Context-Based Instructional Activities in Grade 7 Biology Using Inquiry Based Learning

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CONTEXT-BASED INSTRUCTIONAL ACTIVITIES IN GRADE 7 BIOLOGY USING INQUIRY BASED LEARNING

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DEDICATION

To my parents, Sanny and Perlita for working so hard that made me who I am today;

To my sisters, Sandra, Sally, and Sheryl for unending love, care, and support; and

To my students, for helping me to live a life of purpose

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This academic journey would not be possible without the guidance of the people who inspire me to pursue and believe in my strengths and abilities. It was a long roller coaster ride of immersing my ideas into reality. There were so many times that I stumble and fall but got back up on the right track at the right time.

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ABSTRACT

Name	**:**	**Sarah M. Pascua**
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This study sought to develop and validate Context-based Instructional (CBI) Activities in Grade 7 Biology using inquiry-based learning according to the content standards and learning competencies prescribed in the DepEd Science Curriculum Guide (2016). The framework of the study supported the K to 12 science as learner-centered and inquiry-based emphasizing the use of evidence in constructing explanations.

The development has undergone four phases: Phase 1-Developing and Designing the context-based instructional activities, Phase 2-Validating the developed context-based instructional activities, Phase 3–Revising and finalizing the developed and validated context -based instructional activities, and Phase 4-Pilot testing and Full Implementation. The developed context-based instructional activities were placed in the Explore phase of the 7E instructional model since this phase gives students various opportunities to think freely but within the limits of the activities under the facilitation of the teacher.

The developed CBI activities were validated obtaining acceptable rating in terms of objectives, content, organization and presentation, language and style and indicators for contextualization. It was found have an effect in enhancing student conceptual understanding and engaging students in cognitive, emotional, and behavioural dimensions of learning based on the quantitative and qualitative findings of the study.

It is recommended to use the developed and validated context-based instructional activities as supplementary instructional material in Grade 7 Science in teaching biological concepts and to integrate the context-based instructional activities into multimedia software or other computer applications.

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THE PROBLEM AND LITERATURE REVIEW

Background of the Study

The implementation of the K to 12 Curriculum is one of the significant changes in the Philippine education system as it aims to upgrade Filipino learners to be globally competitive and holistically developed. One item in the "Enhanced Basic Education Act of 2013" is "the curriculum shall be contextualized and global and shall be flexible enough to enable and allow schools to be localized, indigenous and enhance the same based on their respective educational context." (Rule II, Curriculum Section, 10.10.2). As a consequence, contextualization is now an emerging strategy across academic discipline in order to gain the goal of quality education and scientific literacy. The introductions of context in science education establish connections between abstract concepts and everyday life situations in order for students to realize the relevance of science in their own lives.

According to the in depth analysis, studies are mostly done in a need to create recognizable contexts that can be interesting for the students and to provide a real-life scenarios basis for meaningful learning. Studies also proved that context based approach can enhance positive attitude, motivation, engagement, interest, and achievement of the student. Saka (2011) found that there are various interpretations of contexts and consequently also a lot of opinions on the way how these contexts should be used in the teaching and learning of science thus there is also a need for the preparation of context-based materials to utilize in the classroom. However, context is defined in many ways as situations that help students give meaning to concepts, rules and laws. De Jong (2006) expanded this definition by explaining that context is practices that help students to provide meaning to activities in the school laboratory.

Some studies indicate increase in academic achievement based on Acar and Yaman (2011) and positive effect on students' attitudes and motivation as mentioned by Barker and Millar (2000); Campbell, Lubben and Dlamini (as cited by Bennett and Lubben, 2006). Given all its positive impact in science education, it is important to apply the notion in the development of context-based instructional activities specifically in Biology since it is an abstract area which existed in unorganized structures and, therefore, it often results in students' learning difficulties and multiple misconceptions. By developing context-based instructional activities to be used in the classroom, contextual teaching and learning (CTL) is being introduced to help teachers relate real world situations to subject matter. It will also motivate students to establish connections applications of knowledge in their daily lives. The study of Johnson further supported this claim and found that the students discover meaning when they connect the lesson content with the daily-life context. Baker, Hope and Karandjef (2009) identified CTL as a promising strategy that engage students actively and promote learning and skills development.

Wijarwadi (2008) explained seven principles that are useful to gain success in applying contextual teaching and learning into practice. One of the principles is through inquiry which shows how learning is conducted through the process of discovery that needs critical thinking. In this case, knowledge is built by not considering a number of facts but from stimulating learning that allows the students to find their own facts and meaning in the real context.

This research study developed and validated context-based instructional activities highlighting the use of Inquiry-based learning through 7E-Instructional Model (Elicit, Engage, Explore, Explain, Elaborate, Evaluate, Extend), a learning cycle approach for inquiry-based science teaching in Grade 7 Biology and determine its effectiveness when employ in classroom setting. The development of these context based instructional activities was anchored in the contextual teaching and learning theory which is grounded from constructivist and cognitivist learning theories. It geared towards the framework of the K to 12 science curriculum that is learner-centered and inquiry-based. In relation to maximizing the teaching-learning process, these context based instructional activities using the 7E instructional model for Inquiry-based learning can give a sense of importance in relating the curriculum content to a particular setting, situation, or area of application to make competencies relevant and useful in order to produce critically-thinkers and lifelong learners.

Literature Review

The word context is typically used in conversational language, and has a range of meaning. De Jong (2008) clarified the definition of contexts for science teaching and learning and identified four origin of contexts which includes personal, social, professional practice, and scientific and technological. The conception of contexts seems to be associated with the matters associated to authentic experiences, applications or situations indicating the meaning of a given concept. In consonance with this idea, context-based teaching approaches signify instructional practices that show a connection between learning and actual experiences, situations, and activities.

The primary reasons for the development of context-based materials are to address effective learning of science ideas, motivate learners, and provide hands-on and minds-on experiences in studying science concepts, encompassing the improvement of analytical and inquiry skills (Gilbert, 2006, 2008; Schwartz, 2006). Furthermore, Gilbert (2006) expanded the notion on the development of effective context-based teaching materials that starts in providing a social context which help focus learners' attention and engage them mentally in the process. The environment and conditions must be a reflection of inquiry where scientists operate. Learners must have their preconceptions to explore explanatory adequacy.

The features of contextualized teaching are the basis of different model of context-based teaching materials and approaches. These features involve the kind of contexts used to develop teaching materials, the degree to which the materials incorporate the principles of contextualized teaching, the sequence of presentation of teaching materials, and purpose of the contexts in the teaching and learning process.

Models for developing context-based materials

There are four models synthesized by Gilbert (2006) that explained the underpinning principles in the development of context-based materials. Brief discussions for each model are as follows:

Model 1 is the direct application of context to concepts in which centres on learning abstract concepts without using social setting. This model implies a unidirectional and rigid relationship between concepts and applications, in which applications are marked at the end of a theoretical treatment of concepts as a later thought. For example, an educator could give an example of an albino as an application of the effects of the mutation, after teaching abstract concepts of mutation. Usually, no social setting is provided for mental engagement with the contexts. The model evokes little in-depth knowledge. It focuses on abstract learning of specific concepts, without framing the social environment and the behavioural environment beforehand. Therefore, this model lacks a social setting, and does not provide high quality learning tasks and opportunities for learners to acquire a consistent use of a specific scientific language.

Model 2 is the reciprocity between concepts and applications which include the relatedness of context-based materials to concepts and their actual application which enable the learners to connect their preconceptions to the learned materials. The context is formed by juxta positioning concepts and applications in the cognitive structures of learners. In this model, several subgroups can be distinguished from contexts, so that a change between subgroups can imply a different meaning for a concept, which could lead to confusion between both educators and learners. This model offers learners the opportunity to acquire a consistent use of specific scientific language. However, the model does not emphasize the need for learners to value the social environments in which students and educators can operate.

Model 3 is the provision of context by personal mental activity which involves teaching and learning scientific concepts and ideas through the use of historical narratives. In other words, the narratives of historical events are linked to a scientific theme in order to illustrate and explain the concepts within the theme. The model thus provides a social context, and a specific scientific language could be effectively developed. The challenge that could arise from this model is that the use of historical events can require a lot of basic information and preparation so that students can accurately imagine the situation as it happened and evaluate it. It is therefore possible that learners do not recognize the relevance or value of the narrative, since they may not be able to access the basic knowledge required.

Model 4 is the context as social circumstances in which contexts illustrate real-life issues in learners' daily lives. In this model, learning is mainly activity-oriented in which the meaning of the content is being shaped by the content that involves students' active participation and genuine inquiry in the learning process. The model links important scientific concepts and people's activities to the life of communities in the society. In other words, the context provides a clear framework for what happens in the community. The model is therefore based on situated learning and activity theory, whereby educators and learners consider themselves participants in a community of practices. The learning tasks in this model are based on clear illustrations of important scientific concepts that allow students to develop a coherent use of a specific scientific language. It is clear that the fourth model covers the principles of the development of contextual materials for science teaching through discussion associated with the focal event; students are able to achieve an understanding of the concepts involved. The model also involves genuine inquiry, and it emphasizes active participation of students in the learning process.

Development of context-based teaching materials

Three factors are crucial in the development of context-based materials such as the selection of contexts and content, the creation of learning and assessment activities. According to Pilot & Bulte (2006) learners are commonly excluded in the selection of contexts to be used in developing context-based materials because as shown in previous studies large-scale context-based projects were chosen by curriculum developers to avoid mismatch of contexts with the content. When choosing contexts it is appropriate to consider the perceptions and wishes of learners in the development of context-based materials. In terms of small scale context-based teaching materials, contexts are usually determined by educators.

The combination of contexts and content into learning activities is always involve in the development of materials. In most cases, activities are intended to develop critical and analytical thinking skills. Such activities consist of small group discussions, group and individual decision-making and problem-solving activities, investigations, and role-play exercises (Bennett & Holman, 2002). These activities are meant to be intellectually stimulating to elicit learner motivation and conceptual understanding. They are also envisaged to be effective in fostering several learning skills, provide a considerable degree of learner autonomy over the learning process, and be less threatening to learners than educator-talk activities (Bennett, 2003). In accordance with these aspirations, the materials developed in this study consisted of teaching and learning activities involving hands-on and minds-on tasks.

The last thing to be considered in the development of context-based materials is the construction of tasks for assessing learners' understanding and ability. The ideal approach would be to use tasks that are context-based. Such an assessment would have the advantage of measuring learners' ability, scientific knowledge and understanding in relevant and unfamiliar contexts (Bennett, 2003). In most cases however, assessment tasks in contextualized teaching focus on measuring learners understanding, application and evaluation of abstract scientific ideas (Bennett, 2003).

Conceptual understanding in Science Learning

The impact of context-based teaching on conceptual understanding is not consistent in learner achievement, (Taasoobshirazi & Carr, 2008). Some researchers discovered that students exposed to context-based teaching have better conceptual understanding than those exposed to traditional approaches. However, others found conceptual understanding insignificant between two groups of learners. De Jong (2008) explained that the discrepancies in research conclusions on the effect of context-based teaching on conceptual understanding could be accounted to various factors which include the nature and source of contexts, and teacher capability and assertiveness in planning and employing context-based materials.

In the study of Sedat and Azize (2015), the results revealed that students' cognitive styles and motivational styles are main predictors of students' conceptual understandings. Differentiation among conceptual understandings of students with different cognitive and motivational styles has been solely explained based on their abilities. However, the effects of cognitive and motivational styles on students' understandings are not enough variables to explain the roots of variation in students' conceptual understandings since problem solving is a superficial process. The effects of other individual differences like metacognitive awareness, reasoning abilities on students' conceptual understandings about electricity must be examined.

Streveler et al., (2008) argued that a correct conceptual understanding enables students to explain the differences among science concepts that include knowledge on the relationships among quantities. Papadouris and Constantinou (2009) explained that the basis for the development of conceptual understanding is the accumulation of experiences with natural phenomena through active exploration and investigation. There are two elements that appeared to be critical in making successful science instruction which involves understanding on how students made sense of the subject matter and the active engagement in discovering what was happening instead of just witnessing something being presented to them through the process of inquiry-learning (Jaakkola et al., 2010; Muller, Bewes, Sharma, & Reimann, 2008; Trundle &. Bell, 2010; Zacharia, 2007).

Larson (2011) revealed that engagement was significantly associated with conceptual understanding. There was a moderate statistically significant positive relationship between conceptual understanding and engagement. Separate correlations between conceptual understanding and engagement for each experimental condition provided strong support to suggest that the treatment conditions that were designed to increase both engagement and conceptual understanding influenced the high results for the treatment group.

Larson (2011) further elaborated that the positive relationship between engagement and conceptual understanding of biology suggests a contribution to the design of instructional contexts that promote sustained engagement in academic literacy on science learning. The results of the study suggest that conceptual understanding was substantially associated with variables that reflect classroom activity that supported student engagement in active generation of knowledge in collaboration with others through academic discourse, and learning environments that promoted a perceived sense of identity as a science student. Additionally, conceptual understanding was associated with positive feelings, a sense of belongingness in an academic community, and engagement in instruction that develops curiosity and personal interest and leads to learning and competence.

The facilitation of gains in conceptual understanding through the use of daily, graded, reflective journaling indicate that the benefit that students seem to derive through reflection are not necessarily limited to the use of reflective journaling. There is no obvious reason that this activity should only facilitate gains in conceptual understanding for students, in fact the implication is that reflection as a metacognitive activity may enhance conceptual understanding regardless of the content being studied (Dorhety, 2010).

According from the dimensional analysis of Mills (2016) conceptual understanding has four salient dimensions: factual and procedural knowledge, establishing connections, knowledge transfer, and metacognition.

Factual and procedural knowledge. Outcomes associated to conceptual understanding were predominant in the literatures of science and mathematics. The way to understand concepts is by integrating both procedural and factual knowledge (Rittle-Johnson & Star, 2007). In order to grasp conceptual understanding, it is necessary to give emphasis on the eloquence, efficacy, and accuracy of factual and procedural knowledge (Devlin, 2007; Rittle-Johnson & Star, 2007; Ross & Wilson 2012). Thus, the attainment of factual or procedural knowledge was the starting point in the process of conceptual understanding.

Establishing Connections. In the literature of science and mathematics, the use of concept maps and reflection reinforced the connections between knowledge (facts and procedure); making connections, promotes deep learning and better understanding of the concepts (Cassata, Himangshu, & Iuli, 2004; Giddens, 2007; Ritchart, Turner, & Hadar, 2009). A subject is more likely to be understood if knowledge is strongly related to other knowledge.

Knowledge transfer. Knowledge transfer was also emphasized in the education literature. Although it appears identical with making connections, they are both distinct aspects of conceptual understanding. Transfer of knowledge would not be possible without making connections to help learners reinforced what they have learned and think in a different way.

(Franz, Hopper, & Kristonis, 2007; Sigler & Saam, 2006).

Metacognition. Chen & Bradshaw (2007) commonly described the area of metacognition from the perspective of novice learning in the mathematics and science literature. Giddens and Brady (2007) regarded conceptual learning by strengthening the thought processes where students learned how to logically arrange information into rational mental structures. The students can readily and correctly use information as they gather information. The aim of attaining understanding of concepts supports the student in performing complex applications progressively. Metacognition is the use of strategies to guide and redirect thinking on how students organize their knowledge (Gredler, 2008). Conceptual understanding should increase as metacognition increases.

Student engagement in Science Learning

Engagement refers to the extent of a student's active involvement in a learning activity (Skinner, Kindermann, and Furrer, 2009). According to different engagement theorists, students' involvement ranges in multidimensional character from effort, persistence, interest, enthusiasm, interest, concentration, strategic thinking, and self-regulation to intentional acts in deepening one's involvement in the learning activity. Given its multidimensional character involving behavioural, emotional, cognitive, and agentic engagement, careful attention is needed when it comes to assessing student engagement.

Assessing engagement is regarded by its significance and variability because students' engagement is a strong indicator of learners' learning, performance, and academic advancement (Jang, Kim, & Reeve, 2012; Ladd & Dinella, 2009). Several instruments were categorized under different perspectives and serve a diversity of purposes that is why assessing student engagement is characterized by its variability (Skinner, Kindermann, & Furrer, 2008; Wang, Willet, & Eccles, 2011). The validation studies determine a single feature of engagement while others measure two-dimensional, three-dimensional, or four-dimensional assessment strategy. The samples consist of learners from primary to tertiary population respectively.

In a study conducted by Tinio (2009), the assessment of students' engagement was clarified by distinguishing predictors from its contributory aspects and facilitating situations and from engagement-related outcomes such as learning, achievement, and class-specific grades. The levels of student engagement have been verified to regulate academic achievement; students who have higher GPAs are more engaged, (Fechheimer, Webber, & Kleiber, 2011).

Jackman et al. (2011) reported that students who were disinterested, disruptive, and absent from science classes have poor motivation. Thus, a link between engagement and motivation was established. In terms of using game-based learning, a study of Eseryel et al. (2014) shows that self-efficacy is most correlated to engagement. They observed crucial markers of engagement such as autonomy, competency, and relatedness through hierarchal regression analysis. These directly impacted effort and persistence.

When it comes to using survey questionnaires in measuring students' engagement, Riccitelli (2015) found that the use of self-report data yields to high engagement results among the college students. Self-reported scores revealed to be inaccurate (Lelkes, Krosnick, Marx, Judd, & Park, 2012). This may mean that students responded the way they perceived to make them appear better students rather than answering questions honestly. However, to mitigate biases among responses, large sample size must be utilized. Perhaps, high engagement scores came from a population of junior college students. It was stated that junior college students has insufficient background in answering the questions and in making realistic choices; they have a tendency to be more positive, even when positivity is not rooted in reality (Hagerdorn & Purnamasari, 2012; Martin, Galentino, & Townsend, 2014).

According to Glassman (2016) there are numerous factors that influence students' engagement. Previous research has shown that student engagement is related to student background, such as socio-economic status and mother's level of education, family and peer support, and school factors (Wylie & Hodgen, 2012). Teachers, schools, and districts have little ability to alter many factors related to student engagement such as socio-economic status, parents' level of education and family and peer support. However, teachers and schools have much control over the instructional tasks and learning environment provided to students. Further, instruction may have a stronger influence on students' engagement compared to student characteristics. Findings from previous research found that only 25% of the variation in student engagement exists between individuals, whereas 75% of the variation in student engagement fluctuated based on changes in the learning environment (Shernoff, 2010).

Student learning depended not just on what was taught, but how it was taught. Innovative pedagogical strategies such as project-based, inquiry and constructivist instructional approaches promote intrinsic student engagement. These rich learning styles helped students apply knowledge to everyday experiences (Krajcik, McNeill, & Reiser, 2008). Learning in this way better prepared students for future careers that are not apparent yet. Teacher's depth of pedagogical content knowledge directly impacts the effectiveness of inquiry-based instructional practices. Teachers who lacked extensive skills and knowledge struggled to promote student engagement in inquiry-based activities (Kanter & Konstantopoulos, 2010).

The cause of the drop in engagement, motivation and identification in science may be due to social, developmental or instructional changes that also occur in the middle school years. School culture (Vedder-Weiss & Fortus, 2011, 2012), peer influences (DeWitt, Archer, & Osborne, 2013) and home environments (Vedder-Weiss & Fortus, 2011) have been linked to declines in engagement, motivation and identification in science. Teachers' motives for being a teacher, pedagogical skills, self-efficacy and school-based relationships influence their perceptions of the level of student engagement in their classes (Van Uden, Ritzen, & Pieters, 2013). Teachers that promoted autonomy in a structured environment foster student motivation. High levels of behavioural engagement correlate positively to classroom structure and consistent expectations.

Rigorous instruction is not difficult for students; it is engaging and motivating (Tovani, 2011). Increasing rigor requires raised levels of content, increased complexity of tasks, appropriate support and guidance, open-ended tasks and higher expectations (Blackburn, 2013). Rigorous instruction can be used for all learning and ability levels. Scaffolding by adding structure to open-ended tasks, alternate source reading, graphic organizers, and the use of technology and software tools enables all students to perform rigorous tasks (Blackburn, 2013; Blackburn & Williamson, 2009). Leaders should ensure that rigorous tasks are not mistaken for difficult tasks. These misunderstood results to struggling students being perceived as unable or unwilling to perform rigorous tasks. The frustration that students experience from challenging tasks may be enough to catalyze the disengagement process.

Valerie (2016) found that increase in student engagement positively correlate to improved student achievement. The correlational design includes observations of student engagement levels and a student self-report survey of engagement, as indicators of student engagement levels. A multiple regression analysis of each measure of student engagement instruments determines the influence of each variable to student engagement.

Context-based teaching and science inquiry skills

Most context-based approaches also intend to have some impact on the development of other attributes of students like problem-solving and decision-making abilities, argumentation, inquiry skills and critical thinking. There are, however, limited studies focusing on the evidence of impact on these attributes. There is still not enough empirical evidence to relate context-based science education to improved decision-making abilities (Sadler, 2009).

The impact on the learning of science of context-based teaching by secondary students has been analysed in numerous research studies around the world. The implementation of contexts in science education on a large scale is not sufficient due to lack of understanding by teachers on how these approaches are composed and also the way how students learn in a context-based learning environment is not fully understood (King et al. 2013).

Kazeni and Onwu (2010) have clearly shown that contextualized teaching has a profound effect on learner performance and attitude. The results from the data suggest improvement in the learners' performance both from the context-based and traditional teaching groups. The context-based teaching approach is significant for the development of skills and competencies that may enhance sustainability and social responsibility of science education. The enrichment of learners' conceptual understanding, problem solving and decision-making ability is not only essential for learner success but are also necessary for the empowerment of science learners.

Contextual Teaching and Learning (CTL)

Berns and Erickson (2001) describe CTL as the notion of relating subject matter or content to real-world situations in science teaching and learning; and motivating students to create connections between knowledge and its uses to their lives. CTL stresses experiential learning, meaning the students effectively learn if they get immersed in the class activities. According to contextual learning theory, learning occurs only when students process new information or knowledge in such a way that it makes sense to them in their own frames of reference (their own inner worlds of memory, experience, and response).

Carreer (2012) explained that contextual learning theory is all about students processing and managing new information. To acquire good understanding, various aspects of learning environment must be considered. The generation of concept of knowledge originates from process of discovering, reinforcing and relating.

The purpose of contextual learning is to equip students with more realistic knowledge and skills because its main principle is to bridge the gap between theoretical things and practical applications (Wijarwadi, 2008). This method encourages students to make relations between prior knowledge and its application in their life. The CTL was founded from the constructivist philosophy of Jean Piaget which claims that the child has a cognitive structure formed by experience since childhood. In a contextual classroom, the teacher's job is to facilitate learners with more methods to attain their objectives. As with other methods of learning, contextual learning developed more productive and meaningful learning.

