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Assessing the Constructive Learning Environment of Senior High School Practical Research Classes

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ABSTRACT

The purpose of this study was to assess the extent to which constructive learning environment (CLE) is implemented in Senior High School (SHS) Practical Research 2 classes of a local Philippine high school. Specifically, this study determined the extent to which CLE is observed across the different SHS strands such as: Science, Technology Engineering, and Mathematics (STEM); Accountancy, Business, and Management (ABM); Humanities and Social Sciences (HUMSS); and General Academic Strand (GAS). Using the Constructive Learning Environment Survey 2.0 (Johnson & McClure, 2004), the Practical Research 2 teachers (n=21) rated their classes in terms of personal relevance (PR), uncertainty (U), critical voice (CV), shared control (SC), and student negotiation (SN). Findings show that the SHS Practical Research 2 classes of this local high school are generally constructivist in nature where CV ($\bar{x}$=4.50), PR ($\bar{x}$=4.38), and SN ($\bar{x}$=4.32) scored the highest and are therefore observed 'almost always'. For the SHS academic strands, constructive learning environment is 'often' observed in STEM, ABM, and HUMSS; while it is observed 'almost always' in GAS.

KEYWORDS- *constructive learning environment, learning environment, science education, senior high school, practical research, constructivism, Philippine education*

1. INTRODUCTION

Education is one of the sectors which continuously upgrades in order to cope with the ever-changing needs of the society. For the past decade, there has been a great emphasis on enhancing the quality of education to foster world-ready learners. Twenty-first century global reforms on education highlight the preparation of learners to solve real-life complex problems associated with a dynamic, technology-filled setting. (Anagun, 2018). 21st century learners are digital learners and independent thinkers; they are immersed in a world of digital learning resources (Palfrey & Gasser, 2008); and they have an almost instant accessibility to global communication and information (Perry & Stallworth, 2013; Lemley et al., 2014). Thus, today's education should no longer simply provide basic literacy skills, but it should also gear towards the integration of 21st century skills into the core curriculum, particularly in science education (Anagun 2018; Organization of Economic Cooperation and Develoment, 2006; Larson & Miller, 2011).

With the advancement of technology, the importance of science education has been the focus of most educational systems around the world (Khine et al., 2018). In teaching science concepts and skills, teachers often administer standardized tests and employ pedagogies to assess learners' progress and attainment of learning competencies, but most often, psychosocial aspects of the classroom such as the 'learning environment' are neglected (Fraser 2014). Schwab (1973) points out the inclusion of learning environment as the fourth element of education: the learner, the teacher, the subject matter, and the learning environment (Colbert, 2014).

Studies have shown that learners have some preferences for their learning environment (Aldridge et al., 2000; Aldridge et al., 2012; Dorman, 2001; Johnson & McClure, 2004; Durmus, 2016; Widodo, Maria & Fitriani, 2017). These preferences reflect how learning occurs and what possible factors may contribute to students' learning. Hence, if the learners perceive their learning environments positively, they learn better (Dorman, 2001; Fraser, 2014; Tsai, 2000; Saylan, Armagan & Bektas, 2021). The constructivist perspective suggests that learners can construct knowledge and that a constructive learning environment promotes meaningful learning (Lee & Fraser, 2000). Constructivism is a popular approach in science learning focused on designing learning environments (Anagun, 2018). It is a learning perspective where students actively construct knowledge and learn based on their interaction with the environment (Peters & Stout, 2006).

The Constructive Learning Environment Survey (CLES) was developed to measure the extent to which constructivist teaching and learning approaches are applied in the classroom (Taylor, Fraser & White, 1994). CLES was designed not only to help teachers and researchers assess how well a particular person's environment conforms to their epistemological beliefs, but also to provide feedback to help teachers improve their teaching methods. (Aldridge et al., 2000). A revised version of CLES was then developed years later and was refined based on radical constructivist ideas, resulting in CLES2.0 (Johnson & McClure, 2004).

CLES is widely used in many countries including Hong Kong (Kwan & Kong, 2014), Iran (Ebrahimi, 2015), South Africa (Luckay & Laugksch, 2015), Indonesia (Widodo, et al., 2010), Turkey (Anagun & Anilan, 2013) and the US (Partin & Haney, 2012). These studies have claimed that CLES is reliable and can be utilized to assess a constructive learning environment based on five aspects: personal relevance, uncertainty, critical voice, shared control, and student negotiation. Although CLES was initially utilized for learners to respond (Dorman & Adams, 2004; Tsai, 2000; Wanpen & Fisher, 2006; Aldridge et al., 2000; Lee & Fraser, 2001), a variety of studies have used the CLES with teachers (Gash & McCloughlin, 2010; Savasci & Berlin, 2012; Beck, Czerniak, & Lumpe, 2000; Nix, 2012). Teachers believe that integrating constructivist approach in the classroom results in positive educational outcomes such as increased academic success in science and research-based subjects (Unal & Celikkaya 2009; Saygin, Atilboz, & Salman, 2006). Therefore, as closely linked to science, a constructivist learning environment is suitable in imparting 21st century skills.

In the Philippine context of education, the attainment of 21st century skills are considered as the topmost priority as these skills help in molding lifelong Filipino learners from kindergarten up to senior high school (SHS). Aside from learning pure science, students also take science-applied and research-based subjects such as Practical Research (PR) 1 & 2 in the SHS curriculum. PR 1 aims to develop students' critical thinking and problem-solving skills using qualitative methods of research; and PR 2 aims to enhance similar skills using scientific

and/or quantitative research methodology. Exposing students to conduct research allows them to increase their science process skills and understanding towards research process; build academic confidence; and provide more learning opportunities—especially the acquisition of 21st century skills (Lopatto, 2004; Myatt, 2009; Molina, 2021).

