CONSTRUCTIVISM IN THE SCIENCE CLASSROOM: ASSESSING STUDENTS' PERCEPTION OF CONSTRUCTIVISM

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ABSTRACT

Distinct to today's society is rapid change, exemplified in the swift demands that confront professionals and working life. As this ripple to and challenges the educational set up to mold competent individuals, changes occur as the education paradigm shifts. One such change is Constructivism which asserts learning to be an active process where learners actively build on their experiences and knowledge. Students' perceptions of the classroom learning environment are significant and should be of interest to teachers. The study employed a Constructivist Learning Environment Survey which was responded by163 first-year college students. It was intended to assess how students perceive their Science class as taught using the Constructivist approach. It utilized the Statistical Package for the Social Sciences software to analyze data. Findings revealed that students perceived their Science class as "often" taught using Constructivism. Likewise, of the five Constructivist dimensions identified and utilized for this study, four dimensions were regarded as "often" perceived by the students in their science class, the highest often perceived dimension being Student Negotiation. Contrastingly, the only dimension perceived "seldom" by the students and scored the lowest is Shared Control. Thus, it resulted that there is no relationship between the teacher's teaching experience and the teacher's use of constructivist practices.

Keywords: Constructivism, Science Classroom, Constructivist Learning Environment Survey, Science Education

INTRODUCTION

As education is reformed to mold competent individuals, changes occur as the education paradigm shifts. Waves of changes in education have complicated and challenged the teaching profession ever more (Mu et al., 2018). One such change, as argued, the center of gravity needs to shift whereby he [the learner] is at the center. In addition, Dewey believed that teachers should not be in the classroom merely to serve as dispensers of instruction but should take on the role of facilitator and guide, offering students the opportunity to explore and evolve as active and independent learners. Consequently, these changes are products of approaches and models based on theories.

As suggested by one of its proponents, the Constructivist theory, Jerome Bruner, is based upon the idea that the goal of education should be intellectual development. Further, the theory maintains that learning is an active process in which learners develop new ideas or concepts based on current / previous experience or information (Sani, 2017). For Bruner (1961), the goal of education is not to impart knowledge but rather to promote a child's thought and problem-solving skills, which can then be applied to a variety of situations. According to McLeod (2019), the teacher's role should not teach knowledge through rote learning but rather to promote the learning

process. This means that a good teacher will design lessons that help students discover the relationship between bits of information.

In today's society, professionals face demanding requirements. To adapt to the range of skills required in professional work, good pedagogues by reimagining constructivist methods to optimize student learning is adaptive (Krahenbuhl, 2016). Further, peculiar to today's society and working life is rapid change. In a cycle of lifelong learning, experts must constantly develop and rebuild their expertise. Such criteria, in turn, present significant challenges to educational structures which are supposed to generate potential work-life experts.

The truth of science can not only be taught to postmodern students. We ought to draw on their own cognitive, attitudinal, affective, behavioral, and realistic experiences. Participatory learning at work can help students solve scientific and theoretical problems. With the variations that occur with time, it is essential to know the learners and assess the learning environment to provide optimal learning. Referring to "the social, physical, psychological and pedagogical contexts in which learning occurs and affects students' achievement and attitudes" (Fraser, 2012) the learning environment is broad. The urgency of today's educational issues necessitates immediate reform on an impressive scale. The challenge of developing an intimate, context-sensitive, content-rich science education strategy in today's information-driven society has been presented to professional educators worldwide. The creation of the Constructivist Learning Environment Survey (CLES) resulted from integrating constructivist and critical theory perspectives on the framing of the classroom learning environment. CLES helps researchers and teacher-researchers track constructivist approaches to teaching and discuss key constraints on creating constructivist classroom environments (Taylor et al., 1997). The learning environment in schools also referred to as the educational environment or the classroom climate, is the social setting in which learning occurs (Dindar, 2016). These learning environments are the social-psychological factors or learning determinants (Fraser, 2012).

New curricula encourage teachers to follow and implement specific teaching strategies that pay attention to individual variations in the cognitive systems of students or previous knowledge bases and help students incorporate new knowledge with the knowledge they already possess (Yilmaz, 2011). Pedagogy of engagement for multifaceted change that focuses on students' learning and complex social experiences will improve their academic and professional skills (Dames, 2012). Students will be able to carry out learning activities that foster their awareness, attitudes, and skills.

