Jurnal PAJAR (Pendidikan dan Pengajaran)
Volume 8 Nomor 2 March 2024 | ISSN Cetak : 2580 - 8435 | ISSN Online : 2614 - 1337
DOI : http://dx.doi.org/10.33578/pjr.v8i2.8906

Project-Based Learning in Analytical Chemistry 1 Course With A Blended Learning System and Study Graduate Learning Outcomes

Yanti Rosinda Tinenti*, Hironimus Tangi, Vinsensia H. B. Hayon, Theresia Wariani

Universitas Katolik Widya Mandira, Kupang, Nusa Tenggara Timur (NTT), Indonesia
hironkajong@gmail.com, yantitinenti@gmail.com
corresponding author: *hironkajong@gmail.com*

ABSTRACT

This study aims to examine the implementation of the PBP model stages in the lecture process and student graduate learning outcomes (CPL) in the analytical chemistry course in the 1st semester of the academic year 2020/2021 which applies the PBP model with a blended learning system. This type of research is descriptive quantitative. In carrying out this research, it is preceded by planning the lecture process using a project-based learning model (PBP), applying it in the lecture process with a blended learning system, then conducting a process assessment, and seeing the achievement of CPL in the analytical chemistry course I in the form of quantitative values, and further described. The qualitative descriptive type is a type of research to see the implementation of the PBP model steps with a blended learning system and the achievement of CPL. Data was obtained by using observation techniques in the form of narratives and then examined for their suitability with relevant theories and studies related to the implementation of the PBP model steps. The results of this study are the PBP model with a blended learning system in the analytical chemistry course I was carried out well according to the planning, design, implementation, and reporting stages, CPL KU and KK were declared achieved based on the assessment of sub CPMK 6, 7, 8, 9 with the average percentage of achievement is 100, 78, 80, 84, 77 and in general the percentage of achievement for CPl KU 5 and KK 4 is 100% and 79.75%

Keywords*: *project-based learning, blended learning, CPL

Submitted	Accepted	Published
30 June 2022	04 November 2022	30 March 2024

Citation	:	Tinenti, Y.R., Tangi, H., H. B. Hayon, V., & Wariani, T. (2024). Project-Based Learning in Analytical Chemistry 1 Course With A Blended Learning System and Study Graduate Learning Outcomes. *Jurnal PAJAR (Pendidikan dan Pengajaran), 8*(2), 135-148. DOI: http://dx.doi.org/10.33578/pjr.v8i2.8906.

INTRODUCTION

Indonesia is one of the countries affected by the Covid-19 pandemic since early March 2020. This has had an impact on various fields including the economy, social, tourism and education. In the field of education, we can see changes in the implementation of the learning process at all levels of education, from early childhood education to higher education. The efforts made by the government so that the education process can run as it should, and continue to suppress the spread of the Covid-19 virus, namely changing the learning process system which was previously in the form of face-to-face to an online learning system.

In implementing the online learning system, each educational unit uses various types of technology and information facilities such as the Google Meet application, Zoom application, Google Classroom, YouTube, home learning program (BDR) organized by the government TV station (TVRI), through social WhatsApp media, as well as E-learning systems. However, the online learning process encounters various obstacles in terms of the quality of the teaching and learning process. The learning process becomes less well controlled and the competencies that students should have have decreased significantly. This is in line with what Aji (2020: 398) stated that the impact of online learning can result in measurement errors, which are not like the measurement process that is usually carried out. It was further revealed that certain target skills and expertise for students which should have been assessed this year so that it would impact treatment for the coming year, could not be assessed as they should. So that this problem can be resolved properly, teachers and lecturers need to be assisted by providing adequate facilities to assess, teach knowledge as well as skills/skills that are expected according to the competency or profile at a particular educational level.

Jurnal PAJAR (Pendidikan dan Pengajaran)
Volume 8 Nomor 2 March 2024 | ISSN Cetak : 2580 - 8435 | ISSN Online : 2614 - 1337
DOI : http://dx.doi.org/10.33578/pjr.v8i2.8906

Widya Mandira Catholic University (UNWIRA) is one of the universities in East Nusa Tenggara (NTT) Province that implemented an online learning system combined with offline learning at the start of the 2020/2021 academic year. The unit that deals specifically with the teaching sector is the Learning Technology Innovation Center (PITP). The facilities officially determined by PITP UNWIRA to be used in the online learning process are E-learning/Cell-wira. In its implementation, cell-wira has been used generally by 100% of lecturers to carry out the online learning process. Lecturers in the chemistry education study program, Faculty of Teacher Training and Education (FKIP) UNWIRA have used blended learning, in this case combining offline and online face-to-face learning processes using cell-wira in the odd semester of the 2020/2021 academic year.

