
Development of Communication and Creativity Competency Assessment Instruments in The Chempreneurship Course

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Abstract

This study aims to develop and produce an instrument for assessing students' communication skills and creativity in the Chempreneurship course. This research is a development research that uses the 4D model. This assessment instrument contains a theoretical description, a lattice of communication and creativity skills assessment instruments and communication and creativity skills assessment sheets that have been validated by experts and tested. The results of this study are a communication skills and creativity research instrument that is feasible to use, valid, and reliable. The instrument is declared fit for use if the results of the expert appraisal test with CVI obtain a score of ≥ 0.8 . The results of the expert appraisal test for communication instruments with CVI obtained a score of 0.88 and a creativity instrument of 0.90. The results of the development testing of the communication skills instrument obtained 16 items, which were declared valid and reliable with a reliability value of 0.891. The results of the development testing of the creativity instrument show that all items are declared valid and reliable with a reliability value of 0.854. The result of the development instrument is feasible to measure communication skills and creativity.

Keywords: assessment; communication; creativity; instrument

Abstrak

Penelitian ini bertujuan untuk mengembangkan dan menghasilkan instrumen penilaian kemampuan komunikasi dan kreativitas mahasiswa pada mata kuliah Chempreneurship. Penelitian ini merupakan penelitian pengembangan yang menggunakan model 4D. Instrumen penilaian ini berisi uraian teori, kisi-kisi instrumen penilaian keterampilan komunikasi dan kreativitas serta lembar penilaian keterampilan komunikasi dan kreativitas yang telah divalidasi oleh para ahli dan diuji. Hasil penelitian ini adalah instrumen penelitian keterampilan komunikasi dan kreativitas yang layak digunakan, valid, dan reliabel. Instrumen dinyatakan layak digunakan apabila hasil uji penilaian ahli dengan CVI memperoleh skor $\geq 0,8$. Hasil uji penilaian ahli instrumen komunikasi dengan CVI memperoleh skor sebesar 0,88 dan instrumen kreativitas sebesar 0,90. Hasil uji pengembangan instrumen keterampilan komunikasi diperoleh 16 item yang dinyatakan valid dan reliabel dengan nilai reliabilitas sebesar 0,891. Hasil uji pengembangan instrumen kreativitas menunjukkan seluruh butir soal dinyatakan valid dan reliabel dengan nilai reliabilitas sebesar 0,854. Hasil pengembangan instrumen layak untuk mengukur kemampuan komunikasi dan kreativitas.

Keywords: penilaian; komunikasi; kreatifitas; instrumen

Introduction

Learning is a process of interaction between a person and his environment that can be carried out anywhere and anytime. In the learning process, educators not only convey information but also play a role as a facilitator in the learning process (Abu Bakar, 2013). Success in the learning process can be measured using assessment. Assessment is a process or effort to obtain information regarding the development of students during learning activities (Imania & Bariah, 2019). The assessment is intended as material for improving student learning processes and outcomes. Assessment of learning outcomes by educators is carried out by using assessment instruments that have been prepared with the correct parameters. Assessment is divided into three, namely cognitive, psychomotor and affective domains. Assessment of the cognitive domain is related to thinking skills, which include the ability to memorize, understand, apply, analyze, synthesize, and evaluate. Assessment of the psychomotor domain includes skills related to movement or muscles such as writing, speaking, and so on. Meanwhile, the assessment of the affective domain relates to interests and attitudes such as being honest, disciplined, confident, and so on (Saftari & Fajriah, 2019).

Instrument development constantly evolves to keep up with the changing times. In the development of the 21st century, a person is required to have abilities in various ways. The abilities that are important to have in the 21st century are problem-solving skills, critical thinking, decision-making, cooperation, communication, digital literacy, and being personally and socially responsible (Dewi, 2015). This is supported by Retnawati et al., (2018), which state that among the important components that must be owned in this century is problem-solving ability, namely by thinking critically.