Wijarwadi (2008) further elaborated the seven principles in CTL: constructivism, inquiry, questioning, learning community, modelling, reflections, and authentic assessment. Constructivism requires students to actively develop their knowledge and skill. Inquiry involves formulating problem, gathering data through observation, analysing and presenting data. Questioning can be used for checking student's understanding, measuring students' curiosity, focusing student attention, and refreshing students' prior knowledge. Learning Community is where students share the information and knowledge with their friends or specific community. Modelling demonstrates example to the learners and what they want to learn. Reflections are made upon the completion of the teaching and learning process to reiterate what the students learn. Authentic assessment gives information about students learning development through the process of collecting data. This includes clear self-assessment criteria to identify students strengths to enable them to show their abilities.

According to Ketter and Arnold (2003) CTL put emphasis on the delivery of curriculum by using strategies for contextualized teaching and learning, community-based experiences, and school contexts to inform teaching and learning. CTL learning strategy has a positive and useful impact on students' lives since it encourages them to think critically. Additionally, CTL learning strategy facilitates the formation of a conducive learning environment that gives opportunities for students to be actively involved in the building of knowledge, skills, and attitudes through teamwork. This is exactly the opposite of conventional learning strategy where students only accept, record and memorizes lesson, thus no cooperation can foster among learners. The CTL learning strategy is also a social learning strategy that helps students to comprehend the implication of the subject matter in the perspective of their personal, social and cultural life (Lotulung, Ibrahim, and Hetty, 2018).

CTL is a process in which students effectively learn more through hands-on, real-world context than in an abstract manner (Baker, Hope, & Karandjeff, 2009). The characteristics of CTL are as follows: (1) emphasizes on actual skills and knowledge necessary in life; (2) associates of academic learning with actual presentations; (3) distinguishes instruction for every learner; (4) presents intangible ideas through the senses; (5) specifies helpfulness of information; (6) offers factual information in the course of sensible hands-on experiences, and (7) presents information in small augmentations instead of large chunks.

Successful implementation of CTL actively engages students in performing classroom activities. Baker et al. (2009) outlined several psychological and educational theories and research with implications for CTL:

Motivation Theory. It focuses on the mode of instruction and development of students' self-efficacy, which is a key element of CTL. Students are encouraged to think of own ideas and the experiences in which the teaching and resources are rooted. Students become interested and motivated when they see the real-world relevance of what they are learning. Predmore (2005) explained that thinking about content within real-world experience is important in CTL because once the students can see the real-world relevance of what they are learning, they become interested and motivated.

Problem-Centered Learning. This entails group work among learners to lead in a relevant conclusion through complex interconnected problems. The CTL approach supports students to realize the advantages of specific skills since they are interrelated to a real-life problem-solving situation.

Social Learning Theory. Social learning theory emphasizes on collaboration with peers to generate and grasp their own learning within a social situation related with CTL. The social context of collaborative learning also often follows the future expectations of students in a work environment.

Learning Styles. Students past varied knowledge and involvement, motivational aspects, and personalities impact the means in which students absorb learning effectively. CTL reaches a diversity of learning styles because the instructor uses various approaches within the experimental context, such as hands-on learning and cooperative learning.

Brain Research. Learning is shaped by emotion, practice, experience, and the environment because the human brain is highly responsive to association and sensory experience. Brain research is imperative to CTL because it proves that the brain can develop through connections between experience, learning new concepts, and sensory information.

Ariyadi Wijaya, et.al (2015) studied teachers' teaching practices and beliefs regarding context-based tasks in relation with students' difficulties in solving these tasks and found out that the teachers view context-based tasks as plain word problems. The observations revealed that their teaching was predominantly teacher-centered and directive, which is not considered to be supportive for learning to solve context-based tasks. Relating the results of this study with the findings from their earlier study, they found a relationship between how teachers teach context-based tasks and the errors of students in solving these tasks. The findings support students' difficulties in solving context-based tasks because of insufficient opportunity to learn offered by teachers.

In contextualizing instruction Krajcik, et al., (2002) explained the use of particular situations or events that take place outside of class or are of particular interest to students to guide the teacher in the presentation of science ideas and concepts. Contextualizing takes the form of authentic examples or problems that are personally important to students, to the local area, or to the community. These are conditions in which students may have some direct or indirect experience that engage students over periods of time.

Stanisavljević et al. (2016) evaluated the application of context-based teaching and conventional expository teaching in the implementation of the teaching content in terms of its effectiveness. The results displayed a statistically significant difference between the experimental and control groups in post-test evaluation scores of knowledge. The experimental didactic model of context-based teaching verified to be more effective in terms of the quantity and quality of knowledge acquired by the students in the tested teaching field.

7E instructional Model of Inquiry-based Learning

Inquiry is grounded on scientific investigation such as presenting questions, and it have to do acquisition and development with knowledge (Blanchard et al., 2008; Loyens and Rikers, 2011). The fundamental cause for its extensive approval and efficacy in science teaching is its suitability with human nature. From the moment of opening our eyes to nature, all of our learning, except our instinctive behaviours, is based on our observations and inquiries. For that reason, all of our observations, learning needs, and inquiries require raising the correct questions. IBL starts with questions established on actual observations, and proceeds through discussions and explanations based on evidence (Cuevas et al., 2005). According to Savery (2006), learners' answers are generated through a single-step of observation, and deep thinking ability. Inquiry questions permit several responses or solutions through open-ended questions or puzzling situations.

IBL produces several learning outcomes. IBL stimulates one's intellect and creativity through mental processing (Lawson, 2010) since it is known that the mind is thinking and understanding. Intelligence is the liberated thinking about the events, the alteration of new situations, and the capability to gather together actions and attitudes in the centre of unifying idea or purpose. Inquiry based learning also promotes the acquisition of scientific literacy, vocabulary knowledge, conceptual understanding, attitudes toward science (Anderson, 2002), critical thinking (Anderson, 2002; Panasan and Nuangchalerm, 2010), scientific processing skills, cognitive achievement (Anderson, 2002; Panasan and Nuangchalerm, 2010; Lawson, 2010) learning content as well as discipline-specific reasoning skills and practices (Hmelo-Silver et al., 2007).

The 7E instructional model for inquiry-based learning is about the nature of science which is based on analysis and the way in which children learn naturally. A number of phases ranging from 4E to 5E, and most recently to 7E comprise the different versions of the instructional models which have been emerged on the surface of science curricula.

Eisenkraft (2003) stated seven salient elements: elicit, engage, explore, explain, elaborate, evaluate, and extend as the key components of the said model. The stage of elicitation review students' prior experiences that can be linked to the present learning situations. The engagement stage seeks to hold the interest of students and intensify their attention so they would be ready to learn. This phase prompts students to construct link concerning prior concepts and new learning situations. The exploratory stage focuses on the learners by investigating scientific processes vividly, which includes developing hypotheses, separating variables, recording data, organizing experimental procedure, making graphical representation, and formulating final outcomes. The teacher is more of a facilitator that provides queries, informs about paradigms, provides feedback, and measures level of comprehension. The stage of elaboration helps learners in implementation of knowledge acquired ranging from probing inquiries to formulating hypothesis. The evaluation stage is done through summative and formative forms of evaluation. The transformation of what is learnt is being carried out using tasks of extension phase (Eisenkraft, 2003).

In the meta-analysis of Hilal et al., (2016) the study showed that inquiry-based science education led to higher levels of students' academic achievement. It was also revealed that in terms of science process skills and attitudes towards science, inquiry-based learning method had a positive and medium level of effect. It was also noted that inquiry-based learning method had much more significant effects on student achievement
when compared to the traditional teaching method.

In the study conducted by Siribunnam and Tayraukham (2010), it was found out that learning using 7E learning model resulted to higher analytical thinking abilities and attitudes particularly during exploration and elaboration phases. The students themselves discovered the technique to arrange the knowledge to learn. Each learning phase encouraged students to cultivate their thinking abilities, thus their learning performances were also improved. As compared to traditional science classrooms that are teacher centered with demonstrations and lectures, inquiry-based classrooms facilitate the learners' real-world experiences. The students were more enthusiastic while learning because the method was new unlike the conventional learning method. Moreover, students have the chance to evaluate themselves positively and reflect on their knowledge and experiences as well. Various forms of scientific inquiry is much appreciated by provisions of meaningful learning opportunities.

The results of the meta-analysis conducted by Nuri (2016) on the effectiveness of 7E learning cycle in science teaching confirmed the positive effect on learners' performance. The study was composed of 2918 students. The effect of 7E was not significant when it comes to school level but a significant difference was observed with regards to the subject matter. The meta-analysis implies that the 7E learning cycle is a useful strategy that must be included in science curriculums.

In the area of science teaching, many researches have reported positive effects of 7E learning cycle on students' achievement and skills (Bülbül 2010; Damar, 2013; Demirezen, 2010; Gök, 2014; Gürbüz, 2012; Saraç, 2015; Taguiam, 2015; Yenice, 2014). The 7E learning cycle give students the chance to efficiently explore science activities; thus, increasing students' academic and conceptual achievement. Although each phase can be time-consuming because it requires meticulous executions, each phase can guarantee clear and effective learning (Şadoğlu & Akdeniz, 2015).

Conceptual Framework

This study was anchored on the Contextual Teaching and Learning (CTL) which was grounded on the constructivist learning theory and cognitive theories. Before CTL was implemented, the behaviourism and constructivism were emerging theories from where it is grounded. E.L. Thorndike suggested that learning transpires when there is a connection between stimuli and responses through reward. The people who use behaviourism theory in the teaching process found that their students restrict themselves in exploration over their environment since it is non-obligatory for students to think critically. As a consequence, they tend to be passive learners fulfilling the requirements from the teachers. Later, another theory was developed, called constructivism theory. This theory allows students to build their own understanding according to previous knowledge and experience and relate them in a new situation. Constructivism encourages active student participation. However, these theories have some weaknesses. Thus, a new theory was developed called CTL. Dease (2012) stated that CTL learning can only take place when students establish connections between content and context. Febby (2011) further supported this claim by expanding the definition of CTL as a concept of learning that help teachers in relating the subject taught with real-world situations of learners and encouraging them to build connection between the applications of knowledge in their lives.

According to Smith (2010) various instructional strategies were identified by Berns and Erickson (2001) and Lynch and Harnish (2002) that can be utilized in implementing Contextual Teaching and Learning. Five approaches that supported the Contextual Teaching and Learning pedagogical model were identified by Berns and Erickson (2001) whereas Harnish (2002) identified seven approaches. The approaches specified by Berns and Erickson and Lynch and Harnish were problem-based learning, project-based learning, work-based learning, service learning, and cooperative learning. Lynch and Harnish added two approaches to these five. They are inquiry-based learning and authentic assessment.

This study focused on Inquiry-based learning, an approach for nurturing skills through guided learning and small-group discussions. Through inquiry-based learning, students can build their comprehension, critical thinking and communication skills. It also helps students make their own connections on what they have learned instead of primarily memorizing the scientific concepts.

The 7E instructional model of inquiry-based learning stated by Eisenkraft (2003) was highlighted in the development of context-based instructional activities in Grade 7 Biology. 7E learning model comprises of elicit, engage, explore, explain, elaborate, evaluate and extend steps. Elicit is the stage in which the previous knowledge of the student is extracted by framing questions and scenarios. Engage stage captures students' attention and stimulates thinking about the subject matter. Explore is the stage that provides an opportunity for students to explore scientific knowledge by showing scientific attitudes. In this stage, students plan and carry out investigation, analyze and interpret data, and make predictions. Explain is the process which allows students to analyze, clarify, and modify their exploration. In elaborate stage, learners expand and solidify what they have leaned and transfer one concept to another subject or to a real life application. In evaluate stage; teacher determines student performance and understandings of concepts, skills, and processes through formative or summative form of assessment. Extend stage encourages the students to extend concepts in new context and make connections not just in the subject but also beyond it (Eisenkraft et al., 2003).

The 7E instructional model was used in this study since it is a learner-centered model. This model consists of stages of activities organized in such a way that students can master the competencies that must be achieved in learning by playing an active role. 7E models have several advantages, including: stimulating students to remember the subject matter they have learned before, motivating students to be more effective and increasing students' curiosity, training students to learn to do concepts through experimental activities, train students to convey verbally the concepts they have learned, provide opportunities for students to think, search, find, and explain examples of the application of the concepts they have learned.

The 7E instructional model of inquiry-based learning was used for students to cultivate rich understanding of scientific concepts within the context of a concrete situation. Anderson (2002) explained that Inquiry based learning refers to the activities of learners in which they develop knowledge and understanding of scientific ideas as well as an understanding of how scientists study the natural world. Further discussion of the 7E instructional model was as follows:

Elicit phase activates the student’s existing knowledge and revives the older information possessed by the learners. The teacher plays an active role and students are given spaces for projecting their own ideas and creativity.

Engage phase generates interest and stimulates excitement of the students towards the concept by showing small science activities. In this phase, student's previous misconceptions are identified by the teacher. This phase raises many questions in students' minds.

Explore phase gives students various opportunities to think freely but within the limits of the activities. The student's role in this phase is vital and the teacher plays a passive role in guiding the students towards building a new concept during this phase. The teacher provides time for the learners to puzzle with the problem given to them and encourages the learners to work collaboratively. The teacher in explore phase acts as a consultant for the students and creates setting for them. In this phase, peer discussion is given due importance, students discuss their findings with their peer groups. It is in this phase where context-based instructional activity was placed.

Explain phase encourages the students to explain the concept in their own words. Students clarify and justify their answers based on the questions asked. They listen critically to their peer group explanation. Students can also question other's explanation.

Elaborate phase helps in extending learner's conceptual understanding by enhancing and refining the concepts learned. Students tend to draw reasonable conclusion from the evidence.

Evaluate phase is when teacher assesses student's understanding of the concept with formative, as well as, summative evaluation.

In the Extend phase, students practice transfer of learning. They tend to apply the skill or a principle learned in the classroom in a new situation. The transfer of concepts in a new situation will help students to retain the topic for a longer duration.

The developed and validated context-based instructional activities were subjected to pilot testing then full implementation for determining its effectiveness in terms of students' conceptual understanding and students' engagement. Students' conceptual understanding refers to the grasping of science concepts with an awareness of the relationship among them while students' engagement is the students' active involvement in the learning experiences while performing the learning activity.

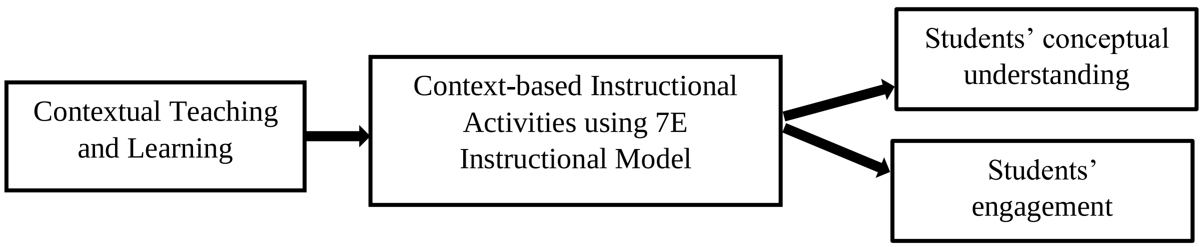

Figure 1. Conceptual Framework of the Study

Statement of Purpose

This research study aimed to develop context-based instructional activities for Grade 7 Biology and determine its effect when employed in the classroom setting.

Specifically, the study focused to meet the following objectives:

1. develop Context-Based Instructional Activities for Grade 7 Biology;
2. validate the Context-Based Instructional Activities for Grade 7 Biology, and
3. determine the effect of the validated Context-Based Instructional Activities for Grade 7 Biology in enhancing students' conceptual understanding and students' engagement.

Significance of the Study

The K-to-12 curriculum framework highlights the fundamental importance of context in shaping the curriculum, and consequently, the teaching learning process so contextualization was included in the last part of day to day learning logs of DepEd teachers. According to Saka (2011), there are various interpretations of contexts and also a lot of opinions on the way how these contexts should be used in the teaching and learning of science thus there is a need for the preparation of context-based instructional activities for teachers and students.

This study can be of great benefit to the teachers, instructional supervisors, and science education as a whole since it highlights the effective integration of 7E instructional model of Inquiry-based learning as an appropriate pedagogical model in developing context based instructional activities in teaching Grade 7 Biology. The study was conducted because the researcher wants to contribute ready-made and validated instructional activities for future use in the classroom. Moreover, this study is for the students as they are main reason why these context-based instructional activities were developed. It is to help them create connection between the knowledge and its application in daily living. The researcher designed the context-based instructional activities to make the competencies more relevant and useful to the learners.The study also aims to enlighten science teachers on the use of context-based instructional activities because presumably most science teachers consider it as time-consuming and difficult so they keep practicing their traditional teaching styles as a consequence. The correct use of context-based instructional activities can have a major influence on the learning experiences of students in secondary science education, the understanding of scientific concepts and the development of their interest, motivation and attitude through scientific inquiry towards science.

Scope and Limitations

The study focused on the development and validation of context-based instructional activities in Grade 7 Biology with use of 7E instructional model for Inquiry-based Learning. The content standards for Grade 7 Biology prescribed in DepEd science curriculum guide (2016) were considered accordingly. There were five major learning content on the existing learner's DepEd curriculum guide: LC 1 – From Cell to Organism; LC 2 – Plants and Animal Cells; LC 3– Living Things Other than Plants and Animals; LC 4 – Reproduction: The Continuity of Life; LC 5 – Interactions. A total of seven lessons were covered across the five learning content; these were (1) Levels of Biological Organization; (2) Animal Cell and Plant Cell; (3) Living Things other than Plants and Animals: Fungi, Protists, and Bacteria; (4) Asexual reproduction and Sexual reproduction; (5) Components of an ecosystem; (6) Symbiotic relationships, and (7) Transfer of energy through trophic levels.

In the process of using the 7E instructional model, the context-based instructional activities were specifically placed in the exploratory phase. The exploratory stage gives students various opportunities to think freely but within the limits of the activities. The student's role in this phase is vital and the teacher will play a passive role in guiding the students towards building a new concept during this phase. The teacher encourages the learners to work collaboratively. The context-based instructional activities were designed based on the four domains as the origin of contexts. The researcher also used particular setting, situation, area of application, and available information in the learners' community that was highly appropriate in the content of the lesson.

The developed context based instructional activities were validated by three content experts and one language expert. Thereafter, the instructional activities were subjected to pilot testing and implementation among the Grade 7 students of Cavite State University, Naic-Science Laboratory High School to determine its effectiveness in terms of students' conceptual understanding and students' engagement.

Definition of Terms

In order to better understand this study, the following terms have been defined:

Context based - Use of real life and fictitious examples in teaching environments in order to learn through the actual experience with a subject rather than just its mere theoretical parts.

Inquiry-based learning – One of the strategies for contextual teaching and learning that will be an integral part in the development of context-based instructional activities.

Instructional Activities - Set of context-based learning activities with the use of 7E instructional model for inquiry-based learning.

Students' Conceptual Understanding – Factual or procedural knowledge that is significantly associated with engagement. The facilitation of gains in conceptual understanding was done through pre-test-post-test and structured scientific journal.

Students' Engagement - Active involvement of students in the learning activity in three dimensions: cognitive, emotional, and behavioural. It was measured using student journal, emotional and cognitive engagement survey and process observer's behavioural engagement checklist.

CHAPTER 2

METHODOLOGY

This chapter presents and discusses the research design, research locale, sampling, participants, instruments, and procedures involved in the development, validation, and implementation phases of context based instructional activities using Inquiry-based Learning.

Research Design

The design of this study is descriptive developmental type since it aims to develop and validate context based instructional activities on different topics of Grade 7 Biology. It was carried out in four phases: Phase 1-Developing and Designing the context-based instructional activities, Phase 2-Validating the developed context-based instructional activities, Phase 3–Revising and finalizing the developed and validated context -based instructional activities, and Phase 4-Pilot testing and Full Implementation of the validated context-based instructional activities to determine its effectiveness in terms of students' conceptual understanding and students' engagement.

Research Locale

The sequence in the development of context-based instructional activities was based on the learning content, content standards, and learning competencies of DepEd Science Curriculum Guide (2016). In developing the instructional activities, the researcher considered the setting of the learners. Setting refers to the classroom management implied in the task (Nunan, 2004 as cited in Nury, 2015). In considering setting, the mode in executing the activities was taken into account whether the learners are operating on an individual or a group basis. The implementation phase was carried out from August to October 2019 at CvSU-Naic – Laboratory Science High School, Bucana, Naic, Cavite where the researcher is connected as Science Instructor.

Sampling and Participants

Purposive sampling method was utilized in choosing the sample participants of the study since the population was composed of 29 Grade 7 students. Purposive sampling is a non-probability sampling that is proven to be effective when limited numbers of participants serve as primary data sources due to the nature of research design and objectives (Black, 2010). Only one section was used in the implementation phase to come up with homogeneous purposive sample and to effectively measure the students' conceptual understanding and students' engagement upon exposure to validated context-based instructional activities. Students' conceptual understanding was investigated using structured scientific journal writing; pre-test-post-test whereas the students' engagement was determined through emotional and cognitive engagement survey and process observer's behavioural engagement checklist.

During the pilot-test and full implementation of the validated context-based instructional activities, there was no involvement of controlled and experimental group. Since the research participants are minors, an assent form (see Appendix C) was distributed and a parental consent (see Appendix B) was sought. The participants were asked to perform seven validated context based instructional activities under the guidance of the researcher, answer pre-test and post-test after each session, write structured reflective journal with guided questions, and rate themselves using emotional and cognitive engagement scale after every activity. The mentioned activities were performed during their time in Science subject for one quarter.

Instruments

The researcher utilized various research instruments such as researcher made context-based instructional activities, validation form of context-based instructional activities, researcher made multiple choice test items, structured scientific journal, activity-level cognitive and emotional engagement survey and process observer's checklist, and validation form engagement instruments.

Context-based Instructional Activities

In the development of context-based instructional activities, the prescribed learning content, content standards, and learning competencies in the DepEd Science Curriculum Guide (2016) for grade 7 biology were considered. Since, the study aimed to use inquiry-based learning in the context based instructional activities, the seven elements for inquiry-based science teaching were integrated and these were elicit, engage, explore, explain, elaborate, evaluate, and extend. Among the 7Es the context-based instructional activity for each lesson was placed in the Explore part of the lesson.