In carrying out the lecture process using cell-wira in general, lecturers only upload teaching materials for students to study independently, and then students take quizzes or assignments which mostly focus on understanding low-level knowledge concepts in the form of assignments/questions which are distributed via media. the. This generally happened at the beginning of the implementation of the online lecture system. Courses that require mastery of skills cannot meet learning outcomes according to the curriculum applicable to the Chemistry Education study program. This is very contradictory to several things emphasized by the Directorate of Learning and Student Affairs at DIKTI in 2013 that: Graduates of academic education in undergraduate programs are expected to be able to:

1. Apply science and/or technology in their field of expertise through scientific reasoning based on logical, critical, systematic and innovative thinking;
2. Publish the results of the final assignment or design/art work, which meets the requirements of scientific writing, and can be accessed by the academic community;
3. Compile and communicate ideas and information in their scientific field effectively, through various forms of media to the academic community;
4. Make appropriate decisions based on analysis in supervising and evaluating the work for which he is responsible;

One of the courses programmed by students in the chemistry education study program is analytical chemistry 1. Based on the KKNI curriculum in the chemistry education study program, the graduate learning outcomes assigned to this course are:

1. General skills (KU) include: Able to make appropriate decisions in the context of solving problems in their field of expertise, based on the results of information and data analysis (KU 5);
2. Special skills (KK) include: Being able to apply the field of chemistry and utilizing knowledge in the field in solving problems and being able to adapt to the situations faced (KK 4);
3. Knowledge (P) includes: Mastering the concepts, principles and procedures of chemistry related to changes, structures, properties and the energy that accompanies these changes (P1);

Meanwhile, the learning outcomes of the courses that have been formulated in order to achieve CPL are being able to plan, design, implement and report the products produced verbally and in writing regarding the application of the principles of separation and identification of cations and anions, as well as gavimetry in the middle school and high school science learning process. , and vocational chemistry.

The cognitive knowledge and skills process dimensions contained in the CPMK and CPL study programs in the analytical chemistry 1 course can be achieved by implementing a project-based learning model (PBP), which in its implementation is carried out in a blended manner, namely combining offline and online learning systems using cellwira.

Project-based learning (PBP) is a learning model whose implementation meets learning process standards because students, in this case students, are involved in the learning process in an interactive, inspiring, fun, challenging, motivating way, for students to participate actively, and provide space for sufficient for initiative, creativity and independence according to students' talents, interests and physical and psychological development (Tinenti, 2018:1). The most basic thing is that the PBP model is very appropriate to be applied through a blended learning system (online and offline), where knowledge aspects and skill aspects can be fully achieved by students and assessed thoroughly by lecturers. This can be achieved if in its

Jurnal PAJAR (Pendidikan dan Pengajaran)
Volume 8 Nomor 2 March 2024 | ISSN Cetak : 2580 - 8435 | ISSN Online : 2614 - 1337
DOI : http://dx.doi.org/10.33578/pjr.v8i2.8906

implementation the stages of the PBP model and the assessment instruments that accompany each stage are prepared systematically and implemented through cellwira. The stages of the PBP model that have been designed and uploaded into the cell-wira system can then be accessed by students and course lecturers to carry out the lecture process using the PBP model online. The stages that are carried out online are planning, designing and reporting scientific projects, while the stages that are carried out offline are the implementation stage which requires students to carry out experiments in the laboratory, of course by prioritizing the implementation of strict health protocols.

The implementation of lecture steps using the PBP model is supported by research by Noor, et al in Abidin et al, (2020: 68) that e-learning in PBP is significantly effective in achieving spiritual attitudes, social attitudes, projects, products and participant learning completion. educate. It was further concluded by Abidin et al, (2020: 68) in their literature study which stated that based on various research results, project-based online learning could be one solution in optimizing learning, especially in the midst of the Covid-19 pandemic. Through project-based online learning, students gain meaningful learning so that the knowledge and knowledge gained has meaning that can be used as a provision for them to become problem solvers of the problems they face.

Based on this background description, it is necessary to carry out research with the title "Project-based learning in analytical chemistry 1 courses with a blended learning system: a study of graduate learning outcomes (CPL)"

The problem formulation in this research is:

1. How are the stages of the PBP model implemented using the blended learning system in the analytical chemistry course 1?
2. What are the learning achievements of graduates in the analytical chemistry 1 course which applies the PBP model with a blended learning system?

