

THE EFFORTS OF CHEMISTRY EDUCATION STUDENTS IN PREPARING TO BECOME PROFESSIONAL TEACHERS IN THE FUTURE

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Abstract. *The purpose of this study is to map the efforts made by students of prospective chemistry teachers in preparing themselves to become professional teachers in the future. This research is naturalistic and is a case study. This research is carried out naturally during the ongoing lecture program (natural setting). The research was carried out when students took part in professional educational lectures in the intermediate semester of 2022. The research participants consisted of 17 chemistry education students. As the main instrument, researchers are a lecturer of professional education courses. Data is collected through documentation methods in the form of essays and then analyzed and interpreted qualitatively. The research results include student activities following professional, pedagogical, social, and personality competence. The most activity is related to pedagogic competence, while the lowest is related to social and professional competence. Needs to be developed grows activities that follow the four competencies proportionally in prospective teacher students. For students' social and professional competence, prospective chemistry teachers are generally at a stage that still needs improvement.*

Keywords: *Professional Teacher, Chemistry, Pedagogic Competence*

INTRODUCTION

Teachers are a profession. The characteristics of the profession include: (1) the work has a social function as community service; (2) it demands specific skills acquired through education and practice; (3) the profession is supported by a particular discipline; (4) there is a code of ethics to which its members are guided; and (5) get rewarded as a consequence of community service [1]. One of the main factors of educational success is teachers' competence.

The competence of professional teachers, according to law no 14 of 2005 about teachers and lecturers, includes four aspects, namely: (1) pedagogic competence; (2) personality competence; (3) social competence; and (4) professional competence. These four competencies can be achieved through formal teacher training and professional education. Becoming a professional teacher takes a long time. Preparation to become a professional teacher can be started by pursuing teacher education. The four competencies that are indicators of professional teachers are trained and developed in a matter of years. Professional

teachers must have four competencies, including (1) pedagogic competencies related to learning management abilities (students, plans, implementation, and evaluation of learning); (2) personality competence is related to activities to appreciate the diversity of learners and be an example; (3) social competence is demonstrated by mastery of communication; and (4) professional competence related to the ability to master scientific substance related to the field of study [2]. Pedagogical competence is known as the ability to teach based on educational principles. Personality abilities are traits possessed by a teacher who can be an example for students as teachers and as members of society. Social competence is the ability of a teacher to get along effectively both in the teaching and learning process and outside of learning activities. Professional competence is the ability of a teacher to understand and apply the field of knowledge.

These four professional teacher competencies have characteristics that distinguish competencies from one another but relate to each other. A teacher must possess four

competencies so that learning objectives are achieved. The ability of teachers to adapt to changes in curriculum and education policies proves that the four competencies of professional teachers are interrelated and supportive of each other. Adaptability is necessary because only some things planned in the Learning Implementation Lesson Plan can be done due to situations beyond expectations. For example, during the Covid-19 pandemic, it has been proven that teacher professionals are tested, one of which is adaptability.

The Covid-19 pandemic has resulted in tremendous changes in all areas of life, including the learning process. All levels of education are 'forced' to transform to adapt suddenly to learning from home through online media [3]. Online learning is a new thing for teachers and learners that cannot be avoided. With sufficient pedagogic and social competence, teachers can handle the rapid change from offline to online learning. Online learning media becomes very close to students; not all content in learning media sourced from the internet is guaranteed validity [4]. Therefore, teachers still need to direct students to acquire understanding and skills. The teacher can direct students about the right chemical content with sufficient professional competence. Teacher capacity is one of the main factors determining the quality of education [5].