Much of the CLES that has been conducted were focused on science classes (Nix, Fraser, & Ledbetter, 2005; Aldridge, Fraser, & Sebela, 2005; Moustafa, Ben-Zvi-Assaraf, Eschach, 2013; Widodo et al., 2017; Cetin-Dindar, 2016; Bas, 2012; Ozkal, et al., 2009), however, there is a lack of literature for studies focused on applied subjects like Practical Research. With this, the present study aims to assess the constructive learning environment of Practical Research 2 classes taken by Grade 12 students from a local high school. As implied by previous literature (Gash & McCloughlin, 2010; Savasci & Berlin, 2012; Beck et al., 2000; Nix, 2012), this study will also use teachers, particularly PR 2 teachers, to serve as respondents.

Anagun (2018) argued that 21st century skills are positively correlated with teachers' perceptions of running constructivist classrooms. A constructivist approach to 21st century skills teaching and research involves a new role for the teacher. Teachers need to be aware of the goals of constructivist learning, the learners, and how to adapt the learning environment to suit their needs. Teachers play a pivotal role in the teaching and learning process; thus, assessing their own scope for creating constructive learning environments is essential to strengthen the implementation of constructivist reform movements in schools.

2. BRIEF LITERATURE REVIEW

2.1 Constructivism in the Classroom

Studies have found consistent associations between the perceptions of learners towards their learning environment and a variety of affective and cognitive educational outcomes. Studies revealed that learners' positive perceptions of their learning environment are linked with favorable attitudes on learning, academic performance, and self-efficacy (Dorman, 2001; Fraser, 1998; Haertel, Walberg, & Haertel, 1981; Tsai, 2000). Studies also showed that learners have preferences for their learning environments (Aldridge et al., 2000; Johnson & McClure, 2004). These preferences represent the way learning happens and what other factors might contribute to meaningful learning. Constructivist perspective suggests that learning environment is vital in promoting meaningful learning (Lee & Fraser, 2000).

Learning environment facilitates acquisition of learning competencies and motivates learners to engage in various learning activities (Holland, 1997). Constructivism is a popular approach to designing learning environments. It theorizes that students learn best when they are able to actively build their knowledge and interact with their environment. Constructivist learning is rooted in learners' active participation in problem solving, creative and critical thinking (Fer & Cirik, 2007). In the learning process, learners are expected to create their own projects, investigate, make decisions, collaborate, and use higher-level thinking skills to achieve desired learning outcomes. (Demirel, 2009).

Constructivist learning environments maintain an atmosphere that allows learners to have hands-on experiences (Bas, 2012). Thus, constructivists believe that activities in learning environments can reinforce active learning and facilitate diverse learning opportunities (Brooks & Brooks, 1999). In addition, constructivists focus on the learner's perception of the

learning environment to determine the extent to which the constructivist approach is observed in the learning environment (Ozkal, 2007).

In constructivist approach, the teacher is not the primary source of knowledge, rather, learning happens when students interpret and make sense of their surroundings. Thus, the role of the teacher is to facilitate engaging activities that will guide the learners into discovering meaning concepts (Peters & Stout, 2006; Leithwood, Mascall, & Strauss, 2009). One of teachers' challenges in guiding students to engage and take responsibility for their own learning is designing an effective learning (National Research Council, 1996). Teachers need to understand the goals of constructivist curricula, the learners entrusted to them, and the reshaping of learning environments to meet their learning expectations (Anagun, 2018). Teachers are considered as critical component in the overall teaching-learning process, thus for the present study, teachers responded to survey-questionnaire called as the Constructive Learning Environment Survey (CLES) by Johnson and McClure (2004) to identify their own learning environment in terms of the principles of constructivism. The results from this survey could be utilized as a baseline data on what aspects should teachers see in designing learning environments which foster the development of 21st century skills and application of these skills to the real world.

2.2 Constructive Learning Environment Survey

Studies on learning environments reported substantial evidences in addressing many educational issues, highlighting the fact that classroom psychosocial factors play an important role in creating meaningful learning environments (Khine et al., 2018). As constructivism grows and becomes more prevalent in science classrooms, many researchers are recommending tools for assessing learning environments which includes the CLES (Aldridge et al., 2000; Taylor & Fraser, 1991; Taylor et al., 1997; Johnson & McClure, 2004). CLES has been used in many countries (Partin & Haney, 2012; Kwan & Wong, 2014; Ebrahimi, 2015; Anagun & Anilan, 2013; Luckay & Laughsck, 2015; Widodo et al., 2010), and these studies report that this instrument is reliable and can be utilized to assess a constructive learning environment.

The CLES was first designed in 1991 (Taylor & Fraser, 1991) and then revised in 1997 (Taylor et al., 1997) to integrate constructivist perspectives in the learning environment. This version of the CLES consists of thirty (30) questions and it assesses constructive learning environment in five dimensions: Personal Relevance, Uncertainty, Critical Voice, Shared Control, and Student Negotiation—which made the CLES more distinguishable from conventional constructive learning environment scales. From 30 items, Johnson & McClure (2004) shortened the original CLES (Taylor et al., 1997) to 20 items and labeled it as CLES 2.0 because some items of the first version had a factor loading less than 0.4 and were found to be vague and redundant. Thus, some of the items found to be unclear and repeating by the teacher-participants were either revised or removed. The CLES 2.0 still retained the five dimensions or scales but with only four (4) questions per scale. The alpha reliability of the total CLES 2.0 instrument was 0.93 and 0.94—indicating a high internal consistency. However, some studies reported that CLES 2.0 has relatively lower reliabilities than those reported by Johnson & McClure (2004). One of these studies is based on the findings of Ozkal et al (2009) where a reliability of 0.57 to 0.74 is found. Nonetheless, the low reliabilities were reasonable for a scale with fewer items (deVellis, 2016).

In CLES, personal relevance (PR) refers to the degree to which teachers relate concepts to students' extracurricular activities. The Uncertainty Scale (U) determines the extent to which students are provided with opportunities to experience how scientific knowledge evolves and is culturally and socially determined. The Critical Voice (CV) scale refers to the extent to which learning environments are established in which learners find it helpful to question the teacher's pedagogical approaches and methods and to voice concerns about learning. The Shared Control (SC) scale measures how well students have a chance to explain and justify their ideas, and how well they are invited to share control of their learning environment with their teachers. Finally, the Student Negotiation Scale (SN) is a measure of how students test the viability of their own and other students' ideas. (Aldridge et al., 2000; Johnson & McClure, 2004).

