



Perceived Relevance of Chemistry Topics to Everyday Life: Inputs to Context Based Enrichment Activities in General and Inorganic Chemistry

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Abstract

Background/Objectives: The purpose of this study stressed on the challenge of developing context-based enrichment activities that will make connections between the concepts taught in the General and Inorganic Chemistry course taken by the General Engineering students at the Bulacan State University-Bustos Campus.

Methods/Statistical analysis: The sample of the study included 50 second year General Engineering students from Bulacan State University – Bustos Campus as well as 10 chemistry instructors from the Meneses, Bustos and Malolos campuses of Bulacan State University. A need analysis and evaluation sheet of the developed context-based enrichment activities in General and Inorganic Chemistry adapted in the study of Basilio (2006) and in consonance to the characteristics of Contextual Teaching and Learning defined by Wilson and Clifford (2000) were used to collect data related to the needs of the students to come up with an instructional material that will connect chemistry concepts to their lives and to validate the developed enrichment activities respectively.

Findings: Results revealed the topics that has high relevance to the students were, gas laws, physical changes, conversion of units, factors affecting rate of solution, factors affecting solubility, types of solution, properties of solutions, variables in gases, chemical changes, substances and mixtures, states of matter, factors affecting reaction rates, types of chemical reactions, compounds, elements, ways of separating mixtures, pH and pOH, rate of reaction, colloids and concentration of solution, and these are the topics contained in the enrichment activities. The students also replied that there is a need to come up with an instructional material that will connect these concepts to their lives since these are fundamental concepts and the contextual approach will aid the convenience of learning such concepts and to enhance enduring knowledge. **Improvements/Applications:** The evaluation of the instructors to the enrichment activities scored an acceptable mark and was commended as useful and applicable.

Index Terms

Contextual Approach, Inorganic Chemistry, Relevance, Enrichment Activities, Bulacan State University, Philippines

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I. INTRODUCTION

Chemistry concepts can be learned and gained substantially, but sometimes the motivation of the students to study is just to have good grades and pass the chemistry class. Student's motivation should not be as extrinsic as this, but it should be intrinsic enough to achieve learning merely because they understand that the concepts taught in their chemistry class give meaning and purpose to their lives. The educator's challenge is not only to transport the importance of learning chemistry in the classroom but to enhance the motivational and affective aspects of the students to learn chemistry in connection to the lives of the students, their society and to their chosen careers.

In teaching chemistry, instructors usually encounter questions from students regarding the need to learn concepts such as stoichiometry, chemical kinetics, chemical equilibrium and solubility products. Such question arises from students which hardly find the topics as abstract collection of facts that are insignificant to their lives. Even though teachers tend to define chemistry as central science during the introduction of the subject, which aims students to have idea that chemistry encompasses all endeavors of life; students are still stranded with the same wonder of its purpose. Students tend to find meaning for every chemistry topics that seems to be irrelevant to their lives.

It is the initiative of the researcher to introduce a new approach called contextual teaching and learning (CTL) to address the search of the students to the purpose of learning particular concepts. Contextual Teaching and Learning is an approach that is used to discover meaning by allowing the students to connect the content of the academic subjects with the immediate context of their daily lives. This learning approach gives a different means of edifying concepts to students. The traditional method of teaching chemistry focuses merely on the acquisition and manipulation of content which requires mastering of ideas and memorizing information to gain knowledge. Contextual approach, on the other hand, gives meaning to concepts by emphasizing on the interrelationship of the parts of the general concepts rather than regarding to the general concept per se. The term context should be understood as the pattern of relationships in one's immediate environment [1]. If students grasp the connection of a concept within the context of his life then they will find more meaning or significance of the topic to them. Finding meaning thru connections is the central characteristic of CTL. Students subject to this approach will not only gain substantive knowledge but also will broaden their idea of the purpose of such concepts to their lives, to the society and to their chosen career.

This study stresses on the challenge of constructing context-based enrichment activities that make connections between the concepts taught in the General Chemistry course and how will the students use the knowledge gained and apply it to their daily lives. The traditional way of teaching seems to be effective but it doesn't nest on the fact that the students have a difficult time in understanding these concepts by using an abstract lecture method. The intention of the study is to introduce the contextual approach in learning chemistry is a respond to the needs of the students to comprehend concepts as they relate them to their lives, their environment, to their workplace and even to their chosen careers.

