



Development and Sandardization of General Chemistry Practices According to the Demands of Bachelor Pharmaceutical Education Curriculum

*Hartika Samgryce Siagian dan Ratih Anggraeni

*Imelda University Medan

Jl. Bilal No.52 Kelurahan Pulo Brayan Darat I Kecamatan Medan Timur, North Sumatera, Indonesia

*Correspondinge-mail: <u>hartikasiagian@gmail.com</u>

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Abstract : Development and Standardization of General Chemistry Practices according To The Demands of Bachelor Pharmaceutical Education Curriculum. General Chemistry is a compulsory subject programmed by the Imelda University Medan Undergraduate Pharmacy Study Program based on the curriculum of the Association of Indonesian Pharmacy Higher Education (APTFI). General Chemistry courses equipped with practicum are requirements that must be passed before achieving a bachelor's degree in Pharmacy.

Practical activities in the laboratory aim to make students master the techniques or work procedures in the laboratory. One of supporting the implementation of practical activities is the availability of practical guidance that has an active role to guide students doing lab activities. The purpose of practicum activities is to support the mission of Medan Imelda University in organizing effective learning. This type of research is development research (R&D) with ADDIE Instructional Design. Data analysis technique used is descriptive statistical analysis with a questionnaire research instruments validator expert (questionnaire I) and students (questionnaire II). The research stage consisted of 4 stages: (1) developing a framework from developing a practicum guide; (2) develop a practical guide; (3) review and improve practical guide covering expert validation (Lecturer Chemistry) and continued analysis of revision; (4) implement a pilot lab, analyze the response of students ; (5) evaluating result analyze continued to draw conclusions. General Chemistry Practical Guidebook has been prepared otherwise very decent by two lecturers and 40 students Bachelor Chemical Pharmaceutical Department to be used as supporting materials on general chemistry course with a score of 90% and 88%.

Keywords : practical guide, general chemistry, curriculum pharmacy

Abstrak: Pengembangan dan Standardisasi Praktek Kimia Umum Sesuai Tuntutan Kurikulum Pendidikan Sarjana Farmasi. Kimia Umum merupakan mata pelajaran wajib yang diprogramkan oleh Program Studi Sarjana Farmasi. Universitas Imelda Medan berdasarkan kurikulum Asosiasi Perguruan Tinggi Farmasi Indonesia (APTFI). Mata kuliah Kimia Umum yang dilengkapi dengan praktikum merupakan persyaratan yang harus dilalui sebelum meraih gelar Sarjana Farmasi. Kegiatan praktek di laboratorium bertujuan agar mahasiswa menguasai teknik atau prosedur kerja di laboratorium. Salah satu penunjang pelaksanaan kegiatan praktikum adalah tersedianya bimbingan praktikum yang berperan aktif membimbing mahasiswa melakukan kegiatan praktikum. Tujuan kegiatan praktikum adalah untuk mendukung misi Universitas Imelda Medan dalam menyelenggarakan pembelajaran yang efektif. Jenis penelitian ini adalah penelitian pengembangan (R&D) dengan Desain Instruksional

ADDIE. Teknik analisis data yang digunakan adalah analisis statistik deskriptif dengan instrumen penelitian angket validator ahli (angket I) dan siswa (angket II). Tahapan penelitian terdiri dari 4 tahap: (1) mengembangkan kerangka kerja dari penyusunan pedoman praktikum; (2) mengembangkan pedoman praktis; (3) mereview dan menyempurnakan panduan praktik yang meliputi validasi ahli (Dosen Kimia) dan analisis lanjutan revisi; (4) mengimplementasikan lab percontohan, menganalisis respon siswa; (5) Evaluasi hasil analisis dilanjutkan untuk menarik kesimpulan.

Buku Pedoman Praktikum Kimia Umum yang telah disusun sebaliknya sangat layak dilakukan oleh dua orang dosen dan 40 mahasiswa Sarjana Kimia Jurusan Farmasi untuk digunakan sebagai bahan penunjang pada mata kuliah kimia umum dengan skor 90% dan 88%.