CLES has been utilized by various academic researchers all throughout the globe. It has been used in a study on science education reform efforts in South Korea (Kim et al., 1999). It was used to study the relationship between the classroom environment and student academic efficiency in Australia and England (Dorman & Adams, 2004). It was also utilized to compare the classroom environments in Australia and Taiwan (Aldridge et al., 2000), and investigate the relationship between students' scientific epistemological beliefs and their perceptions of constructivist learning environments (Tsai, 2000). Research on constructivist learning environments has reached mixed conclusions. Some studies found that classrooms met the criteria for constructivist learning environments (Zeidan, 2015), while others reported opposite results (Ozkal, et al., 2009). A study conducted in Indonesia also revealed discrepancies. However, in general, it can be inferred from related studies that CLES is an important tool in aiding teachers and researchers alike on measuring how well classroom learning environments align with constructivist principles (Aldridge et al., 2000; Johnson & McClure, 2004).

3. METHODOLOGY

3.1 Research Question:

This study aims to assess the constructive learning environment of Senior High School (SHS) Practical Research classes of a local Philippine high school. Specifically, this study seeks to answer:

1. What is the level of constructive learning environment in Practical Research classes in the following SHS academic strands:

    a. Science, Technology, Engineering, and Mathematics (STEM);

    b. Accountancy, Business, and Management (ABM);

    c. Humanities and Social Sciences (HUMSS); and

    d. General Academic Strand (GAS)?

3.2 Research Design

This study utilized a descriptive design to assess the constructive learning environment of SHS Practical Research classes of a local Philippine high school in different academic strands: STEM, ABM, HUMSS, and GAS. Census method will be utilized for this study. Only the teachers teaching Practical Research 2 subject responded to the survey-

questionnaire on constructive learning environment adapted from Johnson and McClure (2004). The gathered data was analyzed using descriptive statistics such as frequency, percentage, mean, and standard deviation.

3.3 Research Locale and Context

The study was conducted in a local Philippine high school. This school is considered as the largest secondary school in its division and is composed of 400 teaching faculty and approximately 11,000 students. It offers a wide scope of curriculums for Junior High School such as the Science, Technology & Engineering (STE), Special Program in the Arts (SPA), Special Program in Sports (SPS), Special Program in Journalism (SPJ), Special Program in Foreign Language (SPFL) and the Enhanced Basic Education Program (EBEP). For Senior High School, it offers Sports Track, Arts & Design, Technical & Vocational Livelihood (TVL) Track and Academic Track with strands on (a) Science, Technology, Engineering & Mathematics (STEM), (b) Accountancy, Business & Management (ABM), (c) Humanities and Social Sciences (HUMSS), and (d) General Academic Strand (GAS).

3.4 Research Respondents

Census method was utilized to identify the respondents of this study which includes all the teachers handling Practical Research 2 across the different SHS academic strands. The school has three (3) STEM classes, three (3) ABM classes, nine (9) HUMSS classes, and six (6) GAS classes. Thus, a total of twenty-one (21) teachers answered to the survey-questionnaire on constructive learning environment.

3.5 Research Instrument

This study adapted the Constructive Learning Environment Survey (CLES) 2.0 by Johnson and McClure (2004). The questionnaire was distributed online. It is composed of twenty (20) items distributed into five (5) sub-themes or aspects such as: (a) learning about the world (personal relevance); (b) learning about science (uncertainty); (c) learning to speak out (critical voice); (d) learning to learn (shared control); and (e) learning to communicate (student negotiation). Each sub-theme has four (4) questions.

Personal relevance (PR) refers to the extent to which school science/research is relevant to students' daily out-of-school experiences. Uncertainty (U) refers to the extent to which opportunities are provided for learners to experience that scientific/research knowledge is dynamic and socially determined. Critical voice (CV) refers to the extent which learners feel that is beneficial to question the teachers' pedagogical methods. Shared control (SC) refers to the extent to which students have the opportunities to elaborate their ideas. Student negotiation (SN) refers to the extent to which students share control of classroom learning activities with teachers.

A 5-point Likert scale is utilized in the study and was interpreted using the scheme presented in Table 1:

Table 1
CLES 2.0 Scoring and Interpretation Guide

Score	Mean Range Interval	Qualitative Description (QD)
5	4.21-5.00	Almost Always (AA)
4	3.41-4.20	Often (O)
3	2.61-3.40	Sometimes (So)
2	1.81-2.60	Seldom (Se)
1	1.00-1.80	Almost Never (AN)

3.6 Data Gathering Procedure

With a granted permission from the school administration, the researcher began by identifying all the teachers handling Practical Research 2 subjects across the different SHS academic strands. These teacher-respondents responded to an online survey-questionnaire which will assess the extent of their application on setting a constructive learning environment. The gathered data was then treated using descriptive statistics such as frequency, percentage, mean and standard deviation.

3.7 Data Analysis

Descriptive statistics such as frequency, percentage, mean, and standard deviation were utilized to assess the constructive learning environment of the Practical Research 2 classes of this local high school from four (4) different academic strands.

4. RESULTS

This study aimed to assess the extent of constructive learning environment implementation on the different SHS academic strands of a local Philippine high school using CLES 2.0 (Johnson & McClure, 2004). The following SHS strands are: Science, Technology, Engineering, and Mathematics (STEM); Accountancy, Business, and Management (ABM); Humanities and Social Sciences (HUMSS); and General Academic Strand (GAS). CLES subdivides the extent of implementation into five key aspects: personal relevance (PR), uncertainty (U), critical voice (CV), shared control (SC), and student negotiation (SN). The questions in every aspect are then rated as: 5-almost always (AA), 4-often (O), 3-sometimes (So), 2-seldom (Se), and 1-almost never (AN). Table 2 shows the descriptive statistics results of the constructive learning environment implementation of the different SHS strands in each of the CLES key aspect.