Chempreneurship is one of the courses that aims to equip students to become chemical entrepreneurs. An entrepreneur not only has cognitive knowledge but also must have skills in

creating, communicating, and collaborating. Communication is essential for students (Brownell et al., 2013; Tsabari & Lewenstein, 2013). Communication skills are among the most important competencies for all humans in the 21st century (Chung et al., 2016). Based on observations on learning Chempreneurship courses in the Chemistry study program at UIN Walisongo Semarang, the provision of 21st-century skills has been delivered through theoretical learning, laboratory practicum, and product sales practicum.

In theory, students are taught about looking for opportunities, managing finances, and becoming reliable businessmen. Practical learning is carried out with assignments to manufacture chemical products, such as fertilizers, biopesticides, biodiesel, cosmetics, and others. Product sales practicum is carried out by students by selecting market shares according to the products they produce. This study aims to train students to collaborate, be creative, and communicate.

A good instrument is an instrument that can be used to measure accurately, namely a valid and reliable evaluation instrument so that it can accurately reveal the true abilities of students (Destiana et al., 2020). Based on the results of observations on the lecture process, instruments to measure creativity and communication have not been prepared optimally. For this reason, it is necessary to develop a learning process instrument that objectively measures student psychomotor skills, especially communication skills and creativity. Communication can be observed orally or in writing (Rahmawati et al., 2021). In relation to the description above, the purpose of writing this article is to develop a psychomotor assessment instrument that can be used to measure students' communication skills and creativity.