Science education plays a vital role in the economic growth of the country. This brings technical change, encourages national prosperity, and enhances health and the manufacturing sector (Dela Fuente, 2019). Fraser (2012) stated that while science education research and evaluation are focused heavily on assessing academic achievement and other valued learning outcomes, these assessments cannot provide a complete picture of the educational process. Dela Fuente (2019) stated that a knowledge-based economy in science education plays a vital role in economic and social development in this digital and fast-changing era. In addition, better curriculum outcomes may provide reliable human resources to help develop and maintain economic growth in the country by knowledge-based means (Morales, 2017). Students are well-positioned to make classroom decisions because they have experienced several different learning environments and have enough time to create accurate classroom perceptions (Fraser, 2012).

According to the constructivist viewpoint, meaningful learning is a cognitive process in which humans become aware of the environment concerning information they have already created. This process of making sense requires constructive communication and creating consensus (Fraser, 2012). It cannot be denied that Constructivism is the current officious approach in teaching. Consequently, Science and Science education are indispensable tools for a country's progress. Therefore, it is essential to establish the degree to which science education has been taught utilizing the constructivist approach. As Fraser (2012) explains, student perceptions of the

learning environment in the classroom are pertinent and should be of attention to teachers in the classroom and can be assessed relatively quickly using perception instruments in the classroom environment.

In response to the need to assess the pioneering and dynamic environments of the classroom, such as implementing the new General Education Curriculum, this research sought to determine the current domineering approach in education, constructivism, as applied and utilized in the tertiary level education in the Philippines. Especially since the GEC courses are newly adapted in the college curricula, this study intended to study the degree of constructivism, particularly in the science class, Science, Technology and Society (STS).

OBJECTIVES OF THE STUDY

This study intended to study the degree of constructivism in the STS course as perceived by first-year college students of a state university (SUC) in Cebu during the academic year 2019-2020. Specifically, this study aimed:1) to assess from the students' perception of their science class taught using the constructivist approach in terms of personal relevance, uncertainty; critical view, shared control, and student negotiation, 2) to identify the dimensions of constructivism that are least and most utilized in the science class, 3) to determine whether there is a relationship between the teacher's years of teaching experience and their application of constructivist practices as perceived by the students, and 4) investigate the overall extent of constructivism is utilized in the science class.

METHODOLOGY

The researcher used a quantitative, non-experimental methodology, specifically the descriptive method, to examine the use of constructivism in a science classroom to achieve this study's goal. The data was gathered through an online survey using convenience sampling of first-year college students of a state university (SUC) in Cebu.

The respondents of the study involved first-year college students of a state university (SUC) in Cebu. The respondents were selected by choosing students who have taken up or are currently taking up the subject Science, Technology and Society (STS) and are first-year college students at a state university (SUC) in Cebu.

Specifically, the study's respondents are composed of 16 students from Bachelor of Science (BS) in Civil Engineering, 20 from BS in Electrical Engineering, 23 from BS in Mechanical Engineering, 22 from BS Industrial Engineering, 28 from BS in Agriculture, and 54 from BS in Information Technology. Overall, the study was responded to by 163 college students.

To realize the purpose of the study, a standardized questionnaire, entitled Constructivist Learning Environment Survey (CLES), was utilized to determine the extent to which constructivism is being used in the teaching of science in class. The questionnaire comprises five scales presented in side-by-side columns to assess students' perceptions on a five-point frequency response scale. The frequency reflects the extent to which relevant and identified psychosocial factors are prevalent in the science class, in this case, the subject Science, Technology and Society (STS) taught by a teacher. The Constructivist Learning Environment Survey (CLES) is a thirty-item questionnaire with five categories of constructivism wherein each dimension has six questions. Students' perceptions of the frequency of occurrence of five key dimensions of a critical constructivist learning environment: Personal Relevance, Uncertainty of Science, Shared Control, Critical Voice, and Student Negotiation were measured using the Constructivist Learning Environment Survey (CLES). One item, item 6 is scored reversely.

The CLES was developed by Taylor, Fraser, and Fisher (1995 and 1997) to assist researchers and teachers in assessing the degree to which a particular classroom's environment is consistent with Constructivist epistemology. Likewise, the CLES aims to assist teachers in reflecting on their epistemological assumptions and reshape their teaching practice.

Amidst the restrictions due to the COVID19 pandemic, data gathering was done through an online survey using Facebook Messenger, which was most accessible for the respondents. The research tapped on STS teachers to undertake data gathering since these teachers have communication with the students. In addition, the teachers handling the STS subject had a varied number of years in terms of teaching experience. After 10 days of online data gathering, the researcher had recorded and tallied 163 responses.