The teacher is the closest person to interacting with students in the learning process. Without good personality competence, teachers will transmit bad personalities to their students. Changes in the world of education will continue to occur both in the extreme and minor. These changes require adaptability. One of the changes that have occurred in the world of Indonesian education is related to learning evaluation. The Minister of Education and Culture officially said in 2019 that the National Examination would be abolished and replaced with the National Assessment in the Independent Learning Program starting in 2021 [6]. The National Assessment (NA) contains a Minimum Competency Assessment (MCA) and a character survey [7, 8]. Instruments for MCA are contextual; question forms vary, measure problem-solving, and stimulate learners to think critically [7]. The learning environment survey is related to the school learning process for the head of the education unit and teachers [9]. MCA aims to measure

two literacies, namely reading literacy and numeracy literacy [10]. Reading literacy is a cognitive process that includes information-seeking, interpretation, and integration activities, while numeracy literacy includes understanding, application, and reasoning [11]. For the implementation of NA, mainly consisting of MCA, character surveys, and learning environment surveys correctly, readiness is needed, especially related to its objectives, implementation, and success indicators.

Extreme conditions such as the Covid-19 pandemic and policy and curriculum changes that directly affect the learning process require teachers who have adequate competence in dealing with them. These abilities must be trained since prospective teachers follow the lecture process from the beginning of entering the education department. Some of the research reports show the weak ability of some prospective chemistry teacher students, including (1) communication and collaboration skills [12]; (2) understanding of the nature of science (NOS) [13]; (3) knowledge of pedagogical content [14]; (4) applying pedagogical content in teaching practice [15]; (5) and the majority of prospective chemistry teachers were found to be less understanding of conducting inquiry-based assessments [16].

Weak professional competence is also shown by the presence of some prospective chemistry teacher students who hold misconceptions. As many as 5 out of 10 chemistry students practicing basic teaching skills experience chemical conceptions of acid-base, reaction rate, electrolyte solution, electron configuration, and chemical bonds [4]. Some prospective chemistry teacher students experienced misconceptions about solutions material [17]. Some prospective chemistry teachers experienced misconceptions about covalent bonding [18]. Several prospective chemistry teachers held misconceptions about acid-base [19]. Misconceptions of chemical bonds are experienced by chemistry students who are prospective chemistry teachers [20]. The misconceptions experienced by students of prospective chemistry teachers show that there are problems in the professional competence of problematic chemical content aspects.

Some research results above show that there are still many prospective chemistry teacher students who have professional competence at a low level. To find out the

causes of the low competence of prospective chemistry teachers is needed about the actions that prospective teacher students have taken and whether the actions that have been taken support the improvement of professional teacher competencies needed in the future. Mapping related to 4 competencies as a requirement for professional teachers owned by prospective teachers needs to be done. The purpose of this study is to map the efforts of prospective chemistry teacher students to prepare themselves to become professional teachers in the future, including the implementation of the independent curriculum.

METHOD

This type of research is descriptive qualitative. The research is carried out naturally when the lecture program runs (natural setting). The research was conducted when students attended in Profesional Education course in the intermediate semester of 2022. One of the demands of professional education courses is that students write scientific papers in essays based on personal experience. The written essay must follow several requirements: (1) contain situations that require professional actions as a student prospective chemistry teacher; (2) contains authentic or experiential actions rather than opinions or arguments or opinions; (3) is unique or individual, meaning that each student has situations and actions that are unique or different from others; (4) the results of those actions are described and use appropriate references; (5) the title attracts a maximum of 20 words, 5-7 pages including references; style of paper, A4, with top, bottom, and right margins of 2.5 cm and left margins of 3 cm; and (6) reference relating to teachers as a profession, professional chemistry teachers, chemistry education, and chemistry content).

The research participants consisted of 22 chemistry education students. However, 20 people collected essay assignments with the theme of actions carried out during their studies in the P Department of chemistry education. However, only 17 essays are eligible for analysis. Three essays are not eligible for analysis because they contain opinions, arguments, and explanations that do not describe real experiences.

Researchers, as the main instrument, are a lecturer of professional education courses with more than ten years of teaching experience. Data is collected through a

documentation method in the form of an essay with content analysis and data interpretation.

The analysis of personal essay documents in this study aims to determine the actions of a person/student prospective teacher based on experience in dealing with specific situations and responsibilities related to activities as a chemistry education student. Based on the essay, the student's actions are analyzed and categorized into four professional competencies of the teacher.