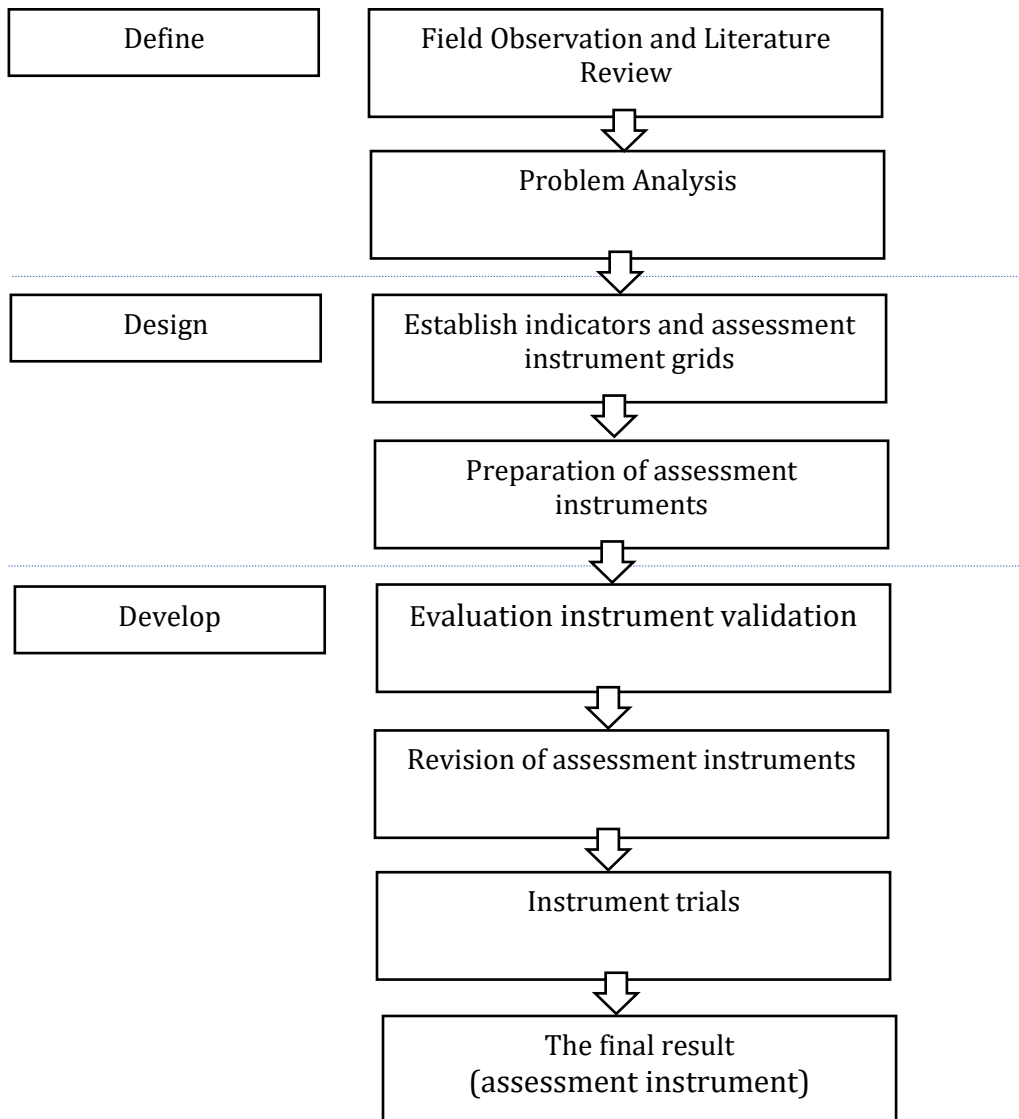
Method

This research is a development research. Development research to create or develop a product through several stages of research and measure its feasibility and

effectiveness (Jihan et al., 2019; Junia & Rachmadyanti, 2018). The development carried out in this research is the development of a psychomotor assessment instrument that will be used to measure

students' communication skills and creativity. This research refers to the 4D development model: Define, Design, Develop, and Deseminate (Thiagarajan, 1974).

Figure 1.
Assessment Instrument Development Flow



At the define stage, the researcher made observations and reviewed the literature. Observations were made in the Chempreneurship class of Chemistry Study at UIN Walisongo Semarang. The observation aims to discover the assessment instruments educators use while carrying out Chempreneurship learning activities in class. At this stage, a literature review was also carried out through books, articles and other

literature to find information regarding definitions or indicators related to instrument development. After obtaining the necessary information, the next stage is designing. At this stage, the instrument preparation process begins. The instrument was prepared by taking into account the indicators needed in the preparation of the instrument.

The next stage is the development of the instrument. Instruments that have been designed then performed instrument validation. Instrument validation aims to determine the quality of the instrument and suggestions or input from the validator. The final stage is deployment. Instruments declared feasible and revised according to the validator's directions are then tried. The instrument test in this study was carried out in Chemistry class 3A of the Chemistry study program, UIN Walisongo Semarang. The instrument development procedures in this study can be seen in Figure 1.

The data collection technique used was observation using observation sheets and questionnaires using questionnaires. Data analysis in this study was carried out by calculating the Content Validity Ratio (CVR), Content Validity Index (CVI), and instrument reliability testing using SPSS.

Result and Discussion

This research began with observations in the Chempreneurship course in the Chemistry Study Program, UIN Walisongo Semarang. The assessment instrument for Chempreneurship courses

has not been prepared optimally. Skills assessment instruments are available, and it is just that these assessment instruments have never been tested for validity and reliability tests. Instruments that were not tested for validity and reliability also resulted in invalid measurement results. Nuswawati et al., (2011) suggest that the instrument used as an evaluation tool is expected to produce an objective and accurate value or score. The main requirement of the instrument is to be able to measure exactly what is to be measured.

One of the goals of Chempreneurship learning is to equip students with 4Cs (Critical Thinking Skills, Creativity, Communication, Collaboration) skills. This study only developed two of the four assessment instruments, namely the communication assessment instrument and the creativity assessment instrument. Based on the literature review result, indicators of communication skills and creativity were obtained which would be used to develop the instrument. According to Carter et al., (2016); Chung et al., (2016); and Harasym et al., (2007) detail the indicators of communication skills as shown in Table 1.