Meanwhile, the objectives of this research are:

1. Examining the implementation of the PBP model stages with a blended learning system in the analytical chemistry course I,
2. Examining graduate learning achievements (CPL) in the analytical chemistry 1 course which applies the PBP model with a blended learning system,

LITERATURE REVIEW

Studies on the Project Based Learning Model (PBP) and using e-Learning have been carried out by many researchers. In this research, we examine the application of the Project Based Learning model which is applied through an Information Technology system.

Research conducted by Susianto Didi (2014;1) regarding the Development of E-Learning Based Teaching Materials Using the Project Based Learning Model in Programming Course II, shows that the Project Based Learning Model has learning stages that are in line with the programming language learning process with Thus, the Project Based Learning model can theoretically increase achievement in the Programming II course specifically for regular students. However, the Project Based Learning Model cannot increase students' overall grades, this can be seen from the small number of graduation presentations with grades A and B. Based on the results of this research, it can support that the Project Based Learning approach or project-based Learning Model can be integrated into E-learning.

Research conducted by Ubaidillah Mujib (2017;1) on Project-Based Learning to Develop a Bioedupreneurship-Based Encyclopedia, shows that project-based learning is able to develop the abilities of prospective teachers in producing bioedupreneurship-based science learning encyclopedias. This research was carried out at the Biology Science Department of IAIN Syekh Nurjati Cirebon. This research provides information that Project Based Learning can produce a bioedupreneurship-based science learning encyclopedia. Thus, in this research, the application of the Project Based Learning Model (PBP) with a blended learning system can be carried out to produce the expected learning products.

Jurnal PAJAR (Pendidikan dan Pengajaran)
Volume 8 Nomor 2 March 2024 | ISSN Cetak : 2580 - 8435 | ISSN Online : 2614 - 1337
DOI : http://dx.doi.org/10.33578/pjr.v8i2.8906

Research conducted by Susilo and Rohman (2019;1) regarding Web Application-Based Online Learning Systems Using the CodeIgniter Framework, shows that the online learning system (SPON) is a new learning system that can be accessed and can be done anywhere without being limited by place, time or location. The results of this research developed a Web application-based learning system and produced an online learning system (SPON). This can be the basis for this research to integrate the Project Based Learning Model (PBP) with a blended learning system to produce the expected learning product.

Kurniawan et al.'s (2015;1) research on the development of an Android-based Classification (Taxonomy) and Scientific Nomenclature (Binomial Nomenclature) Learning System Application, shows that the TAXONOMY Application created as a means of literature review is no more than 1000 words with put forward the state of the art and road map in the field under study. Charts and road maps are created in JPG/PNG format which are then inserted into this field. Relevant primary library/reference sources and prioritizing research results in scientific journals and/or the latest patents. It is recommended to use library sources from the last 10 years. educational support in studying classification (taxonomy) and Latin nomenclature (binomial nomenclature) in the kingdom plantae (plants).

Research conducted by Zulfadhilah Muhammad and Hidayah Nur (2019;1) regarding the Android-based Application for Preparing Chemical Bonds as a Learning Media, shows that the results of making this application are very helpful for students in understanding chemistry learning, especially regarding chemical bonding material. The results of research in developing chemistry learning media support this research in that the application of the Project Based Learning Model (PBP) using a blended learning system can be carried out to produce the expected learning products.

Research conducted by Putra Rizki Suhendar et al (2017;1) on the Effect of Using Android Application-Based Learning Media on Student Learning Outcomes in chemistry learning, shows that 1) the t test on learning outcomes obtained tcount = 1.98 which is greater than ttable = 1.66 is reinforced by the N-gain value of the experimental class of 0.71 compared to the control class of 0.54, so the average value of the experimental class is better than the control class, (2) the use of Android application-based learning media has an influence of 60.16 % of learning outcomes and (3) Android application-based learning media received a positive response from students with questionnaire results of 80.05%. Based on this research, it can be a basis for implementing the Project Based Learning Model (PBP) with a blended learning system to produce the expected learning products.

Research conducted by Fahmi Fahmi, and Wuryandini Wuryandini (2020) regarding Analysis of Creative Thinking Skills in Project-Based Learning Models for High School Students, shows that the results of the research show an increase in students' creative thinking skills from 8.8% in cycle 1 to 77 .9% (fair) to 86.8% (good) in cycle 2, with good success indicators. This increase is also accompanied by an increase in learning behavior for the better. This research can be a basis for implementing the Project Based Learning Model (PBP) with a blended learning system to produce the expected learning products and improve students' thinking skills.

