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Development, Validation, and Evaluation of Instructional Material In Inorganic Chemistry

Jonathan Lord R. Aquino
College of Education
jonathanlord.r.aquino@isu.edu.ph

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Abstract
This study aims to develop and prepare instructional materials in Inorganic Chemistry and determine the validity and acceptability of the proposed instructional materials. The descriptive-evaluative survey was used for the respondents who availed of the proposed instructional material to find out or evaluate its validity through the given criteria. For the realization of this study, there were three groups of participants: 1. Students. 2. Faculty, and IMDU Committee. Research instruments used were a survey questionnaire used to draw out the respondents' perceptions. The criteria for evaluation of this were incorporated in the questionnaires, which are the following: a. Objectives, b. Contents, c. Usefulness, d. Clarity, e. Suitability, and f. Adequacy. It could be deduced from the data that the proposed Instructional Material in Inorganic Chemistry is acceptable and valid to students, instructors, and the IMDU Committee.
Keywords: Development, Validation, Evaluation, Instructional Material, Inorganic Chemistry

Introduction

Due to this Coronavirus or COVID-19 global health outbreak where in fact the educational system is unexpectedly affected and temporarily shut down, from the month of March to October 2020 (Aristovnik, 2020)[1]. Many debates and issues have been raised in pushing for the reopening of classes in the school year 2019-2020 despite the pandemic to ensure that no students are left behind, while parents express curiosity about trying out how remote learning is going on (Magsambol, 2020)[2].

The COVID–19 pandemic brought an interruption in all sectors of society, causing a chain reaction of economic and psycho-social impacts affecting every Filipino citizen. For the Philippine higher education sector, the learning environment has been severely disrupted campuses were closed and face-to-face classes were suspended to protect the health and safety of students. But despite these interruptions, CHED ensured the continuity of learning by enjoining higher education institutions (HEIs) to implement flexible learning modalities. [3]

The CHED Memo Order has led millions of students into temporary 'home-schooling' situations, especially in some of the most heavily impacted our country. These changes have certainly caused a degree of inconvenience, but they have also prompted new examples of educational innovation.

Although it is too early to judge how reactions to COVID-19 will affect education systems around the world, there are signs suggesting that it could have a lasting impact on the trajectory of learning innovation and digitization.[4]

Pursuant to the CMO No. 08 series of 2021, the Isabela State University implemented the Flexible Teaching and Learning Modalities (FTLM), which brings to our students to experience of a combination of online and offline learning. Flexible Teaching and Learning Modalities (FTLM) should be the norm of our teaching, minimizing in-campus presence of students and face-to-face learning [5].

Based on the study conducted by Ambayon (2020), modular instruction is more effective in the teaching-learning method as compared to usual teaching approaches because in this modular approach, the students learn at their own pace. It is an unrestricted self-learning panache in which instantaneous reinforcement, a comment is provided to the practice exercise, which stimulates the students and builds curiosity in them. Hence, this kind of learning modality increases the student-centered approach in learning. However, the implementation of modular instruction fostered various challenges to teachers, students, and parents.[6]

The study of Dangle & Sumaoang (2020) showed that the main challenges that emerged were a lack of school funding in the production and delivery of modules, students struggling with self-studying, and parents' lack of knowledge to academically guide their child/children. Hence, it is evident that there are struggles associated with the use of modular distance learning.[7]

It includes the use of instructional modules among students. According to Carrillo & Flores (2020), learning modules are beneficial because they provide continuity of learning and ensure that the students are safe at home. After all, they need not attend school for a face-to-face discussion with their respective professors.[8]

Developed Supplementary Learning Materials are additional or alternative printed or non-printed materials used for both distance learning and face-to-face classes to promote motivation and to help the students to master competency-based skills on Most Essential Learning Competencies (MELCs), which were not developed during the making of Alternative Learning Modalities (ADM) known as DepEd modules (Llego, 2020)[9]. These are an intervention material for the students who have difficulties in answering their alternative learning modules to enhance the academic achievements of students performing low in the field of General Chemistry (Utami, 2016)[10]. It would increase and deepen students' skills in manipulating, thinking, understanding, and observing.