Table 2
Extent of CLE Implementation per SHS Strand

Strand	Aspects	$\bar{x}$	SD	QD
STEM	PR	4.42	0.43	AA
	U	3.83	0.72	O
	CV	4.67	0.14	AA
	SC	3.25	0.72	So
	SN	4.25	0.43	AA
	Overall	**4.08**		**Often**
ABM	PR	4.33	0.43	AA

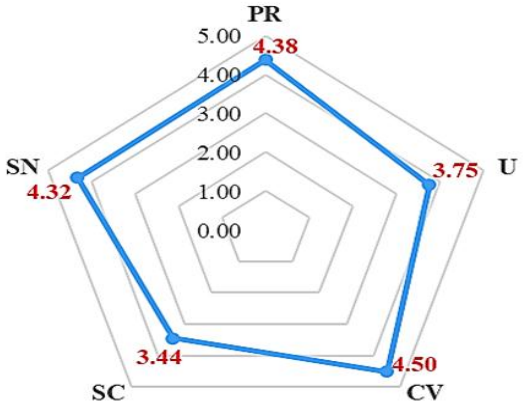
	U	3.42	0.72	O
	CV	4.58	0.14	AA
	SC	3.50	0.72	O
	SN	4.50	0.43	AA
	Overall	**4.07**		**Often**
HUMSS	PR	4.25	0.40	AA
	U	3.25	0.76	So
	CV	4.25	0.50	AA
	SC	3.22	0.51	So
	SN	3.94	0.82	O
	Overall	**3.78**		**Often**
GAS	PR	4.50	0.61	AA
	U	4.50	0.68	AA
	CV	4.50	0.61	AA
	SC	3.80	0.94	O
	SN	4.60	0.89	AA
	Overall	**4.38**		**Almost Always**

In general, it can be inferred that the extent to which constructive learning environment is implemented in Practical Research 2 classes of the school is observed. It is notable that in all the SHS strands, CLE aspects such as personal relevance (PR) and critical voice (CV) are observed 'almost always'. Student negotiation (SN) is also observed 'almost always' except for the HUMSS strand which reported 'often'. For shared control (SC), ABM and GAS scored 'often', while STEM and HUMSS both scored 'sometimes'. Lastly, for uncertainty, only GAS reported 'almost always', while STEM and ABM scores reported 'often' and HUMSS scored 'sometimes'. For the overall results, Table 2 shows that constructive learning environment is observed 'often' in STEM ($\bar{x}$=4.08), ABM ($\bar{x}$=4.07), and HUMSS ($\bar{x}$=3.78); while it is observed 'almost always' in GAS ($\bar{x}$=4.38).

From the results of the study, it can be implied then that Practical Research 2 teachers across different SHS strands in this institution value more about students 'learning about the world' or personal relevance. In the context of this study, it means that teachers emphasized that research is relevant to the daily lives of students. Additionally, 'learning to communicate' or student negotiation is also observed in majority of the SHS strands. Thus, it can be implied that in PR2 classes, student-researchers are given opportunities to explain their ideas in the classroom—a scenario that is ideal in research-based classes, or generally, in constructivist classrooms. Figure 1 shows the overall extent of CLE implementation of the SHS academic strands taking Practical Research 2.

Figure 1 reports that the overall implementation of CLE in this local high school is observed 'almost always' in terms of CV ($\bar{x}$=4.50), PR ($\bar{x}$=4.38), and SN ($\bar{x}$=4.32); while aspects such as U and SC are observed 'often' with overall mean scores of 3.75 and 3.44 respectively. The three aspects which the school scored the highest (CV, PR, and SN) further implies that this secondary institution particularly its academic strands put more emphasis on the involvement of students in the teaching-learning process of Practical Research 2 classes.

Figure 1
Overall Constructive Learning Environment Level



For critical voice or 'learning to speak out', it shows that students are allowed to express their opinions; students speak up for their rights; they may complain when activities are confusing; and they are also allowed to question the way they are being taught. In terms of personal relevance or 'learning about the world', it reflects that Practical Research 2 teachers of the school make students learn about the world outside the school; immerse them to real-world problems; and ensure that they get a better understanding of the world outside the school. Lastly, for student negotiation or 'learning to communicate', it displays that students get the chance to interact with their co-learners or co-researchers by explaining ideas and solving problems together.

5. DISCUSSIONS

5.1 Assessment of Constructive Learning Environment on Practical Research Classes

The overall findings of this study reveal that the Senior High School Practical Research 2 classes of the school studied observe a constructive learning environment. Particularly, CLES aspects such as critical voice, personal relevance, and student negotiation were found to be implemented 'almost always'. Practical Research 2 is a subject which aims to enhance the critical thinking and research skills of senior high school students through quantitative methods of research. One of the major requirements of this subject is for students to produce a research paper or project in line with their academic strand. For example, STEM researches are more focused in conducting scientific researches such as biodiversity studies, species inventory, natural products research, water quality assessment, and developing products or prototypes using technological and engineering principles. ABM researches are focused on assessing factors that might affect small businesses in the community, rating customer satisfaction, and exploring new marketing strategies to improve the sales of small and microenterprises. HUMSS studies are broader in perspective—students from this strand may assess the awareness, knowledge, and attitudes of their fellow students on different existing and relevant social issues in school and its direct community. For GAS students, their research depends on their chosen electives—thus, their studies may include researches across the different strands and fields. Since Practical Research 2 is a research-based subject, a constructive learning environment is fitted to attain the subjects' required competencies. In

this subject, students apply constructivist principles by constructing their own knowledge and applying these to the real-world context through investigation, immersion and inquiry.

It is noteworthy that the Practical Research 2 classes of this institution provide an interactive learning environment which require learners to observe, analyze, gather data, and use these to solve problems (Gagnon & Collay, 2001). The assessment of the PR 2 classes of this school conforms to Fer and Cirik (2007) which states that a constructive learning environment is grounded on learners' active participation in problem solving and critical thinking. Thus, instead of the teacher transferring knowledge, learners conceive (Von Glasserfeld, 1996) and actively construct (Cunningham, 1992) their own knowledge. In terms of conducting their studies, students enrolled in Practical Research 2 are encouraged to produce outputs through collaborative efforts. This practice is in line with the constructivists' perspective in effective learning environment where learners learn better when social interactions amongst co-learners are promoted (Brooks & Brooks, 1999; Saban, 2004; Fer & Cırık, 2007; Karadağ & Korkmaz, 2007; Ozkal, 2007).