In chemistry learning, research on the PBP model is often carried out with the help of E-learning, as carried out by Na'imah et al (2015; 1) regarding the Application of Project-Based Learning Assisted by E-Learning to Improve Student Learning Outcomes, showing that the achievement of psychomotor and affective indicators according to descriptive analysis on average the experimental class was better than the control class. According to the analysis of the coefficient of determination, the results showed that this research contributed to improving student learning outcomes by 12.60%. Based on the results of this analysis, it is concluded that the application of project-based learning assisted by e-learning can improve student learning outcomes.

Research conducted by Kristanti Yulita DIah et al (2016;1) regarding the Project Based Learning Model in Disma Physics Learning shows that 1) there is no significant difference in student learning outcomes between classes that use the project-based learning model. based learning model) and classes that use direct instruction models in physics learning at PGRI Kasiyan High School. 2) The learning activities of experimental class students towards the project based learning model in physics learning at PGRI Kasiyan High School are included in the high criteria. 3) The learning responses of experimental class students towards the project based

Jurnal PAJAR (Pendidikan dan Pengajaran)
Volume 8 Nomor 2 March 2024 | ISSN Cetak : 2580 - 8435 | ISSN Online : 2614 - 1337
DOI : http://dx.doi.org/10.33578/pjr.v8i2.8906

learning model in physics learning at PGRI Kasiyan High School are included in sufficient criteria. Based on the results of the research and discussion, the suggestions given are: 1) for physics teachers, carefulness is needed in managing learning time in schools in implementing the project based learning model, 2) For further researchers, it is hoped that the results of this research can be used as a basis for further research. According to Tinenti (2018; 13) the PBP model syntax consists of: Preparation, Design, Implementation and Reporting stages and has its own flow and assessment so that all PBP Model implementation processes are valued and assessed authentically. With the help of the information technology application system (e-PBP), it will be easier for students to follow and achieve their goals. Based on the research study above, it shows that the Project Based Learning Model can influence learning outcomes, the PBP model in chemistry learning can produce learning products, the PBP model can be taught online.

Thus, the research will apply the PBP model using a blended learning system so that both individuals and groups can follow the process or syntax of the PBP model and follow a clear workflow in order to achieve the final goal of learning. This research has just been studied in depth and is very useful for the advancement of the learning system and the quality of education

METHOD

This type of research is quantitative descriptive. The implementation of this research was preceded by planning the lecture process using the project-based learning model (PBP), implementing it in the lecture process using a blended learning system, then carrying out a process assessment of students, and looking at CPL achievements in the analytical chemistry I course in the form of quantitative values , and then described. The qualitative descriptive type is a type of research to see the implementation of the PBP model steps using the blended learning system. Data was obtained using observation techniques in narrative form and then assessed for suitability with theory and relevant research related to the implementation of the PBP model steps. This research was conducted at Widya Mandira Catholic University (UNWIRA), Faculty of Teacher Training and Education (FKIP), Chemistry Education Study Program. The subjects in this research were 33 students of the chemistry education study program who were taking the analytical chemistry 1 course and lecturers who taught the course.

The research was carried out in the 2020/2021 odd semester academic year.
The research design used is a one shot case study with the following design pattern:

X O

Information:
X: Treatment given in the form of implementing a project-based learning model in a blended learning system,
O: The results obtained after treatment in the form of process values are analyzed to obtain data about CPL achievement

Data collection techniques in this research are assignment and observation.
The data analysis techniques and instruments used in this research are:

1. Analysis and research instruments for the implementation of the PBP model stages with a blended learning system in the analytical chemistry I course

The research instrument used to see the implementation of the stages of the PBP model with a blended learning system in analytical chemistry courses is the observation sheet for the implementation of the stages of the PBP model. In this instrument there is an assessment to observe the planning, design, implementation and reporting steps which are the stages in the PBP model. The results of the observations are in the form of a narrative of the processes that occurred at the planning, design, implementation and reporting stages. The results of these observations are then studied to discuss their suitability with theory and relevant research related to the implementation of the stages of the project-based learning model.