In conceptualizing the context based instructional activities that were placed in the exploratory phase of the lesson, the following were considered:

Format. The activity page layout and structure were designed with visual quality. The activity sheet was given a title relevant to the purpose of the activity.

Content. The content was adequate to the requirements of the objectives identified and suited to the needs of the students. The content was within the scope of the learning competencies of biological concepts of grade 7. The illustrations were clearly and correctly laid out.

Parts. The parts of each activity were composed of objectives, materials, procedure, and guide questions.

Activities. A total of eight CBI activities (see full CBI activities) were developed and validated among the five major learning content in DepEd Science Curriculum Guide (2016): LC 1 – From Cell to Organism; LC 2 – Plants and Animal Cells; LC 3 – Living Things Other than

Plants and Animals; LC 4 – Reproduction: The Continuity of Life; LC 5 – Interactions. A total of seven lessons were covered across the five learning content , these were (1) Levels of Biological Organization; (2) Animal Cell and Plant Cell; (3) Living Things other than Plants and Animals: Fungi, Protists, and Bacteria; (4) Asexual reproduction and Sexual reproduction; (5) Components of an ecosystem; (6) Symbiotic relationships, and (7) Transfer of energy through trophic levels.

Assesment. Among the eight BCI activities developed and validated, five were implemented in collaboration and three were carried out individually. The outputs of the students were evaluated using the correction key for each activity.

Validation Form

In validating the developed context based instructional activities; a validated validation instrument was adopted with permission from Natividad (2013). The instrument was adopted since it was also used in validating the developed contextualized modules for grade 7 biology (see Appendix H for entire validation results). The validation instrument was composed of two parts: Part A focuses on 25-item criteria in terms of Format and Design, Objectives, Content, Organization and Presentation, and Language Style. Part B is the list of indicators for contextualization. The validators were asked to rate the developed contextualized instructional activities using a rating scale in which each criterion was measured on a 5 – point Likert Scale.

Multiple Choice Test Items

A researcher made multiple choice test items (see Appendix M) were validated with table of specifications (see Appendix N). Items were revised based on the comments of the experts (see Appendix O). The exam was administered to a separate set of students and item analysis was done to examine student responses in order to assess the quality of those items and of the test as a whole (see Appendix P). Upon finalizing the test items, it was then administered to the student participants of the study to measure their conceptual understanding before the exposure to context-based instructional activities. Similar test items were used in the post evaluation part.

Structured Scientific Journal

During the period of full implementation of CBI activities; students had an individual structured scientific journal (see Appendix J). This was done to further investigate the conceptual understanding, cognitive, emotional, and behavioural engagement of students. Also, by doing these, students' experiences were also taken into account. This instrument was validated and found relevant to the study.

Student Engagement Instruments

Three aspects of students' engagement were investigated: cognitive, emotional, and behavioural. The seven-item activity-level cognitive and emotional engagement survey was adapted and modified with permission from Henrie (2016) (see Appendix I). The content of each item was changed to fit with the level of respondents. Additionally, a researcher made behavioural engagement survey was used (see Appendix I). The data collection tools for student engagement were validated by three selected State Universities and Colleges (SUC) biology faculty members and items were found **relevant** to the study. The content-experts responses made a contribution in improving the items in the cognitive and emotional engagement scale, process observer's behavioural checklist, and structured scientific journal.

The student participants rated their engagement cognitively and emotionally in every CBIA they performed using the validated instrument. However, the behavioural engagement was determined by the three process observers who were present throughout the conduct of the study. In interpreting the computed results of cognitive, emotional, and behavioural engagement, specific scale with verbal interpretation were used for each item (see Appendix L). The qualitative data of student engagement were gathered using the structured scientific journal of the participants.

Procedure

The procedures to achieve the objectives of the study consisted of three main activities: development, validation and implementation. The development phase started with defining the targets, followed by organizing the tasks of the instructional activities through conceptualization of the goals, input and detailed procedures. The tasks were then integrated into 7E instructional plan and were subjected to content expert validation and language editing. The validation phase was carried out through an adopted validation tool, used with the permission of Nativity (2016). The implementation phase, a pre-evaluation was administered followed by the pilot test of the first instructional activity. Having found that the participants performed the tasks correctly, the researcher proceeded with the full implementation of the material.

Development Phase

1. Defining targets

    All the content standards and learning competencies for Grade 7 Biology in the Science Curriculum Guide were included in the study. There was a need to include all the content standards since developing context based instructional activities means relating the curriculum content to a particular setting or area of application to make the competencies relevant, meaningful and useful to the learners.

2. Organizing tasks

    The components of a good task based on Nunan (2004) as cited in Nury (2015) in developing context based materials were used in organizing context-based instructional activities. They were goals, input, and procedures. The goals were the intentions of the learning task that directly describes the teacher's and learners' activities while input refers to written and visual data that learners work with in completing a task and procedures reflect what learners will actually do with the input. The table below presents the organization of eight context-based instructional activities:

Table 1. Task Conceptualization of Context-based Instructional Activities

Learning Content	Title of Context-based Instructional Activity (CBIA)	CBIA Goals	Input	Procedures
Levels of Biological Organization	From Cell to Biosphere: Connecting Biological Terms	Create visual examples of basic biology vocabulary from cells to biosphere.	Biological organization activity sheet	• Choose an organism found in the community that you would like to learn more about. • Look up the definitions of each level of organization. • Find out what those levels look like for their particular organism. • Create a visual representation of the levels of organization for their organism.
Animal and Plant Cells	Cell Analogy of a Shopping Mall	Develop a model to describe the function of a cell as a whole and ways parts of cells contribute to the function using analogies.	Cell Analogy activity sheets Cell Cards	• With your group mates, brainstorm on the description and function of the given components/parts of a shopping mall. • Match the parts of the cell with the components/parts of a shopping mall. Write your answer

				on Column 3 and 4 of Table 1 on Cell Analogy of Shopping Mall activity sheets. • Cut out the given cell cards. • Using glue, paste the back of the two match cards on one another with inserted popsicle stick at the center. • Place the popsicle on the cork foam board.
Living Things other than Plants and Animals: Fungi, Protists, and Bacteria	Observing Life Forms	Describe life forms other than plants and animals using magnifying lens.	Live specimens: lichen on trunk of trees, green algae from fish pond water, kelp seaweed from the seashore, molds on bread Magnifying lens Activity Sheets	• Observe life forms provided by the teacher using a magnifying lens • Share what you know about these life forms with groupmates * Warning: Do not touch the specimen with your bare hands, taste or smell it, especially for those of who have known allergies. It may be poisonous.
	Sort-It-Out	Identify roles of microorganisms in the natural world and how they are used by humans for food production and other processes	Set of microbe groups cards 20 Microbe Application cards Activity Sheet	• The first set contains three large cards (Bacteria, Fungi, Protist) • The second set includes twenty smaller cards which describes the application of microbes. • With your group mates read, discuss and decide the best

				way to sort the cards into categories based on the application of microbes in food production, ecosystem and disease causing microbes. • Place the large Microbe Group cards on the table and use the clues on each small card to assign it to one or more Microbe group cards. Notice that some roles are fulfilled by microbes belonging to two groups. • When finish assigning the microbe applications into categories, finalize them through table completion
Asexual and Sexual Reproduction	How do Organisms reproduce?	Compare aspects of an organism that reproduces sexually with one that reproduces asexually and explain the advantages and disadvantages of both sexual and asexual reproduction.	Informational sheets Activity Sheet	Situation: • You are a biologist learning about how organisms reproduce. To answer these questions you decide to compare of organisms that reproduce sexually with the number of parents involved, offspring appearance, advantages and disadvantages organisms that reproduce asexually.

				You will begin your study by looking at different organisms. • Fill-out the table with required information for the given organisms reproducing sexually and asexually.
Ecosystems				
Components of an ecosystem	Unraveling Living and Nonliving Things	Distinguish living things from nonliving things	Printed pictures of selected living and non-living thing Matrix Sheet	• From the presented pictures, sort out living things from non-living things. • After examining each item, complete the matrix by anwering the following questions: Can it move? Can it reproduce? Can it eat/obtain energy for growth? Is it made of cells?
Ecological Relationships	Relationship Status: Symbiosis	Differentiate the types of symbiotic relationships present within ecosystem	Adopted video clips: V1: Mutualism https://youtu.be/qRn62gtgntY V2: Commensalism https://youtu.be/jBg59_8TXbM V3: Parasitism https://youtu.be/NFa8-Hagg9Y	• Use the given video clips and examine the organisms in different relationship. Write down the organisms participating and a brief statement about what they are doing. • Decide who is benefitting from the relationship and write the name of the organism in the appropriate.

			Activity sheets	Determine if any organism is harmed, or unaffected and write the name in the appropriate column. • If there is no organism benefitting from the relationship, write “none” in the column. Each possibility of 0-2 answers. • Leave the “Type of Relationship” and “Importance” column blank until given instructions from your teacher. • Cut the Life in a Pond Cards and sort them into three categories: producers, consumers, and decomposers. Create four food chains. Remember, each food chain must start with a producer.
Transfer of Energy in the Ecosystem	Energy Flow: Interconnectedness of Organisms in a Pond	Create a food web illustrating the relationship of organisms in an aquatic habitat.	Life in a Pond cards Activity Sheets	• Use at least 10 of the cards to create a food web to show the relationship between the organisms in a pond habitat. You must use the three cards with stars. After you have created the food web, glue the pieces

	onto a large sheet of construction paper and add arrows to show the feeding relationships.

3. Designing 7E Instructional Plan with context-based instructional activities integration

The seven elements of instructional model for Inquiry-based Learning were integrated in the process of designing the lesson for each instructional activity. The context-based activity for each lesson was placed in the Explore part. The developed instructional activity was in accordance with particular setting within the context of the learners and various resources for scientific content, photographs, videos and diagrams.

Elicit: extracts prior knowledge and understanding

Engage: stimulates thinking and prior knowledge (motivation)

Explore: hands on context-based instructional activities

Explain: constructs explanation and design solution

Elaborate: refines application of concepts learned

Evaluate: uses formative, summative evaluation

Extend: transfer of concepts to a new situation

4. Content Expert validation and Language editing

The developed CBI activities were validated by three content experts with masters and doctorate degree in Biology. The extent of validation was in terms of objectives, content, organization and presentation, language and style. The experts also validated the indicators of contextualization for each instructional activity. Then, it was language edited by one English instructor in a university.

5. Final revisions and drafting

The context based instructional activities had its final revisions based on the comments and recommendations of the content expert validators, and language editor.

The flowchart below presents the summary of the above mentioned procedures in the development of context-based instructional activities for Grade 7 Biology.

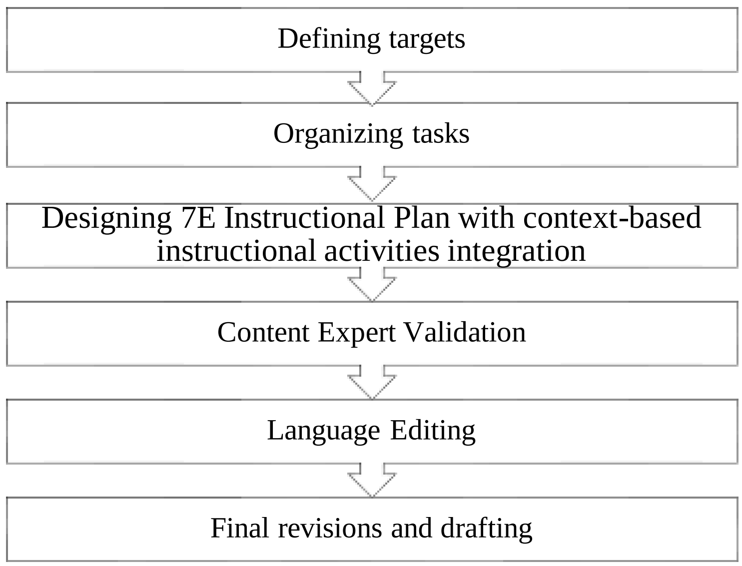

Figure 2. Flowchart for the Development of Context-based Instructional Activities with 7E Inquiry-based Integration

Validation Phase

In validating the developed context based instructional activities; a validation instrument was adopted with permission from Natividad (2013). The instrument was adopted since it was also used in validating contextualized modules in grade 7 biology. The validation instrument was composed of two parts: Part A focuses on 25-item criteria in terms of Format and Design, Objectives, Content, Organization and Presentation, and Language Style. Part B is the list of indicators for contextualization. The validators were asked to rate the developed contextualized instructional activities using a rating scale in which each criterion was measured on a 5 – point Likert Scale. The verbal interpretation used in assessing the given categories is shown below:

Table 2. Likert Scale for the Criteria in the Validation of Context-Based Instructional Activities in Grade 7 Biology

Range		**Qualitative Description**
5	Very acceptable	The indicator is definitely evident
4	Acceptable	The indicator is evident
3	Moderately acceptable	There is moderate evidence that the indicator exist
2	Fairly acceptable	There is little evidence that the indictor exist
1	Not acceptable	There is no evidence that the indicator exist

Other research instruments were also validated such as the researcher made multiple choice test items with table of specifications (see Appendix M and N), structured scientific journal for student participants (see Appendix I), seven-item activity-level cognitive and emotional survey and process observer's checklist (see Appendix K). These instruments were revised based on the recommendation of validators and were found relevant to the study to a great extent.

Implementation Phase

Having found that the developed context based instructional activities and research instruments are valid, the researcher asked for permission and approval from the campus administrator (see Appendix D) to allow the pilot test and full implementation of the validated activities to target participants. The researcher also sent parental consent form to the parents of the students to seek for their approval in allowing their children to participate in the conduct of the study, rest assuring the confidentiality of data with no negative impact on their children academic marks. Also, assent forms for minors were distributed stating the role of the participants in the conduct of the study. Students' involvement in this research was completely voluntary which means that students decided whether to be a part or not and no one was upset in any way if the students do not want to participate or even change mind later and want to stop. Their decision to participate or not had no effect on their grade in the class.

A pre-assessment was administered followed by the pilot-test of the first instructional activity. Having found that the participants correctly executed the tasks, the researcher proceeded with the full implementation of the material. The researcher was the teacher who facilitated the conduct of validated context-based instructional so immediate response was addressed in executing the procedure of the activities. The understanding on how to conduct the activity is crucial for how knowledge would be created. Student participants performed a total of eight (8) validated context-based instructional activities. Each activity in the Explore part was performed by the students for 30-40 minutes; additional time was devoted in the Explain, Elaborate, Evaluate, and Extend elements of 7Es. A post-test was administered after the exposure to context-based instructional activities to determine the improvement of students' conceptual understanding. Student participants were also asked to answer a structured scientific journal every after lesson to investigate their conceptual understanding and engagement in three dimensions (cognitive, emotional, and behavioural). Student engagement was determined using validated activity-level student engagement survey and behavioural engagement was determined by the three process observers using a validated checklist every activity. The three process observers were all science instructors with master's degree in biology. A video recording was also used for verification purposes. After the implementation phase, quantitative and qualitative processing of data was done to arrive at precise analysis and interpretation of results.

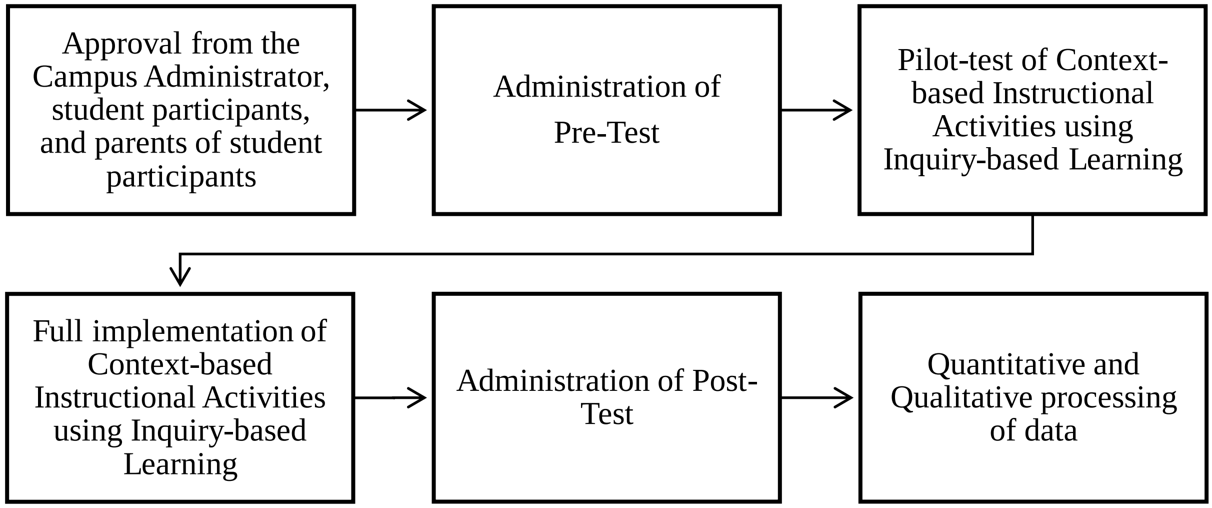

Figure 3. Flowchart of the Implementation Phase

Data Analysis

The quantitative data to measure conceptual understanding were pre-test and post-test scores, which were analyzed using a one tailed t-test. The one-tailed t test was used, since the average post-test scores were expected to be higher than the pre-test scores. Additional quantitative data from the seven item activity-level cognitive and emotional engagement survey and process observer's checklist were analysed using descriptive statistics specifically the mean and SD scores.

Qualitative data for students' conceptual understanding and student engagement were gathered based on the written responses of student participants on their scientific journal or learning logs. All their responses were processed through thematic analysis by Braun and Clarke (2006). The researcher read and reread the learning logs for familiarization and to generate initial codes. Encoded data were manually performed using highlighters and the corresponding codes were listed in the second column (see Appendix P). The initial codes were reviewed for focused coding to generate potential themes and subthemes.

Potential Ethical Issues

This research study adheres to the general principles of PNU Code of Research Ethics such as Respect, Beneficence, and Justice. Since, the study utilized students as participants; the researcher ensured the physical protection and avoided placing the participants in situations where they may be exposed to risk and psychological harm as a consequence of their participation to the research. The researcher also ensured full disclosure about the participants' role in the conduct of research including the nature and the methods involved in the research project. Additionally, the participation in this research was completely voluntary with informed consent and the participants were entitled to withdraw anytime. The informed consent includes the aspects of the research process and the procedure in which the data gathered were used only by the researcher. Moreover, all information from the participants was handled with utmost confidentiality and was not made available to anyone who had no direct involvement in the research.

The participants do not have a direct benefit during the conduct of the study but their exposure to the validated context-based instructional activities would help them make connections between scientific knowledge and its applications to their lives. The researcher wants to contribute a ready-made and validated context based instructional activities with significant effect on students' conceptual understanding and engagement towards the enhancement of science teaching and learning.

The selection of the participants was based on the need and nature of this research study. In the process of developing the context-based instructional activities, all content standards and learning competencies in the curriculum guide were considered and the material did not deviate from the advocacy of K-to-12 science curriculum that is learner-centered and inquiry-based. The developed context-based instructional activities were validated by three content experts and one qualified language editor, not someone the researcher know or have worked with to avoid any personal or financial interests that may affect the validity of the material to be produced. Other instruments, such as multiple-choice item test, structured scientific journal, adapted cognitive and emotional scale, as well as process observers' checklist were validated by experts and were checked by the thesis adviser to ensure that the instruments are free from any form of bias.

The results of the study would be shared to the participants by creating an Information, Education Communication (IEC) Material in the form of brochure where the results would be presented concisely and comprehensively. This intends to present the effective use of validated the context-based based instructional activities in Grade 7 Biology using inquiry based learning in relating scientific content to real world applications. The IEC material can also be distributed in the educational community to encourage the development of context-based instructional activities in other fields of science. Also, the researcher can extend the use of validated context-based instructional activities to nearby DepEd secondary schools at Naic, Cavite (research locale) through an extension activity following the proper protocols and guidelines.

Any stigma or sensitivity to cultural traditions was not observed as the impact of this research in the community but a link between scientific content and context would be established. The researcher developed the context-based instructional activities based on the origin of contexts, particular setting, situation, area of application, and available information in the learners' community to make the competencies relevant and useful for the learners. Additionally, a link between materials taught with real-world situation of students would build connection between the knowledge possessed by its application in their lives as community members.

CHAPTER 3

RESULTS AND DISCUSSION

Validation of Context-based Instructional Activities (CBIA)

The context-based instructional activities were segments of instruction that specify how the teacher and students participate and how they interact with materials and content. The study utilized 7E instructional model of inquiry-based learning since it is one of the approaches used to implement Contextual and Teaching Learning (CTL). The study considered the DepEd science curriculum guide for grade 7 biology in determining the content standards and learning competencies and the learner's material to come up with certain content of the topic. The researcher effectively used various resources for scientific content and photographs to come up with original works in designing and encoding of context-based instructional activities. The CBIA was evaluated by three content experts in terms of objectives, content, organization and presentation, language and style as well as indicators of contextualization. The validation instrument was adapted and modified with permission from Natividad (2013).

Table 3. Profile of the content-expert validators

Validator	Highest Educational Attainment	Specialization	Number of years teaching
1	Master of Science in Biology	Microbiology, Mycology, Biology	28
2	Master of Science in Biology	Biology	10
3	Doctor of Philosophy in Biology	Biology	21

Table 3 summarized the profile of the content-expert validators, their educational attainment, field of specialization, and the length of years teaching Biology. The researcher ensured that the highest educational attainment of the content-expert validators are all at least graduates of Master's degree in Biology and must be in teaching profession for at least 10 years. It consisted of three Biology professors of Science Education at a University.

Table 4. Summary of Context-based Instructional Activities (CBIA) Validation

Items	Mean	SD	Interpretation
Part A.			
Validation of Objectives	4.60	0.32	Very Acceptable
Validation of Content	4.13	0.26	Acceptable
Validation of Organization and Presentation	3.93	0.32	Acceptable
Validation of Language and Style	4.13	0.48	Acceptable
Part B.			
Indicators of Contextualization	4.24	0.36	Acceptable

Table 4 revealed the results of CBIA validation by three content experts. It obtained a very acceptable rating in terms of objectives and an acceptable rating for content, organization and presentation, language and style as well as the indicators of contextualization which means that the criteria for each item were met. The researcher made numerous revisions based on the comments and suggestions of validators in terms of content, procedures, illustrations, formatting, and diagrams of each instructional activity. The validated CBIA was then subjected to language editing by a qualified English instructor in a university. The researcher came up with eight CBIA in the Explore part of the lesson using 7E instructional model for inquiry based learning. Inquiry based learning is one of the approaches in implementing contextual teaching and learning based on Smith (2010).