Educational research and development starts with the administration of a need analysis that is pertinent to the development of the output. The product development includes the selection of materials, design of the lay out, validation of experts and revision of the materials. Also it follows the trying out of the product and final revisions will be applied to come up with a final product. The study adapted this design because it tries to develop an instructional product that needs further study and careful lay out and this method is apt to the process of developing his product. Following the R & D method, the research administered a need analysis to second year engineering students in Bulacan State University Bustos Campus which is composed of fifty students. The self-made instrument used is a survey about the perceived relevance of the respondents with regards to the course contents present in the syllabus of general and inorganic chemistry to their daily lives. The result of the need analysis will provide information about the perception of the students to the connection of chemistry topics to their lives and it will be used as a basis if there is a need to develop context-based enrichment activities and what topics would be included; this is the next step in the research and development cycle. The last step is the validation and revision of the enrichment activities by experts. The research opted to use face validity as a tool of validating the contents, objectives and the use of contextual approach to each enrichment activity.

II. RESEARCH MODEL

A. Methods, Techniques, Population and Instrument

The design of this study is research and development that employs the cycle that were presented by Borg and Gall. Through the findings in the related literature about contextual teaching and learning approach, the development of context-based enrichment activities in General and Inorganic

chemistry was initiated. In the development of the context-based enrichment activities, four procedural steps were utilized according to the research and development cycle.

Administration of a needs analysis is the first step in the research and development cycle to assess the needs of the target audience. The next step in the cycle is the development of the instructional material and the following encompasses the steps to be included: the manual and later on it will be subjected to expert's validation and revision. The scope of this study were the development of the context-based enrichment activities in chemistry and the validation and revision of experts with the content of the manual is included in the course of presenting the manual to experts.

Moreover, the study employed the mixed method design in the construction of the need analysis and validation of the activities. The type of research in which a researcher or team of researchers combines elements of qualitative and quantitative approaches (e.g., use of qualitative and quantitative viewpoints, data collection, analysis, inference techniques) for the purpose of breadth and depth of understanding and corroboration. In a mixed method design, one research question that can be answered with the aid of this method is how to augment evaluation studies with better understanding of intervention implementation. The instrument of this study combines both qualitative and quantitative method of analyses for the study to have an in depth investigation of the need of introducing context-based enrichment activities in General and Inorganic chemistry, that serves an intervention to the difficulty in learning the discipline.

The quantitative analysis was done through five point scale of the relevance of each content in General and Inorganic Chemistry Syllabi and the five point scale to measure the validity of the developed context-based enrichment activities in terms of its objectives, contents and the used approach. The qualitative measurement was added in the form of questions, for the needs analysis students are asked whether there is a need to develop a new instructional material that will connect concepts in chemistry to their lives. While in the face validation, experts were asked about their total impression and evaluation of the proposed enrichment activities.

Both the qualitative and quantitative analyses are salient to the realization of this study, which may lead to the development of the proposed activities. In the development of the context-based enrichment activities, the topics selected to be included is based on the existing course syllabus in General and Inorganic chemistry used in Bulacan State University for the general engineering course and the result of the need analysis. Subsequently, consultation of several books and references in chemistry was done.

In order for the content of the enrichment activities to be context-based, further studies about CTL was conducted by the researcher through literatures.

In the preparation of the context-based enrichment activities the researcher utilized the following procedure. First is the assigning of the title of the enrichment activity and its number. Next is the formulation of the objectives. Afterwards is the construction of the introduction. In this part the selection of materials, then the design and layout of the researcher applied the context-based unit work flowchart by Beasley.

The introduction must include the first steps of the flowchart namely; the entry point to the context by citing into the introduction the application of the concept to be introduced; elaborating the context by introducing a concept map that shows connections of the concepts; framing the problems and hypothesis by stating a question that will lead the students to knowledge inventory leaving them the need to know.

After the introduction is the selection of available materials. In making the procedures, the next steps in the context-based unit work flowchart will again be utilized by citing methods and steps that will investigate research or even demonstrate the answer to the hanging question cited in the introduction part.

And lastly, is the presentation of the guide questions which is the finalization of the learning that is leading to the main concept to be learned.

To validate the objectives, content and the use of contextual approach to each enrichment activity, face validation was utilized. In the conduct of the validation ten (10) college chemistry instructors from the three campuses of the Bulacan State University were given a set of questionnaire to validate the proposed manual. The ten chemistry instructors are graduates of Master of Arts in Education major in chemistry and generalscience.

The population composed of six (6) sections of General Engineering course offered in the Bulacan State University – Bustos Campus in Bustos, Bulacan with a total population of 252 students. The students who have undergone the Chemistry I and Chemistry II courses during the first and second semester of the academic year 2012 and 2013 were the samples because they had completed the two chemistry courses and were therefore, familiar with the course content.

The research sample were fifty (50) students and drawn from the list of students enrolled in the first semester of the academic year 2013 – 2014.

The research instrument includes a need analysis that is constructed which includes the perceived relevance of the course contents present in the course syllabi to the lives of the respondents. Moreover, it also includes the perception of the students of the need to develop a context-based instructional

material that will connect concepts to their daily lives. To validate the result of the need analysis, the same instruments were employed to instructors. The administration of the need analysis questionnaire took 15 minutes to complete. It focuses on two areas; first part is a self rating of the perceived relevance of the contents of General and Inorganic Chemistry 1 and 2 to the lives of the respondents and this part is introduced with a question: "How do you find the relevance of the contents you have learned in General and Inorganic Chemistry 1 and 2 to your life out of school or to the society in general?"