This study utilized the teachers handling Practical Research 2 to assess the extent to which constructive learning environment is applied in their own classes. The findings of the study somehow reflect the beliefs and perceptions of Practical Research 2 teachers on classroom management. The way teachers describe their learning environment is a manifestation of their educational principles and epistemological beliefs (Saylan et al., 2016; Aypay, 2011; Tsai, 2000; Chan, 2003; Yilmaz-Tuzun & Topcu, 2010). Thus, the Practical Research 2 teachers of this secondary school subscribe to the principles constructivism in terms of designing an interactive learning environment. Through CLES 2.0, the Practical Research 2 teachers were able to describe their research classes through the five (5) different aspects of a constructive learning environment.

Personal relevance. The results of this study reveals that personal relevance is observed 'almost always' across the different SHS academic strands. Similar findings were found by Ozkal et al (2009) and Cetin-Dindar (2016) in which personal relevance scored the highest in schools and was found out to be the most effective variable in the CLES. Widodo et al (2010) claimed that immersing the students' in real-life experiences such as research-based activities helps them to generate more meaningful learning. Thus, school science and research subjects should be context-based and should address local scientific issues in order to increase their awareness to science and purpose of science learning (Sjoberg & Schreiner, 2012; Cetin-Dindar, 2016).

Uncertainty. The present study shows that the overall score for uncertainty was 'often' with a mean score of 3.75. Specifically, it is 'often' observed in STEM and ABM, observed 'sometimes' in HUMSS, and observed 'almost always' in GAS. The results of this study are similar with Nix et al (2005) and Aldridge et al (2005) in which uncertainty scored high. This supports the claim of Abrahams & Millar (2008) that activities in the classroom should enable students to verify existing theories and give evidences as they prove their positions. This culture is observed in the Practical Research 2 classes of the school assessed. However, for some studies, uncertainty was one of the aspects in CLES which found to be the most challenging to fully-implement and thus scores on this scale are generally low (Widodo et al., 2017; Cetin-Dindar, 2016; Abrahams & Millar, 2008).

Critical voice. For this study, critical voice was described as 'almost always' across the different SHS academic strands. Similar results were reported by Ozkal (2009), however, there are more studies which reported otherwise (Widodo et al., 2017; Cetin-Dindar, 2016; Nix et al., 2005). In a study conducted by Aldridge et al (2005), learners were not happy to question the teacher about their learning. They felt that they did not have enough experience and that their parents were in a better position to interact with the teachers about such matters. The result of this study implies then that in the case of Practical Research 2 classes of this school, students are free to speak up about the teaching-learning process and talk about the issues in the classroom—thus strengthening the atmosphere of a constructive learning environment.

Shared control. In the context of this school's Practical Research 2 classes, shared control is implemented 'often'. Particularly, it is observed 'sometimes' in both STEM and HUMSS and observed 'often' in ABM and GAS. Overall, the findings revealed generally high scores for this aspect—contrary to the findings of Ozkal et al (2009), Aldridge et al (2005), and Widodo et al (2017) where shared control is scored the lowest. The reason why shared control depicts low scores is that most learners still perceive the teacher as the primary source of knowledge and the main setter of learning objectives in the classroom (Widodo et al., 2017). Therefore, in this school, Practical Research 2 classes, learners are given the opportunities to determine their learning goals and manage their own research-based activities with the teacher playing the role of a facilitator or an adviser.

Student negotiation. The results of this study reveal that student negotiation is generally observed 'almost always' in Practical Research 2 classes. The findings are similar with Widodo et al (2017) and Ozkal (2009); while it is different from the findings of Cetin-Dindar (2016), Nix et al (2005), and Aldridge et al (2005). This implies that the Practical Research 2 classes of this local high school ensure that students have the opportunity to justify their ideas through the conduct of their study; explain their concepts to their teachers and co-learners; and accepts constructive criticisms from teacher-experts to improve their research projects.

In general, Practical Research 2 as a subject in Senior High School provides learners with opportunity to learn beyond the four walls of the classroom by searching for problems in the community and eventually coming up with possible solutions. This main objective of the course can be attained if the learning environment encourages learners to construct their own concepts, investigate relationships, solve problems, explain their ideas, and collaborate with their co-learners. The role of Practical Research 2 teachers is critical in designing a learning environment which follows the principles of constructivism. Using the CLES as a monitoring tool, Practical Research 2 teachers can continually assess their learning environment to cater the needs of the students especially on the acquisition of 21st century skills.

6. CONCLUSION

Based on the findings of the study, this study concludes that the extent to which constructivist learning environment is implemented in a local Filipino secondary institution offering Senior High School Practical Research 2 classes is generally observed with highest ratings on CLES aspects such as critical voice, personal relevance, and student negotiation. In terms of its implementation across the different SHS academic strands, this study shows that: (a) CLE is 'often' observed in Science, Technology, Engineering, and Mathematics (STEM) strand; (b)

'often' observed in Accountancy, Business, and Management (ABM) strand; (c) 'often' observed in Humanities and Social Sciences (HUMSS) strand; and (d) observed 'almost always' in General Academic Strand (GAS).

7. RECOMMENDATION

Constructive Learning Environment Survey (CLES) should be utilize regularly to monitor the constructive learning environment of science-applied and research-based subjects. It can be used along with different instruments which may assess other factors that affect the learning environment and students' learning in general. From this study, it can be implied that CLES can be used to assess Practical Research classes. For future studies, this study recommends to widen the scope of data collection and to integrate CLES in correlational, quasi-experimental, experimental, and mixed methods research to include other learning factors which can contribute in designing and evaluating effective learning environments.