Table 5. Matrix of Validated Context-based Instructional Activity (CBIA)

Learning Content	Content Standards	Learning Competency	Context-based Instructional Activity (CBIA)	CBIA Objective/s
Levels of Biological Organization	Demonstrate an understanding of the different levels of biological organization	Describe the different levels of biological organization from cell to biosphere;	From Cell to Biosphere: Connecting Biological Terms	Create visual examples of basic biology vocabulary from cells to biosphere.
Animal and Plant Cells	Demonstrate an understanding of the difference between animal and plant cells	Differentiate plant and animal cells according to presence or absence of certain organelles;	Cell Analogy of a Shopping Mall	Develop a model to describe the function of a cell as a whole and ways parts of cells contribute to the function using analogies.
Living Things other than Plants and Animals: Fungi, Protists, and Bacteria	Demonstrate an understanding of organisms that can only be seen through the microscope, many of which consist of only one cell	Identify beneficial and harmful microorganisms	Observing Life Forms	Describe life forms other than plants and animals using magnifying lens.
			Sort-It-Out	Identify roles of microorganisms in the natural world and how they are used by humans for food production and other processes
Asexual and Sexual Reproduction	Demonstrate an understanding of reproduction being both asexual or sexual	Differentiate asexual from sexual reproduction in terms of number of individuals involved and similarities of offspring to parents	How do Organisms reproduce?	Compare asexual and sexual reproduction; Differentiate offspring resulting from asexual reproduction with that from sexual reproduction

Ecosystems				
Components of an ecosystem	Demonstrate an understanding of organisms interacting with each other and with their environment to survive	Differentiate biotic from abiotic components of an ecosystem	Unraveling Living and Nonliving Things	Distinguish living things from nonliving things
Ecological Relationships		Describe the different ecological relationships found in an ecosystem	Relationship Status: Symbiosis	Differentiate the types of symbiotic relationships present within ecosystem
Transfer of Energy in the Ecosystem		Predict the effect of changes in one population on other populations in the ecosystem	Energy Flow: Interconnectedness of Organisms in a Pond	Create a food web illustrating the relationship of organisms in an aquatic habitat.

*learning content, content standards, and learning competencies were lifted from DepEd Science Science Curriculum Guide (2016)

Table 5 shows the list of developed and validated CBIA with its corresponding objectives in accordance with the existing content standards and learning competencies of DepEd Science Curriculum Guide. The CBIA was piloted and implemented to Grade 7 students in a Laboratory Science high school which consisted of 29 students. Since the study aimed to measure the effectiveness of CBIA on students' conceptual understanding and student engagement, three instruments were used in this study. The contents of these instruments were a mixture of researcher-made items and adapted instruments, which were tailor-fit for the respondents. The data collection tools were validated by three selected State Universities and Colleges (SUC) biology faculty members and items were found **relevant** to the study. In terms of validation, content-experts responses made a contribution in improving the items in the cognitive and emotional engagement scale, process observer's behavioural checklist, and structured scientific journal.

Effect of CBIA on Student Conceptual Understanding

Conceptual understanding is the factual or procedural knowledge of the subject being studied. The effect of CBIA using inquiry-based learning on conceptual understanding of students was determined through 65 item multiple choice tests that were administered before and after the exposure to eight CBIA.

Table 6. One-Sample Statistics

	N	Mean	Std. Deviation	Std. Error Mean
Posttest	29	56.6552	3.56847	.66265

Table 7. One-Sample Test

	Test Value = 40					
					95% Confidence Interval of the Difference	
	t	df	Sig.	Mean Difference	Lower	Upper
Posttest	25.134	28	<.000	16.65517	15.2978	18.0125

A one-sample t test was conducted to evaluate whether the mean of the assessment scores after utilizing CBIA was significantly different from 40, the accepted mean. The sample mean of 56.65 (SD = 3.568) was significantly different from 40, $t\ (28) = 25.13$, $p < .00$. The p-value indicates that the average score of the sample population is statistically different from 40. The 95% confidence interval estimate for the difference between the population mean scores and 40 is (15.29, 18.01). Thus, the result implies that context based instructional activities has an effect in enhancing the conceptual understanding of students.

The effect of CBIA using inquiry-based learning on conceptual understanding was further investigated through a structured scientific journal. The students were asked to write their conclusions based on the lesson objectives. It was done to assess the scientific concepts drawn by the students and the ability to transfer their knowledge into new situations. Table 8 reveals the themes for the effectiveness of CBIA using the instructional model for inquiry-based learning in terms of conceptual understanding:

Table 8. Themes for the Effect of CBIA in terms of Conceptual Understanding

Themes	Subthemes	Salient Statements
Improvement of conceptual knowledge	Discovering factual knowledge	S8: I have learned that life on earth has organization and biosphere starts from a very small unit. I also learned that organization of life starts from atom, molecules, organelles, cells, tissues, organs, organ system, organism, population, community, ecosystem then biosphere.
	Recognizing relevant concepts	S17: We are living in a world full of good and bad microorganisms. They play important role in food, products, medicines and environment. Some of them can cause disease, but if we know their effects, we can prevent their not bad [sic] effects on our body.
	Connecting conceptual ideas	S5: I can relate the connections of organisms to the flow of energy (food web) in a pond ecosystem. In pond ecosystem, organisms rely on each other for their nutrients and survival. Flow of energy can be seen in all the ecosystem, even a simple aquarium is an ecosystem.
Influential conditions for the enhancement of conceptual understanding	Clarity on misconceptions	S10: It is now clear to me that matter must composed of cells to be consider [sic] as living thing, not everything that is moving and multiplying is a living thing. Viruses are not living things.
	Delivery of instruction	S20: Living things other than plants and animals like bacteria, fungi and protists are quite hard to understand due to terminologies but Maam Sarah's [sic] explained it well in a way that we understand. She use examples that we can see around us in the activity, not only in this lesson but always.

Table 8 shows the themes extracted from the conclusions of the students in their scientific journal using thematic analysis, a good approach to research in finding about people views, opinions, knowledge, and experiences from a set of qualitative data. In analysis, two major themes were decoded such as improvement of conceptual knowledge with three emerging subthemes and two emerging subthemes on the influential conditions for the enhancement of conceptual understanding. The first subtheme is the discovery of factual knowledge, upon cross examining of responses made by the participants; students gave emphasis in learning biological concept in hierarchical order as stated by S1. Students also wrote similarities and differences of the concept learned and often wrote factual information that they have gained like the following statements: S14: "*By performing the activity, I am able to know the organisms reproducing sexually like leech, frog, crocodile, and corn while the organisms that reproduce asexually are amoeba and starfish.*" and S3: "*I now understand that plant cells can contain or hold more amount of water because it has bigger vacuole.*"

The second subtheme is recognizing relevant scientific concepts wherein students can identify the notion of the topic by discerning positive affirmation and valuing the lesson learned through the aid of context-based instructional activities. Students can recognize relevant biological concepts since the activities provided to them depicted real life application of the concept as stated by S17 upon performing the Sort-It-Out activity:S17: "*We are living in a world full of good and bad microorganisms. They play important role in food, products, medicines and environment. Some of them can cause disease but if we know their effects we can prevent their not bad effects on our body."*

The third subtheme is making connections of conceptual ideas to other areas of application. As reflected in their scientific journal, the manner the students establish connections and relate the lesson to other suited example is an indicator of transferring correct scientific information. As written by S5: "*I can relate the connections of organisms to the flow of energy (food web) in a pond ecosystem. In pond ecosystem organisms rely on each other for their nutrients and* *survival. Flow of energy can be seen in all the ecosystem, even a simple aquarium is an ecosystem.*" The three emerging subthemes were clustered in one defining major theme, the improvement of conceptual knowledge.

The researcher also decoded two influential conditions for the enhancement of conceptual understanding: gaining clarity on misconceptions and delivery of instruction. Students wrote in their journal certain misapprehended information which was then corrected as stated by S10 "*It is now clear to me that matter must composed of cells to be consider [sic] as living thing, not everything that is moving and multiplying is a living thing*." S7 also made the remarks "*I thought organisms higher in food web eat everything but the true is they do not eat everything that is lower in the food web but they eat some, not all organism below them.*" The statements are an indicative factor of the corrected misconceptions of the students in learning a particular content. Additionally, it was found that the delivery of instruction is also an influential factor for the enhancement of conceptual understanding as said by S20: "*Living things other than plants and animals like bacteria, fungi and protists are quite hard to understand due to terminologies but Maam Sarah's [sic] explained it well in a way that we understand. She use examples that we can see around us in the activity, not only in this lesson but always.*"

The CBIA using inquiry based learning can enhance students' conceptual understanding by the supporting claims made by the students which means that when it comes to concepts of grade 7 biology, they can apply it in other areas, explain and describe it using their own words, and look for an analogy. Specifically, the students have made the concept their own. Furthermore, context-based instructional activities were explored by the students through the provided instructions so there is active involvement in the learning process, Papadouris and Constantinou (2009) explained that the basis for the development of conceptual understanding comes from the accumulation of experiences through active exploration, investigation, and interpretation.

Effect of CBIA on Student Engagement

Student engagement is a student's cognitive, behavioural, and emotional investment in learning (Henrie, 2016). This study determined the effectiveness CBIA using inquiry-based learning in the three mentioned aspects. Larson (2011) revealed that engagement was significantly associated with conceptual understanding and there was a moderate statistically significant positive relationship between conceptual understanding and engagement. However, the extent of association in three domains was not explicated. In this study, a validated activity-level seven-item survey was used to measure students' cognitive and emotional engagement. Four items used a five-point Likert scale, with questions asking students to rate their engagement experience from "not at all" to "very much." The remaining three items used a seven-point semantic differential response scale, with the positive end indicating an aspect of engagement and the negative end indicating disengagement. In addition, a validated process observer's behavioural engagement checklist with seven items was used to measure the behavioural engagement of students. Appleton et al, (2006), argue that self-report heavily determine the perception of students on their experience, thus making it the most valid measure of cognitive and emotional engagement (see also Fredricks & McColskey, 2012).

Table 9. Descriptive Statistics for Cognitive Engagement Indicators

Items	X	Minimum	Maximum	Mean	SD	Interpretation
Cognitive						
How well were you concentrating?	8	3.76	4.31	4.0025	.19009	Concentrated
Describe your mood during this activity: Passive – Active	8	5.14	5.90	5.4488	.27663	Active

Describe your mood during this activity: Focused – Distracted	8	2.31	2.97	2.5700	.22860	Focused
Valid X (listwise)	8					

**X is the total number of CBIA performed by the students*

Table 9 shows the results of cognitive engagement of student participants from the activity-level survey of engagement. The survey was designed to be short, so as to be used effectively for intensive longitudinal research. Cognitive engagement is the mental energy which includes students' attention, concentration, curiosity, and absorption in learning whereas emotional engagement is the positive emotional response students has to learning, such as enjoyment, excitement, and interest. Cognitive engagement entails an effort to learn, while emotional engagement directs a potential willingness to learn. This synergy between cognitive and emotional engagement can lead to the greatest level of learning gains (see also Fredricks et al., 2011), making both of these factors an important consideration for measurement.

The student participants rated their cognitive engagement experience in every CBIA they performed, students' concentration was determined using a five-point likert scale and seven-point semantic differential scale to measure the attention and absorption in leaning. In terms of concentration, it obtained a mean score of 4.0 which interpreted that students were concentrated during the course of performing the context-based instructional activities. In terms of degree of attention from focused to distracted, it garnered a mean score of 2.57 meaning students are focused in the learning activities. In terms of absorption in learning from passive to active, it gained a mean score of 5.45 which signifies active involvement with the learning materials and collaboration with other learners. The results show that CBIA using inquiry-based learning engaged students cognitively since they are concentrated, active, and focused in the learning process.

In order to further investigate the effect of CBIA, qualitative measure was considered through the use of structured scientific journal where students wrote their own observations as they are performing the activity to determine the extent to which student participants are able to take on the learning task. The researcher decoded four themes with various subthemes as shown in Table 10:

Table 10.Themes for the Effect of CBIA in terms of Cognitive Engagement

Themes	Subthemes	Salient Statements
Preference for challenge	Task completion	S2: My group mates and I do not find the activity easy. We continue pairing the cell cards until we make it because when we think that we have correct pair another parts come up so we repeat it all over.
	Division of task	S11: All of my fellow members are cooperating. We separate who will draw the organism and who will think examples of and etc.
	Group cooperation	S7: The activity is challenging because we need to work in a group and there is time limit.
Effort directed toward learning	Sharing of ideas	S8: That my classmates is [sic] brainstorming and arguing if it's living or nonliving. And that my groupmates is [sic] also doing the same thing. So it's a little noisy.
	Analysis of content	S2: In Sort-It-Out, I observed that we need to analyze and understand the given cards and read the content of bacteria, fungi and protist.
	Note taking	S10: Our group write down the big fish that can eat small fish. We also write letters at the back of the card before we draw the arrows in cartolina.
Motivation to learn	Actively focused	S18: In my observation, is [sic] we are very focused in our work until its done. I now know the highest to lowest of our parts in our body and in the environment.
	Enjoying the teamwork	S7: Before we do the activity, I'm curious on what we are going to do. I thought this will gonna [sic] be easy because it is grouping. While we are doing the activity it is fun because we are helping each other to do the activity.
	Showing interest	S9: We are all interested in sorting out the cards as [sic] given to us. I like doing it and my groupmates are conscious if we are following the instructions
Learning goals	Aiming high scores	S16: About the good conversation and tactics our group made in completing the activity because we like to get high points. I also notice [sic] the same to

		others.
	Refining correct output	S28: In this activity, I observe that we arrange and rearrange this biological level of organization. I noticed that not all of us know that this is how organisms develop. I think we have a bit of struggling in giving correct examples.

The qualitative analysis for the effectiveness of CBIA using inquiry-based learning on cognitive engagement was revealed in Table 10. It was found out that student participants found preference for challenge as they were persistent in completing the assigned task as said by S2, "*we continue pairing the cell cards until we make it because when we think that we have correct pair another parts come up so we repeat it all over*," which means that they were cognitively engaged. Since the instructional activities were designed to be accomplished as a group, there was a division of task among group members and the work required group participation as stated by S11 and S7. The statements imply that when there is persistence, division of academic task, and collaboration, students become more cognitively engaged because they think together as a group. Besides preference for challenge, sharing of ideas, analyzing the content of activity, and notetaking of details were decoded from the responses made by the S8, S2 and S10 which suggests effort directed toward learning. Student participants cognitively put an effort into performing the activities and exert mental energy.

As the students have undergone the implementation of CBIA, motivation to learn was also decoded from their responses. Focusing actively in performing the task completely, enjoying the teamwork among group members, and finding interest in executing the instructions were reported by S18, S7, and S9. It was also noted that students aimed for high scores and there was refinement of answers to arrive with correct output which indicates learning goals as stated by S28. The qualitative findings affirmed and elaborated the quantitative indicators of cognitive engagement as being active, concentrated and focused; hence, further supporting the effect of CBIA through inquiry-based learning.

Table 11. Descriptive Statistics for Emotional Engagement Indicators

Items	X	Minimum	Maximum	Mean	SD	Interpretation
Emotional						
Did you enjoy this activity?	8	3.76	4.48	4.06	.27612	Enjoyed
Was this activity interesting?	8	4.24	4.55	4.37	.09099	Very much interesting
Did you wish you had been doing something else?	8	1.97	2.52	2.21	.17782	Not at all
Describe your mood during this activity: Excited – Bored	8	2.34	3.28	2.70	.29784	Excited
Valid X (listwise)	8					

**X is the total number of CBIA performed by the students*

Table 11 revealed the results for emotional engagement indicators, student participants assessed their emotional engagement using a five-point likert scale with regards to enjoyment, interest and rather do something else and seven-point semantic differential scale to measure excitement in every CBIA they accomplished. In connection with enjoyment, it obtained a mean score of 4.06 meaning students enjoyed the learning activities and they also find it very much interesting since that indicator gained a mean of 4.37. Additionally, when it comes to their mood, they would rather do the presented activity for it obtained an average of 2.21, Lastly, with regards to excitement, using 7-point differential scale from excited to bored, the computed mean was 2.70 denoting excited mood. The findings show the effect of CBIA using inquiry-based learning in engaging students emotionally based on its quantifying measures and interpretation. To deepen the investigation and validate the emotional engagement of student participants, they were asked to write what they felt after the learning activity in their journal. The results were shown in Table 12:

Table 12.Themes for the Effect of CBIA in terms of Emotional Engagement

Themes	Subthemes	Salient Statements
Satisfaction on the learning experience	Eagerness to answer	S7: I should learn more about it so that I can recitate [sic] more and answer my teacher's question.
	Interest and appreciation	S15: I can share this lesson/ideas to my friends or even in the part of my family. I also can use this when I grow up or in higher grades.
	Happiness upon completion of activity	S5: I am happy because we finished the activity. I enjoy this activity because we have a teamwork.
	Success due to teamwork	S21: I feel happy because we finished the work with enjoying and working hard for it. And I feel very successful because of our teamwork
	Excitement on the performance	S13: I feel very excited on our performance and happy of our work.
Affective conditions associated to learning experience	Stress and exhaustion	S17: I learned something but exhausted and a little bit stressed.
	Confusion and difficulty	S24: I was confused at first, but after my teacher explained I finally understand it. It's hard learning about organisms but [by] focusing in what you are doing you will understand it.
	Nervousness	S25: I learned new things that I didn't learned [sic] back then. But a little nervous because there is upcoming quiz.

The above mentioned responses in Table 12 confirmed the satisfaction on the learning experience based on the feelings learners had such as eagerness to answer teacher's questions (S17), interest and appreciation of the topic (S15), happiness upon completion of activity (S5), success and accomplishment due to teamwork (S21), and excitement on the performance (S13). The finding implies emotional involvement of the student participants in performing the handed activities to them. Emotional involvement helps make the material and the learning experience more memorable. Tyng et al., (2017) published an article reviewing the impact of emotion on learning, which suggests that emotionally stimulating events and activities are remembered more clearly, accurately and for longer periods of time. The evidence suggests that engaging students with material on an emotional level is likely to lead to better memory recall in the long term.

Throughout the implementation of CBIA using inquiry-based learning, affective conditions associated to the learning experience were also decoded to few student participants such as stress and exhaustion in group activities (S17), confusion and difficulty in completing the task (S24), and nervousness due to performance evaluation (S25). These were the subsurface emotions that were found with little importance in academic contexts. Rowe, et al., (2015) explained that discrete negative emotions that impacts learning include anxiety, fear, frustration, anger, boredom, sadness, shame, hopelessness, guilt and embarrassment and these were not present in the responses made by the student participants. Although some may think of stress as a solidly negative emotion or response to a situation or activity, it’s actually quite common for people to experience stress in neutral and positive situations as well.

The last key aspect of student engagement that was measured in this study was the observable act of students being involved in learning. Behavioural engagement has been defined as interactions with the academic setting that are active, goal driven, flexible, and constructive (Hughes, Wu, & West, 2011; Martin, 2008; Skinner & Pitzer, 2012). According to these authors, some indicators of behavioural engagement in academic contexts are planning, effort, on-task attention, time expended, attendance, voluntary participation, task involvement, and following classroom rules and norms. Frequently, this behaviour was accompanied by emotions such as enthusiasm, interest, enjoyment, and satisfaction.

During the implementation of CBIA using inquiry-based learning, there were three process observers in charge to observe the engagement of students as they perform the activity.

The measurement of behavioural engagement is more straightforward as compared with emotional and cognitive engagement because behavioural patterns can be observed, defined, and interpreted. Using validated observation checklist the observers have examined the degree to which students' exhibit engagement ranging from very high to very low behavioural engagement. The items correspond to students' participation and efforts to perform the given context-based instructional activities. The results and its interpretation are shown in Table 13:

Table 13. Descriptive Statistics for Behavioural Engagement Indicators

Observations	X	Mean	SD	Interpretation
Students exhibit postures that indicate they are paying attention to the teacher and or/other students.	8	4.00	.0000	Very High
Students focused on the learning activity with minimum disruptions.	8	3.84	.1764	Very High
Students express thoughtful ideas and questions relevant and appropriate to learning.	8	3.88	.17079	Very High
Students exhibit confidence and can initiate and complete a task with limited coaching and can work individually/group.	8	3.42	.34608	Very High
Students feel comfortable seeking help and asking questions.	8	3.84	.17639	Very High
Students describe the activity being done during class.	8	3.84	.17639	Very High
Students find the work challenging and connected to learning.	8	3.96	.11667	Very High
Valid X (listwise)	8			

**X is the total number of CBIA observed by the process observers*

As indicated in Table 13, the three process observers rated the overall behavioural engagement indicators **very high** throughout the implementation. They had observed that students are: paying attention to the teacher and or/other students; focused on the learning activity with minimum disruptions; expressing thoughtful ideas and questions relevant and appropriate to learning; exhibiting confidence and initiating and completing a task with limited coaching; able to work individually in a group; comfortable seeking help and asking questions;

able to describe the activity being done during class, and finding the work challenging and connected to learning. This finding implies that students made active responses to the learning tasks presented. Very high interpretations can directly be related with the way CBIA was designed because accomplishing the CBIA that was placed in the Explore part of the lesson required group work. Some studies recommend that high levels of student engagement are associated in working as a group (Shernoff et al., 2003; YazzieMintz & McCormick, 2012). Therefore, CBIA is found to be effective based on quantitative measures in terms of engaging students behaviourally.

In order to further broaden the evidence on the effectiveness of CBIA on behavioural engagement, student participants were asked to write their dialogue that had transpired as they perform the activity with others (students/teacher). It was done to assess active or passive engagement among students. The results were shown in Table 14:

Table 14.Themes for the Effect of CBIA in terms of Behavioural Engagement

Themes	Subthemes	Salient Statements
Active Participation in Student-Student Interaction	Students cooperation in group discussion	S14: I cooperate to my group mates and tell my idea about the symbiotic relationship and we also discuss each other [sic] opinion about the given organisms.
	Students participation in group performance	S15: We talked about the plan of our presentation for our group performance. We agreed that everybody in our group will be joining the performance. We further practice to come up with a very good performance.
Involvement in Student-Teacher Interaction	Interactive question-answer between students and teacher	S2: I think that all of us participate well with the activity. With my teacher we really had a great time [with her]. We might be asking a lot of questions but she answered diligently.
	Constant checking of students' understanding	S10: Maam Sarah explain what is expected in our activity. Every time we have a question, she is not hesitant to answer us and always checking [sic] us if we understand the meaning of it.