Jurnal PAJAR (Pendidikan dan Pengajaran)
Volume 8 Nomor 2 March 2024 | ISSN Cetak : 2580 - 8435 | ISSN Online : 2614 - 1337
DOI : http://dx.doi.org/10.33578/pjr.v8i2.8906

2. Analysis and research instruments for CPL achievement in analytical chemistry course 1 using the application of the PBP model with a blended learning system

In collecting data about CPL achievement in the analytical chemistry 1 course using the following instruments:

a. Student planning assessment sheet,
b. Student design assessment sheet,
c. Student implementation assessment sheet,
d. Student presentation assessment sheet,

Written report assessment sheet to assess students' achievement of CPL general skills and specific skills,

The data analysis technique used to see the achievement of CPL, general skills (KU) and special skills (KK) follows the following stages:

1. Calculate the average score obtained by all students for each aspect assessed at each PBP stage
2. Calculate the percentage of achievement of each aspect using the equation:

PK= a/b x100

Information:
PK: percentage of achievement of each aspect
a : the average score obtained by all students
b: maximum score

3. Calculate the percentage of achievement (PK) of CPL by averaging the percentage of achievement of each aspect classified in the CPL.

A CPL is said to be achieved if PK CPL≥75%
(2020 Unwira Academic Guidelines)

RESULTS AND DISCUSSION

The results of research on project-based learning in the analytical chemistry 1 course with a blended learning system and studies on graduate learning outcomes (CPL) will be presented in detail based on the following objectives:

1. Implementation of the PBP model stages with a blended learning system in the analytical chemistry I course.

Observations regarding the implementation of the stages of the PBP model with the blended learning system in the analytical chemistry I course were carried out by members of the research team, the lecturer in charge of the analytical chemistry course 1 (head of the research team). The research results can be stated as. At the PLANNING stage of the PBP model, the following observation results were obtained: a) Lecturers prepare material on knowledge aspects based on the RPS. The study material is about conventional qualitative analysis which includes the basics of separation and identification of cations and anions, b) The lecturer uploads teaching materials about the basics of separation and identification of cations and anions, in the form of PDF files via cell-wira before the lecture schedule, and asks students to access the teaching materials to study independently. c) Teaching material on this knowledge aspect in 3 face-to-face meetings online using the zoom application. The method used is presentation of material by the lecturer, followed by discussion between the lecturer and students via zoom media. d) At the end of each meeting the lecturer gives assignments in the form of knowledge aspect questions that can guide students to have a deep understanding of conventional qualitative analysis in the form of separation and identification of cations and anions. e) The lecturer assesses the achievement of CPL knowledge using an instrument of test questions prepared based on CPMK and sub-CPMK aspects of knowledge. These questions are then uploaded to cell-wira for students to work on within a certain time limit.

Jurnal PAJAR (Pendidikan dan Pengajaran)
Volume 8 Nomor 2 March 2024 | ISSN Cetak : 2580 - 8435 | ISSN Online : 2614 - 1337
DOI : http://dx.doi.org/10.33578/pjr.v8i2.8906

The lecturer examines the results of student work as a knowledge value, and to record students' ability to master conventional qualitative analysis knowledge,The lecturer directs students to make plans in the form of:

1) Examine the material contained in the Middle School Science and High School/Vocational School Chemistry curriculum, which is related to the material being studied. (high school/vocational/middle school material),
2) Determine the title of the practicum according to the Project Assignment Theme, namely: "Separating or identifying cations and anions in certain samples",
3) Based on the theme, conduct a literature review and make a plan to carry out an investigation process. This PLANNING consists of: Problem formulation, hypothesis formulation, identification of variables into control variables, response variables, and manipulation variables, and defining each of these variables operationally.

This assignment is made in the form of a Google form, and the link/URL is distributed to students via cell-wira. Lecturers assess student project PLANNING using the planning assessment sheet instrument. Lecturers are active in directing students so that planning meets good criteria to be continued at the next stage. At the DESIGN stage the following data was obtained. The lecturer directs students to make designs in the form of: 1) If components 1 to 3 at the planning stage have been corrected by the course instructor and have been revised, the next stage is to make a DESIGN which consists of: Determining the tools and materials needed. 2) Determine work procedures that can be carried out. 3) Determine the data analysis technique that will be used to analyze the experimental data. This assignment is made in the form of a Google form, and the link/URL is distributed to students via cell-wira. Lecturers assess student project DESIGNS using the design assessment sheet instrument. Lecturers are active in directing students so that the design meets the criteria to be continued at the next stage.

At the IMPLEMENTATION stage the following data was obtained. At this stage the lecturer has prepared an assessment instrument for the implementation of student investigation projects to assess students in testing the experimental steps that they have prepared at the design stage in the laboratory. Lecturers and the research team assess students' skills in preparing tools and materials and carrying out work procedures that they have prepared in the design stage, recording observational data from experimental results. Assign students to analyze data, discuss and conclude. Develop products in the form of scientific procedures to identify cations or anions in certain samples in the form of student activity sheets (LKPD). At the reporting stage the following data was obtained: Assign students to make written reports and present products and test results they carried out in the laboratory. Students submit the report in the form of a Google Drive link/URL to the hero's cell and it is corrected by the lecturer using the student project report assessment sheet. Students present and display the results of innovative products in the form of LKPD via zoom media and the lecturer assesses them using the student presentation assessment sheet.