The second part of the need analysis questionnaire includes a question that were answered by the students about their perceived need of having a context-based instructional material to keep concepts in context and the question read, (2) "Is there a need to come up with an instructional material that will connect the concepts taught in chemistry to your daily living? Why or why not?" For the instructors, three more questions were added to the instrument. (3) "What made you choose certain topics you perceived has high relevance to the lives of the students?" (4) "In the course of your instruction with these topics, as chemistry instructors, do you incorporate insights that connect chemistry concepts to the lives of your students? Please cite examples." and "Do you think topics with high perceived relevance should be enriched with activities that would further augment teaching and learning chemistry? Why or why not?"

The two parts of the questionnaire served a unique purpose to this study. The first part gauged the perceived extent of relevance of each course content or topics in the syllabus and will also serve as a basis of selecting what topics will be included in the context-based enrichment activities in chemistry. The topics that resulted very high or high relevance to the perception of the students and instructors were the priority topics that the researcher included in the context-based enrichment activities. Conversely, the second part of the questionnaire sought to answer the perceived need of students to have instructional materials that will bridge the gap between the concepts learned in chemistry to their lives and the basis of choosing contents with high perceived relevance to be included in the enrichment activities.

In the validation of the context-based enrichment activities in chemistry face validity was incorporated in the study. The purpose of the face validity served its rationale of appraising whether the objectives are attainable; the contents are adequate and the relevance of the use of contextual approach to each enrichment activity. The study adapted the instrument utilized by Basilio (2006) in evaluating the objectives and the content of the enrichment activity. Descriptive measures were applied to guide the respondents throughout the evaluation.

The descriptive measure of the instructors of the enrichment activities in terms of the objectives were (1) the objectives in each frame are well defined and (2) the objectives are congruent to the objectives of the frame. For the content or the lessons that are included in the manual these are the descriptive measures to be evaluated by the instructors; (1) the topic is relevant to the needs of the learners; (2) the information presented

"How do you find the relevance of the following course are accurate; (3) the language used is appropriate for the learners; (4) the level of difficulty appropriate for the learners; (5) the contents of the manual is not too long nor too short; (6) the learning activities are appropriate for the learners; and (7) the enrichment activities are interesting.

Descriptive measures for the evaluation of the use of CTL in the enrichment activities were based on the characteristics of CTL cited by Wilson and Clifford (2000) these are; (1) emphasizes problem solving; (2) recognizes the need for teaching and learning to occur in multiple contexts; (3) teaches students to become self-regulated learners; (4) anchors teaching in student's diverse life contexts; (5) encourage students to learn from each other in independent groups; and (6) employs authentic assessment. At the end of the questionnaire a qualitative evaluation will be answered with the question, "What is your general impression of the context-based enrichment activities in General and Inorganic Chemistry?"

These are the instruments used to collect pertinent data about the study and to be analyzed for the interpretation of the results.

B. Data Gathering Procedure and Processing

The context-based enrichment activities in General and Inorganic Chemistry were prepared and constructed by the researcher with the guide of the existing course syllabus in General and Inorganic Chemistry used in Bulacan State University for the general engineering course. Prior to this study a need analysis was conducted to fifty (50) general engineering students who have taken up their General and Inorganic chemistry 1 and 2 during the first and second semester of the academic year 2012-2013 as well as five (5) chemistry instructors of the Bulacan State University Malolos Campus who are B.S. Chemistry and Chemical Engineering graduates. Permission to conduct the survey was asked to the campus administrator on May 23, 2013. The need analysis was distributed to fifty (50) students during their enrolment period and was also submitted on the same day, May 23, 2013. Consequently, the permission of the dean of the College of Science of the Malolos Campus to conduct the need analysis to five (5) chemistry instructors of the department were also sought. The result of the need analysis aided the

researcher to assess the topics that are needed to be incorporated to the enrichment activities and to gauge the students' perception of a need to develop a context-based instructional material. Moreover, the result of the need analysis administered to instructors validated the student's results. To further justify the result of both the need analysis of the students and instructors, supplementary interviews was conducted. The result of both quantitative and qualitative measurements of their perception of the relevance of the course contents in the syllabi are determining factors to which topics are included in the construction of the context-based enrichment activities. In the course of the study references from chemistry books and other related references were consulted. Further study about contextual teaching and learning approach was done, thru related literatures, to ensure that the enrichment activities included employed context-based techniques. Furthermore, to test the validity of the proposed context-based enrichment activities, a face validation was administered to ten (10) chemistry instructors from the Bustos, Meneses and Malolos city campuses of the University. The result of the face validation aided the researcher to consider some revisions and augmentations before the final product is presented. The suggestions and revisions made by the adviser and critic were highly considered to better improve the enrichment activities. The ten chemistry instructors are graduates of Master of Arts in Education major in chemistry and general science.