Across the eight CBIA performed by the students, an active participation of student-student interaction and involvement in student-teacher interaction were decoded as themes based on the responses made by the students. As said by S14, cooperation in group discussion was evident among their group members whereas participation in group performance was stated by S15. Student interactions with their peers are significant as positive interpersonal climate is associated with engagement positively (Davis & McPartland, 2012).

Similarly, students who think their peers will help them are more behaviourally engaged (Patrick et al., 2007). Additionally, as conveyed by S2, there was an interactive question-answer between students and teacher as well as constant checking of students' understanding as mentioned by S10. Teachers that encourage communications among students around educational tasks have higher levels of student engagement (Jones et al., 2008; Ryan & Patrick, 2001). These findings can be attributed to teacher's classroom routines in implementing the CBIA such as dividing the class into small groups, moving the chairs in circles for group discussion and letting the students present their collaborative output that help students stay on task or remain engaged. Moreover, these findings highlight the important role of student interaction with peers and teacher in understanding student behavioural engagement.

CHAPTER 4

SUMMARY, CONCLUSION, AND RECOMMENDATIONS

Summary of the Study

The study titled "Context Based Instructional Activities in Grade 7 Biology using Inquiry-based Learning" was anchored on the Contextual Teaching and Learning (CTL) which was grounded from the constructivist learning theory and cognitive theories. Dease (2012) stated that in CTL learning can only take place when students establish connections between content and context. Febby (2011) further supported this claim by expanding the definition CTL as a concept of learning that help teachers' in relating the subject taught with real-world situations of learners and encourage them to build connection between the applications of knowledge in their lives. According to Smith (2010) inquiry-based learning is one of the approaches identified by Lynch and Harnish (2002), an approach for nurturing skills through guided learning and small-group discussions. Through inquiry-based learning, students can build their comprehension, critical thinking and communication skills. It also helps students make their own connections on what they have learned instead of primarily memorizing the scientific concepts.

The use of 7E instructional model of inquiry-based learning was highlighted in the development of context-based instructional activities in Grade 7 Biology. In a published article of Shalini Sharma (2018) explained the 7E learning cycle model as a paradigm shift in instructional approach. 7E learning model consists of elicit, engage, explore, explain, elaborate, evaluate and extend steps. Elicit phase activates the student's existing knowledge and revives the older information possessed by the learners. Engage phase generates interest and stimulate excitement of the students towards the concept by showing small science activities through teacher's facilitation. This phase raise many questions in students' minds. Explore phase gives students various opportunities to think freely but within the limits of the activities. The student's role in this phase is vital and the teacher plays a passive role in guiding the students towards building a new concept during this phase. The teacher encourages the learners to work together in a collaborative and cooperative manner. The teacher provides time for the learners to puzzle with the problem given to them. In short the teacher in explore phase act as a consultant for the students and create need to know setting for them. In this phase peer discussion is given due importance, students discuss their findings with their peer groups. Explain phase encourages the students to explain the concept in their own words. Students clarify and justify their answers. They also listen critically to their peer group explanation. Students can also question other's explanation. Elaborate phase helps in extending learner's conceptual understanding by enhancing and refining the concepts learned. Students tend to draw reasonable conclusion from the evidence. Evaluate phase measures student understands of the concept with formative as well as summative evaluation. Extend phase practices students' transfer of learning. They tend to apply the skill or a principle learned in the classroom in a new situation. The transfer of concepts in a new situation will help students to retain the topic for a longer duration.

The development has undergone four phases: Phase 1-Developing and Designing the context-based instructional activities, Phase 2-Validating the developed context-based instructional activities, Phase 3–Revising and finalizing the developed and validated context - based instructional activities, and Phase 4-Pilot testing and Full Implementation the validated context-based instructional activities to determine its effectiveness in terms students conceptual understanding and students engagement. The developed context-based instructional activities were placed in the Explore part of every lesson.

The developed context-based instructional activities were validated by three content experts in biology using a modified and adopted validation instrument from Natividad (2013). It was also proofread by one english language instructor in a university. The validated context-based instructional activities were subjected to pilot testing and full implementation for one grading period among 29 grade 7 students in a laboratory science high school. The study aimed to determine its effectiveness in terms of students' conceptual understanding and students' engagement.

Students' conceptual understanding is the factual or procedural knowledge that is significantly associated with engagement. The facilitation of gains in conceptual understanding was done through researcher made pre-test-post-test and structured scientific journal writing. Students' Engagement is the active involvement of students in the learning activity in three dimensions: cognitive, emotional, and behavioural. It was measured using a validated activity-level seven items survey for students' cognitive and emotional engagement. Four items used a five-point Likert scale, with questions asking students to rate their engagement experience from "not at all" to "very much." The remaining three items used a seven-point semantic differential response scale, with the positive end indicating an aspect of engagement and the negative end indicating disengagement. Appleton et al., (2006), argue that the most valid measure of cognitive and emotional engagement is self-report as these aspects of engagement focus heavily on students' perceptions of their experience (see also Fredricks & McColskey, 2012). Additionally, a validated process observer's checklist with seven items was used to quantity the behavioural engagement of students by three process observers/science teachers. The measurement of behavioural engagement is more straightforward as compared with emotional and cognitive engagement because behavioural patterns can be observed, defined, and interpreted. A video recording was also used for verification purposes.

Summary of Results

The developed context-based instructional activities were evaluated by three content experts in two parts. The validation instrument was composed of two parts: Part A focuses on 25-item criteria in terms of Format and Design, Objectives, Content, Organization and Presentation, and Language Style. Part B is the list of indicators for context based instructional activities. The validators were asked to rate the developed contextualized instructional activities using a rating scale in which each criterion was measured on a 5 – point Likert Scale. Accordingly, the CBIA obtained a mean score of 4.25 or very acceptable rating meaning all the indicators for each items were met. The researcher made numerous revisions based on the comments and suggestions of validators in terms of content, procedures, illustrations, formatting, and diagrams of each instructional activity. Other related instruments such as researcher made multiple choice test items; 7-item activity level student engagement survey; process observer's checklist, and format for structured scientific journal were subjected to validation and the items shows relevance to the study to a great extent.

Upon the approval of campus administrator and consent of students and parents, the researcher proceed to pilot testing and then the full implementation to determine the effectiveness of CBIA using inquiry-based learning in terms of conceptual understanding and student engagement. The results show that there was a significant average difference between pre-test and post-test scores. The difference in the scores showed that CBIA using inquiry-based learning was effective in enhancing the conceptual understanding of students. It was determined that post test scores were averagely 29.62 points higher than pre-test scores. Aside from quantitative measures, a thematic analysis was done on the responses made by the students in their scientific journal. It was found that performing the CBIA using the 7E instructional model for inquiry-based learning improve the conceptual knowledge of student participants for they were able discover factual knowledge, recognize relevant scientific concepts, and make connections of conceptual ideas to other areas. Additionally, two influential conditions for the enhancement of conceptual understanding were noted from students remarks such as gaining clarity on misconceptions and delivery of instruction. Context-based instructional activities were explored by the students through the provided instructions so there is an active involvement in the learning process, Papadouris and Constantinou (2009) explained the accumulation of experiences through active exploration, investigation, and interpretation provided a basis for the development of conceptual understanding.

Student engagement is a student's cognitive, behavioural, and emotional investment in learning (Henrie, 2016). This study determined the effectiveness CBIA using inquiry-based learning in the three mentioned aspects. Larson (2011) revealed that engagement was significantly associated with conceptual understanding and there was a moderate statistically significant positive relationship between conceptual understanding and engagement. However, the extent of association in three domains was not explicated.

Cognitive engagement. Results show that CBIA using the 7E instructional model for inquiry-based learning is effective in engaging students cognitively based on the computed mean scores for each indicator signifying that they were concentrated, active, and focused in the learning process. Furthermore, the decoded themes from their journal were (1) preference for challenge (completing the task persistently, dividing the assigned task to members and requiring group participation); (2) effort directed toward learning (sharing of ideas in performing the activity, analysing the content of activity, and note taking of details); (3) motivation to learn (focusing actively in completing the task, enjoying the teamwork, finding interest in executing the procedure, and (4) learning goals (aiming high scores and refining answers to arrive with correct output). The decoded themes from statements of students implies that when there is persistence, division of academic task, and collaboration, students become more cognitively engage because they think together as a group.

Emotional engagement. The computed mean scores for the emotional engagement indicators show that student participants experience in performing the CBIA were exciting, enjoyable and very much interesting. To validate the emotional engagement of student participants, they were asked to write what they felt after the learning activity in their journal. Accordingly, satisfaction on the learning experience was found based on the feelings learners had such as eagerness to answer teacher's questions, interest and appreciation of the topic, happiness upon completion of activity, success and accomplishment due to teamwork, and excitement on the performance. Affective conditions associated to the learning experience were also decoded to few student participants such as stress and exhaustion in group activities, confusion and difficulty in completing the task, and nervousness due to performance evaluation.

Behavioral engagement. The three process observers rated the overall behavioural engagement indicators very high. This finding implies that students made active responses to the learning tasks presented. Very high interpretations can directly be related with the way CBIA was designed and can also be attributed to teacher's classroom routines in implementing the CBIA. Across the eight CBIA performed by the students, an active participation of student-student interaction through cooperation in group discussion and participation in group performance were decoded from the statements in the student journals. In addition, involvement in student-teacher interaction was explicated by interactive question-answer between students and teacher as well as constant checking of students' understanding. These findings highlight the important role of student interaction with peers and teacher in understanding student behavioural engagement.

Limitations

This study has certain limitations in the use of 7E instructional model of inquiry-based learning for context-based instructional activities specifically in the evaluation phase. The study only includes multiple choice type tests in assessing the conceptual understanding of the students. Additionally, the CBIA was implemented in homogenous class and the instructional activities were carried out into small groups since there was a small available sample size of student participants. The effectiveness of CBIA method used in determining of student engagement in cognitive, emotional, and behavioural was measured quantitatively and qualitatively but student engagement is not consistent; it varies from time to time depending on the context of situation so another method can be considered to establish more justifiable results minimizing self-report data.

Conclusion

The following conclusions were drawn from the findings of this research study:

The Context-Based Instructional Activities in Grade 7 Biology using 7E Instructional Model of Inquiry-based Learning were developed in four phases. It was validated by three content experts obtaining an acceptable rating in terms of objectives, content, organization and presentation, language and style and indicators for contextualization.

The CBIA using inquiry-based learning was found to have an effect in enhancing students' conceptual understanding based on the significant average difference between pre-test and post-test scores. Qualitatively, student participants were able to discover factual knowledge, recognize relevant scientific concepts, and make connections of conceptual ideas to other areas which lead to the improvement of conceptual knowledge. Gaining clarity on misconceptions and delivery of instruction were the two influential conditions for the enhancement of conceptual understanding.

The CBIA using inquiry-based learning was found have an effect in three aspects of student engagement according to the interpreted mean scores for each indicator of cognitive, emotional, and behavioural engagement. The cognitive traits possessed by the student participants were preference for challenge, effort directed toward learning, motivation to learn, and learning goals. The emotional attributes were generalized as satisfaction on the learning experience. Other affective conditions related to learning experience were also decoded. Behaviourally, student participants demonstrated active participation in student-student interaction and involvement in student-teacher interaction.

Recommendations

In view of the findings and conclusions of this study, the following are recommended:

1. use the developed and validated context-based instructional activities as supplementary instructional material in Grade 7 Science in teaching biological concepts;
2. determine the effectiveness of context-based instructional activities in other aspects of student learning;
3. evaluate the teachers experience in using context-based instructional activities through 7E instructional model in teaching Grade 7 Biology for further development, and
4. integrate the context-based instructional activities into multimedia software or other computer applications.

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APPENDICES

Appendix A
Informed Consent Form

I, ____, being with the age of 12 years old hereby consent to participate/be a respondent in this project titled: Context-Based Instructional Activities in Grade 7 Biology Using Inquiry Based Learning.

I am aware that I should keep a copy of the Letter of Introduction and Consent Form for future reference;

I understand that:

I may not directly benefit from taking part in this research.

I am free to withdraw from the participation in this research at any time and I am free to refuse to answer particular questions.

While the information gained in this study will be published as explained, I will not be identified, and individual information will remain confidential.

Participant's signature: _____________________________ Date: ___________________

I certify that I have explained the purpose of research to the participants and consider that she/he understands what is involved and liberally consents to participate.

SARAH MORALES PASCUA
Researcher

____
Date

Appendix B
Parental Consent Form

I, ___________________________________ hereby consent ______________________________

(Name of Guardian/Parent) (Name of Son/daughter)

to participate in the study titled "Context-Based Instructional Activities in Grade 7 Biology Using Inquiry Based Learning."

I am aware that I should keep a copy of this Parental Consent Form and Assent Form for Minors for future reference;

I understand that:

My son/daughter may not directly benefit from taking part in this research.

My son/daughter is free to withdraw from the participation in this research at any time and may refuse to answer particular questions.

While the information gained in this study will be published as explained, my son/daughter will not be identified, and individual information will remain confidential.

Participant's Signature: _____________________________ Date: ___________________

Appendix C
Assent Form For Minors

Dear Student,

My name is Sarah M. Pascua. I am a graduate student from Philippine Normal University, with the degree Master of Arts in Science Education in Biology. I am asking if you would like to take part in a research study titled "Context-based Instructional Activities in Grade 7 Biology using Inquiry based Learning," which is about determining the effectiveness of the developed and validated context-based instructional activities in terms of student conceptual understanding and student engagement.

Your participation in this research will involve performing the validated context-based instructional activities under the facilitation of the researcher. You will be asked to answer two-tier multiple choice test items and write a reflective journal with guided questions per lesson as part of measuring student conceptual understanding and with regards in measuring student engagement a process observer will be around during the session. Your involvement in this research is completely voluntary. Your decision to join or not join has no impact on your grade in this class.

Please talk this over with your parents before you decide whether to participate or not. I will asked your parents to give their permission for you to take part in this study but even if your parents said agreed, you can still choose not to take part in the study, and that will be fine.

Your individual answers will not be linked with your name in any reports of the data. You may read the Informed Consent for further clarifications. All information collected for this research will be kept strictly confidential and anonymous (to the extent allowed by law) in any written report.

If you become uncomfortable at any time you are free to not answer discomforting questions or withdraw from the study. While no direct benefit to you, your participation in this research will help you make connections between scientific knowledge and its applications to real life.

You can ask any questions that you have about this study. If you have a question later that you did not think of now, you can call me at +639355339274.

Signing your name at the bottom means that you agree to be in this study. You and your parents will be given a copy of this form after you have signed it.

______________________________ _______________
Name and Signature of Child Date

Appendix D
Sample Accomplished Informed Consent Form

Informed Consent Form

I, ______________________ being with the age of 12 years old hereby
Name of Participant
consent to participate/be a respondent in the thesis titled: Context-Based Instructional Activities in Grade 7 Biology using Inquiry Based Learning.

I am aware that I should keep a copy of the assent form for minors for future reference.

I understand that:

I may not directly benefit from taking part in this research.
I am free to withdraw from the participation in this research at any time and I am free to refuse to answer particular questions.
While the information gained in this study will be published as explained, I will not be identified, and individual information will remain confidential.

Participant's signature: ______________________ Date: 08.21.19

Parent's signature: ______________________ Date: 08.21.19

I certify that I have explained the purpose of research to the participants and consider that she/he understands what is involved and liberally consents to participate.

SARAH MORALES PASCUA
Researcher

08/19/2019
Date

Appendix E
Sample Accomplished Assent Form

Assent Form for Minors

Dear Student,

My name is Sarah M. Pascua, I am a graduate student from Philippine Normal University taking up Master of Arts in Science Education with specialization in Biology. I am asking if you would like to take part in a research study entitled "Context-based Instructional Activities in Grade 7 Biology using Inquiry based Learning," which is about determining the effectiveness of the developed and validated instructional activities in terms of student conceptual understanding and student engagement.

Your participation in this research will involve performing the eight context-based instructional activities, answering the validated multiple choice test items and writing of reflective journal with guided questions. Your involvement in this research is completely voluntary.

Your individual answers will not be linked with your name in any reports of the data. You may read the Informed Consent for further clarifications. All information collected for this research will be kept strictly confidential and anonymous (to the extent allowed by law) in any written report.

If you become uncomfortable at any time you are free to not answer discomforting questions or withdraw from the study. While no direct benefit to you, your participation in this research will help you make connections between scientific knowledge and its applications to real life.

You can ask any questions that you have about this study. If you have a question later that you did not think of now, you can call me at +639355339274.

Signing your name at the bottom means that you agree to be in this study. You and your parents will be given a copy of this form after you have signed it.

Name and Signature of Child

08/21/19
Date

Appendix F
Letter of Request to the Office of Campus Administrator

August 13, 2019

Campus Administrator
Cavite State University-Naic

Sir:

Greetings!

I am a graduate student from Philippine Normal University taking up Master of Arts in Science Education with specialization in Biology. I am now on the final stage of my thesis titled **"Context-based Instructional Activities in Grade 7 Biology using Inquiry based Learning."** In this regard, I am requesting your good office to allow the pilot-test of the developed and validated instructional activities among the Grade 7 students of Laboratory Science High School during their Science subject this First Quarter. This undertaking aims to determine the effectiveness of the instructional activities in terms of student conceptual understanding and student engagement.

Attached here are assent form for minors, informed consent form and parental consent form to be distributed to students upon your approval.

I am hoping for your positive response regarding this matter.

Thank you very much and God bless.

Sincerely,

SARAH M. PASCUA
Researcher

Noted:

JOSEPHINE E. TONDO, PhD
Thesis Adviser

Recommending Approval:

Principal, Laboratory Science High School

Approved:

Campus Administrator

Appendix G
Validation Instrument for
Context Based Instructional Activities

To the Validator:

Name of the Validator	
Highest Educational Attainment	
Field of Specialization	
Affiliation	

Attached herewith is the validation instrument modified from Santos (2013) for the developed ***Context-based Instructional Activities in Grade 7 Biology using Inquiry-based Learning***. It is composed of two parts: Part A has 20 items which are arranged in terms of Objectives, Content, Organization and Presentation, and Language/Style while Part B is a set of indicators for contextualization. Kindly rate the following using the rating scale below by placing a check (/) in the appropriate space. Your answer will be kept in strict confidentially.

5 – Very Acceptable
4 – Acceptable
3 – Moderately Acceptable
2 – Fairly Acceptable
1 – Not acceptable

Your time and effort in extending your expertise to the undersigned will be greatly appreciated.

Respectfully yours,

SARAH M. PASCUA
Researcher

Part A
1. Validation of Objectives

Items	1	2	3	4	5	Remarks
1. The objectives take into account the needs of slow learners.						
2. The objectives are measurable and attainable.						
3. The objectives are stated in behavioural terms.						
4. The objectives of each instructional activities support the attainment of the learning competencies.						
5. The objectives are relevant to the topic of each instructional activities.						

2. Validation of Content

Items	1	2	3	4	5	Remarks
1. The content is adequate to the requirements of the objectives identified.						
2. The content of the developed instructional activities is suited to the needs of the students.						
3. The content is within the scope of the learning competencies of Biological Concepts of Grade 7 Science of K to 12 program.						
4. The content contains sufficient number of exercises.						
5. The illustrations are clearly and correctly laid out.						

3. Validation of Organization and Presentation

Items	1	2	3	4	5	Remarks
1. The topics are organized, arranged logically and clearly presented.						
2. The content, procedures, and illustrations in each instructional activities are clear, precise and simple in which Grade 7 students can follow easily.						
3. The sequence of the topics link the gap of the learners' knowledge.						
4. The content contains activities suitable to students' different weaknesses of problems.						
5. The icons or pictures are presented to develop critical thinking on biological concepts creatively.						

4. Validation of Language and Style

Items	1	2	3	4	5	Remarks
1. The modules use appropriate style in order to promote mastery on the teacher's part.						
2. The language used in the illustrations is simple and easy to understand.						
3. The language used in the instructions are adequate enough to explain in her own words the answer to the developmental questions in every activity.						
4. The writing style of each instructional activity is enjoyable to read.						
5. The icons and pictures are to motivate interest in describing the topics and encourage the teachers in facilitating the discussions.						

Part B. Indicators of Contextualization

Items	1	2	3	4	5	Remarks
1. begins activities with what students already know from home, community, and school						
2. designs instructional activities that are meaningful to students in terms of local community and knowledge.						
3. assists students to connect and apply their learning to home and community.						
4. plans jointly with students to connect and apply their learning to home and community						
5. varies activities to include students' preferences, from collective and cooperative to individual and competitive.						
6. employs strategies in the lesson procedure show the integration of contextualization in instruction						
7. integrates contextualization to make performance tasks more relevant for learners						

*** Adopted with permission from Natividad, M. (2013). Development and Validation of Contextualized Modules For Grade 7 Science Teachers. Manila, Philippines: Philippine Normal University.