Ethical Statement

A written communication was addressed to the principal of the secondary school where the study was conducted to seek permission for the general conduct of the study. The approved entry was forwarded to the Research Coordinator of the institution. A consent form was attached together with the permit to orient the teacher-respondents of the study. In compliance with the Philippine Data Privacy Act of 2012, the names and information gathered from this study were treated with utmost confidentiality, and were used for research purposes only.

REFERENCES

i. Abrahams, I., & Millar, R. (2008). Does practical work really work? A study of the effectiveness of practical work as a teaching and learning method in school science. *International journal of science education*, 30(14), 1945-1969. https://doi.org/10.1080/09500690 701749305

ii. Aldridge, J. M., & Fraser, B. J. (2008). Technology-Rich Outcomes-Focused Learning Environment Inventory (TROFLEI). *Outcomes-Focused Learning Environments*.

iii. Aldridge, J. M., Fraser, B. J., Bell, L., & Dorman, J. (2012). Using a new learning environment questionnaire for reflection in teacher action research. *Journal of Science Teacher Education*, 23(3), 259-290. https://doi.org/10.1007/s10972-012-9268-1

iv. Aldridge, J. M., Fraser, B. J., & Huang, T. C. I. (1999). Investigating classroom environments In Taiwan and Australia with multiple research methods. *The Journal of Educational Research*, 93(1), 48-62. https://doi.org/10.1080/00220679909597628

v. Aldridge, J. M., Fraser, B. J., & Sebela, M. P. (2004). Using teacher action research to promote constructivist learning environments in South Africa. *South African Journal of Education*, 24(4), 245-253. https://www.ajol.info/index.php/saje/article/view/24996

vi. Aldridge, J. M., Fraser, B. J., Taylor, P. C., & Chen, C. C. (2000). Constructivist learning environments in a cross-national study in Taiwan and Australia. *International Journal of Science Education*, 22(1), 37-55. https://doi.org/10.1080/095006900289994

vii. Anagun, Ş. S. (2018). Teachers' Perceptions about the Relationship between 21st Century Skills and Managing Constructivist Learning Environments. *International Journal of Instruction*, 11(4), 825-840. https://eric.ed.gov/?id=EJ1191700

viii. Anagun, S. S., & Anilan, H. (2013). Development and validation of a modified Turkish version of the Teacher Constructivist Learning Environment Survey (TCLES). *Learning Environment Research*, 16(2), 169-182. https://doi.org/10.1007/s10984-013-9130-1

ix. Aypay, A. (2011). The Adaptation of the Teaching-Learning Conceptions Questionnaire and Its Relationships with Epistemological Beliefs. *Educational Sciences: Theory and Practice*, 11(1), 21-29. https://eric.ed.gov/?id=EJ919887

x. Bas, G. (2012). Investigating the correlation between students' perceptions on the constructivist learning environment and their academic success in science course with path analysis. *Journal of Baltic Science Education*, 11(4), 367. https://doi.org/10.33225/jbse/12.11.367

xi. Beck, J., Czerniak, C. M., & Lumpe, A. T. (2000). An exploratory study of teachers' beliefs regarding the implementation of constructivism in their classrooms. *Journal of Science Teacher Education*, 11(4), 323-343. https://doi.org/10.1023/A:1009481115135

xii. Brooks, J. G., & Brooks, M. G. (1999). *In search of understanding: The case for constructivist classrooms*. Association for Supervision and Curriculum Development.

xiii. Cetin-Dindar, A. (2016). Student motivation in constructivist learning environment. *Eurasia Journal of Mathematics, Science and Technology Education*, 12(2), 233-247.https://doi.org/10.12973/eurasia.2016.1399a

xiv. Chan K.W. (2003). Hong Kong teacher education students' epistemological beliefs and approaches to learning. *Research in Education*, 69(1), 36-50

xv. Colbert, J. (2014). Classroom design and how it influences behavior. *Early Childhood News*, 9(3), 22-29.

xvi. Cunningham, D. J. (1992). Beyond educational psychology: Steps toward an educational semiotic. *Educational psychology review*, 4(2), 165-194. https://doi.org/10.1007/BF01322343

xvii. Demirel, M. (2009). Lifelong learning and schools in the twenty-first century. *Procedia-Social and Behavioral Sciences*, 1(1), 1709-1716. https://doi.org/10.1016/j.sbspro.2009.01.303

xviii. deVellis, R. F. (2016). *Scale development: Theory and applications* (4th ed.). Thousand Oaks, CA: Sage.

xix. Dorman, J. P. (2001). Associations between classroom environment and academic efficacy. *Learning Environments Research*, 4(3), 243-257. https://doi.org/10.1023/A:1014490922

xx. Dorman, J., & Adams, J. (2004). Associations between students' perceptions of classroom environment and academic efficacy in Australian and British secondary schools. *Westminster Studies in Education*, 27,69−85. https://doi.org/10.1080/0140672040270106

xxi. Dorman, J. P., Adams, J. E., & Ferguson, J. M. (2001). The Relationship between High School Mathematics Classroom Environment and Student Self-Handicapping. https://eric.ed.gov/?id=ED452075

xxii. Durmus, T.Y. (2016). Effective Learning Environment Characteristics as a Requirement of Constructivist Curricula: Teachers' Needs and School Principals' Views. *International Journal of Instruction*, 9(2), 183-198. DOI: 10.12973/iji.2016.9213a

xxiii. Ebrahimi, N. A. (2015). Validation and application of the Constructivist Learning Environment Survey in English language teacher education classrooms in Iran. *Learning Environment Research*, 18(1), 69-93. https://doi.org/10.1007/s10984-015-9176-3

xxiv. Fer, S., & Cırık, I. (2007). *Constructivist learning: From theory to practice.* İstanbul: Morpa Publishing house.

xxv. Fraser, B. J. (1994). Research on classroom and school climate. *Handbook of research on Science teaching and learning*, 493-541.

xxvi. Fraser, B. J. (1998). Classroom environment instruments: Development, validity and applications. *Learning environments research*, 1(1), 7-34. https://doi.org/10.1023/A:1009932514731

xxvii. Fraser, B. J. (2014). Classroom learning environments: Historical and contemporary perspectives. *Handbook of research on science education*, 2, 118-133.