RESULTS AND DISCUSSION

Most of the students tell about their responsibilities when they are taking practicum courses. In this case, students are asked to write a report in a manual or handwritten, and before carrying out the practicum, there is a pretest exam referred to as a response activity. Another situation told by students is the three holidays of Idul Fitri. During the holidays, many tasks must be completed, including compiling the lesson plan that is most considered difficult by students when taking the Chemistry Learning Planning course and other course assignments. One of the situations presented by students is the remedial opportunity given by the lecturer for the Textbook Study Course. The actions students have taken have been mapped out in Tables 1 and 2. The actions/efforts of prospective teacher students in line with the four teacher competencies can be seen in Table 1.

Table 1. Actions that prospective chemistry teacher students have taken for each specific condition

	N	%
<i>Pedagogic Competence (management)</i>		
Define task priority	4	23,5
Schedule/arrange the implementation of tasks	3	17,7
Instalments do the task	2	11,8
Take advantage of the additional time from the lecturer	1	5,9
Reducing time off to do tasks (taking risks)	1	5,9

	N	%
Use and maximize communication facilities when studying online	1	5,9
Search for learning materials independently	1	5,9
Amount	13	
Personality Competence (appreciate diversity and be a role model)		
Agree to vote when there are many different opinions	1	5,9
Discipline, not putting off tasks/doing assignments at the earliest time	3	17,7
Responsible for working on group assignments	1	5,9
Tough learn again with the maximum when remedial	1	5,9
Tough, looking for references facing difficulties when making practicum reports	1	5,9
Amount	7	
Social Competence (can communicate and socialize effectively)		
Discuss with friends how to write a practicum report	1	5,9
Provide ideas/discussion in group assignments	1	5,9
Communicating with the lecturer when there is an error in the assessment	1	5,9
Amount	3	
Professional Competence (ability to understand the material)		
Study hard when given the opportunity to remedial high school chemistry class XII and finally get a better understanding	1	5,9
Looking for lots of references to compile practicum reports and finally being able to compile reports by understanding the contents of the report	1	5,9

	N	%
The focus of learning for each subject is not only when doing assignments and ultimately better mastery of the material for each course.	1	5,9
Amount	3	

Student Activities Prospective Chemistry Teachers who Show Pedagogic Competence.

Based on Table 1. The student activities of prospective chemistry teachers indicate the existence of pedagogical competence. This pedagogic competence is related to management in completing tasks, including (1) compiling task priorities; (2) organizing/scheduling the work of duties; (3) completing the task gradually; (4) taking advantage of the additional time given by the lecturer; (5) taking risks is interrupting duties, i.e. reducing rest periods; (6) maximizing resources in completing tasks; and (7) looking for learning resources independently. The activity is in line with pedagogical competence that is most widely carried out to compile task priorities. Four students carry out the activity of compiling this priority.

Prioritizing tasks is very important in task management. This way is to ensure the implementation of the task based on the urgency, deadline time, and the impact caused in carrying out the task. The ability to prioritize tasks when becoming a prospective teacher-student is in line with pedagogical competence when they become teachers in the future.

Pedagogic competence is mastery of teaching methods, including developing learning strategies for a learner, learning resources, curriculum and how to prepare a learning activity until its evaluation [21]. Pedagogic competence is related to the regulation of learning from preparation to the evaluation of learning.

Student Activities Prospective Chemistry Teachers who Show Personality Competence

Several students have carried out activities that show good respect for diversity. This activity shows prospective teachers' professional competence, especially the personality side. Student activities of prospective chemistry teachers who show personality competence include: (1) agreeing to carry out voting when there are many different

opinions in the team; (2) discipline, doing tasks at the beginning of time or according to the schedule; (3) responsible for being involved in completing group tasks; (4) graceful, learning again to the fullest when there is a remedial opportunity; and (5) tough, looking for references to difficulties when it is challenging to make practicum reports. The personality competence of students who are prospective chemistry teachers is classified as better than their social competence and professional competence. This finding is in line with the findings [22], which report that students of prospective chemistry teachers have a higher positive attitude than their communication and collaboration skills.