The weighted mean was determined and consequently interpreted to assess how constructivism is used in their science class as perceived by the students. Likewise, the students' perception of constructivism in their science class per dimension was obtained. After the weighted mean was identified, the results were ordered and ranked to determine the dimensions of constructivism that are least and most utilized in the science class. The students' overall perception of constructivism in their science class was obtained by determining the overall grand mean based on their responses. To determine whether there is a relationship between the teacher's number of years in teaching and their utilization of constructivist practices in teaching their classes, the weighted mean for each dimension and the grand weighted mean were identified by categorizing the teachers in their teaching experience in years. Pearson correlation was employed using the Statistical Package for the Social Sciences (SPSS) software.

RESULTS AND DISCUSSION

1. Personal Relevance of the Science class

According to (Ebrahimi, 2015), the Personal Relevance Scale focuses on the relation between school science and the out-of-school experiences of students and the use of the daily experiences of students as a relevant framework for the creation of scientific and mathematical knowledge of students. As shown in Table 1, item 3 obtained the highest "often" response wherein students perceived how science can be part of their out-of-school life. Item 6 scored the lowest and is perceived to be sometimes supposed by the students implying that students view their science class and science as something they could utilize in their life outside of school.

Table 1
Students' Perception of Personal Relevance of their Science Class

	Student Perception	*xm*	Interpretation
1.	I learn about the world outside of school.	3.74	Often
2.	My new learning starts with problems about the world outside of school.	3.94	Often
3.	I learn how science can be part of my out-of-school life.	4.19	Often
4.	I get a better understanding of the world outside of school.	3.77	Often
5.	I learn interesting things about the world outside of school.	3.85	Often
6.	What I learn has nothing to do with my out-of-school life.	2.99	Sometimes
	Grand Mean	**3.75**	**Often**

Since learners interpret new information based on their current knowledge, constructivist pedagogy is focused on students' earlier perceptions and beliefs about the topics to be learned, implying that teachers consider and build on students' previous knowledge when introducing new lessons. Likewise, although languages and cultures enable us to understand things the same way, people, because of individual experiences, may attribute the same things with different meanings. This, therefore, emphasizes the advantages of context-based learning, may it be primary or secondary. According to Giamellaro (2014), providing students with strategic prospects to learn science content in contexts wherein content can also be applied and observed may help students develop a more robust and more accurate understanding of the intended science content.

2. Uncertainty of Science

According to (Ebrahimi, 2015) this dimension indicates the provisional status of scientific knowledge. The Uncertainty scale, shown in Table 2, assesses the extent to which students are given opportunities to perceive scientific

knowledge as coming from theory-dependent inquiry, including human experience and values and developing, non-foundational, and culturally and socially driven (Taylor et al., 1997).

Table 2
Students' Perception of Uncertainty in their Science Class

	Student Perception	*xm*	Interpretation
1.	I learn that science cannot provide perfect answers to problems.	3.04	Sometimes
2.	I learn that science has changed over time.	4.17	Often
3.	I learn that science is influenced by people's values and opinions.	3.97	Often
4.	I learn about the different sciences used by people in other cultures.	3.85	Often
5.	I learn that modern science is different from the science of long ago.	3.93	Often
6.	I learn that science is about creating theories.	3.98	Sometimes
	Grand Mean	3.82	**Often**

Five out of six items obtained "often" responses for this dimension, and only one item was perceived as "sometimes." Item 2, the highest perceived item, indicates that students see science as a dynamic which may be similarly attributed to a constantly changing and fast-paced world of science and technology. Students also often perceive that science is about creating theories, people's values and opinions perceive that science, that modern science is different from the science of long ago, and that they have learned about the various sciences used by people in other cultures. The item that received the lowest score is item 1, which may imply that students view science as a body of knowledge in a continuous search for knowledge as exemplified by research and development activities.

3. Critical Voice in the Science Class

The Critical Voice scale examines how a social climate has been created in which students believe it is legitimate and desirable to challenge the teacher's pedagogical plans and techniques and express concerns about any learning obstacles (Taylor et al., 1997).