Inorganic chemistry is one of the subjects that is considered difficult by students. Stoichiometry is one example of a chemistry topic, and students often have a problem understanding this topic. The most common problems studying stoichiometric calculations in college are: (1) the resources are only textbooks or reference books, (2) there are many abstract and complicated concepts, (3) the weak interaction between teachers and students in the classroom, and 4. Time constraints are available in classroom learning. Teaching material commonly used is a textbook that students can't

fully understand the concepts very well makes students unable to understand the process occurring at the particular level (Rochmawati,2021).[11]

The study of Choppin (2020) stated that the teachers responded more to features in the instructional materials than to the curriculum aims and objectives articulated in the CCSSM while planning and enacting lessons, which has implications for policymakers who aim to influence instruction through national standards and for school districts as they select materials.[12] Another study investigated the utilization of instructional materials as tools for effective academic performance of students (Bukoye, Roseline Olufunke, 2019).[13]

In the study of Russel, et. al. (2022) that the teacher should prioritize and organize content so that students are introduced to big ideas rather than getting lost in a welter of details, and allow them to respond flexibly to questions raised by their students in using the instructional material. [14]

Additionally, instructional clarity has been demonstrated to improve students' enjoyment and achievement in mathematics while reducing boredom in both groups, with the advantage being greater in Hong Kong classrooms. (Chen and Lu, 2022). [15]

The results of the study revealed that the availability and suitability of the materials varied among the different types of schools investigated and that there was much room for improvement. Most teachers have not yet reached higher levels of operation regarding the use of instructional materials. In conclusion, a number of recommendations are made to improve the situation. Teachers should select, reorganize, and design the learning resources for students according to the learning content of the textbooks. Thus, in this study, SE-OLR refers to the teachers' ability to specifically select and control online learning resources based on the learning content of the textbooks. (Zhu, et. al. ,2022)[16]

According to Molyko-Buea, Cameroon (2022) that the importance of quality and adequate instructional materials in teaching and learning can occur through their effective utilization during classroom teaching. Instructional materials here include all the tools that the teachers can use to make the learning more interesting, memorable, and also improve on academic performance of students.[17]

The format of the instructional material is based on the module template given by the Office of Academic Related Affairs through the Office of Instruction. It consists of the following:

1. Title of the Module

2. Overview/Introduction - this part sets the stage for the learning that will take place. It prepares the students by building some related vocabulary, defining expected situations, expected outcomes, and expected learnings. It also poses the module question.

3. Learning Outcome/Objective - it contains the list of competencies that students should acquire during the learning process.

4. Learning Content/Topic - it contains readings, selections, and discussion questions, and sets of activities that students can work on individually or in groups.

5. Teaching and Learning Activities - This is a list of concepts and thinking skills that were covered in the module. It also includes questions or an activity that integrates the idea, helps learners connect to the module question, assess progress, and look ahead. Likewise, this may contain additional problems that could be used for homework or tests, or additional readings that allow students to apply new knowledge and skills in a different context.
6.Assessment Task - this allows the students to pull together what they have learned and the skills they have developed in order to answer the module question. In this part, students are given Self-assessment Questions (SAQs) and asked to consider broader aspects of the question, such as social and economic.
7. References (Copyrighted within the last 5 years) - this contains the list of references/readings which students can explore.
It is the purpose of this study to develop and prepare an instructional material in Inorganic Chemistry and determine the validity and acceptability of the proposed instructional material for the Second Year Bachelor of Secondary Education major in Science of the College of Education of Isabela State University, Cauayan Campus, Cauayan City, Isabela.
More specifically, this study sought to answer the following objectives:

1. To determine the profile of the students in terms of:
    a. age
    b. gender
2. To determine the profile of the teachers in terms of:
    a. teaching load
    b. years of teaching
3. To evaluate the proposed Instructional Material for Inorganic Chemistry by the student respondents in terms of the following criteria?
    a. Objectives
    . Content
    . Usefulness
    . Clarity
    . Suitability
    . Adequacy
4. From the results of the evaluations of the Chemistry teachers, to determine the content on the use of Instructional Materials for Inorganic Chemistry in terms of the following criteria?
    . Objectives
    . Content
    . Usefulness
    . Clarity
    . Suitability

. Adequacy

5. From the results of the evaluations of the Instructional Material Development Unit (IMDU) Committee, to determine the face validity of the use of Instructional Materials for Inorganic Chemistry in terms of the following criteria?
    . Objectives
    . Content
    . Usefulness
    . Clarity
    . Suitability
    . Adequacy