2. Achievement of CPL in analytical chemistry course 1 which uses the application of the PBP model with a blended learning system

Before showing the achievement of CPL in the analytical chemistry course 1, it is necessary to state that the use of the PBP model in teaching the analytical chemistry course 1 has been planned in a structured manner during the CPL analysis imposed on the analytical chemistry course 1. This structured planning can be described based on the learning achievements of the course. courses (CPMK) in analytical chemistry 1 in general, and sub-CPMK specifically for each CPL which is contained in the KKNI curriculum for the chemistry education study program, UNWIRA teaching and education faculty. CPL, CPMK, and sub-CPMK analytical chemistry 1 can be stated as follows:

CPL KU 5: Able to make appropriate decisions in the context of solving problems in their field of expertise, based on the results of information and data analysis. Described in CPMK form as follows: Able to plan, design, implement and report the products produced verbally and in writing regarding the application of the principles of separation and identification of cations and anions, as well as gavimetry in the learning

Jurnal PAJAR (Pendidikan dan Pengajaran)
Volume 8 Nomor 2 March 2024 | ISSN Cetak : 2580 - 8435 | ISSN Online : 2614 - 1337
DOI : http://dx.doi.org/10.33578/pjr.v8i2.8906

process of junior high school science and vocational school chemistry. It is further described in sub-CPMK form as follows: Sub-CPMK-6; Able to develop the benefits of the science of the principles of separation and identification of cations and anions, as well as gravimetry to be applied to the science/chemistry learning process for junior high and vocational schools in accordance with curriculum demands, by making an investigation project planning stage.

CPL KK 4: Able to apply the field of chemistry and utilize knowledge in the field to solve problems and be able to adapt to the situations faced. Sub-CPMK-7; Able to design an investigation project by examining aspects of process skills that can be applied in the junior high school science learning process, and then develop LKPD to identify dangerous chemical substances contained in household products" by using process skill steps and applying the principle of separation and identification of cations and anions; Sub-CPMK-8; Able to prepare and carry out experiments in the laboratory to test work procedures that have been developed in the LKPD (the product produced in the project is the LKPD); Sub-CPMK-9; Able to report products produced verbally and in writing effectively and empathetically.

Based on the sequence of CPL and Sub CPMK above, it can be revealed that, to see the achievement of the CPL, the instrument was developed based on the sub-CPMK that has been prepared for each CPL, be it KU, KK, or P. It can also be stated that the achievement of the sub-CPMK is the knowledge aspect is included in the prerequisites before starting the PBP model stages in the lecture process, while the implementation of the PBP model stages starting from the planning, design, implementation and reporting stages illustrates the achievements of the KU and KK CPL. The results of data analysis on the achievement of CPL KU and KK in the analytical chemistry 1 course which were measured at each stage of the PBP model are shown in table 1.

Table 1. Results of Data Analysis of KU and KK CPL Achievement at PBP Stages

No	Rated aspect	The average score obtained by all students	Percentage of achievement for each aspect	Percentage of sub-CPMK achievement (%)
Planning stage (sub CPMK 6)/CPL KU 5				
1	Alignment of project objectives with the theme	4	100	100
2	Formulation of the problem	4	100	
3	Hypothesis formulation	4	100	
4	Suitability of specified variables	4	100	
5	Operational definition of variables	4	100	
Percentage of Achievement of CPL KU 5 (%)				**100**
Design stage (sub CPMK 7)/CPL KK 4				
1	Data collection procedures	3,0	75	78
2	Determine the data analysis technique that will be used	2,7	68	
3	Prepare the tools and materials needed	3,6	91	
Implementation stage (Sub CPMK 8)/CPL KK 4				
1	Prepare samples for the identification process	2,6	66	80
2	Carry out the identification process	3,0	75	
3	Experimental steps	2,7	68	
4	Experimental data	2,7	68	
5	Maintain cleanliness, tidiness and safety	4,0	100	
6	Group collaboration	4,0	100	
Reporting stage (sub CPMK 9)/CPL KK 4				
Written report				

Jurnal PAJAR (Pendidikan dan Pengajaran)
Volume 8 Nomor 2 March 2024 | ISSN Cetak : 2580 - 8435 | ISSN Online : 2614 - 1337
DOI : http://dx.doi.org/10.33578/pjr.v8i2.8906