xxviii. Fraser, B. J., Giddings, G. J., & McRobbie, C. J. (1995). Evolution and validation of a personal form of an instrument for assessing science laboratory classroom environments. *Journal of Research in science Teaching*, 32(4), 399-422. https://doi.org/10.1002/tea.3660320408

xxix. Gagnon, G. W., & Collay, M. (2001). *Designing for learning: Six elements in constructivist classrooms.* Corwin Press.

xxx. Gash, A. H., & McCloughlin, T. (2010). Primary and Secondary School Differences in Thinking about Learning Science. *International Journal of Educational Researchers*, 1(3), 92-102. http://ijer.eab.org.tr/1/3/7_gash.pdf

xxxi. Haertel, G. D., Walberg, H. J., & Haertel, E. H. (1981). Socio- psychological environments And learning: A quantitative synthesis. *British educational research journal*, 7(1), 27-36. https://doi.org/10.1080/0141192810070103

xxxii. Holland, J. L. (1997). *Making vocational choices: A theory of vocational personalities and work environments*. Psychological Assessment Resources. https://psycnet.apa.org/record/1997-08980-000

xxxiii. Johnson, B., & McClure, R. (2004). Validity and reliability of a shortened, revised version of the Constructivist Learning Environment Survey (CLES). *Learning Environments Research*, 7(1), 65-80. https://doi.org/10.1023/B:LERI.0000022279.89075.9f

xxxiv. Karadağ, E., & Korkmaz, T. (2007). Evaluation of the effectiveness of the drama method in life science teaching according to cognitive field steps. *Ahi Evran University Journal of Kirsehir Education Faculty*, 8 (1), 179-195. https://dergipark.org.tr/en/pub/kefad/ issue/59535/856322

xxxv. Khine, M. S., Fraser, B. J., Afari, E., Oo, Z., & Kyaw, T. T. (2018). Students' perceptions of the learning environment in tertiary science classrooms in Myanmar. *Learning Environments Research*, 21(1), 135-152. https://doi.org/10.1007/s10984-017-9250-0

xxxvi. Kim, H. B., Fisher, D. L., & Fraser, B. J. (1999). Assessment and investigation of constructivist science learning environments in Korea. *Research in Science & Technological Education*, 17(2), 239-249. https://doi.org/10.1080/0263514990170209

xxxvii. Kwan, Y. W., & Wong, A. F. L. (2014). The constructivist classroom learning environment and its associations with the critical thinking ability of secondary school students in liberal studies. *Learning Environment Research*, 17(2), 191-207. https://doi.org/10.1007/s10984-014-9158-x

xxxviii. Larson, L. C. & Miller, T. N. (2011). 21st Century Skills: Prepare Students for the Future. *Kappa Delta Pi Record*, 47:3, 121-123.

xxxix. Lee, S. S., & Fraser, B. J. (2000). *The Constructivist Learning Environment of Science Classrooms in Korea.* https://eric.ed.gov/?id=ED452089

xl. Lee, S. S., & Fraser, B. J. (2001). High School Science Classroom Learning Environments in Korea. https://eric.ed.gov/?id=ED452088

xli. Leithwood, K. A., Mascall, B., & Strauss, T. (Eds.). (2009). *Distributed leadership according to the evidence*. London: Routledge.

xlii. Lemley, J. B., Schumacher, G. & Vesey, W. (2014). What learning environments best address 21st-century students' perceived needs at the secondary level of instruction? *NASSP Bulletin*, 98(2), 101-125.

xliii. Lopatto, D. (2004). Survey of undergraduate research experiences (SURE): first findings. *Cell Biology Education*, 3, 270-277. https://doi.org/10.1187/cbe.04-07-0045

xliv. Luckay, M. B., & Laugksch, R. C. (2015). The development and validation of an instrument to monitor the implementation of social constructivist learning environments in grade 9 science classrooms in South Africa. *Research in Science Education*, 45(1), 1-22. https://doi.org/10.1007/s11165-014-9410-5

xlv. Majeed, A., Fraser, B. J., & Aldridge, J. M. (2002). Learning environment and its association with student satisfaction among mathematics students in Brunei Darussalam. *Learning Environments Research*, 5(2), 203-226. https://doi.org/10.1023/A:1020382914724

xlvi. Molina, R. (2021). Research Competencies of Science, Technology, Engineering and Mathematics (STEM) Students in a State College in Zamboanga City, Philippines. *Eurasian Journal of Educational Research* (EJER), (94). https://doi.org/ 10.14689/ejer.2021.94.16

xlvii. Moos, R. H., & Trickett, E. J. (1974). Classroom environment scale: Manual.

xlviii. Moustafa, A., Ben-Zvi-Assaraf, O., & Eshach, H. (2013). Do junior high school students perceive their learning environment as constructivist?. *Journal of Science Education and Technology*, 22(4), 418-431. https://doi.org/10.1007/s10956-012-9403-y

xlix. Myatt, P. (2009). *Student perceptions of the undergraduate research experience: What do they think they really gain and how much influence does it have?* http://science.uniserve.edu .au/workshop/Conference2009.html

l. National Research Council. (1996). *National science education standards*. Washington, DC: National Academy Press

li. Nix, R. K. (2012). Cultivating constructivist classrooms through evaluation of an integrated science learning environment. *Second international handbook of science education*, 1291-1303. https://doi.org/10.1007/978-1-4020-9041-7_83

lii. Nix, R. K., Fraser, B. J., & Ledbetter, C. E. (2005). Evaluating an integrated science learning environment using the Constructivist Learning Environment Survey. *Learning Environments Research*, 8(2), 109-133. https://doi.org/10.1007/s10984-005-7251-x

liii. OECD (2006). *Assessing Scientific, Reading and Mathematical Literacy: A Framework for PISA 2006*. Paris: OECD Publications.