Descriptive statistics was used to summarize the data collected in the needs analysis and evaluation of the manual. For the need analysis, measures of central tendency was employed and the weighted average score of each content in the syllabus with regards to the perceived relevance of the students to their daily lives was obtained.

Descriptive measures were applied to guide respondents throughout the evaluation and they will have to answer on a five point scale where

- 5 = very high relevance
- 4 = high relevance
- 3 = relevant
- 2 = low relevance
- 1 = very low relevance.

Similar treatment was utilized to get the weighted average of the perception of instructors to the relevance of each topic in the syllabus to the lives of the students. Both the computed mean as to the level of perceived relevance of the students and instructors were considered and the average of both results was obtained to came up with a list of the topics ranked from moderately relevant to highly relevant. Ten (10) contents of the syllabus with the highest weighted average score in terms of the perceived relevance of

the students and instructors to their lives are considered as priority topics to be included in the developed context-based enrichment activities in chemistry.

Moreover, same statistical procedure was conducted in the validation of the content, objective and the use of contextual approach of the proposed context-based enrichment activity. Descriptive measures was used to guide the respondents throughout the evaluation and they will have to answer on a five-point scale where

- 5 = Strongly agree
- 4 = Agree
- 3 = Not sure
- 2 = Disagree
- 1 = Strongly disagree

The weighted average of each descriptive measure was computed and the interpretation of it reflected the agreement of the instructors to the validity of the developed enrichment activities.

III. RESEARCH RESULTS

The perceived relevance of students of chemistry topics to everyday life is used to gauge how topics in their General and Inorganic Chemistry 1 and 2 are significant to their lives and chosen careers. It was determined by a five point scale from very low relevance to high relevance of each topic to their daily lives.

The topic with the lowest mean of 2.48 which in turn descriptively marked has low relevance to their daily lives is the topic in formula writing. It was found out that next to formula writing are balancing redox equations (2.88), state of equilibrium (3.00), buffer solutions (3.10), redox (3.12), determination of empirical formula (3.22), colligative properties (3.22), Covalent bonding (3.24), factors affecting rate of solutions (3.26) and ionic bonding (3.28).

It is important to note that in the result of the perceived relevance covalent bonding, ionic bonding and formula writing are included in the list. These topics are fundamental concepts that if not well understood by students it will affect their comprehension to topics in higher chemistry just like rest of the cited topics with low marks. According to Abraham et. al (1992) and Nakleh (1992) that content in chemistry are full of abstract concepts that is why chemistry learning requires much intellectual thought and discernment. It was also cited that concepts such as dissolution, particulate nature of matter and chemical bonding are fundamental to learning chemistry. Sirhan (2007) stated that unless these fundamental concepts are understood, topics including rate, acids and bases, electrochemistry,

chemical equilibrium and solution chemistry become arduous.

In addition, as a chemistry instructor that students find difficulty in memorizing chemical symbols and names plus the respective charges that is a prerequisite in writing formula. It is conspicuous that writing formula got the lowest mean since it just tasks students to write formulas without even trying to relate its relevance to their lives. As the researcher taught these topics, students would normally asks what the importance of doing so. Merely, students just thought of having to memorize the rules without any implication to their lives. As instructors emphasized to students that writing formula is essential and very basic in their topic such as stoichiometry and electrochemical cells. Chemistry subject that will lead them to fully understand succeeding topics such as bonding and equations. Furthermore, textbooks would only introduce the topic with rules and examples that students should follow and derive a correct formula for a given compound. The topic in formula writing is more conceptual rather than putting it into the context of the students' lives.

Likewise topics in chemical bonding, such as covalent and ionic bonding also got a score of moderate relevance to the lives of the students. Bonding is a central concept in the chemistry teaching, and therefore a thorough understanding of it is essential for understanding almost every other topic in chemistry such as carbon compounds, proteins, polymers, acids and bases, chemical energy, and thermodynamics. According to the literature, bonding is considered by teachers, students, and chemists to be a very complicated concept. It was observed that in teaching chemical bonding students usually see it very vague and arduous. Since the topic is delivered merely by the use of models and underlying concepts that would lead students having a mental model of the processes. Without delivering it in a contextual approach, students have difficulty in grasping the lesson and just hold on to the idea that this topic is a prerequisite in understanding chemical phenomenon. Since the idea of chemical bonding is in the microscopic level, or to be specific in a nanoscopic level, the students find it very taxing to understand the lesson.