Table 3
Students' Perception of their Critical Voice in the Science Class

	Student Perception	*xm*	Interpretation
1.	It's OK for me to ask the teacher 'Why do I have to learn this?'	3.07	Sometimes
2.	It's OK for me to question the way I'm being taught.	3.12	Sometimes
3.	It's OK for me to complain about teaching activities that are confusing.	3.32	Sometimes
4.	It's OK for me to complain about anything that prevents me from learning.	3.56	Often
5.	It's OK for me to express my opinion.	4.03	Often
6.	It's OK for me to speak up for my rights.	3.82	Often
	Grand Mean	**3.49**	**Often**

As shown in Table 3, half of the items that reflect students' critical view in their class obtained "often" responses. This set of questions is designed to probe the legitimacy of expressing a critical opinion (Koh, 2013). Consequently, three of six responses were perceived 'sometimes" as identified by the respondents. This may be reflective that in modern classrooms where students' voices are heard "often" implying a need to provide more opportunities for students to amplify their voice. On the other side, three items were perceived as "sometimes" by the students. This result could be attributed to the still persistent and strong influence of the traditional classroom set-up, where the teacher is seen as the sole voice in class. Thus, the items scored "sometimes" since students are still hesitant to consult about the teaching-learning practices. Therefore, this suggests a need to emphasize the constructivist view that the classroom should be both teacher and student-centered, not just teacher-centered.

4. Shared Control in the Science Class

Table 4 exhibits that students' perception of shared control in their Science class. The Shared Control Scale deals with the students being encouraged to share the control of the learning

experience with the teacher, including the articulation of learning objectives, the design and management of learning activities, and the commitment and implementation of assessment criteria (Taylor et al., 1997).

Table 4
Students' Perception of Shared Control in their Science Class

	Student Perception	*xm*	Interpretation
1.	I help the teacher to plan what I'm going to learn.	2.22	Seldom
2.	I help the teacher to decide how well I am learning.	2.41	Seldom
3.	I help the teacher to decide which activities are best for me.	2.17	Seldom
4.	I help the teacher to decide how much time I spend on learning activities.	2.13	Seldom
5.	I help the teacher to decide which activities I do.	2.15	Seldom
6.	I help the teacher to assess my learning.	2.83	Sometimes
	Grand Mean	**2.32**	**Seldom**

Likewise, this describes students' perceived participation in planning, conducting and assessing learning. Most of the items obtained 'seldom' responses as perceived by the students, and only 1 item scored "sometimes." On the other hand, of the five items, the item that students perceived to be the lowest is the item that talks about the students helping the teacher decide how much time is spent on learning activities. This is suggestive that students still perceive having weak or no control in the planning process. According to (Kivunja, 2014), student participation nurtures 21st century skills demanded of students; capable of thinking for themselves, problem-solving, working with a group and lead others to success.

5. Student Negotiation their Science Class

How students perceive negotiation in their Science class is categorized and shown in Table 5, which reflects Student Negotiation. This scale (Taylor et al., 1997) measures the degree to which opportunities exist for students to explain and justify their newly formed ideas to other students, to listen carefully and focus on the viability of the ideas of other students, and then to focus self-critically on the viability of their ideas. In addition, Nix et al. (2005) stated that this dimension describes the students' role in evaluating the feasibility of new concepts with other students.

Table 5
Students' Perception of Student Negotiation in their Science Class

	Student Perception	*xm*	Interpretation
1.	I get the chance to talk to other students.	4.10	Often
2.	I talk with other students about how to solve problems.	3.70	Often
3.	I explain my understandings to other students.	3.80	Often
4.	I ask other students to explain their thoughts.	3.93	Often
5.	Other students ask me to explain my ideas.	3.47	Often
6.	Other students explain their ideas to me.	3.87	Often
	Grand Mean	**3.81**	**Often**

All of the items in this dimension obtained "often" responses as perceived by the students. The item that had the highest response is item 1, wherein students stated that they had the chance to talk to other students in their science class. Item 5 scored the least yet is still in the "often" level, which contains statements wherein other students ask the student to explain their ideas. Constructivism suggests that teachers (Taylor et al., 1997) recreate their positions as mediators of student interactions with their social and physical environments, and as facilitators of perceptions and reconceptualization of students.

6. Students Perception of Constructivism in the Science Class per Dimension

Based on Table 6, the dimension of constructivism that obtained the lowest responses from the student is Shared Control. Remarkably, this is the only dimension that was perceived "seldom" by the students. Likewise, there seemed to be a remarkable difference or gap from the next upper rank, the Critical Voice dimension. This dimension of constructivism, shared control, was shown to be "seldom" perceived by students. The

results may indicate that students still believe that the teacher has the sole power to plan for teaching-learning activities (TLAs) and assessments. In addition to and as indicated by the result, the students felt little power in the control of planning for TLAs and assessment which mirrors the traditional set-up of education.