liv. Özkal, K. (2007). Scientific epistemological beliefs, perceptions of constructivist learning environment and attitude towards science as determinants of students approaches to learning (Master's thesis, Middle East Technical University). http://etd.lib.metu.edu.tr/upload/12609091/index.pdf

lv. Ozkal, K., Tekkaya, C., Cakiroglu, J., & Sungur, S. (2009). A conceptual model of relationships among constructivist learning environment perceptions, epistemological beliefs, and learning approaches. *Learning and individual differences*, 19(1), 71-79. https://doi.org/10.1016/j.lindif.2008.05.005

lvi. Palfrey, J., & U. Gasser. (2008). *Born digital: Understanding the first generation of Digital Natives*. New York: Basic Books. Pamuk,

lvii. Partin, M. l., & Haney, J. J. (2012). The CLEM model: Path analysis of the mediating effects of attitudes and motivational beliefs on the relationship between perceived learning environment and course performance in an undergraduate non-major biology

course. *Learning Environment Research*, 15(1), 103-123. https://doi.org/10.1007/s10984-012-9102-x

lviii. Perry, T. B. & Stallworth (2013). 21st-century students demand a balanced, more inclusive canon. *Voices from the Middle: Urban*, 21(1), 15-18.

lix. Peters, J. M., & Stout, D. L. (2006). *Methods for teaching elementary school science*. Prentice Hall.

lx. Saban, A. (2004). Prospective classroom teachers' metaphorical images of selves and comparing them to those they have of their elementary and cooperating teachers. *International Journal of Educational Development*, 24(6), 617-635. https://doi.org/10.1016/j.ijedudev.2004.03.003

lxi. Savasci, F., & Berlin, D. F. (2012). Science teacher beliefs and classroom practice related to constructivism in different school settings. *Journal of Science Teacher Education*, 23(1), 65-86. https://doi.org/10.1007/s10972-011-9262-z

lxii. Saygın, Ö., Atılboz, N. G., & Salman, S. (2006). The effect of contructivist teaching approach on learning biology subjects: The basic unit of the living things-cell. *Gazi Üniversitesi Eğitim Fakültesi Dergisi*, 26(1), 56-64. https://dergipark.org.tr/en/pub/gefad/issue/ 6754/90809

lxiii. Saylan, A., Armagan, F. Ö., & Bektas, O. (2016). The Relationship between Pre-Service Science Teachers' Epistemological Beliefs and Preferences for Creating a Constructivist Learning Environment. *European Journal of Science and Mathematics Education*, 4(2), 251-267. https://doi.org/10.30935/scimath/9468

lxiv. Sharkey, M., & Gash, H. (2020). Teachers' constructivist and ethical beliefs. *Behavioral Sciences*, 10(6), 96.

lxv. Sjøberg, S., & Schreiner, C. (2012). Results and Perspectives from the ROSE Project: Attitudinal aspects of young people and science in a comparative perspective. *Science education research and practice in Europe*.

lxvi. Schwab, J. J. (1973). The practical 3: Translation into curriculum. *School Review*, 81, 501– 522.

lxvii. Taylor, P. C., & Fraser, B. J. (1991, April). CLES: An instrument for assessing constructivist learning environments. In annual meeting of the National Association for Research in Science Teaching, Lake Geneva, WI. https://www.academia.edu/download/32199466/ Taylor__Fraser_NARST_1991.pdf

lxviii. Taylor, P.C., Fraser, B.J., & White, L.R. (1994). *CLES: An instrument for monitoring the development of constructivist learning environments*. Paper presented at the annual meeting of the American Educational Research Association, New Orleans

lxix. Taylor, P. C., Fraser, B. J., & Fisher, D. L. (1997). Monitoring constructivist classroom learning environments. *International Journal of Educational Research*, 27(4), 293-302. https://doi.org/10.1016/S0883-0355(97)90011-2

lxx. Tsai, C. C. (2000). Relationships between student scientific epistemological beliefs and perceptions of constructivist learning environments. *Educational Research*, 42(2), 193-205. https://doi.org/10.1080/001318800363836

lxxi. Ünal, Ç. & Çelikkaya, T. (2009). The effect of constructivist approach on success, attitude and permanency at the social sciences teaching: 5th class example. *Atatürk Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, 13(2), 197-212. http://edergi.atauni.edu.tr/index.php/ SBED/article/view/2659/2651

lxxii. Von Glasersfeld, E. (1996). Farewell to objectivity. *Systems Research*, 13(3), 279-286. https://doi.org/10.1002/(SICI)1099-1735(199609)13:3%3C279::AID-SRES91%3E3.0.CO;2-L

lxxiii. Walberg, H. J., & Anderson, G. J. (1968). Classroom climate and individual learning. *Journal of educational Psychology*, 59(6p1), 414. https://psycnet.apa.org/record/1969-03123-001

lxxiv. Wanpen, S., & Fisher, D. L. (2006). Creating a collaborative learning environment in a computer classroom in Thailand using the CLES. *Contemporary approaches to research on learning environments: Worldviews*, 97-312. https://doi.org/10.1142/9789812774-651_0012

lxxv. Widodo, A., Nugraha, I., Trisnawati, R., Nurbaety, H., & Biana, B. (2010). *The use of interactive e- book to promote constructivist learning environment in biology lessons*. Paper presented at the The fourth International Seminar on Science Education, Bandung

lxxvi. Widodo, A., Maria, R. A., & Fitriani, A. (2017). Constructivist learning environment during virtual and real laboratory activities. *Biosaintifika: Journal of Biology & Biology Education*, 9(1), 11-18. https://doi.org/10.15294/biosaintifika.v9i1.7959

lxxvii. Yilmaz-Tüzün, Ö., & Topcu, M. S. (2010). Investigating the relationships among elementary school students' epistemological beliefs, metacognition, and constructivist science learning environment. *Journal of Science Teacher Education*, 21(2), 255-273. https://doi.org/10.1007/s10972-009-9163-6

lxxviii. Zeidan, A. (2015). Constructivist learning environment among Palestinian science students. *International Journal of Science and Mathematics Education*, 13(5), 947-964. https://doi.org/10.1007/s10763-014-9527-z