Students' misconceptions regarding this concept have been noted worldwide since students live and operate within the macroscopic world of matter and do not easily follow shifts between the macroscopic and submicroscopic levels. In addition, students try to build alternative conceptions and non-scientific models just to memorize the concept of chemical bonding[5]. Most alternative conceptions in Chemistry are not derived from the learner's informal experiences of the world but from prior science teaching. In this case, it is ardent to say that teachers

should find another pedagogical method that would lead scientific conceptions and models of chemical bonding that will direct the conceptions of students in a more scientific model without compromising its significance to the lives of the students, not just emphasizing its significance to the succeeding topics [6].

Other topics which got moderate relevance to students' lives are determination of empirical formulas and balancing oxidation and reduction equations. Just like writing formula, these topics involve formulas and rules that can be manipulated to get the correct answer. In this case, students just grasp a learning outcome of calculating, writing formula and balancing equations which manifests low significance to their lives but have significant worth as a fundamental concept in a higher topics such as stoichiometry and electrochemical cells.

These concepts also provide students mathematical tools and equations to represent concepts in a microscopic level that aren't seen and experienced by students. So, experience wise, students hardly relate these topics to their lives. Likewise with state of equilibrium, this concept in chemistry is delivered in terms of mathematical equations and operations that involve getting the equilibrium constants and equilibrium concentrations. Though equilibrium isn't only presented in quantitative analysis but also in a qualitative manner, the basic concepts are carried out again in a microscopic level, since in the state of equilibrium, macroscopically it appears nothing is happening but microscopically it is dynamic.

It is remarkable that buffer solutions, colligative properties and factors affecting rate of solutions are contents that belong to scores having moderate relevance to students' lives. These topics are presented to students with its applications to their lives, such as in a buffer system the blood is an example of a medium that resist drastic change in pH level. The general engineering students were also lectured that the importance of the buffer system in blood is essential in maintaining the homeostasis of the pH level of the blood that any abrupt change in it would lead to a serious medical condition called alkalosis or acidosis. Likewise colligative properties were also presented to them in a contextual manner, giving examples such as antifreeze used in radiators, use of salt in melting snow in pavements and the use of salt in lowering the freezing point of ice used in freezing ice cream. Another surprising result of having moderate relevance to the lives of the students are the factors affecting the rate of solutions, it is unforeseen since every day we are dealing with solutions and solubility. Moreover, as the instructor of the respondents also has conducted laboratory activities for these contents. To the light of this astonishing result for these topics, the researcher in

his recollection that in his course of delivering these topics he was focused more on the quantitative analysis of variables involved in the concepts not having more time on the discussion of its applications.

For supplementary justification of the result an interview was conducted as to why the students have chosen such topics with moderate relevance and high relevance to their lives and here are some of the answers of the students. According to J.E. "*para po sa akin sir yung hindi gaanong relevant ay yung topic about sa atoms at mga subatomic particles dahil di po gaanong nagap-uusapan at nagagamit masayado yung kaalaman about dun sa araw araw na buhay. It requires deeper study and understanding.*" Another respondent, C.C., replied "*formula writing for me has low relevance because I see it has no significant in life as far as my knowledge is concern.*". Furthermore A.S. responded to the question and according to him, "*yung balancing redox and formula writing po hindi gaanong relevant sa buhay ko kasi po more on quantitative napo e I think hindi ito ganun kaimportante sa pang araw-araw na buhay ,kasi hindi naman po applicable sa araw-araw yun kapag bumili po ba tayo ng itlog sa tindahan hindi naman po itatanung ang redox pero po ung itlog kapag pinirito makikita yung changes nung sa itlog. Kaya po yung physical and chem change I think mahalaga po just like dun po sa tinalakay natin tama na po yung scientific literate ang isang individual and I guess yung physical and chem change nakakasalamuha natin araw-araw and kung aware tayo dun scientific literate natayo.*"

Here are some of the replies of the students emphasizing topics that they perceived very relevant to their lives. According to A.B.D.V. "*sir napaka-importanteng changes sa basic living kaysa chemical change malalamanmo kung panis yung gatas naitinum mo kapag may sudden change of color nahabang kung di moalam malakihang tendency na magkasakit ka. Sa physical change and chemical changes din sir mahalaga rin best example pag nagluluto ka malalaman mong luto na yung food kapag nakita mong iba na ang kulay.*" Furthermore J.S. replied "*sir para posa akin ... mahalaga pong pag-aralan yung physical ang chemical changes ... because there are lot of changes happen in our our surroundings ... and we people nag undergo din pong physical and chemical changes in and out of the body.. importante po ito upang maipaliwanag kung bakit ,ano ang dahilan,,at effect ng physical and chemical reaction ..*" According to G.R. "*sir sakin po mahalaga mapagaralan kahit di po gaanong ung iba po di magagamit sa araw-araw ,mahalagapoito para maintindihan po natin ung mga nangyayaring tulad ng mga changes around us. Ok lang po ito pag-aralan to be aware and knowledgeable enough in chemistry.*" To note