REVIEW OF RELATED LITERATURE

Instructional Materials and Their Role in Learning

Instructional materials play a vital role in enhancing comprehension and academic success by offering varied and interactive ways to present complex ideas, thus aiding better understanding. For instance, employing digital tools such as PhET simulations in elementary science classes has led to notably higher student performance and improved ability to articulate reasoning during problem-solving activities compared to traditional textbook methods, highlighting the effectiveness of instructional materials in enhancing conceptual understanding and academic results(Diab et al., 2024). Furthermore, transitioning from passive, teacher-focused instruction to active, student-centered learning through resources such as discussion forums, concept maps, and interactive content significantly boosts student engagement, comprehension, and retention, with active learning demonstrating much higher retention rates than passive approaches(Gamo, 2022). Instructional materials also promote meaningful, independent, and self-paced learning by enabling learners to interact with the content dynamically and at their own speed. Interactive learning tools, such as H5P interactive videos, although sometimes facing challenges with engagement levels, offer personalized learning experiences and have received positive feedback from students, indicating their potential to encourage self-directed learning(Jacob & Centofanti, 2023). These resources contribute to intrinsic motivation and satisfaction, which mediate engagement and learning effectiveness across various educational contexts, emphasizing the role of instructional materials in supporting autonomous learning(Nguyen-Viet et al., 2024). Additionally, instructional modules significantly enhance student engagement and conceptual understanding by incorporating active learning strategies and cognitive task designs that promote knowledge construction and collaboration. For example, higher-order tasks that involve analysis and application foster deeper engagement and knowledge elaboration than simpler retrieval tasks, leading to richer social interactions and group collaboration during learning activities(Reid et al., 2022). These modules help shift the learning paradigm towards active participation, where students take responsibility for their own learning, thereby deepening their conceptual understanding and engagement(Gamo, 2022). Overall, well-crafted instructional materials and modules serve not only as a means for

content delivery but also as catalysts for increased student engagement, meaningful learning, and enhanced academic performance.

Modular Learning and Flexible Instruction

The COVID-19 pandemic led to a swift transition towards modular and adaptable learning methods to maintain educational progress during school shutdowns. Modular learning has emerged as a viable option for numerous students, particularly those with limited technological access, as it facilitates self-directed study through physical or digital modules, catering to various learner situations and capabilities(Agaton & Cueto, 2021). This approach effectively addresses the diversity among learners by allowing personalized pacing, which is crucial when synchronous teaching is difficult. This adaptability benefits students who need additional time or different methods to fully understand concepts(Mariano & Cordova, 2022). Nonetheless, modular distance learning has posed considerable obstacles for both educators and students. Teachers encountered challenges due to insufficient training in digital teaching methods and a lack of resources to create and deliver effective modular content(Celik et al., 2022). Students struggled with issues related to motivation, time management, and limited interaction, which affected their engagement and learning outcomes(Cardullo et al., 2021). Furthermore, technological challenges, such as inadequate Internet connectivity and a lack of devices, disproportionately impacted marginalized students(Agaton & Cueto, 2021). Despite these difficulties, modular learning remained an inclusive option to address educational inequalities during the pandemic, highlighting the necessity for ongoing support and training to enhance flexible teaching models in the future.

Development of Instructional Modules

When creating instructional modules, it is crucial to follow fundamental principles and guidelines to ensure that they are well-structured and educationally effective. The modules should clearly outline the learning objectives to direct both teachers and students toward the desired outcomes. These objectives must be specific, measurable, achievable, relevant, and time-bound to support focused learning and evaluation. Organizing content in a logical order is vital, as it allows information to flow coherently, gradually enhancing learners' comprehension. This organization should consider prior knowledge and appropriately introduce new concepts. Ensuring content accuracy is essential for upholding the module's credibility and reliability, thereby supporting effective learning. Additionally, instructional modules must align with course syllabi to ensure consistency between the module content, activities, and assessments with the overall course objectives and standards. Such alignment helps to meet institutional requirements and provides a consistent learning trajectory. Instructional design templates play a significant role in module development by offering standardized formats that assist educators in systematically organizing the content. Examples include the Faculty Teaching and Learning Module (FTLM) and formats recommended by offices such as the Office of the Vice President for Academic Affairs (OVPAA). These templates typically feature sections on objectives, content, learning activities, assessments, and references. Utilizing these templates ensures that modules meet academic quality standards,

promote uniformity across courses, and simplify review and revision processes. Overall, instructional design templates streamline the module creation process while ensuring educational rigor and alignment with institutional policy.

Validation of Instructional Materials

Ensuring the quality, effectiveness, and suitability of educational resources depends on the validation of instructional materials. This process typically includes assessments by experts, feedback from students, and evaluations by organizations such as the Instructional Materials Development Unit (IMDU), all of which work together to maintain instructional integrity and educational relevance. Expert assessments confirmed that the materials adhered to academic standards, whereas student feedback provided insights into their usability and engagement levels. The IMDU reviews generally ensure that the materials comply with institutional and pedagogical standards. Important criteria for validating instructional modules encompass the clarity and appropriateness of objectives, accuracy and relevance of content, utility in achieving learning goals, and overall clarity, suitability, and adequacy for the intended learners. Objectives should be clearly defined and measurable, content must be accurate and relevant, usefulness should align with learner needs, clarity is necessary for understanding, suitability should match learner levels, and adequacy should cover the necessary scope and depth of the subject. Research has shown that instructional materials validated through this thorough process lead to better learning outcomes. For example, Anselmo and Anselmo (2024) found that validated modules are more effective in improving student comprehension and academic performance, highlighting the crucial role of systematic validation in instructional design. These findings emphasize the importance of ongoing evaluation and validation in developing quality instructional materials.