1	Abstract	2,6	66	84
2	Theory study/theoretical basis	2,3	57	
3	Experimental procedures	4,0	100	
4	Results and Discussion	2,6	66	
5	Conclusions and suggestions	4,0	100	
6	bibliography	4,0	100	
7	Attachment	4,0	100	
Oral report				
1	Mastery of material	2,6	66	77
2	Seminar media	3,0	75	
3	Group cooperation/cohesion	3,6	91	
Percentage of Achievement of CPL KK 4 (%)				**79,75**

Discussion

1. Implementation of the PBP model stages with a blended learning system in the analytical chemistry I course.

Based on the narrative data presented in the points above, it can be stated that the PBP model is a learning model that can be used to teach high-level thinking skills to students. By implementing PBP steps/stages with a blended learning system, we can solve the problem of a tendency to decline in high-level thinking skills which is very likely to occur during the current implementation of online learning.

During the current implementation of online learning, almost all learning activities are carried out from home. Thus, lecturers or teachers need to be creative in designing learning activities so that they maximize students' thinking processes and skills. One learning model that can be used is the project-based learning model. As with the research results presented in the previous points, it can be discussed that in the analytical chemistry 1 course, the complete lecture process to direct students to fulfill the CPL in terms of general skills, special skills and knowledge can be implemented using a blended learning system. Platforms such as Googleform, Google Drive, and e-learning media (cell-wira), as well as the Zoom application, can be used to implement the PBP model steps, and can be followed properly by lecturers and students. The results of this research show that online learning does not limit lecturers and students from exploring knowledge and skills in more depth.

The PBP model with a blended learning system has been successfully implemented by lecturers to direct students to apply knowledge to produce products that are closely related to the creativity that prospective teacher students must have. Material on conventional qualitative analysis regarding the separation and identification of cations and anions can be used by students to design and test worksheet which can be used in the middle school and high school chemistry learning process. The LKPD is a product of implementing the PBP model with a blended learning system. This is in line with what was expressed by Abidin, et al (2020) who stated that the main component of project-based learning is asking questions or problems that are presented to organize and start activities that emphasize a number of projects until the final result is obtained in the form of a product as a series of individual communication activities or various task results that answer questions. So, project-based learning provides opportunities for students to study concepts in depth while also improving their learning outcomes.

2. Achievement of CPL in analytical chemistry course 1 which uses the application of the PBP model with a blended learning system

Based on the data displayed in table 1, several things can be discussed as follows:

a. The design stage is to see the achievement of sub CPMK 6

Before entering the planning stage, students have followed a series of lecture processes to understand the material in the knowledge aspect. This was done at 3 initial meetings, where at each meeting the lecturer uploaded teaching material files and structured assignments via the cell wira system. The teaching material file contains a description of material related to the study material, namely "the basics of conventional

Jurnal PAJAR (Pendidikan dan Pengajaran)
Volume 8 Nomor 2 March 2024 | ISSN Cetak : 2580 - 8435 | ISSN Online : 2614 - 1337
DOI : http://dx.doi.org/10.33578/pjr.v8i2.8906

qualitative analysis in the form of techniques for separating and identifying cations and anions". Apart from that, face-to-face lectures were held using the zoom meeting application to discuss the study material. It can also be revealed that the structured assignments given are then submitted by individual students via their respective cell-wira accounts. At the end of the 3rd meeting, students were directed to plan a scientific investigation project according to the theme given, namely "Identifying cations and anions found in household products or materials in the surrounding environment" and each student made a plan that then submitted via their respective cell-wira accounts.

At the planning stage (sub CPMK 6) the percentage for each aspect measured is 100. This shows that all students have been able to plan the objectives of the investigation project according to the given theme, formulate the problem according to the project objectives, formulate a hypothesis according to the problem formulation, identify appropriate and measurable variables according to the hypothesis formulation, and defining these variables operationally or logically describing how these variables are measured, and the measuring instruments used.

The aspects assessed at the planning stage of a scientific investigation project are part of the aspects that a prospective chemistry teacher needs to have to be able to create a scientific work. Meanwhile, the ability to produce scientific work is one of the absolute competencies required by a professional teacher. This refers to Law No. 14 of 2005 concerning teachers and lecturers, that professional teachers must prove their ability to write scientific papers which is a condition for promotion and position. Likewise, the Ministerial Regulation (Permen) for the Empowerment of State Apparatus (PAN) and Bureaucratic Reform (RB) Number 16 of 2009, dated 10 November 2009 concerning Teacher Functional Positions and Credit Scores, Article 17 explains that first teachers, young teachers, intermediate teachers, Primary Teachers who will be promoted to a position or rank, the credit score required for promotion to the position or rank must have a credit score from the scientific publication sub-element (Mulia and Suwarno, 2016).