Kata kunci: pedoman praktikum, kimia umum, kurikulum farmasi.

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INTRODUCTION

General Chemistry is one of the compulsory courses programmed by the University of Imelda Medan Undergraduate Pharmacy Study Program which is based on the curriculum of the Association of Indonesian Pharmacy Higher Education (*APTFI*). General Chemistry has a weight of 3 credits consisting of two types of activities, namely 2 credits of theory lectures and 1 credit of practicum (APTFI, 2013). General Chemistry courses equipped with practicum are a requirement that must be passed before achieving a Bachelor of Pharmacy degree. This is in accordance with one of the points that organize missions through effective instructional learning system in accordance with the National Standards for Higher Education (*SNPT and KKNI*) to produce graduates fit the profile expected.

Theory lecture activities undertaken to achieve the goal is that students master the general chemistry concepts. Its main activity is aimed to make students master the techniques or procedures in Chemistry Laboratory. The theoretical lecture process is carried out with a cooperative learning approach while practicum is carried out through experiments or experiments (APTFI, 2013).

Practicum is an activity that helps students in the learning process during lectures. Practicum provides opportunities for students to improve the quality of understanding concepts, train skills and attitudes (Asmaningrum, 2018). Through this practicum, students are expected to be able to play an active role in accommodating students' understanding of general chemistry learning concepts through experiments.

According to the research results Arianti (2017) practicum activities for students aim at: (1) to motivate students to learn science, (2) to teach general scientific skills, (3) to increase understanding of concepts, (4) to understand and use scientific methods, (5) to develop a scientific attitude. By doing practicum students are motivated, skilled and easy to understand concepts in teaching Chemistry. The purpose of this lab activities support the mission of the University of Imelda Terrain in implementing effective learning.

According to Purwaningsih (2014) one of supporting the practical implementation is the availability of practical guide to guide students in doing lab activities. Practicum guides include: (1) practicum topics, (2) the objectives of practicum activities, (3) theoretical generals that underlie the practical topics, (4) tools and materials used, (5) practicum work procedures (complete with pictures and supporting schemes), (6) pieces of observation practicum, (7) the analysis of lab results, (8) the evaluation made at the end of the practicum. The practicum guide plays an active role in practicum activities in accordance with the research road map for the Undergraduate Program of Pharmacy, University of Imelda Medan (UIM) to create superior

analytical methods so that the practicum guide must be developed optimally. The importance of a general chemistry lab guide is shown from the results of the study Asmaningrum (2018) that the development of a practicum guide has a positive effect on student motivation in understanding the concepts of general chemistry. It is in line with the results of research Prayitno (2017) which states that the development of a General Chemistry practicum guide can equip students' knowledge of General Chemistry concepts and improve practical skills.

The problem that the researchers encountered when conducting observations in the General Chemistry laboratory at the Undergraduate Pharmacy Study Program at University of Imelda Medan was the unavailability of practicum guides that were in accordance with the APTFI curriculum standards as a guide for practicum activities. The results of these observations serve as the basis for the analysis of the need to develop a general Chemistry practicum guide in the Undergraduate Pharmacy Study Program. One solution to the above problems is the need to develop a practical guidebook on General Chemistry courses as a learning facility to support the implementation of General Chemistry practicum. Thus, students can be motivated, skilled and easily understand the concepts in General Chemistry learning.

METHOD

Research design

The research was conducted to develop a General Chemistry Practicum Guide in accordance with the Core Curriculum of the Undergraduate Pharmacy Program. This study applies an Education Research and Development (R&D) design. The development model used in this study refers to the Principles of Media Development according to (12) which consists of four stages, namely: (1) compiling a framework for developing tools, developing specifications and standards; (2) developing parts of the media that have been matched with the framework; (3) review and improve the product; (4) implement the final product.