Suitability and Adequacy of Learning Resources

The suitability and adequacy of learning resources depend on their alignment with students' academic level, curriculum standards, and course objectives. Learning materials must be tailored to learners' prior knowledge and cognitive abilities to effectively support comprehension and skill acquisition. Proper alignment with curriculum standards ensures that the instructional content meets predetermined educational benchmarks, providing a coherent framework for achieving the intended course outcomes. Equally important is the alignment with course objectives, which clarifies the purpose of the resource and its role in promoting the targeted competencies. Furthermore, adequate activities, examples, and assessments are integral to reinforcing the development of competency. Well-designed activities encourage active engagement and practice, facilitating a deeper understanding and mastery of skills. Examples serve to contextualize theoretical concepts, making learning more relevant and more accessible. Assessments, particularly those constructively aligned with learning outcomes, provide critical feedback that guides students' progress and competency attainment. Research has shown that such alignment between learning materials, activities, and assessment strategies enhances soft-skill acquisition and supports holistic competency development across disciplines. Incorporating formative feedback

into these assessments further strengthens learning by identifying areas that need improvement and fostering student reflections. Thus, learning resources must not only be suitable in terms of content and level, but also adequate in terms of the variety and depth of supportive activities and assessments to effectively cultivate the required competencies (Alt et al., 2023; Kalmpourtzis & Romero, 2020; Macphail et al., 2021; Solera et al., 2025).

Impact of Well-Designed IMs on Academic Performance

Research shows that employing well-crafted, high-quality instructional modules (IMs) can greatly enhance academic success. For example, converting traditional classes into online formats that include active student participation, digital settings, and ongoing assessments has led to improved student performance compared with in-person teaching. This indicates that IMs that engage students through live and recorded activities, self-evaluation, and group tasks encourage deeper learning and better academic results(Freire & Rodríguez, 2021). Furthermore, the use of instructional technology boosts learners' motivation, self-confidence, and skills, which are directly associated with academic achievement(Al-Khresheh & Alkursheh, 2024). The importance, clarity, and focus on the learner in instructional modules are crucial for improving students' academic performance. Approaches centered on the learner that provide autonomy and promote active involvement cultivate positive achievement emotions and self-determination, which are vital for effective learning, although more research is needed on their impact on emotions(T. Jacob & Centofanti, 2023). Instructional clarity and quality have been associated with better student outcomes, with teacher satisfaction and positive student–teacher relationships mediating instructional quality and cognitive activation, both of which are essential for academic success(Harrison et al., 2023; Wang et al., 2025). Additionally, promoting learner-centered interactions increases student satisfaction and success in online learning environments, highlighting the importance of incorporating these principles into IM design(Katsarou & Chatzipanagiotou, 2021). In summary, well-designed IMs that focus on relevance, clarity, and learner-centeredness create favorable conditions for enhanced academic performance.

Methodology

a. **Research Design**

The descriptive-evaluative survey was used for the respondents who availed of the proposed instructional material to find out or evaluate its validity through the given criteria using the proposed instructional material for Inorganic Chemistry.

b. **Sampling Procedure**

For the realization of this study, there were three groups of participants. The **first group** of participants was the twenty (20) students in the second year of Bachelor of Secondary Education (BSEd) major in Science of the College of Education of Isabela State University, Cauayan City, Isabela were utilized for the school year 2022-2023. They evaluated the instructional material based on the objectives, content, usefulness, clarity, suitability, and adequacy.

The **second group** of participants was the seven (7) chemistry instructors of Isabela State University, Cauayan campus. They evaluated the instructional material's content validity based on the objectives, content, usefulness, clarity, suitability, and adequacy.

The **third group** of participants was the Instructional Material Development Unit of the campus and the university. These validators included one expert on instructional material development and three content experts or subject specialists. They evaluated the instructional material's face validity based on the objectives, content, usefulness, clarity, suitability, and adequacy.

c. **Methods of Data Collection**

A questionnaire on the perception of students on modular learning was **adopted** for the research study to determine the experiences and perception of second year Bachelor of Secondary Education major in Science of College of Education at Isabela State University, Cauayan City, Isabela.

The research instruments used were a survey questionnaire used to draw out the respondents' perceptions. The criteria for evaluation of this were incorporated in the questionnaires, which are the following: a. Objectives, b. Contents, c. Usefulness, d. Clarity, e. Suitability, and f. Adequacy. Comments, suggestions, recommendations, and constructive criticisms for the improvement of the IM from the respondents were also drawn from this instrument.

