, Scientific and technological advances have played an essential role in tackling this health problem. Science and technology have been put to use in the service of business for decades under the global economic system outlined by the neoliberal economic order.

Theme 7. Study the COVID 19 Implication

A participant agreed that the topic should be included in the Science, Technology and Society curriculum. According to the participant, "Yes, it should be strategically included. The matter of COVID-19 crisis is huge burden

towards the society. The rapid regress is significantly felt by everyone. Not just the medical aspects, but also to the others; economic distress, educational challenges, food crisis etc.; of the pandemic have made the stakeholders suffer massively. So, in the Science, Technology and Society, the implications of COVID-19 crisis should be thoroughly studied." This has to be looked at historically, analyzed, and synthesized. The Sustainable Development Goals can only be achieved if we all work together to share our knowledge and skills. During and after the COVID Crisis, it was necessary to build long-term sustainable policies for the health and agri-food sectors (Chriscaden, 2020).

Conclusion

The level of understanding of the students based from the traditional assessment test is fairly satisfactory. The level of understanding of the students based from the essay assessment test is fairly satisfactory. The level of conceptual understanding based from the relationship between the assessment tests has moderate positive correlation. The perspectives of the teachers regarding the inclusion of COVID-19 Pandemic concept in the Science, Technology and Society curriculum, 7 themes have emerged including: (a) emphasize health aspects on the covid crisis experience; (b) synthesize possible coping strategies; (c) address multiple dimensions; (d) conduct curriculum review; (e) establish science communication; (f) empower scientific, technological and societal literacy; (g) study the COVID-19 implication.

Recommendations

Enhance students' awareness and comprehension of the COVID 19 Pandemic. Through a succession of subjects and instructional styles, reinforce their conceptual knowledge of the COVID-19 Pandemic. Thus, they may apply their knowledge across different aspects of society. Incorporate the COVID-19 Pandemic idea strategically within the Science, Technology and Society curriculum. The scope should be comprehensive and value-driven. Conduct a historical and analytical examination. Finally, synthesize coping options for the challenges that society encountered during the COVID crisis based on the analysis. Conduct extensive

and wider study on the COVID-19 and its conceptual understanding.

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