Overall Rating ________________________

Additional Comments/Recommendations:

____
____
____
____
____
____
____
____
____

____

Signature over Printed Name

Appendix H
Validation Results of Context-Based Instructional Activities

Part A.						
1. Validation of Objectives	V_1	V_2	V_3	**Mean**	**SD**	**Interpretation**
Items						
1. The objectives take into account the needs of slow learners.	5	4	5	4.67	0.58	Very Acceptable
2. The objectives are measurable and attainable.	5	5	4	4.67	0.58	Very Acceptable
3. The objectives are stated in behavioural terms.	4	4	4	4.00	0.00	Acceptable
4. The objectives of each instructional activities support the attainment of the learning competencies.	4	5	5	4.67	0.58	Very Acceptable
5. The objectives are relevant to the topic of each instructional activities.	5	5	5	5.00	0.00	Very Acceptable
				4.60	**0.32**	**Very Acceptable**
2. Validation of Content						
Items	V_1	V_2	V_3	**Mean**	**SD**	**Interpretation**
1. The content is adequate to the requirements of the objectives identified.	5	4	4	4.33	0.58	Acceptable
2. The content of the developed instructional activities is suited to the needs of the students.	4	4	4	4.00	0.00	Acceptable
3. The content is within the scope of the learning competencies of Biological Concepts of Grade 7 Science of K to 12	5	4	4	4.33	0.58	Acceptable
4. The content contains sufficient number of exercises.	4	5	4	4.33	0.58	Acceptable
5. The illustrations are clearly and correctly laid out.	4	3	4	3.67	0.58	Acceptable
				4.13	**0.26**	**Acceptable**
3. Validation of Organization and Presentation						
Items	V_1	V_2	V_3	**Mean**	**SD**	**Interpretation**
1. The topics are organized, arranged logically and clearly presented.	5	4	5	4.67	0.58	Very Acceptable
2. The content, procedures, and illustrations in each instructional activities are clear, precise and simple in which Grade 7 science teachers can follow easily.	4	3	3	3.33	0.58	Acceptable
3. The sequence of the topics link the gap of the learners' knowledge.	4	3	4	3.67	0.58	Acceptable
4. The content contains activities suitable to students' different weaknesses of problems.	4	4	4	4.00	0.00	Acceptable
5. The icons or pictures are presented to develop critical thinking on biological concepts creatively.	4	4	4	4.00	0.00	Acceptable
				3.93	**0.32**	**Acceptable**

4. Validation of Language and Style						
Items	V_1	V_2	V_3	**Mean**	**SD**	**Interpretation**
1. The modules use appropriate style in order to promote mastery on the teacher's part.	4	5	4	4.33	0.58	Acceptable
2. The language used in the illustrations is simple and easy to understand.	5	5	3	4.33	1.15	Acceptable
3. The language used in the instructions are adequate enough to explain in her own words the answer to the developmental questions in every activity.	5	5	3	4.33	1.15	Acceptable
4. The writing style of each instructional activity is enjoyable to read.	4	4	3	3.67	0.58	Acceptable
5. The icons and pictures are to motivate interest in describing the topics and encourage the teachers in facilitating the discussions.	4	4	4	4.00	0.00	Acceptable
				4.13	**0.48**	**Acceptable**
Part B. Indicators of Contextualization	V_1	V_2	V_3	**Mean**	**SD**	**Interpretation**
1. begins activities with what students already know from home, community, and school	4	5	5	4.67	0.58	Very Acceptable
2. designs instructional activities that are meaningful to students in terms of local community and knowledge.	5	4	4	4.33	0.58	Acceptable
3. assists students to connect and apply their learning to home and community.	5	3	4	4.00	1.00	Acceptable
4. plans jointly with students to connect and apply their learning to home and community	4	4	4	4.00	0.00	Acceptable
5. varies activities to include students' preferences, from collective and cooperative to individual and competitive.	4	4	4	4.00	0.00	Acceptable
6. strategies employed in the lesson procedure show the integration of contextualization in instruction	5	4	4	4.33	0.58	Acceptable
7. performance tasks integrate contextualization to make it more relevant for learners	5	4	4	4.33	0.58	Acceptable
				4.24	**0.36**	**Acceptable**
			General Rating:	**4.25**	**0.33**	**Very Acceptable**

Appendix I
Validation Instrument for Student Engagement Indicators

Name of the Validator	
Highest Educational Attainment	
Field of Specialization	
Affiliation	
Present Position/Rank	

To the Validator:

Following are researcher-made instruments: (1) cognitive and emotional engagement scale and (2) process observer's behavioral engagement checklist. Kindly validate these instruments to determine their relevance/applicability with regards to measuring the student engagement as one of my variables in investigating the effectiveness of my validated *Context-based Instructional Activities in Grade 7 Biology using Inquiry based Learning*. Please rate each item by checking the column of the number that represents the scale with their numeric equivalent as follows:

Numerical Equivalent	Code	Verbal Interpretation	Description
3	HR	Highly Relevant	The item* is well-written and shows relevance to the study to a great extent.
2	FR	Fairly Relevant	The item* is relevant to the study to some extent.
1	IR	Irrelevant	The item* shows no relevance to the study.
0	NR	Needs Revision	The item* contains inappropriate content and ideas.

INSTRUMENT: <u>Emotional and Cognitive Engagement Scale</u>

	SCALE ITEMS	3	2	1	0	REMARKS
<u>Emotional Engagement Scale</u>						
1	Did you enjoy this activity?					
2	Was this activity interesting?					
3	Did you wish you had been doing something else?					
4	How can you describe your mood during this activity? *Excited to Bored					

Cognitive Engagement Scale						
1	How well were you concentrating?					
2	Was this activity interesting?					
3	Did you wish you had been doing something else?					
4	How can you describe your mood during this activity? *Passive to Active					
5	How can you describe your mood during this activity? *Focused to Distracted					

INSTRUMENT: Process Observer's Behavioral Engagement Checklist

CHECKLIST ITEMS		**3**	**2**	**1**	**0**	**REMARKS**
In this activity, the students are able to…						
1	exhibit postures that indicate they are paying attention to the teacher and or/other students.					
2	focused on the learning activity with minimum disruptions.					
3	express thoughtful ideas and questions relevant and appropriate to learning.					
4	exhibit confidence and can initiate and complete a task with limited coaching and can work individually/group.					
5	feel comfortable seeking help and asking questions.					
6	describe the activity being done during class					
7	find the work challenging and connected to learning					

SIGNATURE OF VALIDATOR: ________________________________

Student Engagement Survey Items

Direction: After performing the activity titled __________________________________ , honestly evaluate your involvement by encircling the number that corresponds to your experience.

Emotional Engagement Scale

1. Did you enjoy this activity? Not at all 1 2 3 4 5 Very Much
2. Was this activity interesting? Not at all 1 2 3 4 5 Very Much
3. Did you wish you had been doing something else? Not at all 1 2 3 4 5 Very Much
4. Describe your mood during this activity: Excited 1 2 3 (Neither 4) 5 6 7 Bored

Cognitive Engagement Scale

5. How well were you concentrating? Not at all 1 2 3 4 5 Very Much
6. Describe your mood during this activity: Passive 1 2 3 (Neither 4) 5 6 7 Active
7. Describe your mood during this activity: Focused 1 2 3 (Neither 4) 5 6 7 Distracted

Process Observer's Behavioral Engagement Checklist

Direction: Please tick the number that corresponds to your assessment on the level of behavioral engagement of students in performing the given context-based instructional activity.
Please assess using the following scales:

Scale	Interpretation	Description
4	Very High	Statement is highly evident
3	High	Statement is evident
2	Low	Statement is somehow evident
1	Very Low	Statement is not that evident

Observations	1	2	3	4
Students exhibit postures that indicate they are paying attention to the teacher and or/other students.				
All students are focused on the learning activity with minimum disruptions.				
Students express thoughtful ideas and questions relevant and appropriate to learning.				
Students exhibit confidence and can initiate and complete a task with limited coaching and can work individually or in a group.				
Students feel comfortable seeking help and asking questions.				
Students describe the activity being done during class.				
Students find the work challenging and connected to learning.				

Appendix J
Structured Scientific Journal

My Observations

During the activity entitled "From Cell to Biosphere: Anchoring Biological Terms"

I observed the following:

Lesson Objectives:

1. describe the levels of organization in biological systems from cells to the biosphere;
2. explain the manner in which cells are organized into cells, tissues, organs, and organ systems, and organisms, and
3. create visual examples of basic biology vocabulary from cells to the biosphere.

My dialogue with others

During this lesson, I had the following conversations with my teacher/ group members:

My main conclusions from this lesson

At the end of this lesson, I feel that

Appendix K
Validation Results of Student Engagement Indicators

Indicators	Exp 1	Exp 2	Exp 3	Mean	SD	Interpretation
Emotional Engagement						
EE1	3	3	3	3	0	Highly Relevant
EE2	3	3	3	3	0	Highly Relevant
EE3	3	3	3	3	0	Highly Relevant
EE4	3	3	3	3	0	Highly Relevant
Cognitive Engagement						
CE1	3	3	3	3	0	Highly Relevant
CE2	3	3	3	3	0	Highly Relevant
CE3	3	3	3	3	0	Highly Relevant
Process Observer's Behavioral Engagement Checklist						
Checklist Item	**Exp 1**	**Exp 2**	**Exp 3**	**Mean**	**SD**	**Interpretation**
O1	3	3	3	3	0	Highly Relevant
O2	3	3	3	3	0	Highly Relevant
O3	3	3	2	2.67	0.577	Highly Relevant
O4	3	3	3	3	0	Highly Relevant
O5	3	3	3	3	0	Highly Relevant
O6	3	3	3	3	0	Highly Relevant
O7	3	3	3	3	0	Highly Relevant

Appendix L
Student Engagement Scale

Emotional Engagement Scale

Item 1: Did you enjoy this activity?	
Range	Interpretation
1.0- 1.80	Not at all
1.81-2.60	Neither enjoy nor not enjoy
2.61- 3.40	Slightly enjoy
3.41- 4.20	Enjoy
4.21- 5.00	Very much enjoy

Item 2: 1. Was this activity interesting?	
Range	Interpretation
1.0- 1.80	Not at all
1.81-2.60	Neither interesting nor uninteresting
2.61- 3.40	Somewhat interesting
3.41- 4.20	Interesting
4.21- 5.00	Very much interesting

Item 3: Did you wish you had been doing something else?	
Range	Interpretation
1.0- 1.80	Not at all
1.81-2.60	To a small extent
2.61- 3.40	To some extent
3.41- 4.20	To a moderate extent
4.21- 5.00	Very much

Item 4: Describe your mood during this activity?	
Range	Interpretation
1—3	Excited
4	Neither excited nor bored
5-7	Bored

Cognitive Engagement Scale

Item 5: How well were you concentrating?	
Range	Interpretation
1.0- 1.80	Not at all
1.81-2.60	Slightly concentrated
2.61- 3.40	Moderately concentrated
3.41- 4.20	Concentrated
4.21- 5.00	Very much concentrate

Item 6: Describe your mood during this activity	
Range	Interpretation
1-3	Passive
4	Neither Passive nor Active
5-7	Active

Item 7: Describe your mood during the activity	
Range	Interpretation
1-3	Focused
4	Neither focused nor distracted
5-7	Active

Behavioral Engagement Scale

Range	Interpretation
3.27 – 4.00	Very High
2.52 – 3.26	High
1.76 – 2.51	Low
1.00 – 1.75	Very Low

Appendix M
Validation Tool in the Multiple Choice Test Items

Name of the Validator	
Field of Specialization	
Affiliation	

To the Validator:

Attached herewith is a researcher-made **multiple-choice questionnaire** for my research study entitled ***Context-based Instructional Activities for Grade 7 Biology using Inquiry-based Learning***. Kindly validate this instrument to determine its relevance/applicability with regards to the main concern of this by checking the column of the number that represents the scale with their numeric equivalent as follows:

Kindly indicate your assessment in each of the following questions by following the rubric below.

Numerical Equivalent	Code	Verbal Interpretation	Description
3	**R**	**Relevant**	The items are well written and relevant.
2	**FR**	**Fairly Relevant**	The items are relevant to some extent.
1	**IR**	**Irrelevant**	The items show no relevance.
0	**NR**	**Needs Revision**	Have incorrect/irrelevant ideas.

Your time and effort in extending your expertise to the undersigned will be greatly appreciated.

Respectfully yours,

SARAH M. PASCUA
Researcher

Sample Draft of Multiple Choice Test Items

	QUESTIONS	3	2	1	0	REMARKS
1.	Which of the following is the basic unit of structure and function in all living things? A. Cell C. Organ B. Tissue D. Organ System					
2.	Which among the following is the smallest level of organization? A. Community C. Organism B. Population D. Organ system					
3.	Aurora is studying the levels of structural organization of an animal‟s body. Which level would describe a dog‟s eye? A. organ C. organism B. tissue D. organ system					
4.	Cells that are similar in structure and function join together to form ___________ A. Cell C. Organ B. Tissue D. Organ System					
5.	The food that you eat travels from your mouth, down your esophagus, into your stomach, and through your small and large intestines before your body rids itself of solid waste. As the food passes through your body, it is digested, and you get important nutrients from the food. Which of the following is the correct term used to describe a group of body parts working together to perform a specific function? A. Organism C. Organ B. Tissue D. Organ System					
6.	All of the following are true except ____________ A. Skin is an organ. B. Tissues are made up of organs. C. Each organ is made up of its own kind of tissue. D. Tissues are made up of cells.					
7.	What is formed by a group of cells and tissues that work together to carry out a specific function? A. organism C. organ system B. organelle D. organ					
8.	Which letter correctly identifies the 5 levels of organization from simplest to the most complex? A. person, circulatory system, heart, cardiac muscle tissue, muscle cell B. muscle cell, cardiac muscle tissue, heart, circulatory system, person C. muscle cell, heart, cardiac muscle tissue, circulatory system, person D. person, muscle cell, heart, circulatory system, cardiac muscle tissue					
9.	Life is organized in a hierarchical fashion. Which of the following sequences illustrates that hierarchy as it goes upward? A. ecosystem, population, organ system, cell, community, molecule,					

	organ, organism B. cell, molecule, organ system, organ, population, organism, ecosystem, community C. organism, organ system, population, organ, community, cell ecosystem, molecule D. molecule, cell, organ, organ system, organism, population, community, ecosystem					
10.	Each part of an organ system plays a specific function. Which of the following structures does not match its function? A. Eyes: Sight C. Heart: Circulation B. Kidneys: Respiration D. Stomach: Digestion					
11.	Which cell feature holds the genetic information (DNA) of the cell? A. lysosome C. ribosome B. nucleus D. mitochondria					
12.	Which of the following organelles converts the energy of the sun into sugar? A. cell membrane C. cytoplasm B. chloroplast D. nucleus					
13.	Which phrase best describes the function of mitochondria? A. located in the cytoplasm B. bacteria-sized organelle C. converts energy for cell use D. contains a folded inner membrane					
14.	What monitors and controls entry of materials into and out of the cell? A. vacuole C. ribosome B. chloroplast D. cell membrane					
15.	The organelle that creates proteins and can float within the cytoplasm is called A. cytoplasm C. nucleus B. ribosome D. mitochondria					
16.	Which structures are present in animal and plant cells? A. Vacuole, nucleus and cell membrane B. Nucleus, cell membrane, cytoplasm C. Nucleus, cell wall, cytoplasm D. Cell membrane, chloroplast, cell wall					
17.	What is the name of the jelly-like fluid that fills the cells and suspends the organelles? A. chloroplast C. cytoplasm B. nucleus D. lysosome					
18.	What is the main function of the cell wall? A. Protect and provide support for the cell B. Build proteins C. Convert solar energy to chemical energy D. Transport materials inside the cell					
19.	Which cell part helps transport proteins? A. cell wall C. lysosome B. endoplasmic reticulum D. vacuole					
20.	In what plant cell structure is water stored? A. chloroplast C. vacuole B. cell wall D. cytoplasm					

21.	What characteristic differentiates bacteria from plants aside from their small size? A. They are multicellular and eukaryotic. B. They have waxy layer that helps in drying out. C. They capture the energy of sunlight and use carbon dioxide from the air to make their own food. D. They are useful to nature, man, and life on earth, though some of them can cause diseases to humans.					
22.	Fungi cannot make their own food thus they obtain absorb nutrients from plant and animal matter, which may be living or dead. What is the effect of their food getting activities? A. Decomposition of living things B. Production of starch C. Trapping of solar energy D. Release of oxygen					
23.	Which of the following is NOT a characteristic of all living things? A. All living things reproduce. B. All living things sense and respond to change. C. All living things obtain water by drinking. D. All living things use energy.					
24.	What important ecological role do bacteria play? A. They return basic chemicals to the environment. B. They slow down food spoilage. C. They kill harmful bacteria. D. They produce vitamins.					
25.	Every year people are hospitalized with bacterial infections. These infections can result in removal of medical illness of the infected area to save the person from other dreaded conditions. The persistent use of what modern technology has caused the rise in resistant bacteria? A. vaccines C. fertilizers B. antibiotics D. solar panels					
26.	Bacteria are classified by which of the following shapes? A. rod, cone, spiral B. rod, sphere, spiral C. rod, sphere, cone D. sphere, cone, spiral					
27.	Algae are found in all of the following places except A. oceans C. lakes and streams B. soils D. associates with fungi					
28.	The following are the characteristics of protist except ______ A. Some protists are microscopic while others are macroscopic B. Protist have well defined nucleus and a cell membrane C. Protists vary greatly in how they obtain food D. Protist can can break down food sources through fermentation					
29.	Bacteria are known to cause disease; which of the following diseases is not brought by a certain type of bacteria? A. Anthrax C. Tuberculosis B. Stomach ulcer D. Thrush					
30.	Which disease is caused by a protozoan carried by mosquitoes? A. Malaria C. Athlete‟s foot B. Measles D. Potato blight					

Appendix N
Table of Specifications of MCT

Topic	Objectives	No. of days taught	Remembering	Understanding	Applying	Analysing	Evaluating	Creating	Total No. of items	% of items
Levels of Biological Organization	• describe the levels of organization in biological systems from cells to the biosphere; • explain the manner in which cells are organized into cells, tissues, organs, and organ systems, and organisms,	2	2	4	4				10	14.29
Plant and Animal Cells	• describe cellular organelles and their functions with the use of analogies • differentiate plant cells from animal cells	2	5	4	1				10	14.29
Fungi, Protists, and Bacteria	• describe life forms other than plants and animals using magnifying lens; • identify the roles of microorganisms in the natural world and how they are used by humans for food production and other processes.	2	2	2	4	2			10	14.29
Asexual and Sexual Reproduction	• compare asexual and sexual reproduction; • explain the different types of sexual and asexual reproduction.	2		3	4	3			10	14.29

Components of an ecosystem	• identify the components of the ecosystem; • describe how organisms interact with each other and with their environment.	2	1	5	3	1			10	14.29
Ecological relationships	• describe the different ecological relationships in the ecosystem; • describe how common patterns of relationships among populations of organisms are affected by symbiosis.	2		3	5	2			10	14.29
Transfer of energy through trophic levels	• describe producers, consumers, and decomposers; • explain how energy flows through an ecosystem and how an environmental change affects a habitat.	2	2	2	4	2			10	14.29
TOTAL		**14**							**70**	**100**
TOTAL NO. OF ITEMS			**12**	**23**	**25**	**10**				

Appendix O
Sample Validation Results of the Multiple Choice Test Items

	QUESTIONS	V1	V2	V3	Mean	SD	Interpreta-tion
1.	Which of the following is the basic unit of structure and function in all living things? A. Cell C. Organ B. Tissue D. Organ System	3	3	3	3.00	0.00	Relevant
2.	Which among the following is the smallest level of organization? A. Community C. Organism B. Population D. Organ system	3	3	3	3.00	0.00	Relevan t
3.	Aurora is studying the levels of structural organization of an animal‟s body. Which level would describe a dog‟s eye? A. organ C. organism B. tissue D. organ system	3	3	3	3.00	0.00	Relevant
4.	Cells that are similar in structure and function join together to form __________ A. Cell C. Organ B. Tissue D. Organ System	3	2	3	2.67	0.58	Relevan t
5.	The food that you eat travels from your mouth, down your esophagus, into your stomach, and through your small and large intestines before your body rids itself of solid waste. As the food passes through your body, it is digested, and you get important nutrients from the food. Which of the following is the correct term used to describe a group of body parts working together to perform a specific function? A. Organism C. Organ B. Tissue D. Organ System	3	3	3	3.00	0.00	Relevant
6.	All of the following are true except ___________ A. Skin is an organ. B. Tissues are made up of organs. C. Each organ is made up of its own kind of tissue. D. Tissues are made up of cells.	3	2	2	2.33	0.58	Fairly Relevant
7.	What is formed by a group of cells and tissues that work together to carry out a specific function? A. organism C. organ system B. organelle D. organ	3	3	3	3.00	0.00	Relevant
8.	Which letter correctly identifies the 5 levels of organization from simplest to the most complex? A. person, circulatory system, heart, cardiac muscle tissue, muscle cell B. muscle cell, cardiac muscle tissue, heart, circulatory system, person C. muscle cell, heart, cardiac muscle tissue, circulatory system, person D. person, muscle cell, heart, circulatory system, cardiac muscle tissue	3	3	2	2.67	0.58	Relevant

9.	Life is organized in a hierarchical fashion. Which of the following sequences illustrates that hierarchy as it goes upward? A. ecosystem, population, organ system, cell, community, molecule, organ, organism B. cell, molecule, organ system, organ, population, organism, ecosystem, community C. organism, organ system, population, organ, community, cell ecosystem, molecule D. molecule, cell, organ, organ system, organism, population, community, ecosystem	3	3	3	3.00	0.00	Relevant
10.	Each part of an organ system plays a specific function. Which of the following structures does not match its function? A. Eyes: Sight B. Kidneys: Respiration C. Heart: Circulation D. Stomach: Digestion	3	3	3	3.00	0.00	Relevant
11.	Which cell feature holds the genetic information (DNA) of the cell? A. lysosome C. ribosome B. nucleus D. mitochondria	3	3	3	3.00	0.00	Relevant
12.	Which of the following organelles converts the energy of the sun into sugar? A. cell membrane C. cytoplasm B. chloroplast D. nucleus	3	3	3	3.00	0.00	Relevant
13.	Which phrase best describes the function of mitochondria? A. located in the cytoplasm B. bacteria-sized organelle C. converts energy for cell use D. contains a folded inner membrane	3	3	3	3.00	0.00	Relevant
14.	What monitors and controls entry of materials into and out of the cell? A. vacuole C. ribosome B. chloroplast D. cell membrane	3	3	3	3.00	0.00	Relevant
15.	The organelle that creates proteins and can float within the cytoplasm is called _____ A. cytoplasm C. nucleus B. ribosome D. mitochondria	3	2	2	2.33	0.58	Fairly Relevant
16.	Which structures are present in animal and plant cells? A. Vacuole, nucleus and cell membrane B. Nucleus, cell membrane, cytoplasm C. Nucleus, cell wall, cytoplasm D. Cell membrane, chloroplast, cell wall	3	3	3	3.00	0.00	Relevant
17.	What is the name of the jelly-like fluid that fills the cells and suspends the organelles? A. chloroplast C. cytoplasm B. nucleus D. lysosome	3	3	3	3.00	0.00	Relevant