Each item of the domains was rated on a 5-point Likert scale: (1) Mostly disagree; (2) Definitely disagree; (3) Neither agree nor disagree; (4) Definitely agree; and (5) Mostly agree.

Rating Scale	Descriptive Rating
4.21 – 5.00	Strongly Agree
3.41 – 4.20	Agree
2.61 – 3.40	Somehow Agree
1.81 – 2.60	Disagree
1.00 – 1.80	Strongly Disagree

The instructional material in the form of a module has been constructed by the researcher himself using several textbooks in Inorganic Chemistry as references. Upon completion, the IM was referred to the researcher's department head of science, subject specialists, and some science instructors for comments, suggestions, and recommendations.

At the start, the researcher secured permission from the President and Executive Officer of Isabela State University, Cauayan Campus, which was endorsed by the Dean and Program Chair. The subjects of the study were the science instructors and the second year students of the College of Education, Isabela State University – Cauayan Campus, Cauayan City, Isabela were utilized. The twenty (20) Second year BSEd major in Science were subjected to evaluate the proposed module together with their borrowed textbooks of Inorganic Chemistry. Some lessons of the IM were

conducted for the previous school year. Before using the IM, the students were given proper instruction on its usage since students had not yet received the new IM-aided instruction.

d. **Methods of Data Analysis**

The data were exported into the Statistical Package for the Social Sciences (SPSS), which was used for data manipulation and analysis. The data were checked for accuracy. Descriptive statistics were used to organize and summarize the data. Specifically, the mean was used to present the data gathered from respondents.

Results and Discussion

This study presents the data gathered from the respondents on the validity and acceptability of the proposed IM. The answer to the queries stated is hereby presented and analyzed, and interpreted in table form.

Table 1**. Student Profile**

Table 1.a. Frequency and Percentage Distribution of Student Respondents According to Sex

Gender	f	%
Male	7	35
Female	13	65
Total	20	100

In this study, it indicates that the male respondents outnumbered the female respondents; out of twenty (20) respondents, there are 7 or 35 percent males, while there are 13 or 65 percent female respondents.

Table 1.b. Frequency and Percentage Distribution of Student Respondents According to Age

Age	f	%
19	13	65
20	5	25
21	1	5
22	1	5
Total	20	100%

As gleaned in the table, the majority of the respondents, with 13 or 65 percent, belong to the age of 19, 5 or 25 percent belong to the age of 20, while the other respondents were 1 or 5 percent belong to the age twenty-one 21, as well as age 22.

Table 2 **Faculty Profile**

Table 2.a. Frequency and Percentage Distribution of Faculty Respondents According to Teaching Load

Teaching Load	f	%
Inorganic Chemistry	3	42.85
Organic Chemistry	2	28.57
Biochemistry	1	14.29
Analytical Chemistry	1	14.29
	7	**100**

Regarding the teaching load of the faculty respondents, the table above presents that there are 3 or 42.85 percent teacher respondents who are teaching Inorganic Chemistry, 2 or 28.57 percent of instructor respondents are teaching Organic Chemistry, 1 or 14.29 percent of instructor respondents are teaching Biochemistry, and 1 or 14.29 percent of instructor respondents are teaching Analytical Chemistry.

Table 2.b. Frequency and Percentage Distribution of Faculty Respondents according to Years of Teaching.

Years of Teaching	f	%
31 years above	0	-
26 - 30	1	14.29
21 - 25	1	14.29
16 - 20	0	-
11 - 15	3	42.85
6 -10	2	28.57
5 years below	0	-
Total	**7**	**100**

In the interpretation of years of teaching experience, table 2.b reveals that 2 or 28.57 percent of 7 respondents are in the bracket of 6 – 10 years of teaching experience and 3 or 42.85 percent respondents are in the bracket of 11 - 15 years of teaching, 1 or 14.29 percent of the respondents are in the bracket of 21 – 25 years of teaching experience as well as 26 – 30 years of teaching. And no one has a teaching experience of 5 years below, 16 – 20 years 31 years of teaching experience.

Table 3. **Instructional Material Development Unit (IMDU) Committee**

	Designation	Name
1	Program Chair	Dr. Ronnie Boy V. Blas
2	Dean	Dr. Donabel A. Dumelod
3	College Secretary	Ms. Janeth Marites R. Brillantes
4	Laguage Editor	Ms. Arriane Kris M. Manalastas

3	Subject Specialist	Dr. Rosalyn L. Bautista
4	Education Specialist	Dr. Teresita C. Molano
5	Chief, IMDU	Mr. Charlie T. Anselmo

Table 4. Students' and Instructors' Evaluation of the **Objectives** of the Proposed IM in Inorganic Chemistry.