Research Instruments

In this research instrument used was a questionnaire. There are 2 (two) questionnaires compiled in order to capture the information needed in the preparation of practicum guides in accordance with the applicable curriculum, namely: (1) Questionnaire I and (2) Questionnaire II. Questionnaire I is a questionnaire that will be filled out by the Chemistry lecturers of the Undergraduate Program of Pharmacy, University of Imelda Medan to obtain information about the feasibility of the practicum guide. Questionnaire II was filled in by students of class I batch 2019 of the University of Imelda Medan Pharmacy Study Program with the aim of obtaining information about the student's absorption of the content or messages contained in the practical manual book.

Research procedure

This research procedure consists of 4 stages, namely: (1) developing a framework from the development of a practicum guide; (2) developing practicum modules in accordance with the framework including the initial design of the practicum guide; (3) reviewing and improving the practicum guide which includes expert validation (Chemistry lecturers) and analysis followed by revision of the practicum guide; (4) implementing practicum guide by testing one of the practicum topics, analyzing student responses, (5) evaluating result analyzing followed by drawing conclusions.

Data Analysis Techniques

The data obtained will be analyzed based on descriptive analysis techniques compiled from scoring sheets (questionnaires) given to expert validators and students. Data obtained in the form of Lecturer Chemistry assessment and responses from students were analyzed by calculating the average %score and determine the criteria for the interpretation of %score. Indicators of guiding practical feasibility if %score Lecturer Chemistry and assessment of the response from the students reach 61% (Handayani, 2014).

• **RESULT AND DISCUSSION**

The results of the preliminary survey conducted by researchers related to the availability and use of general chemistry lab manuals for the Undergraduate Program in Clinical Pharmacy, it was found that the practicum manual used was the lecturer handout practicum manual.

Based on the core curriculum of courses to undergraduate pharmacy practicum courses General Chemicals discuss about the introduction of the laboratory, laboratory safety, the properties of physics and chemistry, cation class I, cation group II, cations group III, cation class IV and V, aninon group I, anion group II, volumetry, primary standard solution, secondary standard solution, acidimetry and alkalimetry.

The scope of discussion includes: (1) Physical and Chemical Properties; (2) Cation Group I; (3) Cation Group II; (4) Qualitative Cations, Group III; (5) Qualitative Cations, Groups IV and V; (6) Group I anions; (7) Group II anions; (8) Volumetry; (9) Primary Standard Solution; (10) Secondary Raw Solution; (11) Acidimetry; (12) Alkalimetry.

The components included in the practicum guidebook include: Practicum title; Competency standards; General competencies; Experiment Purpose; Theoretical basis; Tools and Materials; Work procedures; Observation Result Table; Question (Task); Conclusion; and Student Assessment Sheets.

The General Chemistry Practicum Guide that has been designed by the researcher will be validated by the Validator Lecturer. Furthermore, the researchers distributed a questionnaire to 2 (two) chemistry lecturers of the UIM Pharmacy Study Program who were selected as samples based on the size of expertise in chemistry who teaches in General Chemistry courses and as lecturers of General Chemistry practicum. The results of the feasibility test assessment of the general chemistry practicum handbook that have been filled in by the Chemistry lecturers of the UIM Pharmacy Study Program are shown in Table I.

No	Description	Lectu	rer	Total	%
		1	2		
1	Interesting to read	3	4	7	87.5
2	Easy to understand	4	3	7	87.5
3	Has a table of contents	4	4	8	100
4	Has complete contents	4	4	8	100
5	Compliance with the applicable curriculum	4	3	7	87,5
6	Presentation of material starts from the concept	4	3	7	87.5
7	Achieve the expected goals	3	3	6	75
8	Cover image design matches the material	3	4	7	87,5
9	Presentation of tables and figures	3	3	6	75

Table I. Result of Feasibility Test Assessment of General Chemistry Practicum

 Handbook by Chemistry Lecturers of Pharmacy Study Program of UIM

10	Formulation of work procedures with theoretical	3	4	7	87,5
	review				
11	Suitability of tools and materials	4	3	7	87,5
12	The observation table represents the results of the	3	4	8	87.5
	experiment as a whole				
13	Involving students	4	4	8	100
14	In accordance with the development of students	4	4	8	100
15	Be communicative	3	4	8	87.5
16	Live (with accurate terms, language and symbols)	3	4	8	87.5

Lecturer Information: (1) Roby Pahala Januario Gultom, S.Si., M.Si., (2) Ratih Anggraeini, S.Farm., Apt. M.Si.