Table 1.
Comparison of Communication Skills Indicators According to Experts

Harasym et al.(2007)	Chung et al.(2014)	Carter et al.(2015)
Adaptability	Develop a shared understanding	Write well-organized and coherent reports
Responsive	Judge other people's opinions	Create effective audiovisual presentations
Managing self-awareness during the speaking process	Develop active statements	Create tables or graphs to communicate solutions
Listen	Understand the key ideas of other people's speech	Communicate effectively with clients, co-workers, and supervisors
Gather information		Communicate effectively with non-technical audiences
Solution to problem		Communicate effectively with people from different cultures or countries

In line with the opinion of the figures, Rahmawati et al., (2021) grouped communication indicators into two, namely understanding the key ideas of other people's speech and presenting or reading data in the form of tables or graphs. Both of

these indicators represent communication skills, both verbal and written communication. Understanding other people's ideas is an oral communication competency while reading data in tables or graphs is a written communication

competency. Oral communication competence is broken down into sub-indicators: clarity, politeness, fluency, and courage. At the same time, language communication is not described. The results of the literature study on creativity are classified into: fluency, flexibility, elaboration, and originality.

The next stage is design. The design stage in this study began with designing assessment instruments, including setting goals, preparing instrument grids, compiling

scoring rubrics, and setting score guidelines. In this study, the assessment rubric was not prepared because the answer choices only consisted of two options, namely "yes" and "no". The results obtained at this stage are the initial product design in the form of communication skills and creativity instruments consisting of identity, work instructions, and assessment sheets. The lattice instruments for communication skills and creativity are presented in Table 2 and Table 3.

Table 2.
Communication Instruments Lattice

Indicator	Sub Indicator	Statement	
Verbal communication (understand key ideas of other people's speech)	Clarity	(1) The material discussed is clear and can be understood by others	
		(2) Words / speech heard clearly by the other person	
	Courtesy	(3) Can express opinions to others politely,	
		(4) The language used when speaking uses good language, does not offend other people.	
		(5) Do not show angry faces when discussing (can control emotions)	
		(6) Don't interrupt when others are talking	
		(7) When talking to other people, face towards the person you are talking to	
		(8) Pay attention to the explanations of others	
		(9) When talking or paying attention to the person you are talking to, show a pleasant face (friendly)	
		(10) When discussing do not show a dominant attitude (selfish)	
		Smoothness	(11) Fluent in presenting the results of the discussion
			(12) Able to express opinions/report results smoothly
	Courage	(13) No difficulty finding vocabulary in answering other people's questions.	
		(14) It doesn't take long to answer other people's questions.	
(15) Dare to participate in presenting the results of the discussion.			
(16) Not nervous/nervous when expressing opinions/presenting material.			
Write Communication (presenting or reading data in the form of tables or graphs)	Skills	(17) Can interpret tables into written form	
	Clarity	(18) Can create tables based on reading / writing	
		(19) Can interpret graphics into written form	
	Courtesy	(20) Can make graphs based on reading / writing	
		(21) Can interpret images into written form	
		(22) Can make pictures based on reading / writing	
		(23) Skilled in changing spoken form into writing	
	(24) Skilled in changing written form into spoken form		

Table 3.
Lattice of Creativity Instruments

Aspect	Indicator	Statement
Creativity	Fluency	(1) Students have more than 1 idea/way/answer to solve the problem.
		(2) Students can answer questions/explain concepts fluently.
		(3) Students participate in giving suggestions to their friends.
	Flexibility	(4) Students have varied ideas, answers, or questions.
		(5) Students can see problems from different points of view.
		(6) Students have more than one alternative in solving a given problem.
	Elaboration	(7) Students can develop products according to their ideas.
		(8) Students can arrange products in an interesting way.
	Originality	(9) Students give ideas in an unusual way
		(10) Students can produce new and unique products

The next stage is the develop stage. There are two activities at this stage: expert appraisal and development testing. Expert appraisal is a technique for assessing the feasibility of product designs (Fuadah et al., 2017). The expert appraisal stage determines the feasibility level of the developed learning process assessment instrument format. The assessment instruments that have been developed are validated by four experts based on Clarity, Appropriateness, and Language Accuracy. Indicators on clarity include clarity of instructions for filling in, clarity of statement items, and clarity of statements. The suitability aspect indicators include the suitability of the aspects studied, representativeness, relevance to the research objectives, and the suitability of the answers. Indicators of language accuracy consist of the use of language, the use of effective sentences, and compliance with Indonesian language rules. The results of the expert's assessment are then calculated using the Content Validity Index (CVI). CVI is generally used to determine content validity (Shrotryia & Dhanda, 2019).