Objectives	**Weighted Mean**			**Averaged Weighted**	**Description**
	Students	**Teachers**	**IMDU**		
1. The objectives are relevant to the course objectives.	4.8	4.6	4.6	**4.67**	**Strongly Agree**
2.The objectives enhances the interest of the learner.	4.8	4.5	4.4	**4.57**	**Strongly Agree**
3.The objectives stimulate and provokes the students to gain confidence in attaining high level of learning.	4.7	4.5	4.6	**4.60**	**Strongly Agree**
4.The objectives are based on learning abilities of the students.	4.9	4.6	4.4	**4.63**	**Strongly Agree**
5.The objectives furnished with a more comprehensive sets of learning activities enabling the students to deal with problems and become more responsible.	4.9	4.4	4.4	**4.56**	**Strongly Agree**
			Grand Mean	**4.61**	**Strongly Agree**

Table 4 reveals that the perception of students and teachers in the objectives of the proposed IM in Inorganic Chemistry is relevant to the course, with a strong agreement as evidenced by the mean of 4.67. The objectives enhances the interest of the learner got a description of strongly agree shared with the objectives stimulate and provokes the students to gain confidence in attaining high level of learning, the objectives are based on learning abilities of the students and the objectives

furnished with a more comprehensive sets of learning activities enabling the students to deal with problems and become more responsible with a average weighted mean of 4.57, 4.60, 4.63 and 4.56 respectively. The grand mean of 4.61, with an interpretation of "strongly agree," implies that the objectives of the proposed module are acceptable to the course objectives. None perceived them as agree, somewhat agree, disagree, or strongly disagree. This study is related to Choppin, Jeffrey, et.al. (2020) that the teachers responded more to features in the instructional materials than to the curriculum aims and objectives articulated in the syllabus while planning and enacting lessons, which has implications for policymakers who aim to influence instruction through national standards and for school districts as they select materials.

Table 5. Students' and Instructors' Evaluation of **Contents** of the Proposed IM in Inorganic Chemistry.

Contents	**Weighted Mean**			**Averaged Weighted**	**Description**
	Students	**Teachers**	**IMDU**		
1. Each activity given in the IM was based on what has been learned in related subjects	4.9	4.7	4.5	**4.70**	**Strongly Agree**
2. The contents are properly planned by the teacher to come out with a more comprehensive learning package.	4.9	4.7	4.5	**4.70**	**Strongly Agree**
3. Each activity given by the teacher contains systematized knowledge and facts that were collected from various references.	4.9	4.7	4.4	**4.67**	**Strongly Agree**
4. The content of each activity are arranged in proper sequence.	4.8	4.8	4.6	**4.73**	**Strongly Agree**
5. The content is consistent with the subject objective.	4.8	4.8	4.8	**4.80**	**Strongly Agree**
6. The content outline based with the course syllabus.	4.8	4.6	4.6	**4.67**	**Strongly Agree**
			Grand Mean	**4.71**	**Strongly Agree**

One of the criteria in the proposed module is the content. As shown in Table 5, the students and instructors rated item number 5 as the highest rating of 4.80, stating "The content is consistent with the subject matter. This was followed by item number 4, which states that "the content of each activity is arranged in proper sequence", with a mean of 4.73. The item number 1 which state that "Each activity given in the module was based on what has been learned in related subjects" and item number 2 which state that "The contents are properly planned by the teacher to come out with a more comprehensive learning package" have the same mean of 4.70. And item number 3 which state that "the content of each activity are arranged in proper sequence", and item number 6 which states that "the content outline based with the course syllabus", with same means of 4.67. To sum up, the overall perception of this criterion of the proposed module was acceptable, with a grand mean of 4.71, with a descriptive rating of strongly agree. According to Russel, et. al. (2022) that this talk allowed teachers "to prioritize and organize content so that students are introduced to big ideas rather than getting lost in a welter of details, and allows them to respond flexibly to questions raised by their students."

Table 6. Students' and Instructors' Evaluation on the **Usefulness** of the Proposed IM in Inorganic Chemistry.

