



# Implementation of Digital-Based Authentic Assessment to Assess Observing, Inferring and Predicting Skills in Prospective Chemistry Teachers

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**Abstract:** As the spearhead of successful learning in the classroom, a prospective teacher must have qualified abilities and skills, teacher competence and teaching quality need to be ensured. One of the ways to measure the competence of prospective chemistry teachers is by using authentic assessments. This assessment can be done digitally through an authentic digital-based assessment with a project-based learning model. The model, research design and instrument development carried out in this study is an adaptation of the test preparation procedure with the following instrument preparation steps: (1) planning the test, (2) trying out the test, (3) establishing test validity, (4) establishing test reliability, (5) interpreting the score. In this study, there were three parameters studied, namely (1) Analysis of the needs of prospective teachers at school. (2) Preparation of authentic assessment instruments that have been developed based on validators, (3) Analysis of observing, inferring and predicting skills. Analysis of school needs is the basis for the preparation of authentic assessment instruments and models that are compiled. The results of the learning instruments that have been compiled and have been developed have excellent quality criteria with an average per aspect of 0.875 and are declared valid based on the assessment of material experts, media experts and peer reviewers. The validated instrument is then implemented where the Implementation Analysis on prospective teachers in the observing aspect gets a score of 3,374 including in the excellent category, as for inferring, it gets a score of 3,217 including in the good category, in the predicting aspect it gets a score of 3,553 including the excellent category, so that the average teacher candidate gets a score of 3,392 including the excellent category. Meanwhile, the affective instrument of students got a score of 3.22 on the persistence aspect and 3.16 on the attention aspect, both of which were in the good category. So that the average affective aspect of the participants got a score of 3.19 and was included in the good category.

**Keywords:** Authentic Assessment; Inferring; Observing; Predicting

## Introduction

The learning process is fundamental that is important in the educational process (Maison et al., 2020). Good learning will result in a good education as well. To improve the quality of education, there are three elements that must be considered, namely teachers, students, and curriculum or learning materials (Dudung, 2018). A teacher must have 4 competencies, namely pedagogic, professional, personality, and social

competencies (UU RI, 2005). Pedagogic competence is related to teacher competence in the implementation of learning, such as mastery of student characteristics, curriculum development, implementation of learning, use of technology in learning, to facilitate the development of student competencies (Permendiknas, 2007).

As the spearhead of successful learning in the classroom, a prospective teacher must have qualified abilities and skills (Dudung, 2018; Merdekawati, 2018).

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One of the lessons taught by teachers is learning Chemistry. Learning chemistry requires comprehensive and continuous material delivery, as well as a mix of theory and practice. Because it involves abstract things, students are required to be able to reason the material presented and analogize it with the knowledge they already have (Bokosmaty et al., 2019; Pikoli, 2020). The quality of prospective chemistry teachers who are competitive in the era of the Industrial Revolution 4.0, is not only about academic achievement or cognitive learning outcomes, but also about the development of soft skills such as problem solving and chemistry learning. (Cheung, 2011; Wahyudiati, 2021; Wahyudiati et al., 2020).

To improve the quality of learning in the future, the competence of prospective teachers needs to be ascertained before entering the real world of education. The observing, inferring and predicting abilities that are part of pedagogic competence can be measured through a series of assessments before prospective teachers are declared worthy to enter the world of education. Three components, namely observing, inferring, and predicting skills, are the main components in assessing chemistry learning. A detailed assessment of students' skills is required to project their skills, where these three skills are closely related, Assessment is part of the learning process because the existence of measurement and assessment factors play a very important role in learning (Arikunto, 2013; Sari et al., 2018). Many assessments have been developed to measure specific abilities or skills, such as written assessments, performance appraisals, as well as authentic assessments.

Authentic assessment is considered a form of assessment that reflects actual learning outcomes, can use various means or forms such as portfolios, journals, projects, demonstrations, written reports, and check observation guidelines (Hargreaves et al., 2002). Authentic assessment aims to observe, analyze and interpret the information collected. Students can conduct detailed research, think critically, solve problems and transfer the knowledge gained at school into everyday life (Ambiyar et al., 2020; Hakim & Zammi, 2020). Authentic assessment is not only an assessment of the process to complement student learning opportunities, but also an assessment of the teacher's teaching process (Azim & Khan, 2012; Dewi & Pramarta, 2021; Ilmiwan et al., 2019). Students will find it difficult to compete in the global era due to the lack of authentic experience gained in lectures (Prasetya et al., 2020).