Testing the validity of the psychomotor assessment instrument is carried out using the Guttman scale, namely by giving a score of 1 or 0. The validator can give a value of 1 if the statement items match

the expected criteria and give a value of 0 if the statement items do not match the expected criteria. The Guttman scale was chosen because it has a higher reproducibility than the Likert scale and does not require a panel of experts, such as the Thurstone scale. The Guttman scale has several advantages, including predicting responses to all statements by only looking at one response and creating short questionnaires with good discrimination abilities (Gothwal et al., 2009). The Guttman scale focuses more on the meaning of measurement results (Wilson, 2005). The results of the validation of communication and creativity instruments based on the three indicators above are presented in Table 4 and Table 5.

The results of the content validation show that the communication competence and creativity assessment instrument is appropriate in terms of clarity, appropriateness, and accuracy of answers with a value of ≥ 0.8 with a category suitable for use. The results of a good expert validation show that the communication skills and creativity instruments are prepared based on the theory of reasonable development procedures and indicators of communication and creativity skills. The results of the expert validation are not only in the form of the instrument's feasibility but

also obtain input from experts regarding the assessment instrument being developed. Suggestions from the validator include sentence consistency, such as there are sentences that use the word or and some that use the slash symbol (/), and there are sentences that are not yet effective. Suggestions from experts are then used as a

reference in making improvements to the instrument. The research instrument resulting from the development revised according to expert input is then developed by development testing. Development testing tests the development result instrument on the actual subject (Fuadah et al., 2017).

Table 4.
Feasibility Test Results for Communication Instruments

Aspect	Expert 1	Expert 2	Expert 3	Expert 4	(Ne)	CVI	Conclusion
Clarity	0	1	1	1	3	0.75	
	1	1	1	1	4	1	
	1	1	1	1	4	1	
Suitability	1	1	1	1	4	1	
	1	1	1	1	4	1	
	1	1	1	1	4	1	
Accuracy of Answer	1	1	1	1	4	1	
	0	1	1	0	2	0.5	
	0	1	1	0	2	0.5	≥ 0.8
						0.88	Suitable for used

Table 5.
Feasibility test results for creativity instruments

Aspect	Expert 1	Expert 2	Expert 3	Expert 4	(Ne)	CVI	Conclusion
Clarity	0	1	1	1	3	0.75	
	0	1	1	1	3	0.75	
	1	1	1	1	4	1	
Suitability	1	1	1	1	4	1	
	0	1	1	1	3	0.75	
	1	1	1	1	4	1	
Accuracy of Answer	1	1	1	1	4	1	
	1	1	1	0	3	0.75	
	1	1	1	1	4	1	≥ 0.8
						0.9	Suitable for used

The development test was conducted in the Chemistry Study Program 3A Chemistry class at UIN Walisongo Semarang with 28 student respondents. Instruments for student communication skills and creativity are presented in a Google form. Assessment of communication skills and creativity is carried out by colleagues. Assessment is done randomly, such as student A assessing student B, student B assessing student C, and so on. Data obtained

from students were then processed using SPSS software to obtain the Peason score, as presented in Table 6.

Based on Table 6, it is known that there are 8 statement items which are declared invalid. Invalid statement items, among others: (1) the material discussed is explicit and can be understood by others, (11) fluent in presenting the results of the discussion, (13) no difficulty finding vocabulary in answering other people's

questions, (14) it does not take long to answer other people's questions, (15) dare to participate in presenting the results of the discussion, (20) can make graphs based on

reading/writing, (21) can interpret images into written form, (23) skilled in changing spoken form into writing.