18.	What is the main function of the cell wall? A. Protect and provide support for the cell B. Build proteins C. Convert solar energy to chemical energy D. Transport materials inside the cell	3	3	3	3.00	0.00	Relevant
19.	Which cell part helps transport proteins? A. cell wall C. lysosome B. endoplasmic reticulum D. vacuole	3	3	3	3.00	0.00	Relevant
20.	In what plant cell structure is water stored? A. chloroplast C. vacuole B. cell wall D. cytoplasm	3	3	3	3.00	0.00	Relevant
21.	What characteristic differentiates bacteria from plants aside from their small size? A. They are multicellular and eukaryotic. B. They have waxy layer that helps in drying out. C. They capture the energy of sunlight and use carbon dioxide from the air to make their own food. D. They are useful to nature, man, and life on earth, though some of them can cause diseases to humans.	3	3	3	3.00	0.00	Relevant
22.	Fungi cannot make their own food thus they obtain absorb nutrients from plant and animal matter, which may be living or dead. What is the effect of their food getting activities? A. Decomposition of living things B. Production of starch C. Trapping of solar energy D. Release of oxygen	3	3	3	3.00	0.00	Relevant
23.	Which of the following is NOT a characteristic of all living things? A. All living things reproduce. B. All living things sense and respond to change. C. All living things obtain water by drinking. D. All living things use energy.	3	3	3	3.00	0.00	Relevant
24.	What important ecological role do bacteria play? A. They return basic chemicals to the environment. B. They slow down food spoilage. C. They kill harmful bacteria. D. They produce vitamins.	3	3	3	3.00	0.00	Relevant
25.	Every year people are hospitalized with bacterial infections. These infections can result in removal of medical illness of the infected area to save the person from other dreaded conditions. The persistent use of what modern technology has caused the rise in resistant bacteria? A. vaccines C. fertilizers B. antibiotics D. solar panels	3	3	3	3.00	0.00	Relevant

Appendix P
Item Analysis of Multiple Choice Test Items

Item Number	Total Correct Responses (Upper Group)	Total Correct Responses (Lower Group)	Total Correct Responses	Difficulty Index		Discrimination Index		Decision
				P	Interpretation	D	Interpretation	
1	7	5	12	0.75	Easy	0.25	Discriminating	Accepted by slightly increasing difficulty
2	7	4	11	0.69	Easy	0.38	Discriminating	Accepted by slightly increasing difficulty
3	5	4	9	0.56	Moderately Difficult	0.13	Moderately Discriminating	Accept but needs slight revision on the stem or choices
4	3	2	5	0.31	Difficult	0.13	Moderately Discriminating	May need revision on the stem and/or choices
5	5	3	8	0.50	Moderately Difficult	0.25	Discriminating	Accept as it is
6	3	5	8	0.50	Moderately Difficult	-0.25	Not Discriminating	Needs revision especially on the choices
7	5	3	8	0.50	Moderately Difficult	0.25	Discriminating	Accept as it is
8	5	3	8	0.50	Moderately Difficult	0.25	Discriminating	Accept as it is
9	5	4	9	0.56	Moderately Difficult	0.13	Moderately Discriminating	Accept but needs slight revision on the stem or choices
10	5	5	10	0.63	Easy	0.00	Moderately Discriminating	Needs major revision on the stem and/or choices
11	5	2	7	0.44	Moderately Difficult	0.38	Discriminating	Accept as it is
12	4	3	7	0.44	Moderately Difficult	0.13	Moderately Discriminating	Accept but needs slight revision on the stem or choices
13	4	4	8	0.50	Moderately Difficult	0.00	Moderately Discriminating	Accept but needs slight revision on the stem or choices
14	5	5	10	0.63	Easy	0.00	Moderately Discriminating	Needs major revision on the stem and/or choices
15	3	7	10	0.63	Easy	-0.50	Not Discriminating	Totally discard
16	5	3	8	0.50	Moderately Difficult	0.25	Discriminating	Accept as it is
17	4	4	8	0.50	Moderately Difficult	0.00	Moderately Discriminating	Accept but needs slight revision on the stem or choices
18	8	1	9	0.56	Moderately Difficult	0.88	Very Discriminating	Accept as it is
19	2	8	10	0.63	Easy	-0.75	Questionable	Totally discard
20	8	0	8	0.50	Moderately Difficult	1.00	Very Discriminating	Accept as it is
21	8	0	8	0.50	Moderately Difficult	1.00	Very Discriminating	Accept as it is
22	8	0	8	0.50	Moderately Difficult	1.00	Very Discriminating	Accept as it is
23	8	0	8	0.50	Moderately Difficult	1.00	Very Discriminating	Accept as it is
24	8	0	8	0.50	Moderately Difficult	1.00	Very Discriminating	Accept as it is
25	8	0	8	0.50	Moderately Difficult	1.00	Very Discriminating	Accept as it is
26	8	0	8	0.50	Moderately Difficult	1.00	Very Discriminating	Accept as it is
27	2	8	10	0.63	Easy	-0.75	Questionable	Totally discard
28	2	8	10	0.63	Easy	-0.75	Questionable	Totally discard
29	3	3	6	0.38	Difficult	0.00	Moderately Discriminating	May need revision on the stem and/or choices
30	6	1	7	0.44	Moderately Difficult	0.63	Very Discriminating	Accept as it is
31	5	1	6	0.38	Difficult	0.50	Discriminating	Accept with little revision if necessary
32	4	2	6	0.38	Difficult	0.25	Discriminating	Accept with little revision if necessary
33	5	1	6	0.38	Difficult	0.50	Discriminating	Accept with little revision if necessary
34	2	8	10	0.63	Easy	-0.75	Questionable	Totally discard
35	7	1	8	0.50	Moderately Difficult	0.75	Very Discriminating	Accept as it is
36	8	1	9	0.56	Moderately Difficult	0.88	Very Discriminating	Accept as it is
37	6	2	8	0.50	Moderately Difficult	0.50	Discriminating	Accept as it is

38	6	2	8	0.50	Moderately Difficult	0.50	Discriminating	Accept as it is
39	5	2	7	0.44	Moderately Difficult	0.38	Discriminating	Accept as it is
40	5	2	7	0.44	Moderately Difficult	0.38	Discriminating	Accept as it is
41	4	2	6	0.38	Difficult	0.25	Discriminating	Accept with little revision if necessary
42	6	6	12	0.75	Easy	0.00	Moderately Discriminating	Needs major revision on the stem and/or choices
43	8	2	10	0.63	Easy	0.75	Very Discriminating	Accepted by slightly increasing difficulty
44	7	2	9	0.56	Moderately Difficult	0.63	Very Discriminating	Accept as it is
45	8	3	11	0.69	Easy	0.63	Very Discriminating	Accepted by slightly increasing difficulty
46	8	5	13	0.81	Very Easy	0.38	Discriminating	Accepted by slightly increasing difficulty
47	6	3	9	0.56	Moderately Difficult	0.38	Discriminating	Accept as it is
48	8	1	9	0.56	Moderately Difficult	0.88	Very Discriminating	Accept as it is
49	7	1	8	0.50	Moderately Difficult	0.75	Very Discriminating	Accept as it is
50	7	0	7	0.44	Moderately Difficult	0.88	Very Discriminating	Accept as it is
51	6	0	6	0.38	Difficult	0.75	Very Discriminating	Accept with little revision if necessary
52	7	0	7	0.44	Moderately Difficult	0.88	Very Discriminating	Accept as it is
53	8	0	8	0.50	Moderately Difficult	1.00	Very Discriminating	Accept as it is
54	7	2	9	0.56	Moderately Difficult	0.63	Very Discriminating	Accept as it is
55	6	1	7	0.44	Moderately Difficult	0.63	Very Discriminating	Accept as it is
56	7	3	10	0.63	Easy	0.50	Discriminating	Accepted by slightly increasing difficulty
57	8	4	12	0.75	Easy	0.50	Discriminating	Accepted by slightly increasing difficulty
58	6	5	11	0.69	Easy	0.13	Moderately Discriminating	Needs major revision on the stem and/or choices
59	5	3	8	0.50	Moderately Difficult	0.25	Discriminating	Accept as it is
60	7	4	11	0.69	Easy	0.38	Discriminating	Accepted by slightly increasing difficulty
61	5	3	8	0.50	Moderately Difficult	0.25	Discriminating	Accept as it is
62	6	3	9	0.56	Moderately Difficult	0.38	Discriminating	Accept as it is
63	8	2	10	0.63	Easy	0.75	Very Discriminating	Accepted by slightly increasing difficulty
64	8	1	9	0.56	Moderately Difficult	0.88	Very Discriminating	Accept as it is
65	8	2	10	0.63	Easy	0.75	Very Discriminating	Accepted by slightly increasing difficulty
66	8	3	11	0.69	Easy	0.63	Very Discriminating	Accepted by slightly increasing difficulty
67	7	3	10	0.63	Easy	0.50	Discriminating	Accepted by slightly increasing difficulty
68	7	2	9	0.56	Moderately Difficult	0.63	Very Discriminating	Accept as it is
69	8	5	13	0.81	Very Easy	0.38	Discriminating	Accepted by slightly increasing difficulty
70	7	2	9	0.56	Moderately Difficult	0.63	Very Discriminating	Accept as it is

Summary of Results

Accept as it is	36	May need revision on the stem and/or choices	2
Accept with little revision if necessary	4	Needs revision especially on the choices	2
Accepted by slightly increasing difficulty	13	Needs major revision on the stem and/or choices	3
Accept but needs slight revision on the stem or choic	5	Totally discard	5
		Improbable - Discard	0

Appendix Q
Sample Final Multiple Choice Test-Items (With Key)

Instructions: Read and analyze each item carefully. Encircle the letter that best answers the question or completes the statement.

1. Which of the following is the basic unit of structure and function in all living things?

A. Cell	C. Organ
B. Tissue	D. Organ System

2. Which among the following is the smallest level of organization?

A. Community	C. Organism
B. Population	D. Organ system

3. Aurora is studying the levels of structural organization of an animal's body. Which level would describe a dog's eye?

A. organ	C. organism
B. tissue	D. organ system

4. Cells that are similar in structure and function join together to form _________

A. Cell	C. Organ
B. Tissue	D. Organ System

5. The food that you eat travels from your mouth, down your esophagus, into your stomach, and through your small and large intestines before your body rids itself of solid waste. As the food passes through your body, it is digested, and you get important nutrients from the food. Which of the following is the correct term used to describe a group of body parts working together to perform a specific function?

A. Organism	C. Organ
B. Tissue	D. Organ System

6. All of the following are true *except* _________

A. Skin is an organ.	C. Each organ is made up of its own kind of tissue.
B. Tissues are made up of organs.	D. Tissues are made up of cells.

7. What is formed by a group of cells and tissues that work together to carry out a specific function?

A. organism	C. organ system
B. organelle	D. organ

8. Which letter correctly identifies the 5 levels of organization from simplest to the most complex?

A. person, circulatory system, heart, cardiac muscle tissue, muscle cell
B. muscle cell, cardiac muscle tissue, heart, circulatory system, person
C. muscle cell, heart, cardiac muscle tissue, circulatory system, person
D. person, muscle cell, heart, circulatory system, cardiac muscle tissue

9. Life is organized in a hierarchical fashion. Which of the following sequences illustrates that hierarchy as it goes upward?

A. ecosystem, population, organ system, cell, community, molecule, organ, organism
B. cell, molecule, organ system, organ, population, organism, ecosystem, community
C. organism, organ system, population, organ, community, cell ecosystem, molecule
D. molecule, cell, organ, organ system, organism, population, community, ecosystem

10. Each part of an organ system plays a specific function. Which of the following structures does not match its function?

A. Eyes: Sight	C. Heart: Circulation
B. Kidneys: Respiration	D. Stomach: Digestion

11. Which cell feature holds the genetic information (DNA) of the cell?

A. lysosome	C. ribosome
B. nucleus	D. mitochondria

12. Which of the following organelles converts the energy of the sun into sugar?

A. cell membrane | C. cytoplasm
B. chloroplast | D. nucleus

13. Which phrase best describes the function of mitochondria?

A. located in the cytoplasm | C. converts energy for cell use
B. bacteria-sized organelle | D. contains a folded inner membrane

14. What monitors and controls entry of materials into and out of the cell?

A. vacuole | C. ribosome
B. chloroplast | D. cell membrane

15. Which structures are present in animal and plant cells?

A. Vacuole, nucleus and cell membrane | C. Nucleus, cell wall, cytoplasm
B. Nucleus, cell membrane, cytoplasm | D. Cell membrane, chloroplast, cell wall

16. What is the name of the jelly-like fluid that fills the cells and suspends the organelles?

A. chloroplast | C. cytoplasm
B. nucleus | D. lysosome

17. What is the main function of the cell wall?

A. Protect and provide support for the cell
B. Build proteins
C. Convert solar energy to chemical energy
D. Transport materials inside the cell

18. In what plant cell structure is water stored?

A. chloroplast | C. vacuole
B. cell wall | D. cytoplasm

19. What characteristic differentiates bacteria from plants aside from their small size?

A. They are multicellular and eukaryotic.
B. They have waxy layer that helps in drying out.
C. They capture the energy of sunlight and use carbon dioxide from the air to make their own food.
D. They are useful to nature, man, and life on earth, though some of them can cause diseases to humans.

20. Fungi cannot make their own food thus they obtain absorb nutrients from plant and animal matter, which may be living or dead. What is the effect of their food getting activities?

A. Decomposition of living things | C. Trapping of solar energy
B. Production of starch | D. Release of oxygen

21. Which of the following is NOT a characteristic of all living things?

A. All living things reproduce.
B. All living things sense and respond to change.
C. All living things obtain water by drinking.
D. All living things use energy.

22. What important ecological role do bacteria play?

A. They return basic chemicals to the environment.
B. They slow down food spoilage.
C. They kill harmful bacteria.
D. They produce vitamins.

23. Every year people are hospitalized with bacterial infections. These infections can result in removal of medical illness of the infected area to save the person from other dreaded conditions. The persistent use of what modern technology has caused the rise in resistant bacteria?

A. vaccines | C. fertilizers
B. antibiotics | D. solar panels

24. Bacteria are classified by which of the following shapes?

A. rod, cone, spiral | C. rod, sphere, cone
B. rod, sphere, spiral | D. sphere, cone, spiral

25. Bacteria are known to cause disease; which of the following diseases is not brought by a certain type of bacteria?

A. Anthrax
B. Stomach ulcer
C. Tuberculosis
D. Thrush

26. Which disease is caused by a protozoan carried by mosquitoes?

A. Malaria
B. Measles
C. Athlete's foot
D. Potato blight

27. A sperm cell unites with an egg cell to form a zygote. Which process is taking place?

A. Pollination
B. Fertilization
C. Asexual reproduction
D. Vegetative propagation

28. What type of asexual reproduction occur when a new organism grow from the pieces of a parent?

A. Fragmentation
B. Fusion
C. Fission
D. Vegetative Reproduction

29. Which species can reproduce offspring that are genetically different from their parents?

A. A species that has few variations
B. A species that reproduces asexually
C. A species that reproduces sexually
D. A species that competes with a similar species

30. Which of these is true about asexual reproduction?

A. Only plants use asexual reproduction.
B. All organisms use asexual reproduction.
C. There are at least two parent organisms in asexual reproduction.
D. There is only one parent organism in asexual reproduction.

31. A single bacteria cell divide into two identical cells. This is an example of which type of asexual reproduction?

A. Fragmentation
B. Binary Fission
C. Vegetative reproduction
D. Spore formation

32. A piece of a geranium plant is cut and placed in a jar of water in the window. Several weeks later the piece has grown into a new plant. Which of the following is true about the genetic relationship between the first plant and the new one?

A. The two plants are different genetically.
B. The two plants are slightly different genetically.
C. The two plants are genetically identical.
D. There is no way to know the genetic relationship.

33. Which of the following organisms reproduce asexually?

A. Rats
B. Mosquitoes
C. Bacteria
D. Salmon

34. A white cat had kittens that were orange, grey, and black and white spotted. Is this the result of sexual or asexual reproduction? How would you characterize the offspring listed above?

A. Sexual reproduction with uniform offspring
B. Asexual reproduction with diverse offspring
C. Sexual reproduction with diverse offspring
D. Asexual reproduction with uniform offspring

35. If you cut a starfish into pieces, each piece can develop into a new starfish. This is an example of which type of asexual reproduction?

A. Binary Fission
B. Fragmentation
C. Budding
D. Vegetative Propagation

36. An environment's biotic and abiotic factors interact to make a(n) ___________

A. habitat.
B. ecosystem.
C. niche.
D. resource.

Appendix R
Pre-test and Post-test Results

Student Code	Pre-test	Post-test
S1	28	61
S2	27	60
S3	28	61
S4	27	60
S5	31	56
S6	29	59
S7	27	55
S8	28	57
S9	30	55
S10	24	57
S11	25	52
S12	22	51
S13	24	60
S14	28	61
S15	25	57
S16	31	53
S17	29	58
S18	25	56
S19	32	57
S20	24	57
S21	31	55
S22	27	55
S23	23	53
S24	31	63
S25	27	56
S26	23	48
S27	27	52
S28	25	56
S29	26	62

Appendix S
Results of Cognitive and Emotional Engagement Survey

Results of Cognitive and Emotional Engagement Survey cont…

Context-based Instructional Activity: Cell Analogy							
	EE1	**EE2**	**EE3**	**EE4**	**CE5**	**CE6**	**CE7**
S1	5	5	3	1	5	7	1
S2	4	3	1	3	3	6	4
S3	5	5	1	2	5	1	2
S4	4	3	2	3	3	5	3
S5	5	5	2	1	5	7	7
S6	3	3	1	3	4	6	5
S7	4	4	4	2	4	6	2
S8	5	4	1	6	4	6	2
S9	5	5	2	3	4	6	1
S10	5	5	1	1	5	7	1
S11	5	5	4	1	5	7	1
S12	5	5	5	3	4	3	3
S13	5	5	2	2	4	7	2
S14	5	5	1	1	5	7	1
S15	2	4	3	3	4	6	2
S16	5	5	1	1	5	7	1
S17	5	5	1	2	4	7	2
S18	5	4	2	5	3	5	5
S19	5	4	1	1	5	6	1
S20	4	3	3	4	4	5	4
S21	4	5	2	4	5	4	1
S22	5	5	1	1	5	7	1
S23	5	5	3	1	3	7	2
S24	4	3	3	4	5	6	1
S25	4	4	2	3	5	7	1
S26	5	5	1	1	5	6	1
S27	4	4	3	2	4	6	2
S28	4	5	1	7	5	7	7
S29	3	3	3	3	3	4	4

Results of Cognitive and Emotional Engagement Survey cont…

Context-based Instructional Activity: Observing Life Forms							
	EE1	**EE2**	**EE3**	**EE4**	**CE5**	**CE6**	**CE7**
S1	5	5	3	1	5	7	1
S2	4	3	2	4	3	5	4
S3	4	4	2	4	5	6	2
S4	4	5	2	3	4	5	2
S5	5	5	1	1	4	6	1
S6	3	4	3	3	3	3	3
S7	4	4	4	2	4	6	1
S8	4	5	1	3	3	6	3
S9	5	5	2	1	4	7	2
S10	5	5	1	1	5	6	1
S11	4	4	4	2	4	5	1
S12	4	4	2	2	5	6	2
S13	3	4	3	4	3	4	4
S14	5	5	1	1	5	7	1
S15	5	5	2	1	4	5	2
S16	5	5	1	1	5	6	1
S17	4	5	1	1	4	4	2
S18	4	5	2	3	4	5	5
S19	1	2	3	5	2	3	5
S20	3	4	3	4	4	5	5
S21	5	5	1	3	3	5	2
S22	4	5	3	4	4	4	4
S23	2	3	3	4	3	4	5
S24	4	5	4	2	5	6	2
S25	4	5	1	1	5	6	1
S26	5	5	1	2	5	5	1
S27	5	4	2	1	4	6	2
S28	3	5	2	4	5	5	2
S29	2	3	3	4	3	4	4
Mean	3.97	4.41	2.17	2.48	4.03	5.24	2.45
SD	1.05	0.82	1.00	1.33	0.87	1.09	1.43

Results of Cognitive and Emotional Engagement Survey cont…

Context-based Instructional Activity: Sort-It-Out							
	EE1	**EE2**	**EE3**	**EE4**	**CE5**	**CE6**	**CE7**
S1	5	5	1	1	5	6	2
S2	3	4	2	4	3	5	7
S3	5	5	1	2	4	6	2
S4	4	3	2	2	3	5	3
S5	5	5	2	1	4	5	4
S6	5	4	2	2	3	6	3
S7	4	5	1	2	5	6	2
S8	5	5	1	3	4	5	3
S9	4	5	4	3	5	5	3
S10	4	4	1	2	4	6	2
S11	4	4	5	2	4	5	1
S12	5	5	3	3	4	6	3
S13	3	2	2	5	3	4	3
S14	5	5	1	1	5	7	1
S15	4	5	2	2	2	6	2
S16	5	5	1	1	4	7	4
S17	3	4	2	4	4	5	3
S18	4	4	3	5	3	3	3
S19	3	2	1	4	3	5	3
S20	4	4	1	3	4	6	3
S21	2	4	1	3	2	3	5
S22	4	5	2	3	4	6	2
S23	3	3	2	3	3	5	3
S24	5	5	2	2	5	4	6
S25	4	5	2	3	3	5	4
S26	5	5	2	2	5	6	2
S27	3	4	3	1	3	5	2
S28	3	4	2	2	5	7	1
S29	2	3	3	5	3	4	4
Mean	3.97	4.24	1.97	2.62	3.76	5.31	2.97
SD	0.94	0.91	0.98	1.21	0.91	1.04	1.38

Results of Cognitive and Emotional Engagement Survey cont…

Context-based Instructional Activity: How do organisms reproduce?							
	EE1	**EE2**	**EE3**	**EE4**	**CE5**	**CE6**	**CE7**
S1	3	5	1	1	5	6	2
S2	4	4	3	4	3	5	4
S3	4	5	1	2	5	6	2
S4	5	5	1	2	4	5	2
S5	5	5	2	1	5	7	1
S6	4	4	2	3	4	5	3
S7	5	4	4	1	5	6	1
S8	5	5	1	2	5	6	1
S9	5	5	3	2	5	6	3
S10	3	4	2	3	5	5	1
S11	4	5	4	2	5	6	1
S12	3	5	3	3	4	6	2
S13	4	5	3	3	4	5	3
S14	5	5	1	1	5	7	1
S15	4	4	3	5	4	5	2
S16	4	5	2	2	5	4	1
S17	3	5	3	4	4	3	3
S18	3	4	3	6	3	3	3
S19	4	5	1	2	5	6	3
S20	3	2	3	4	3	3	3
S21	3	4	3	4	3	5	6
S22	4	5	3	4	4	4	3
S23	2	4	2	4	2	3	5
S24	5	5	2	1	4	7	2
S25	4	5	2	2	5	7	1
S26	4	5	3	3	5	6	3
S27	4	4	3	4	3	5	4
S28	3	5	3	4	4	6	1
S29	2	4	3	4	3	4	4
Mean	3.83	4.55	2.41	2.86	4.17	5.24	2.45
SD	0.89	0.69	0.91	1.33	0.89	1.24	1.33