one of the students D.A. answered "*For me it is important to study the physical and chemical changes dahil we can see or observe it in our daily life po. Tsaka sir di naman lahat ng pagkakataon e magagamit natin yung ibang topics like formula writing o balancing redox, pero yung physical and chemical madali pong iapply. . And it easy to explain, remember and share it to others po.*" Moreover S.M.S., said "*para sakin chemical changes kasi po diba it produce a new substance. Now a days madaming na proprouce dang human from simple to complicated. For example po yung pop corn or fireworks para knowledgeable sila. nasamga seeds eh nakakagawang pop corn and the question is how? May mga studyante po kasi ng matanung kung paano nangyayari ang isang phenomena. If napagaralan yung chemical changes ng mga bagay-bagay madaling maipaliwanag kasi knowledgeable na about dun.*" Additionally A.T. stated "*oo naman sir like for example the topic about chemical and physical changes, na-i-a-apply natin ito every day. Just ike putting water in to the refrigerator to freeze it, cutting wood, dropping plates, or cups, chopping fruits or vegetables, tearing paper, breaking items, chewing pencils and peeling potatoes. Kahit hindi natin si nanadya we used and apply it every day.*"

From these interviews it is conspicuous that some of the topics in chemistry were perceived relevant to the lives of the students. In connection to the concepts learned in chemistry they have this appreciation to the topics like changes that matter undergo. The respondents experience it every day and apply the scientific behind this to explain and deeply understand such phenomena.

Moreover, the topics that the general engineering students perceived have more relevance to their lives. The content that got the highest rating and has a descriptive rating of high relevance to the students is chemical changes with a mean of 3.98. The succeeding contents with a descriptive rating of high relevance to student's lives are physical changes (3.96), substance and mixture (3.96), compounds (3.94), states of matter (3.92), types of solutions (3.84), properties of acids and bases (3.82), ways of separating mixtures (3.82), properties of matter (3.80), elements (3.80), types of chemical reactions (3.78), precision and accuracy (3.70), properties of solutions (3.68), classification of elements (3.66), rate of reaction (3.62), factors affecting reaction rates (3.58), kinetic molecular theory (3.58), gas laws (3.56), general features of the periodic table (3.56), balancing chemical equations (3.54) and colloids (3.52).

From the result, mostof the topics that students perceived with high relevance are the contents that they took during their general and inorganic chemistry 1 course. In this course it covers the fundamental concepts of chemistry in order to

understand deeply the concepts to be taught in general and inorganic chemistry 2. The research opted to include the topics with high relevance to students' lives as contents to his context-based enrichment activities. Since most of the contents that got high relevance to students are fundamental concepts, it is the initiative of the study to enrich these topics with context-based activities. This is in consonance with a study that if in practice these fundamental concepts are developed with care while allowing concepts to be approached from several directions, the learners will be enabled to develop ideas more meaningfully. This study is parallel to the objectives of CTL since these key concepts should build significance to the lives of the students, which will direct meaning to the lessons learned.

In addition to the descriptive measure of the relevance of these topics to the lives of the students, they were asked if there is a need to come up with an instructional material that will connect the concepts taught in their chemistry class to their daily lives. Majority of the respondents replied yes there is a need to come up with an instructional material that will connect these concepts to their lives. There were several reasons why

these students agreed to come up with an instructional material that is context-based.

The students replied with the following reasons: (1.) "Yes, because we all know that chemistry is everywhere that is why it is clear that we can apply it to our daily lives." (2.) "Yes, in some concepts. So that it would help us understand more the importance of chemistry in our daily living." (3.) "Yes, in order for us to understand the lesson more." (4.) "I think yes, simply because it would be a lot easier for students like me to understand chemistry more if it would be taught practically." (5.) "Of course we have to be accurate in some measurements and cost of some items. Chemistry taught me how to be accurate." (6.) "Yes, in our daily living we use measurements like converting one unit to another." (7.) "Yes, because we need chem in our daily life." (8.) "Yes, because it's better to have ideas about chemistry, the more you acquire knowledge the more you can face life." (9.) "Yes, because we usually witness some physical and chemical changes that happens every day." (10.) "Yes, for example are the elements. So that we can easily determine what kind of element is that and where is that usually found."

The perceived relevance of the students to the topics to their lives served as the basis to what contents should be included in the enrichment activities. According to Morales (2009) in his development of instructional materials in a contextual approach, it is salient to focus first in the needs of the learner. The needs analysis can give an impression to what topics the students cannot elate in their daily life and to what interests them. In this

study, the question as to the need of coming up an instructional material in chemistry that is context-based served as a need analysis and a basis of the construction of the context-based enrichment activities. It is conspicuous that from the answers of the students there is a need to come up with context-based enrichment activities that will connect concepts to the lives of the students.