More recently, the use of technology and cutting-edge developments in education have helped design new learning environments that encourage real, authentic, meaningful, and engaging learning experiences (Lawrence & Tar, 2018; Saritas, 2015). One

of the ways to improve the quality of education is to utilize information technology to improve the quality of learning activities (Darmaji et al., 2020; Sari et al., 2018; Unaida et al., 2022). In today's digital era, almost all activities can be carried out digitally, as newspapers that have been replaced with digital newspapers, job applications using email, access to population data, student grades, and even the needs of various teacher administrations can be accessed digitally. In this paperless era, it is certainly not impossible for an assessment or evaluation to also be carried out digitally (Kirschner et al., 2017; Koedinger et al., 2010; Shute & Rahimi, 2017; Shute & Ventura, 2013; Soto Rodríguez et al., 2021). Likewise, the assessment of observing, inferring, and predicting skills for prospective teachers can also be done digitally. One way to improve the competence of prospective chemistry teachers, it is necessary to conduct authentic assessments for observing, inferring, and predicting skills (Hakim & Zammi, 2020). This assessment can be done digitally through authentic android-based assessments.

## Method

This research was carried out at SMA/MA in North Aceh and students of the Chemistry Education Study Program at Malikussaleh University. The parameters measured in this study are analysis of the needs of prospective teachers in schools, preparation of authentic assessment instruments that have been developed based on material expert validation and learning evaluation, and analysis of observing, inferring and predicting skills.

The model, research and development design carried out in this study is an adaptation of the test preparation procedure developed by (Oriondo & Antonio, 1984) has the following steps: (1) planning the test, (2) trying out the test, (3) establishing test validity, (4) establishing test reliability, (5) interpreting the score. Data collection was obtained from the results of questionnaires and portfolios. The data analysis carried out in this study is descriptive statistics.

## Result and Discussion

The results of data analysis of this study are used to measure observing, inferring, and predicting skills of prospective chemistry teachers. There are three parameters measured, namely the analysis of the needs of prospective teachers in schools, the preparation of authentic assessment instruments that have been developed based on validators, and the analysis of observing, inferring and predicting skills.

The first parameter measured is the analysis of the needs of prospective teachers in schools. Analysis of the needs of prospective teachers includes an analysis of the

needs of model and media variations for students. The needs analysis in this study was based on the results of a questionnaire with the population of SMAN in the city of Lhokseumawe with four sub-districts, namely Banda Sakti, Muara Dua, Blang Mangat and Muara Satu districts. Data on model and media variations were obtained through questionnaires from 413 samples. Based on the data, there is a total score of 17.990 model variations, and the average score obtained from the model variation was 43.56 belongs to the good category.

As for the data on the media, the total score was 18.069, and the average score of 43.75 was included in the good category.

The next parameter measured is the preparation of authentic assessment instruments that have been developed based on validators. Analysis of the validity of the instruments used in this study to validate aspects of Observing, Inferring and Predicting. The result of this validity for each item is presented in Table 1.

**Table 1.** Validity of aspects of Observing, Inferring and Predicting Prospective Chemistry Teachers

Aspects	Items	Indicators	Aikens Index V	Average
Observing	1	Learners can perform sensing activities appropriately	0.89	0.846
	2	Learners can determine data quantitatively	0.78	
	3	Learners can qualitatively determine data	0.89	
	4	Students are able to observe changes that occur in the object under study	0.89	
	5	Students are able to describe the observed object comprehensively	0.78	
Inferring	6	Make a plan to record the results of observations,	0.9	0.9
	7	Correctly record the data or information of the results of observations,	0.9	
	8	Annotate an image or graphic correctly,	0.9	
	9	Illustrating graphs based on observations.	0.9	
Predicting	10	Perform a simple prediction,	0.9	0.9
	11	Test predictions.	0.9	
Total				0.875

Based on Table 1, the lowest V-Aiken index in points 2 and 5 was obtained at 0.78 and the highest at 0.9. The data acquisition states that all items can be declared valid according to the validity coefficient table Aiken (1985), where in the table it is stated that if the raters are 6 and the answer scale on the questionnaire sheet uses a scale of 4, the value of the aiken's V index is minimal for the significance level for 1% by 0.89 and for 5% by 0.78, therefore all items in the test instrument developed are

proven to be valid because they are above the significance level of 5%.