Usefulness	**Weighted Mean**			**Averaged Weighted**	**Description**
	Students	**Teachers**	**IMDU**		
1. The degree of usefulness of the Proposed IM in Inorganic Chemistry.	4.7	4.6	4.5	**4.60**	**Strongly Agree**
2. The students gain more information using the proposed IM.	4.7	4.5	4.5	**4.63**	**Strongly Agree**
3. The students are encouraged to perform better with the use of the proposed IM.	4.8	4.7	4.7	**4.73**	**Strongly Agree**
4. The concepts taught with the use of the proposed IM are complete no need for library research.	4.6	4.5	4.6	**4.57**	**Strongly Agree**
			Grand Mean	**4.59**	**Strongly Agree**

Table 6 reveals the students' and instructors' evaluation of the usefulness of the proposed IM in Inorganic Chemistry. It is interesting to note that the students and instructors gave item 3 the highest rating, which stated that "the degree of usefulness of the proposed IM in Inorganic Chemistry". It is followed by item 2, which says, "the students gain more information using the proposed IM," and item 3, which states that "the students are encouraged to perform better with the use of the proposed IM" with respective means of 4.73 and 4.63. While item number 1 states that "The degree of usefulness of the Proposed IM in Inorganic Chemistry," and item number 4 says that "the concepts taught with the use of the proposed IM are complete no need for library research," having a means of 4.60 and 4.51, respectively. The usefulness of the proposed IM in Inorganic Chemistry has a descriptive rating of strongly agree with a grand mean of 4.59. This is somehow in line with the findings of Bukoye, Roseline Olufunke. (2019) on her study brought about implications for both theory and practice regarding the usefulness of IM in classroom instruction and the teacher devising the IM. Specifically, the researcher hopes that the study will investigate the utilization of instructional materials as tools for effective academic performance of students.

Table 7. Students and Teachers' Evaluation of **Clarity** of the Proposed IM in Inorganic Chemistry.

Clarity	**Weighted Mean**			**Averaged Weighted**	**Description**
	Students	**Teachers**	**IMDU**		
1. The activities given by the instructor are clear and descriptive.	4.6	4.4	4.5	**4.5**	**Strongly Agree**
2. The topics are easily understood because the procedures are clear.	4.4	4.5	4.5	**4.47**	**Strongly Agree**
3. The activities are planned in an orderly manner.	4.7	4.6	4.5	**4.60**	**Strongly Agree**
4. The contents facilitate understanding and retention of information.	4.6	4.4	4.4	**4.47**	**Strongly Agree**
5. The questions of each activity are clear and concise	4.5	4.4	4.4	**4.43**	**Strongly Agree**
			Grand Mean	**4.53**	**Strongly Agree**

The next criterion of the proposed module, which was taken into consideration, is the clarity of the IM. As could be gleaned from the data above, the students and teachers evaluated item number 3 as the highest rank with a mean of 4.60, which states that "the activities are planned in an orderly manner" and an interpreted as very comprehensive. Next in rank is item number 1 with a mean of 4.5 which says that "the activity given by the teachers are clear and descriptive. With items 2 and 4 have the same weighted mean of 4.47 which states that "the topic are easily understood because the procedures are clear" and "the contents facilitate understanding and retention of information" respectively. For item number 5 gain the lowest mean of 4.34 which says that "the questions of each activity are clear and concise". The perception of the evaluators in these criteria is descriptively rated strongly agree with the grand mean of 4.53. This study is congruent with the study of Chen, Xin, and Linhai Lu. (2022) that the instructional clarity has been demonstrated to improve students' enjoyment and achievement in mathematics while reducing boredom in both groups, with the advantage being greater in Hong Kong classrooms. However, there were some negative comments relating to the lack of clarity of the assessment criteria and the whole-day time commitment, but these were in the minority. The assessor provides suggestions on the IM compiled, which includes the attractiveness of the IM, the picture, the clarity of the message conveyed, the suitability of the material with the target population, the language used, the validity of the references, the power of persuasion, and the ease of intervening.

Table 8. Students and Teachers' Evaluation on the **Suitability** of the Proposed IM in Inorganic Chemistry.

Suitability	**Weighted Mean**			**Averaged Weighted**	**Description**
	Students	**Teachers**	**IMDU**		
1. The language used by the instructor is suited for the second year BSE Science students.	4.8	4.5	4.4	**4.57**	**Strongly Agree**
2. The proposed module guides the students in fulfilling the course objectives.	4.8	4.4	4.4	**4.53**	**Strongly Agree**
3. The proposed module prepares the students for actual learning activities.	4.8	4.6	4.6	**4.67**	**Strongly Agree**
4. The proposed IM is for IM in Organic Chemistry.	4.7	4.6	4.4	**4.56**	**Strongly Agree**
Grand Mean				**4.58**	**Strongly Agree**

As manifested from Table 8, the students as well as the instructors favored that the proposed IM prepares the students for actual learning activities to instill in the students hands-on learning or learning by doing in the classroom, with the descriptive rating of strongly agree and weighted mean of 4.67. The students and teachers rated items 1 and 4 with a mean of 4.57 and 4.55, respectively, with the same interpretation of strongly agree. Item number 2 received the lowest rank with a mean of 4.53 and an interpretation of strongly agree. In totality, the overall perception of this criterion of the proposed IM among both groups of evaluators was acceptable, with a grand mean of 4.58 and descriptively rated as strongly agree.