Table 6.
Results of Communication Instrument Validation

Item Number	Score Pearson	Result
1	-	Invalid
2	0.623	Valid
3	0.594	Valid
4	0.560	Valid
5	0.720	Valid
6	0.841	Valid
7	0.657	Valid
8	0.711	Valid
9	0.814	Valid
10	0.447	Valid
11	-	Invalid
12	0.558	Valid
13	0.371	Invalid
14	-0.57	Invalid
15	-	Invalid
16	0.493	Valid
17	0.493	Valid
18	0.484	Valid
19	0.594	Valid
20	0.310	Invalid
21	-	Invalid
22	0.594	Valid
23	0.094	Invalid
24	0.623	Valid

Invalid statement items on the communication instrument are not included in the calculation of the reliability test. The eight statement items that were removed did not affect the measurability of each indicator. Each sub-indicator is represented by several valid statements. The valid item numbers on indicators and sub-indicators are presented in Table 7.

The reliability test determines the extent to which the assessment tool can be trusted to describe the abilities of the respondents being measured. The instrument is declared reliable with a Cronbach Alpha value > 0.7 . The communication instrument reliability test results with a total of 16 statement items obtained a Cronbach Alpha score of 0.891. Based on the Cronbach Alpha value obtained,

it can be concluded that the communication instrument is reliable. The results of the validation of creative competency instruments based on development testing conducted on 28 respondents are presented in Table 8.

Table 7 shows that all creative instrument items are declared valid so that all statement items on the creativity instrument can be included in the calculation of the reliability test. The results of the reliability test of the creativity instrument with a total of 10 statement items obtained a score of 0.854. This means that the creativity instrument developed is reliable. Instruments developed based on the reference of instrument development will result in proper, valid and reliable instruments.

Table 7.

The Valid Item Numbers on Indicators and Sub-Indicators

Number	Indicators/Sub Indicators	Number Item Valid
1	Verbal communication	
	Clarity	2
	Courtesy	3, 4, 5, 6, 7, 8, 9,10
	Smoothness	12
	Courage	16
2	Write Communication	
	Skills	17
	Clarity	18, 19
	Courtesy	22, 24

Table 8.

Creativity Instrument Validation Results

Item Number	Score Pearson	Conclusion
1	0.801	Valid
2	0.642	Valid
3	0.606	Valid
4	0.580	Valid
5	0.792	Valid
6	0.784	Valid
7	0.514	Valid
8	0.743	Valid
9	0.628	Valid
10	0.634	Valid

Several things that need to be considered in developing the instrument are a) the clarity of the statement, including the language used in the instrument is straightforward to understand, the language is not multi-interpreted, and the use of effective sentences according to the rules b) the suitability of the statement with the indicators. The point is that in developing statements, one has to adjust to the indicators to be studied, and c) clear answer choices are provided so that respondents can answer questions with confidence. Besides that, the stages that need to be considered at the develop stage according to Zamanzadeh et al., (2015) are identifying content domains, generating sample item files, and constructing instruments.

The content domain can be done by conducting a literature review, content analysis, or interviews with the group to be studied. The literature review helps researchers identify various research gaps in the underlying constructs. Sample item files are carried out by involving experts to confirm or evaluate the sample items being

developed. This aims to ensure the content validity of the instrument being developed. Selection of experts should be based on specified criteria, such as expert knowledge or expert professional experience in a particular field. In addition, to carry out content validity, it is recommended to involve a minimum of three experts (Shrotryia & Dhanda, 2019).

Conclusion

The results of this study are a communication skills and creativity research instrument that is feasible to use, valid, and reliable. The instrument is declared fit for use if the results of the expert appraisal test with CVI obtain a score of ≥ 0.8 . The results of the expert appraisal test for communication instruments with CVI obtained a score of 0.88 and a creativity instrument of 0.90. Based on the feasibility test results, the instrument developed is feasible to measure students' communication skills and creativity. The results of the development testing of the communication

skills instrument obtained 16 items of the communication skills instrument, which were declared valid and reliable with a reliability value of 0.891. The results of the development testing of the creativity instrument show that all items (10 items) are declared valid and reliable with a reliability value of 0.854. Even though the communication skills and creativity instruments are declared feasible, valid, and reliable, there is nothing wrong if the instruments resulting from this development are tested for validity and reliability on different samples at other universities to create an agreement about broader feasibility, validity, and constancy.

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