This personality competence needs to be possessed by chemistry teachers considering that one of the goals of high school chemistry is to cultivate a scientific attitude, including an honest, objective, tenacious, not easily discouraged, open attitude and being able to cooperate with others [23]. Agreeing to vote when there is some dissent after deliberation indicates an open stance. Discipline is one of the values that must be integrated into learning following the demands of the 21st century [24]. Therefore, more is needed for a teacher to know. A good personality is one of the competencies of professional teachers. Effective learning will be achieved if teachers present it with good knowledge and personality [25]. The teacher's personality competence is illustrated when the teacher practices positive values when engaging with students. Positive values practised by teachers and trained to students either integrated into teaching the lesson topic or when interacting indicate the existence of character education. The instillation of values in education is essential to foster and improve student attitudes and behaviours [26]. Character education is the main thing in human life, individually and in society [27]. Through character education, there is a more significant opportunity to make students gain knowledge and apply it in character.

Student Activities Prospective Chemistry teachers who Show Social Competence

A number of student activities of prospective chemistry teachers have shown social competence, including: (1) discussing with other friends how to write practicum reports; (2) contributing ideas in group

discussions; and (3) communicating with the lecturer when there is an error in the assessment. These three activities show the ability to communicate with students who are prospective chemistry teachers. In addition to communication skills, these three activities indicate the ability to get along effectively. The teacher's social competence can be in the form of ability in several ways: (1) oral, written, and gesture communication; (2) getting along effectively with students; and (3) the use of communication and information technologies [28]. Communication and collaboration skills are part of the demands of 21st-century learning, in addition to mastery of concepts and their application. The results showed that the social competence of chemistry teachers was lower than that of pedagogic and professional competencies [29]. Meanwhile, to live and survive in the 21st century, it is necessary to live and live socially [29,30]. Therefore, social competence is part of what needs to be improved by prospective chemistry teachers, even for chemistry teachers who already have teaching experience.

Student Activities Prospective Chemistry teachers who Show Professional Competence

Activities that have been carried out by students who are prospective chemistry teachers and show professional competence include (1) maximum learning when given the opportunity to take the remedial test for high school chemistry material class XII; (2) finding references related to chemical content/topics as material for compiling practicum reports; and (3) focus on studying for each course and not just doing coursework. These three activities show the efforts of students to understand chemical content and ultimately have a better understanding of chemistry than before.

Activities carried out by prospective chemistry teacher students related to professional competence are classified as lagging behind pedagogic and personality competencies. Only three activities (11.5%) of the 26 activities were classified as professional competencies. Professional competence is related to the mastery of the concept of chemical matter. The finding shows a need for more chemistry understanding that many prospective chemistry teacher students experience misconceptions [4], [17-19]. The misconceptions on several chemistry topics

experienced by prospective teacher students show an inadequate level of professional competence in content aspects.

Learning in the 21st century and the industrial era 4.0 demands the ability to use information and communication technology [30]. Mastery of technology can also be classified into professional competence if technology is used to make it easier to understand the material. Virtual learning that contains animation modelling of material structures to the particle-level shows the use of information and communication technology that can expand opportunities for students to understand learning chemistry [32]. For chemistry topics that do not allow experiments to be carried out in school laboratories due to the harmful properties of substances such as benzene, through virtual experiments understanding of chemistry can still be obtained by students without bearing health risks.

Competencies that Need to Be Continuously Improved

Social and professional competence is the lowest ability shown by students of prospective chemistry teachers because efforts or actions that align with this competence are only three activities each. These findings align with a report by Shidiq & Yamtinah (2019) which found that prospective chemistry teachers need better communication and collaboration skills. This finding means that the ability to communicate and the ability to get along with other parties need to be given more ample opportunities for students who are prospective chemistry teachers. On the other hand, the opportunity to improve the chemistry understanding and apply it must be propagated in some tasks.