The last parameter measured is the analysis of observing, inferring and predicting skills. The implementation of this trial was carried out on prospective chemistry teachers totaling 44 respondents. The following are the results of the observing, inferring and predicting aspects of the 38 prospective teachers, which are described in Table 2.

**Table 2.** Aspects of Observing, Inferring and Predicting

Aspects	Items	Indicators	Average Score	Criteria	Avg	Category
Observing	1	Perform sensing activities appropriately	3.684	Very good	3.374	Very good
	2	Establishing data quantitatively	3.421	Very Good		
	3	Qualitatively assign data	3.237	Good		
	4	Able to observe changes that occur in the object under study	3.316	good		
	5	Able to describe the observed object comprehensively	3.211	Good		
Inferring	6	Make a plan to record the results of observations,	3.263	Good	3.217	Good
	7	Correctly record the data or information of the results of observations,	3.237	Good		
	8	Annotate an image or graphic correctly,	3.184	Good		
	9	Illustrates a graph based on the results of observations.	3.447	Very good		
Predicting	10	Perform a simple prediction,	3.632	Very good	3.553	Very good
	11	Test predictions.	3.474	Very good		
Total					3.392	Very good

Table 2 outlines the Observing, inferring and Predicting Aspects implemented for 38 prospective teachers. Implementation Analysis on prospective teachers in the observing aspect received a score of 3.374 and was included in the excellent category. Observations were made on the qualitative analytical chemistry MK project in the form of the availability of the right tools and materials in accordance with the study of independently selected journals, and determination of mini-research projects to be implemented. Prospective teachers describe the results of observing natural materials correctly, besides that prospective teachers can also describe the results of their observations correctly.

Inferring skills are the skill of making temporary conclusions drawn based on the facts from the observations of prospective teachers, it is observed how to plan in making a plan in recording the results of

observations appropriately. The inferring aspect received a score of 3.217 and was included in the good category. Prospective teachers do accuracy in recording data and information from observations correctly and nothing is missed, besides that prospective teachers also caption images or graphs correctly.

While predicting skills are logical statements based not only on observation, the knowledge side is also a component that serves as a foundation in action. Predicting skills scored 3.553 is in the excellent category. Prospective teachers are able to predict and hypothesize based on theory before testing these predictions, prospective teachers are also observed how to experiment in conducting mini research. So, the results of the observing, inferring and predicting aspects of prospective teachers get an average score of 3.392 and are in the very good category. While the results of the affective aspect category can be seen in Table 3.

**Table 3.** Categories of affective aspects

Indicators	Items	Score	Average of Indicators	Category	Average of Aspects	Category
<i>Tenacity</i>						
Persistence of facing problems		3.00	3.15	Good	3.22	Good
		2.95				
		3.40				
Persistence in overcoming difficulties in chemistry learning		2.95	3.27	Very good		
		3.55				
		3.30				
Persistence in achieving success		2.95	3.26	Very good		
		2.95				
		3.75				
<i>Attention</i>						
Pay attention to the explanations, instructions, and information submitted	11	3.00	3.21	Good	3.16	Good
	12	3.25				
	13	3.30				
have a willingness to be active in learning	14	2.90	3.09	Good		
	15	2.95				
	16	3.40				
	17	2.95				
Have care or sincerity in learning	18	3.25	3.22	Good		
	19	3.15				
	20	3.20				

In affective instruments, students are measured when prospective teachers are doing a mini-research project and get a score of 3.22 on the persistence aspect and 3.16 on the attention aspect, both of which are in the good category, so that the average affective aspect of the participant gets a score of 3.19 and is included in the good category. So, the future teacher pays attention to instructions, is active in project activities and seems to have concern for the research tasks given.

**Conclusion**

In this study, there were three parameters studied, namely (1). Analysis of the needs of prospective teachers at school. (2). Preparation of authentic assessment instruments that have been developed based on validators, (3). Analysis of observing, inferring and predicting skills. Analysis of the needs of prospective teachers includes an analysis of the needs of variations in models and media for students. The data obtained is the average score of the model variation, which is 43.56, which is included in the good category. Meanwhile, data on the media obtained an average score of 43.75 which

is included in the good category. Then the results of the learning instruments that have been compiled and have been developed have excellent quality criteria with an average per aspect of 0.875 and are declared valid. So, the analysis of observing, inferring, predicting aspects in prospective teachers got a score of 3.392 and was in the very good category. While the average affective aspect of students gets a score of 3.19 and is included in the good category.

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