This is parallel with the study conducted by Zhu, Yonghai, et. al. (2022) that teachers should select, reorganize, and design the learning resources for students according to the learning content of the textbooks. Thus, in this study, SE-OLR refers to the teachers' ability to specifically select and control online learning resources based on the learning content of the textbooks. According to the module, the learner is a self-learner as he is the center of the teaching process, and can find within the module the necessary resources of information that can support his learning, so he chooses what is suitable, the learner decides when he will start and where to begin. The results reveal that the availability and suitability of the materials varied among the different types of schools investigated and that there was much room for improvement. Most teachers have not yet reached higher levels of operation regarding the use of instructional materials. In conclusion, a number of recommendations are made to improve the situation.

Table 9. Students and Teachers' Evaluation on **Adequacy** of the Proposed IM in Inorganic Chemistry.

Adequacy	**Weighted Mean**			**Averaged Weighted**	**Description**
	Students	**Teachers**	**IMDU**		
1. The proposed module used by the students during class instruction have an adequate materials for the class activity.	**4.5**	**4.5**	**4.5**	**4.5**	**Strongly Agree**
			Grand Mean	**4.5**	**Strongly Agree**

The last criterion on the evaluation of the proposed IM that was taken into consideration is its adequacy. As could be observed in Table 9, the perception of the students and teachers of the item under this criterion is acceptable, with a strong agreement with the average and grand mean of 4.5. This indicates that the module has adequate supplementary activities for the learner.

According to Molyko-Buea, Cameroon (2022) that the importance of quality and adequate instructional materials in teaching and learning can occur through their effective utilization during

classroom teaching. Instructional materials here include all the tools that the teachers can use to make the learning more interesting, memorable, and also improve on academic performance of students.

Table 9. **Summary** Table of the Students and Instructors' Evaluation on the Proposed Instructional Material in Inorganic Chemistry.

Criteria	Grand Weighted Mean	Description
1. Objectives	4.61	Strongly Agree
2. Contents	4.71	Strongly Agree
3. Usefulness	4.59	Strongly Agree
4. Clarity	4.53	Strongly Agree
5. Suitability	4.58	Strongly Agree
6. Adeaquacy	4.50	Strongly Agree
Over-all Mean	**4.64**	**Strongly Agree**

The data on the table reveal that the students, teachers, and IMDU Committee evaluators found that the objectives, contents, usefulness, clarity, suitability, and adequacy of the proposed IM in Inorganic Chemistry were acceptable to a great extent.

The results of the evaluation of both groups show that:

1. The objectives of the proposed IM strongly agree in teaching Inorganic Chemistry.
2. The contents are properly planned, arranged in proper sequence, based on the subject matter, and based on the course outline, with the description strongly agrees.
3. The degree of usefulness of the proposed IM in Inorganic Chemistry is descriptively rated as strongly agree.
4. The clarity of the activities and topics in the proposed IM is clear, descriptive, and concise to facilitate understanding and retention of information, and it is rated a strongly agree.
5. The suitability of the proposed IM in Inorganic Chemistry is very suitable for the Second year BSEd Science students, as strongly agreed upon, as described in the interpretation table.
6. The adequacy of the proposed IM used by the students during the activity has adequate exercises for the topics is strongly agreed upon as described in the interpretation.
7. It could be deduced from the data that the proposed IM in Inorganic Chemistry is acceptable and valid to students, instructors, and the IMDU Committee.

Summary of Comments and Suggestions

The evaluators gave some comments and suggestions. See to it that the activities are not too long, and they can be performed by second-year students. Too many long activities, make shorter, and 2. Check the consistency of the parts of each activity

Conclusions

From the findings of the study, the following conclusions were drawn:

1. The proposed IM is valid and acceptable in the teaching-learning process in second-year BSEd Science students.
2. The proposed IM is useful in teaching Inorganic Chemistry.
3. The proposed IM helps in guiding the students properly in the absence of a teacher.

Recommendation

Based on the foregoing findings and conclusions, the researchers offered the following recommendations:

1. The Instructional Material may be constructed for other fields in science.
2. In the process of the implementation of the instructional material, a yearly process of continuous evolution should be made to match the existing needs of the school systems.
3. Teachers should be given the necessary support to undertake further research on the effectiveness of the manual to improve the teaching-learning process.
4. Teachers who will be using the laboratory manual should continuously utilize the resources of the community. This will further make the lessons more relevant, meaningful, purposeful, and realistic.
5. At the previous AACCUP accreditation, it is recommended that the school should have Instructional materials for each faculty.

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