Scoring using a Likert scale with four selection categories, namely: (1) Less Good, (2) Fair, (3) Good, (4) Very Good.

To calculate the% score results of due diligence assessment handbook General Chemistry lab used the following formula:

% score: <u>acquisition score</u> x 100% maximum score

Maximum score = $2 \times 4 = 8$ Information: 2 = lecturers, 4 = highest questionnaire score

Based on the acquisition of% score from the above equation, then we can determine the feasibility of the general chemistry lab handbook in accordance with the eligibility criteria guiding college chemistry lab basis as shown in Table 4.3.

No	Eligibility level	Score
1	Very feasible	86-100%
2	Feasible	75-85%
3	Pretty feasible	65-74%
4	Less Feasible	<65%

Table II. Eligibility Criteria for General Chemistry Practicum Guides

Based on the results of the feasibility test assessment of the general chemistry practicum guidebook that has been filled in by 2 (two) chemistry lecturers of the UIM Pharmacy Study Program, it can be seen that the interesting description reads a score of 87.5% (very feasible), easy to understand 87.5% (very feasible) , has a 100% table of contents (very feasible), 100% complete content (very feasible), conformity with the applicable curriculum 87.5% (very feasible), the presentation of material starts from the concept of 87.5% (very feasible), achieve the expected target 75% (feasible), suitability of cover image design and material 87.5% (very feasible), presentation of tables and figures 87.5% (very feasible), formulation of work procedures with 75% theory review (very feasible) , the suitability of the experimental tools and materials was 87.5% (very feasible), involving students (interactive) 100% (very feasible), according to the development of students 100 % (very feasible), communicative 87.5% (very feasible), and direct (with accuracy of terms, language and symbols) 87.5% (very feasible).

Based on the results of the overall calculation, it can be interpreted that the general chemistry practicum guidebook obtained a score of 89% was declared very feasible by 2 chemistry lecturers of the UIM Pharmacy Study Program. Based on the results of the feasibility test assessment of the chemistry lab manual and suggestions given by the chemistry lecturer of the Pharmacy Study Program, the researchers made a revision of the General Chemistry practicum manual.

Chemistry lab handbook revised based on assessment results due diligence handbook general chemistry lab and suggestions of two (2) Pharmaceutical chemistry lecturer, and then the general chemistry lab handbook is tested at the Laboratory of Chemistry University of Imelda Medan. The trial conducted selected 1 (one) experiment, namely the Cation Identification Group IA.

Simultaneously with the trial of general chemistry practicum guidebooks, the second questionnaire was distributed to level I students of the Undergraduate Pharmacy Study Program at the University of Imelda Medan who had been assigned as samples. The results of the feasibility test assessment of the general chemistry practicum handbook that have been filled in by level I students of the Undergraduate Pharmacy Study Program at the University of Imelda Medan are shown in Table III.

Table	III.	The	Resul	t of	Feasibi	lity	Test	Assessm	ent	of	Elementary	High	School
Chemis	stry	Pract	icum 1	Hand	book by	y L	evel I	students	of t	the	Undergradu	ate Pl	harmacy
Study I	Prog	ram a	t Univ	ersity	y of Ime	lda	Meda	n					

No	Description	Average	Total	%
		score	Score	
1	Interesting to read	3,59	140	90
2	Easy to understand	3,59	140	90
3	Has a table of contents	3,69	144	92
4	Has complete contents	3,64	142	91
5	Presentation of material starts from the	3,44	134	86
	concept			
6	Achieve the expected goals	3,59	140	90
7	Increase student understanding of general	3,59	140	90
	chemistry courses			
8	Increased student interest in studying	3,59	140	90
	chemistry after practicum			
9	Cover image design matches the material	3,59	140	90
10	Goals of the experiment objectives	3,44	134	86
11	Suitability of experimental tools and	3,72	145	93
	materials			
12	Involving students	3,54	138	88
13	In accordance with the development of	3,59	140	90
	students			
14	Be communicative	3,59	140	90
15	Live (with accurate terms, language and	3,59	140	90
	symbols)			

To calculate the %score of the result of the feasibility test assessment of the general chemistry lab manual, the formula is used:

% score: <u>acquisition score</u> x 100% maximum score Maximum score = $40 \times 4 = 160$

Information: 39 = number of students, 4 = highest questionnaire score Based on the acquisition of% score from the above equation, then we can determine the feasibility of the general chemistry lab handbook in accordance with the eligibility criteria guiding the general chemistry lab as shown in Table IV.