Table 6
Students' Perception of Constructivism per Dimension (Ranked in Ascending Order)

	Dimension of Constructivism	*xm*	Interpretation
1	Shared Control	2.32	Seldom
2	Critical Voice	3.49	Often
3	Personal Relevance	3.75	Often
4	Uncertainty	3.82	Often
5	Student Negotiation	3.87	Often
	Overall Grand Mean	**3.44**	**Often**

The education program was criticized for failing to establish work-life skills pre-requisites. Traditional teaching is believed to generate inert knowledge in students, which can be used in educational settings such as training for exams and examinations but cannot be transferred to real-life situations.

The dimension of constructivism that obtained the highest perceived response is Student Negotiation, which was perceived "often" by the students. Student negotiation allows students to communicate with the teacher and communicate with other students to discuss their learnings. Constructivism emphasizes that learning is a learner's active continuous process of developing and reconstructing his or her perceptions of phenomena, rather than a passive intake of knowledge.

As perceived by the students, the overall grand mean of constructivism in their science class is 'often". This finding, as indicated by Table 6, could imply that the students often perceive constructivism as an approach to education. However, there is a small yet significant difference to the "sometimes" perception, the next lower level. This could imply that constructivism had been adopted in the classroom set-up, particularly in science class. Though the overall result tends to be inclined to the positive aspect, a lot of work and effort must be exerted for constructivism to be fully domineering. Likewise, a small yet critical difference separates the scale of the result to the next lower range, the "sometimes" perception. There is, therefore, a need to reinforce and promote constructivism, especially in the lower level of education, since the result is representative only of the college level, particularly first-year college students.

7. Relationship Between Teaching Experience and Constructivist Practice

Table 7
Teaching Experience and Use of Constructivist Practices Perceived by Students

Teacher	Years of Teaching	Weighted Mean per Category					Grand Weighted Mean
		Personal Relevance	Uncertainty	Critical Voice	Shared Control	Student Negotiation	
Teacher A	0 -5	3.68	3.82	3.50	2.29	3.94	**3.45**
Teacher B	6 - 10	3.55	3.65	3.26	2.13	3.65	**3.25**
Teacher C	11 - 15	3.79	3.97	3.66	2.50	3.82	**3.55**

Pearson Correlation = 0.327
Sig. (2-tailed) = 0.788

Based on Table 7, which categorizes the teachers' teaching experience in years and their respective application of constructivist practices as perceived by the students, there is no statistically significant linear relationship. Though there is an approximately moderate strength in the correlation between the variables, there is not enough evidence indicating a relationship between the teacher's teaching experience and the teacher's use of constructivist practices. This could be attributed to the fact that the teaching experience in years of a teacher is not the sole determinant of the teacher's teaching practices. Other factors also influence the teacher, such as continuing professional development through seminars and training, continual education. The teacher's educational background and personality might also affect the teacher in the teaching practice.

CONCLUSIONS

The following are the conclusions reached after careful study of the data and analysis of the research findings.

1. Constructivism had been adopted in the classroom set-up, in this case, in a Science class. The overall result tends to be inclined to the positive aspect. However, this implies that teachers, curriculum planners and education and policy makers must exert a lot of effort for constructivism to be fully domineering.
2. Of the five dimensions of constructivism identified and utilized for this study, four dimensions were regarded as "often" perceived by the students in their science class. The highest often perceived dimension was Student Negotiation. Student negotiation allows students to communicate with the teacher and communicate with other students to discuss their learnings.
3. Contrastingly, the only dimension that was perceived "seldom" by the students and scored the lowest is Shared Control. The results may indicate that students still believe that the teacher has the sole power to plan for teaching-learning activities (TLAs) and assessments.
4. In the Personal Relevance Scale, five or 83% of the items scored Often. The other item was revealed to be sometimes perceived by the students. For Uncertainty of Science dimension, five out of six items obtained "often" responses, and only one item was perceived as "sometimes." Fifty percent or half of the items that reflect students' critical voice in the science class obtained "often" responses, whereas the other items scored "sometimes." The majority of the items in the Shared Control dimension, specifically 83.3% or 5 out of 6 items, obtained 'seldom' responses as perceived by the students. Only 1 item scored "sometimes." All of the Student Negotiation dimension items obtained "often" responses as perceived by the students.

RECOMMENDATIONS

Based on the findings of this study, the researcher recommends that teachers consider the results of the study and build on least practiced or low perceived constructivist practices, as revealed by the study, to promote constructivism in class. Furthermore, the following recommendations are made and aligned based on the study's findings:

1. Practices found to be often practiced, though well perceived, should be further strengthened to thoroughly reinforce constructivism.
2. Teachers are recommended to refresh and revisit the tenets of constructivism.
3. Future studies that intend to utilize the Constructivist Learning Environment Survey (CLES) might consider assessing constructivism in lower education years.

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