The perceived relevance of instructors of chemistry topics to everyday life is used to gauge how topics in their General and Inorganic Chemistry 1 and 2 are significant to the lives of their students. It was determined by a five point scale from very low relevance to high relevance of each topic to their daily lives.

The result of the frequency distribution and descriptive measures of the perceived relevance of the instructors to chemistry topics to everyday lives of the students serve as a basis of comparison between the results of the perceived relevance of students to chemistry topics in their everyday lives. This is used to validate both the results from the instructor and student respondents.

This shows a parallel questionnaire answered by experts in the field of chemistry. The respondents of the questionnaire are five instructors in Bulacan State University Malolos campus who are graduates of Bachelor of Science in Chemistry and Bachelor of Science in Chemical Engineering. The purpose of having this survey is to validate the results of the perceived relevance answered by the students.

The result manifests that the content that got the lowest mean is naming inorganic compounds with a rate of 2.60 which is moderately relevant. The following topics also got a descriptive measure of having moderate relevance to students and these are: general features of the periodic table (2.80), determination of empirical formula (2.80), buffer solutions (2.80), branches of chemistry (3.0), atomic number, mass and isotopes (3.0), formula writing (3.0), ionic bonding (3.0), covalent bonding (3.0) and properties of covalent bonds (3.0). From the results it is important to note that the results of the students and the instructors are somehow congruent in terms of having a general descriptive mean of moderately relevant to the topics that got the lowest mean. In addition, it was observed that formula writing, buffer solutions, determination of empirical formula, covalent bonding and ionic bonding are the contents that are in agreement with students and instructors to belong in the contents that got the lowest means.

From the results in table no. 2 the content that got the highest mark in terms of the perceived relevance is precision and accuracy that gained a mean of 4.40, high relevance. The following topics are also included to the top twenty contents that got the highest score and a descriptive rating of high relevance: gas laws (4.20), physical changes (4.20),

conversion of units (4.20), factors affecting rate of solution (4.00), factors affecting solubility (4.00), types of solutions (4.00), properties of solutions, variables in gases (4.00), chemical changes (4.00), substances and mixtures (4.00), states of matter (4.00), factors affecting reaction rates (3.80), types of chemical reactions (3.80), compounds (3.80), elements (3.80), ways of separating mixtures (3.80), pH and pOH (3.60), rate of reaction (3.60), colloids (3.60) and concentration of solutions (3.60).

From the results, it showed that fifteen of the contents chosen by students having high relevance are in agreement with the choices of the experts. These are the topics that are parallel with both results: colloids, gas laws, factors affecting reaction rates, rate of reaction, properties of solutions, precision and accuracy, types of chemical reactions, elements, ways of separating mixtures, types of solutions, states of matter, compounds, substances and mixtures, physical changes and chemical changes.

It is observed that these topics are also the contents of the general and inorganic chemistry 1 course of the general engineering students. This means that these topics are fundamentals and key concepts in chemistry that may help students be directed to their general and inorganic chemistry 2 courses. However, the researcher still opted to choose the top twenty contents that got the highest mean since the results of the perceived relevance answered by instructors will just serve as a basis of validating the results of the perceived relevance answered by the students.

In addition to the perceived relevance of the instructors of the topics in chemistry to the lives of the students, the following questions were asked and consequently here are their replies.

The first question is cited as "Is there a need to come up with an instructional material that will connect the concepts taught in chemistry to the lives of the students? Why and why not?" (1.) "Yes, for them to understand more in practical ways the importance of chemistry in their respective fields." (2.) "Yes, so that the students can realize the importance of chemistry in their daily lives." (3.) "Yes, because it is one way where students can appreciate the importance of chemical concepts which are so abstract and vague for them."

The next question is "What made you choose certain topics you perceived has high relevance to the lives of the students?" (1.) "Since engineering students usually encounter these topics in their higher sciences." (2.) "The importance of these topics in their field of specialization."

Another question that goes, "In the course of your instruction with these topics, as chemistry instructors, do you incorporate insights that connect chemistry concepts to the lives of your students? Please cite examples." (1.) Yes, like for example in solution, the

procedure they do in combining coffee, tea, sugar with water. Also colloid and suspension." (2.) "As much as possible, I do. Solutions and subtopics under them are good examples, since organisms; including human absorb materials in ionic forms."

Lastly this question was also asked, "Do you think topics with high relevance should be enriched with activities that would further augment teaching and learning chemistry? Why or why not?" (1.) "Yes, these would not only help the instructors in their teaching strategies, students will also be given a chance to apply chemistry principles in their day to day living." (2.) "Yes, so they will better understand the application of these topics. Besides some concepts in chemistry are too abstract, thus, they need to understand this on the macro level."