Results of Cognitive and Emotional Engagement Survey cont…

Context-based Instructional Activity: Unraveling Living and Nonliving							
	EE1	**EE2**	**EE3**	**EE4**	**CE5**	**CE6**	**CE7**
S1	5	5	3	1	5	7	1
S2	5	5	2	1	2	7	6
S3	4	5	1	3	5	6	3
S4	4	3	2	3	4	3	2
S5	5	5	1	3	5	6	2
S6	4	4	2	3	3	5	3
S7	5	4	1	1	5	7	1
S8	5	5	1	2	4	7	2
S9	5	5	3	1	4	7	2
S10	5	5	5	1	5	7	2
S11	4	4	4	2	4	6	4
S12	5	5	3	2	4	6	2
S13	3	4	3	3	4	5	3
S14	5	5	5	1	5	7	1
S15	4	3	3	3	4	5	2
S16	5	5	1	1	5	7	1
S17	4	5	2	4	5	6	1
S18	5	4	2	3	3	5	3
S19	5	4	1	1	3	6	2
S20	4	4	2	5	4	5	4
S21	5	5	1	1	5	4	1
S22	5	5	3	5	2	4	6
S23	3	3	2	4	3	4	4
S24	5	5	2	2	5	6	2
S25	5	5	1	1	5	7	2
S26	4	5	1	2	5	6	2
S27	4	4	3	3	3	5	3
S28	4	4	1	3	4	7	1
S29	4	3	2	3	3	5	4
Mean	4.48	4.41	2.17	2.34	4.07	5.79	2.48
SD	0.63	0.73	1.17	1.23	0.96	1.15	1.38

Results of Cognitive and Emotional Engagement Survey cont…

Context-based Instructional Activity: Relationship Status: Symbiosis							
	EE1	**EE2**	**EE3**	**EE4**	**CE5**	**CE6**	**CE7**
S1	5	5	1	1	5	7	1
S2	4	4	2	2	3	5	3
S3	5	5	1	2	4	6	2
S4	4	4	3	1	5	3	2
S5	4	5	1	5	4	6	2
S6	4	5	2	2	4	5	3
S7	4	5	2	1	5	7	1
S8	5	4	1	2	5	6	1
S9	5	5	4	1	3	7	2
S10	4	4	2	4	4	3	2
S11	4	5	2	2	4	6	2
S12	4	5	2	2	4	6	3
S13	3	4	2	3	5	6	2
S14	5	5	1	1	5	7	1
S15	4	4	2	2	4	6	2
S16	4	5	1	4	5	7	1
S17	4	5	2	4	5	6	1
S18	4	4	2	3	4	3	3
S19	5	4	3	3	2	5	5
S20	3	2	4	3	4	3	3
S21	4	4	3	4	2	4	4
S22	5	5	1	1	5	7	1
S23	3	3	3	4	3	5	4
S24	5	5	1	2	4	6	2
S25	5	5	5	1	5	7	1
S26	3	4	2	3	5	4	3
S27	3	3	3	4	3	5	2
S28	3	3	2	4	3	5	4
S29	3	4	2	4	3	4	4
Mean	4.07	4.31	2.14	2.59	4.03	5.41	2.31
SD	0.75	0.81	1.03	1.24	0.94	1.35	1.14

Results of Cognitive and Emotional Engagement Survey cont…

Context-based Instructional Activity: Life in a Pond							
	EE1	**EE2**	**EE3**	**EE4**	**CE5**	**CE6**	**CE7**
S1	5	4	1	4	5	7	3
S2	5	5	2	2	2	4	4
S3	5	5	1	3	5	7	1
S4	4	3	3	1	3	3	3
S5	4	5	3	3	4	5	2
S6	3	4	3	4	3	5	4
S7	5	5	2	1	5	7	1
S8	4	5	1	2	4	6	3
S9	5	5	5	1	5	6	1
S10	3	4	3	4	4	4	2
S11	3	4	4	3	3	4	3
S12	3	5	2	2	4	5	2
S13	4	5	2	2	4	5	2
S14	5	5	1	1	5	7	1
S15	3	4	2	3	4	6	1
S16	4	5	3	4	5	4	4
S17	3	3	2	4	4	5	1
S18	4	4	2	3	4	5	5
S19	5	5	2	2	3	5	3
S20	3	4	3	4	3	4	4
S21	5	4	2	4	4	5	3
S22	5	5	3	4	2	4	5
S23	3	3	2	4	3	4	4
S24	4	5	4	3	3	5	2
S25	5	5	5	1	5	7	1
S26	3	4	2	3	5	5	2
S27	3	3	3	4	3	5	2
S28	5	4	3	4	3	6	4
S29	2	4	2	4	3	4	4
Mean	3.97	4.34	2.52	2.90	3.79	5.14	2.66
SD	0.94	0.72	1.06	1.14	0.94	1.13	1.29

Summary of Cognitive and Emotional Indicators

	CBIA 1	CBIA 2	CBIA 3	CBIA 4	CBIA 5	CBIA 6	CBIA 7	CBIA 8	**Mean**	**SD**
Emotional Engagement										
1. Did you enjoy this activity?	3.76	4.45	3.97	3.97	3.83	4.48	4.07	3.97	**4.06**	**0.27**
2. Was this activity interesting?	4.38	4.34	4.41	4.24	4.55	4.41	4.31	4.34	**4.37**	**0.09**
3. Did you wish you had been doing something else?	2.21	2.07	2.17	1.97	2.41	2.17	2.14	2.52	**2.21**	**0.18**
4. Describe your mood during this activity: Excited - Bored	3.28	2.55	2.48	2.62	2.86	2.34	2.59	2.90	**2.70**	**0.30**
Cognitive Engagement										
5. How well were you concentrating?	3.86	4.31	4.03	3.76	4.17	4.07	4.03	3.79	**4.00**	**0.19**
6. Describe your mood during this activity: Passive - Active	5.69	5.90	5.24	5.31	5.24	5.79	5.41	5.14	**5.47**	**0.29**
7. Describe your mood during this activity: Focused - Distracted	2.83	2.41	2.45	2.97	2.45	2.48	2.31	2.66	**2.57**	**0.23**

Appendix T

Results of Process Observer's Checklist- Behavioral Engagement

Context-based Instructional Activity: From Cells to Biosphere						
	PO1	**PO2**	**PO3**	**Mean**	**SD**	**Interpretation**
O1	4	4	4	4.00	0.00	Very high
O2	3	4	4	3.67	0.58	Very high
O3	4	4	4	4.00	0.00	Very high
O4	3	3	3	3.00	0.00	High
O5	3	4	4	3.67	0.58	Very high
O6	4	4	3	3.67	0.58	Very high
O7	4	4	4	4.00	0.00	Very high
Context-based Instructional Activity: Cell Analogy of a Shopping Mall						
	PO1	**PO2**	**PO3**	**Mean**	**SD**	**Interpretation**
O1	4	4	4	4.00	0.00	Very high
O2	4	4	3	3.67	0.58	Very high
O3	4	4	4	4.00	0.00	Very high
O4	4	4	3	3.67	0.58	Very high
O5	4	4	3	3.67	0.58	Very high
O6	4	3	4	3.67	0.58	Very high
O7	4	4	4	4.00	0.00	Very high
Context-based Instructional Activity: Observing Life Forms						
	PO1	**PO2**	**PO3**	**Mean**	**SD**	**Interpretation**
O1	4	4	4	4.00	0.00	Very high
O2	4	4	4	4.00	0.00	Very high
O3	4	4	4	4.00	0.00	Very high
O4	4	3	4	3.67	0.58	Very high
O5	4	4	4	4.00	0.00	Very high
O6	4	4	4	4.00	0.00	Very high
O7	4	4	4	4.00	0.00	Very high
Context-based Instructional Activity: Sort-It-Out						
	PO1	**PO2**	**PO3**	**Mean**	**SD**	**Interpretation**
O1	4	4	4	4.00	0.00	Very High
O2	4	3	4	3.67	0.58	Very High
O3	3	4	4	3.67	0.58	Very High
O4	4	3	3	3.33	0.58	Very High
O5	4	4	3	3.67	0.58	Very High
O6	4	3	4	3.67	0.58	Very High
O7	4	4	4	4.00	0.00	Very High

Context-based Instructional Activity: How do organisms reproduce?						
	PO1	**PO2**	**PO3**	**Mean**	**SD**	**Interpretation**
O1	4	4	4	4.00	0.00	Very High
O2	4	4	4	4.00	0.00	Very High
O3	4	4	4	4.00	0.00	Very High
O4	3	3	3	3.00	0.00	High
O5	4	4	4	4.00	0.00	Very High
O6	4	3	4	3.67	0.58	Very High
O7	4	4	3	3.67	0.58	Very High
Context-based Instructional Activity: Unraveling Living and Nonliving Things						
	PO1	**PO2**	**PO3**	**Mean**	**SD**	**Interpretation**
O1	4	4	4	4.00	0.00	Very High
O2	4	4	4	4.00	0.00	Very High
O3	4	4	4	4.00	0.00	Very High
O4	4	3	3	3.33	0.58	Very High
O5	4	4	4	4.00	0.00	Very High
O6	4	4	4	4.00	0.00	Very High
O7	4	4	4	4.00	0.00	Very High
Context-based Instructional Activity: Relationship Status: Symbiosis						
	PO1	**PO2**	**PO3**	**Mean**	**SD**	**Interpretation**
O1	4	4	4	4.00	0.00	Very High
O2	4	4	4	4.00	0.00	Very High
O3	4	4	3	3.67	0.58	Very High
O4	4	4	4	4.00	0.00	Very High
O5	4	4	4	4.00	0.00	Very High
O6	4	4	4	4.00	0.00	Very High
O7	4	4	4	4.00	0.00	Very High
Context-based Instructional Activity: Energy Flow: Interconnectedness of Organisms in a Pond						
	PO1	**PO2**	**PO3**	**Mean**	**SD**	**Interpretation**
O1	4	4	4	4.00	0.00	Very High
O2	3	4	4	3.67	0.58	Very High
O3	3	4	4	3.67	0.58	Very High
O4	4	3	3	3.33	0.58	Very High
O5	3	4	4	3.67	0.58	Very High
O6	4	4	4	4.00	0.00	Very High
O7	4	4	4	4.00	0.00	Very High

Appendix U

Sample Thematic Analysis of Student Conceptual Understanding and Student Engagement

Salient Statements: Effectiveness of CBIA in terms of Conceptual Understanding

My main conclusions from this lesson…			
Response		**Initial Coding**	**Focused Coding**
I have learned that life on earth has organization and biosphere starts from a very small unit. I also learned that organization of life starts from atom, molecules, organelles, cells, tissues, organs, organ system, organism, population, community, ecosystem then biosphere.		learning of hierarchical biological concept	
I learned that certain parts of plant cell are not present in the animal cell like cell wall large vacuole and chloroplast. But animal cell has centrioles that are not present in plant cell. I noticed they differ in shape and color.		drawing similarities and differences of the concept learned	discovering of factual knowledge
I now understand that plant cells can contain or hold more amount of water because it has bigger vacuole than the animal cells.		abstracting ideas	
By performing the activity, I am able to know the organisms reproducing sexually like leech, frog, crocodile, and corn while the organisms that reproduce asexually are amoeba and starfish. It is surpising [sic] to know that.		distinguishing organisms characteristics	
Symbiotic relationship is important because the relationships allow species to survive better than they would as individuals.		discerning positive affirmation of the topic	
We are living in a world full of good and bad microorganisms. They play important role in food, products, medicines and environment. Some of them can cause disease but if we know their effects we can prevent their not bad effects on our body.		raising awareness	recognizing relevant scientific concepts in real life situations
All organisms are interconnected and dependent on their environment to give them what they need like food, shelter and water. We need to do something to keep our ecosystem for our own good and the future generations.		realizing the notion of the topic valuing of the lesson	
I have realized that microorganisms are being used to manufacture products like yakult, yogurt, antibiotics, and gulaman. But some of them are also harmful causing disease like tuberculosis. Some bacteria are helpful in		realizing the applications of the topic	

Salient Statements: Effectiveness of CBIA in terms of Cognitive Engagement

During the activity, I observed…			
Responses		**Initial Coding**	**Focused Coding**
I observed that our activity is hard and complicated but if you read and read it, it will be more meaningful.		reading the activity twice to get the meaning	
My group mates and I do not find the activity easy. We continue pairing the cell cards until we make it because when we think that we have correct pair another parts [sic] come up so we repeat it all over.		repeating the pairing of cell cards	completing the task persitently
All group did their best to complete the task Ms. Sarah gave. I thought our group cannot finish but we hurriedly focus and concentrate so make it on time.		focusing and concentrating to finish the activity	
All of my fellow members are cooperating. We separate who will draw the organism and who will think examples of cells and etc.		assigning of roles to group members	dividing the assigned task to group members
I observe that other groups work faster than us. Maybe they agree and do who will do this and who will do that. My group also do best.		pointing out members to do specific work	
The activity is challenging because we need to work in a group and there is time limit.		seeing the need for teamwork	
My other members need to participate more. Mam Sarah mention our group twice.		seeing the need for maximum participation	requiring group participation
During the activity my group members are very hardworking while answering and I saw the others good too.		noticing hardword among members	
That my classmates is brainstorming and arguing if its living or nonliving. And that my groupmates is also doing the same thing. So it's a little noisy.		brainstorming answers	
I observe my classmates are saying different thoughts about reproduction and the examples are interesting.		stating opinions about the topic	sharing of ideas in performing the activity
Debated in our team that not everything is what it seems or what it looks like.		debating opinions	
In Sort-It-Out, I observed that we need to analyze and understand the given cards and read the content of bacteria, fungi and protist and so on.		analyzing the content presented materials	analysing and understanding the content of the activity
I observed that we first read the instruction and think carefully about what is written in the worksheet.		reading the instructions carefully	
Our group write down the big fish that can			

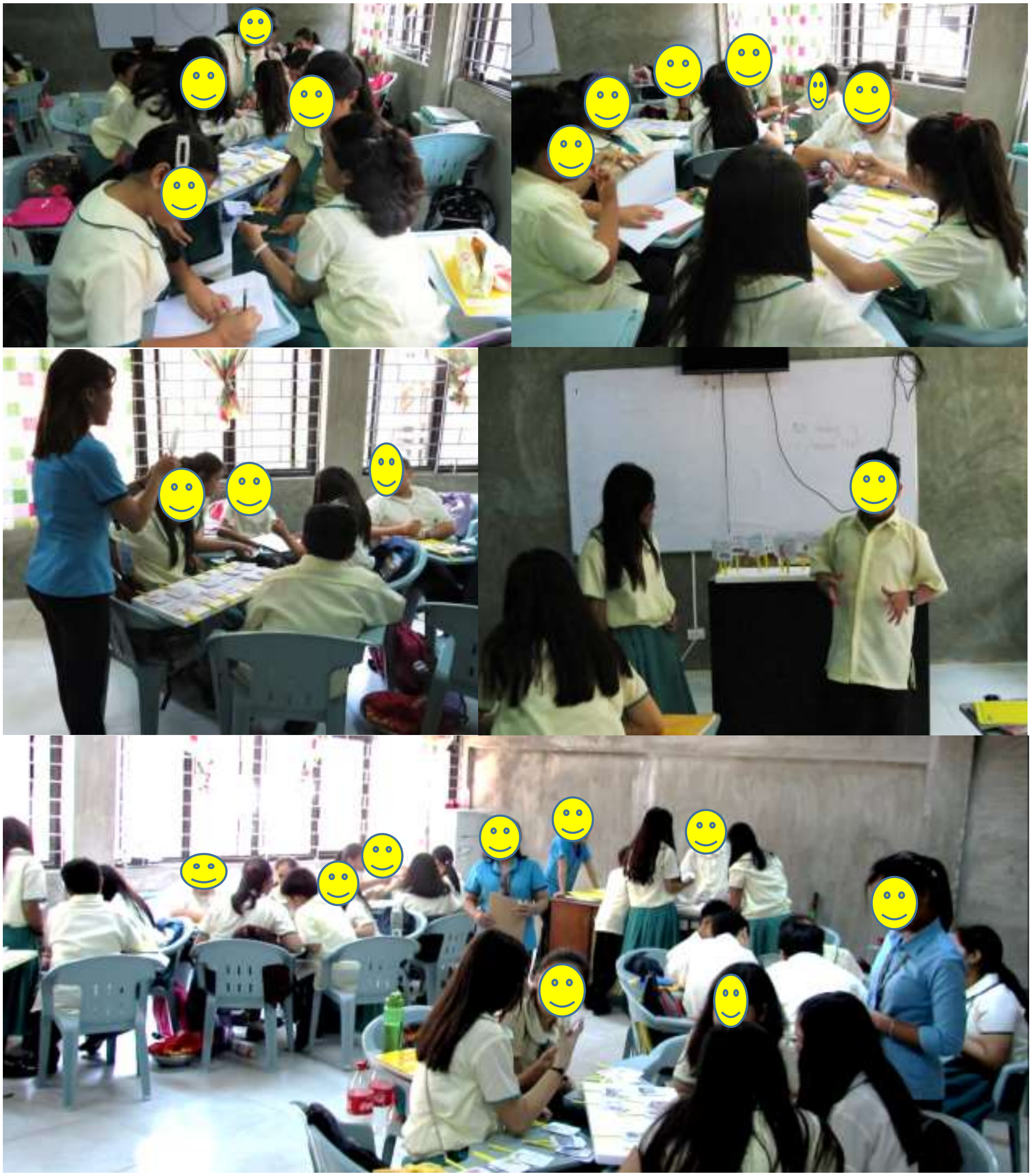
Salient Statements: Effectiveness of CBIA in terms of Emotional Engagement

At the end of the learning activity, I feel that…		
Responses	**Initial Coding**	**Focused Coding**
I should learn more about it so that I can recite [sic] more and answer my teacher's question.	acquiring more knowledge to recite frequently	eargerness to answer teacher's questions
I need to excel more so that I can answer and recite [sic] more.	wanting to excel in recitation	
I can share this lesson/ideas to my friends or even in the part of my family. I also can use this when I grow up or in higher grades.	finding usefulness in the topic	interest and appreciation of the topic
I felt that science is very interesting. Science is so important to us because it helps is to know things that we didn't know yet.	finding interest and importance in learning science	
Its amazing because we are made up of smaller fragments but we cannot see them because they are not visible.	finding amusement in the learning	
I should appreciate even the smallest forms of life.	appreciating the lesson	
I am happy because we finished the activity. I enjoy this activity because we have a teamwork.	feeling of happiness upon finishing the task	happiness upon completion of activity
I feel happy because I learned so many things about how do organisms reproduce.	feeling of happiness in learning the topic	
In the end, I have many question that is answered in my mind so I am happy.	feeling of happiness for anwered questions	
I feel happy because we did the activity. Im glad because we knew another lesson.	feeling of gladnessn in doing the activity	
I feel happy because we finished the work with enjoying and working hard for it. And I feel very successful because of our teamwork.	finishing the work because of teamwork	success and accomplishment due to teamwork
I fit in my group and had fun.	belongingness in the group	
I feel very excited on our performance and happy of our work.	feeling of excitement in presentation	excitement on the performance
I learned something but exhausted and a little bit stress.	exhausting activity	stress and exhaustion in group activities
Im stress but I amaze about the cells and the mall and its functions.	surprising and stressful group task	
The analogy of mall is so very amazing and very stressful.		
We go through many stages. I need to study a lot because there a lot to understand.		

Appendix V

Photo Documentation during the Implementation Phase

Student participants as they are presenting their output together with the process observers during the actual conduct



Student participants as they are presenting their output together with the process observers during the actual conduct

Student participants as they are presenting their output together with the process observers during the actual conduct

Student participants as they are presenting their output together with the process observers during the actual conduct

Appendix W
Authenticity Result

Philippine Normal University
The National Center for Teacher Education
PUBLICATION OFFICE
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AUTHENTICITY RESULT

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Authenticity Report:

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Appendix X
Text Editing Certification

This is to certify that the undersigned has proofread the *Context-based Instructional Activities using Inquiry based Learning* developed by Ms. Sarah M. Pascua.

pgparaan
PAULINE GISELLE L. PARAAN
Teacher, PNU-ITL

Appendix Y
Curriculum Vitae

For interested science educators who would like to have a copy of the validated context-based instructional activities for grade 7 biology, you can reach the author thru the given contact number and email address below.

1. Personal data

Name: **SARAH MORALES PASCUA**

Contact No.: 09355339274

Email Address: sarahpascua@cvsu-naic.edu.ph

2. Educational Qualifications

Master's Degree
Master of Arts in Science Education with specialization in Biology
Philippine Normal University-Manila
Candidate for Graduation

Tertiary
Bachelor of Secondary Education
Major in Biological Science
Cavite State University-Naic
Bucana, Naic, Cavite
April 7, 2014

Secondary
Ternate National High School
H. Ventura St. Ternate, Cavite
March 26, 2010

Elementary
Anastacio N.F Dinglas Elementary School
San Jose Ternate, Cavite
March 26, 2006

3. Work Experience

Instructor I
Cavite State University-Naic
Bucana Malaki, Naic, Cavite
August 2018-Present

Teacher I
Bucal National High School
Bucal 2, Maragondon, Cavite
November 2015 up to August 2018

Instructor (Part Timer)
Cavite State University-Naic
Bucana, Naic, Cavite
June 2014 up to October 2015

SEMINARS/TRAININGS ATTENDED

Legal Issues in Online Teaching and Learning
June 22, 2020
Cavite State University-Naic

Google Classroom Webinar-Workshop
June 9, 2020
Cavite State University-Naic

Cvsu Naic: Shifting to Blended Learning; Response To Covid-19 Pandemic
June 2, 2020
Cavite State University-Naic

Seminar-Workshop in Enhancing Teacher's Capability for Teaching Academic Subjects In Intermediate Grades
February 14, 2020
Cavite State University-Naic

Capability Enhancement Training on Extension
June 13, 2019
Cavite State University-Indang

Training-Workshop on Basic Food Hygiene and Good Manufacturing Practices
February 26-28, 2019
Cavite State University-Naic

Division Training - Workshop on Philippine Standards for Teachers (PPST)
March 23, 2018
Department of Education – Cavite

Seminar-Workshop on Writing Thesis/Dissertation Manuscript Using APA Guidelines
March 24, 2018
Philippine Normal University-Manila

Training of Teachers on the Implementation of the Special Science Program (Luzon Cluster - Batch 2)
December 11-15, 2017
Department of Education – Cavite

PLDT Infoteach Outreach Program (Phase 4) On Digital Skills and Productivity Tools for 21st Teachers
February 20 – March 10, 2017
Department of Education – Cavite