One of the sections of social competence and professional competence (content) that chemistry teachers constantly need to develop is the skill of using information and communication technology [32]. The use of computer applications helps teach chemistry, especially topics whose concepts are abstract. Generally, chemistry contains abstract concepts. The abstract concept is presented in learning in the form of representation. In this case, the presentation of chemical representations macroscopic, submicroscopic, and symbolic requires the skill of using information and communication technologies (Social Competence) and mastery of the

concept of chemistry itself (Professional Competence).

For example, it is conceivable that the teacher described a picture of the process to explain the concept of osmotic pressure involving differences in solvent migration using a whiteboard such as the following figure:

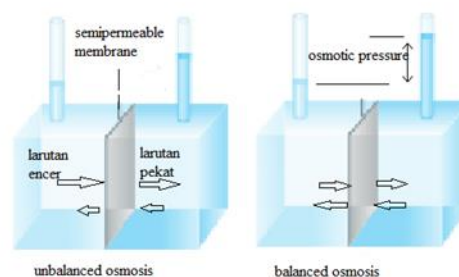


Figure 1. Differences in solvent migration in osmosis phenomena before and after a balanced state occur. Source: [33].

Another example, can be imagined if the teacher explains the law of conservation of mass by using reactions between NO gas and hydrogen gas by drawing them on the board as follows:

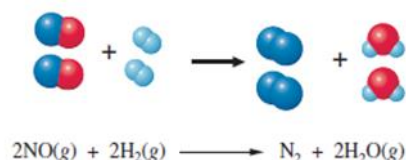


Figure 2. The reaction between NO gas and hydrogen gas. Image source: [34]

Explaining the concept of osmotic pressure, such as Figure 1, and the law of conservation of mass, such as Figure 2, drawing on the board will take quite a long time. However, with the skill of using computer applications, it becomes easier and faster. Another advantage, images are stored longer, whereas, with a whiteboard, they will be deleted immediately if the learning reaches the next topic. In addition, students are easier to understand concepts because drawings with computer applications will produce images as close to concepts as possible when compared to drawings on a whiteboard. Representations with computer applications can be proportional to colour, atom/molecule size of ions, and how they bind. Thus learning will be more efficient, and the end will be effective.

Achievement of Competencies by Every Student

Each student tells the actions taken in dealing with one situation/responsibility of the lecture. For each situation faced by each student, the achievement of their competencies is mapped according to Table 2.

Table 2. Achievement of Competency by Each Student

Competence possessed by each student for each situation encountered	<i>f</i>
One Competence	
Pedagogic	6
Personality	1
Social	0
Professional	1
Total	8
Two Competencies	
Pedagogic - personality	5
Pedagogic -social	0
Pedagogic -profesional	0
Personality -social	2
Personality -profesional	1
Social-profesional	0
Total	8
Three Competencies	
Pedagogic - personality -social	1
Pedagogic -social- profesional	0
Personality -social- profesional	0
Total	1
Four Competencies	
Pedagogic - personality -social- profesional	0
Total	0

Based on Table 2, mapping student actions when facing lecture situations and responsibilities can be stated, among others: (1) none of the students have all four competencies (pedagogic, personality, social, professional) at once; (2) one student has three competencies (pedagogic, personality, social) at once; (3) eight students have two competencies at once, and (4) eight students have one competency each out of four teacher competencies that are a requirement for a teacher's professionalism. Therefore, course supervisors must provide ample opportunities to prospective chemistry teacher students through structured tasks that can prepare them to achieve four professional teacher competencies. Although students have yet to achieve the four professional competencies simultaneously in carrying out responsibilities, they feel they have completed the task well and still have time. The self-assessment only describes the quantitative side.

Therefore, efforts are still needed to realize learning that aims to improve the quality of completion of responsibilities/tasks by students. The quality of completing this task is predicted to increase by increasing professional competence, mainly social and professional competence.

CONCLUSION

The most dominant efforts of prospective chemistry teacher students are related to pedagogical competence. The prospective chemistry teacher's social and professional competence must match his pedagogical and personality competence. There need to be more expansive opportunities for prospective teacher students to improve social and professional competence from an early age.

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