No	Eligibility level	Score
1	Very feasible	86-100%
2	Feasible	75-85%
3	Pretty feasible	65-74%
4	Less Feasible	<65%

Table IV. Eligibility Criteria for General Chemistry Practicum Guides

The results of the assessment of the feasibility test for general chemistry practicum guides that have been filled in by 40 first-level students of the Pharmacy Study Program at the University of Imelda Medan, it can be seen that the interesting description reads a score of 90% (very feasible), easy to understand and 90% implemented (feasible) has a list of contents 92% (very feasible), has complete contents 91% (very feasible), presentation of material starting from the concept of 86% (very feasible), achieving the expected target 90% (feasible), increasing student understanding of chemistry courses 90% (feasible), increased student interest in studying chemistry after doing practicum 90% (very feasible), suitability of cover image design with material 90% (very feasible), target goal of experiment 86% (very feasible), suitability of experimental tools and materials 93 % (very feasible), involving students (interactive) 88% (very feasible), according to the development of students 90% (feasible), communicative 90% (feasible), and direct (with accurate terminology, language and symbols) 90% (very feasible). Based on the results of the overall calculation, it can be interpreted that the general chemistry practicum guidebook obtained a score of 90% was declared very feasible by 40 level I students of the Undergraduate Pharmacy Study Program at the University of Imelda Medan.

Based on the results of the feasibility test assessment of the general chemistry practicum handbook, it can be seen that the results of the Chemistry lecturers' assessment results for the Undergraduate Program in Pharmacy UIM are lower than the results of the student assessment, as shown in Table V.

Table V. Comparison of the Percentage of Assessment Results of Chemistry lecturers for the Undergraduate Pharmacy Study Program of UIM and Level I Students of the UIM S1-Pharmacy Study Program

Lecturer	Student
88%	90%

Based on the percentage of the results of the assessment of the feasibility test for general chemistry practicum guides, the percentage of the chemistry lecturers' score for the Undergraduate Program in Pharmacy was lower, namely 88%. This is because chemistry lecturers are more familiar with student characteristics and important indicators in practicum based on the applicable curriculum. In addition, the experience of a chemistry lecturer in the Pharmacy Study Program who is more familiar with the

characteristics of students makes chemistry lecturers more aware of practicum guides that are suitable for Level I Pharmacy Study Program students.

CONCLUSION

Based Curriculum University Association of Indonesian Pharmaceutical (APTFI) which are listed in accordance with the National Standards for Higher Education (SNPT and KKNI) to produce graduates fit the profile to be expected, that the number of practicum general chemical carried by the second semester students are a total of 12 experimental lab are: (1) Physical and Chemical Properties; (2) Cation Group I; (3) Cation Group II; (4) Qualitative Cations, Group III; (5) Qualitative Cations, Groups IV and V; (6) Group I anions; (7) Group II anions; (8) Volumetry; (9) Primary Standard Solution; (10) Secondary Raw Solution; (11) Acidimetry; (12) Alkalimetry. The General Chemistry Practicum Handbook that has been compiled was declared very feasible by 2 Chemistry lecturers of the UIM Pharmacy Study Program to be used as a supporting book for general chemistry courses with a score of 90%. The General Chemistry Practicum Handbook that has been prepared was declared very feasible by 40 undergraduate students of Pharmacy Study Program to be used as a supporting book for general chemistry learning with a score of 88%. General Chemistry Practicum Guide which has been standardized to support student interest in learning. This can be proven based on student responses when carrying out practicum (trials).

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