The answers of the experts are in agreement that there are needs to come up with an instructional material that will aid connect chemistry concepts to the lives of the students. These instructors also in high relevance to the lives of the students should be enriched so that they can link these key concepts to their lives and even their chosen careers. It is evident that these experts and instructors are aware of the importance of the contextual approach of teaching and learning chemistry since they too apply the approach by giving examples and activities that are contextual chemistry.

The need analysis of both students and instructors is utilized in order to measure how the topics in General and Inorganic Chemistry are significant to their lives. The researcher opted to have a parallel need analysis administered to instructors to validate whether the result of the need analysis of students are reliable. To check the reliability of the results, the average of the means of the student's need analysis and instructor's need analysis were obtained. The result of the comparison aided the research to determine whether the perceived relevance of the topics in general and inorganic chemistry in the lives of the students of both the instructor respondents and engineering student respondents are congruent with each other. The congruency of the result helped the researcher to objectively choose the topics to be included in the context-based enrichment materials in general and inorganic chemistry. This part is salient since the perception of both the instructors and students who are engaged in the teaching and learning the subject gave an objective information to pursue the development of such enrichment activities contextually.

The result shows the contents of General and Inorganic Chemistry syllabus perceived by both students and instructors with moderate and high relevance to their lives. To analyse the result it is seen that the mean of the students in terms of perceived relevance of this topics are congruent to the mean of the instructors. This manifests that the

rated contents with moderate relevance and high relevance are reliable since there is an agreement between the learners and the instructors.

To state from the result, the topics having an average that fall between 3.45 and 4.40 which is rated as highly relevant for both students and instructors are: chemical equations, stoichiometry, general properties of gases, concentration of solutions, pH and pOH, significant figures, colloids, kinetic molecular theory, properties of acids and bases, rate of reaction, factors affecting the rate of solution, variables in gases, factors affecting reaction rates, properties of matter, factors that affect solubility, types of chemical reactions, elements, ways of separating mixtures, conversion of units, properties of solution, states of matter, substances and mixtures, chemical changes, precision and accuracy and physical changes.

The study opted to consider the topics perceived by both students and instructors with high relevance to everyday living to be the contents of the developed context-based enrichment activities.

However, only 19 topics with a rate of high relevance were drafted as contents of the enrichment activities. Among the topics with high relevance here are the contents of the context-based enrichment activity: colloids, chemical equations, elements, kinetic molecular theory, factors affecting rates, rate of reaction, precision and accuracy, properties of solution, types of chemical reaction, properties of matter, ways of separating mixture, properties of acids and bases, types of solution, states of matter, compounds, gas laws, conversion of units, substances and mixture, physical changes and chemical changes. The topic element was considered to have two enrichment activities since this topic is incorporated in the features of the periodic table.

With the same instrument used in the study of Basilio (2006), the results in table five shows the strong agreement of ten chemistry instructors from BulacanSatte University Malolos, Bustos and Menesescampuss with the objectives and the contents of the enrichment activities.

According to Jones (2012), that contextual teaching and learning should lead the students in the enjoyment of knowing how the world works. Moreover, Biag (2003) emphasized in his study the importance of evaluating the validity in terms of the content and the way the CTL materials are presented. Meanwhile, Belen (2005) also marked the significance of evaluating the developed materials using contextual approach in terms of the content of the lesson, the development of scientific skills and attitudes, how appropriate are the strategies used and its relevance to real life experiences. These related studies are important basis of the evaluation of the developed enrichment activities.

The above descriptive measures of the use of contextual teaching and learning are adapted to the definition of CTL by the Ohio State University (1999) in which it states that the effectiveness of the employment of CTL is based on it. From the results in table no.4 the context-based enrichment activities passed with a strong agreement from 10 chemistry instructors in terms of the use of CTL. However, it is good to note that some of the respondents just agreed that the activities emphasize problem solving and got the lowest score of 4.40.

The impressions of the respondents to the enrichment activities were cited in the answered questionnaires. The instructors noted that the activities will enable students to learn content and principles more easily and attain higher level of retention. In addition, the enrichment activities are applicable to the daily activities of the students and they may possibly learn better and appreciate chemistry. Another comment says that the activities are interesting and useful.

IV. CONCLUSION

Based on the findings, the following conclusions were made:

1. The majority of the contents perceived with low relevance to the lives of students are the topics that are included in their general and inorganic chemistry.
2. While the contents that are perceived with high relevance are the contents that are fundamental and key concepts in chemistry.
3. Based on the results of the validity of the context-based enrichment activities in general and inorganic chemistry it is revealed that it is objectives, contents and the use of CTL are applicable.
4. The processes that are involved in the development of context-based enrichment activities are administering a need analysis, selection of the topics to be included in the activities, constructing the activities using contextual approach and validating the activities with the aid of chemistry instructors.
5. The impressions of the chemistry instructors with the context-based enrichment activities are remarkably good as they have found it interesting and contextual.

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