Based on this description, it can be concluded that, through this planning stage, students already have several abilities required for professional teacher competency through a lecture process that applies the PBP model with a balanced learning system. This is proven by the process of measuring students' abilities, using a valid instrument, namely the student planning assessment sheet.

b. The design stage is to see the achievement of sub CPMK 7

At the design stage, an assessment process is carried out by the lecturer on students using a design assessment sheet. After students carry out the planning process and are assessed, students then carry out the design stage. At this design stage, the first aspect to be assessed is that students determine the data collection procedures, obtaining an average percentage of 75. Based on this data, it can be revealed that all students received a score of 3. A score of 3 is the result of the assessment which indicates that the data collection procedure plan made by the students is procedures that are valid, have clear sources, can be trusted to be used as data collection procedures and have been created in the form of a clear and appropriate workflow, but have not been modified according to the needs of the investigation project they wish to carry out. Therefore, this modification process was then suggested by the lecturer during the assessment process and was corrected by the students.

The second aspect assessed was determining the data analysis technique used to obtain an average percentage of 68. Based on this data, it can be revealed that of the 33 students who were research subjects, 24 students got a score of 3 and 9 others got a score of 2. A score of 3 means the data analysis method was used. selected is suitable for use and has been written clearly but is not complete. A score of 2 means that the data analysis method chosen is not completely appropriate and is not written down completely. Thus, at this stage the lecturer must use a different strategy, in this case holding online face-to-face meetings to encourage students one by one to determine the appropriate data analysis method and write it down in full. This data analysis technique must be modified according to the type of project they have planned.

The third aspect, namely preparing the tools and materials needed, got an average percentage of 91. Based on this data, it can be revealed that there were 12 students who got a score of 3 and 21 others got a score

Jurnal PAJAR (Pendidikan dan Pengajaran)
Volume 8 Nomor 2 March 2024 | ISSN Cetak : 2580 - 8435 | ISSN Online : 2614 - 1337
DOI : http://dx.doi.org/10.33578/pjr.v8i2.8906

of 4. A score of 4 means that the tools and materials prepared were complete according to the tool data. and the materials needed, the solutions are available in the required concentration form, and the samples to be studied are available in the form to be analyzed. Meanwhile, a score of 3 means that the tools and materials are complete, the sample you want to study is available but the required solutions have not been made in the concentration that will be used. This is done by students offline in the laboratory by implementing health protocols. After the assessment process is carried out by the lecturer, students who have not prepared a solution according to the required concentration are directed to prepare it.

The average percentage for the 3 aspects assessed at the design stage is 78. This shows that the CPMK 12 sub assessed using this instrument has been achieved with the control carried out by the lecturer during the lecture process. According to Aji (2020), one of the disadvantages of students and the assessment process during the Covid 19 pandemic is that certain student skill and expertise targets which should have been assessed this year so that they impact treatment for the coming year, cannot be carried out for students who have was able to master many skills this year but did not get the proper assessment. This loss has been minimized through implementation and assessment at the planning stage in the analytical chemistry lecture process 1. Where the assessment at the planning stage has become the basis for continuing with the next stage of the process in the PBP model, namely the implementation stage.

c. Implementation stage to see the achievement of sub CPMK 8

At the implementation stage, an offline assessment is carried out in the laboratory. The first aspect assessed, namely preparing samples for the identification process, obtained an average percentage of 66. Based on the results of this data analysis, it can be revealed that when preparing samples for the identification process there were 21 students who got a score of 3 and 12 others got a score of 2. A score of 3 means that all The steps that have been planned and designed can be carried out independently with a little help from lecturers or assistants. Meanwhile, a score of 2 means that these steps can be carried out independently but with lots of direction and assistance from lecturers and assistants.

The second aspect assessed was carrying out the identification process, obtaining an average percentage of 85. Based on the results of data analysis, it can be revealed that all students received a score of 3, which means that the process of identifying cations and anions in the sample can be carried out independently by each student with a little help from the lecturer. or companion.

The third and fourth aspects assessed, namely carrying out work steps/procedures and writing down observational data, obtained an average percentage of 68. Based on the results of data analysis, it can be revealed that 24 students obtained a score of 2, which means they can be carried out independently with a lot of help from lecturers/supervisors. and the other 9 got a score of 3, which means they can be done independently with a little help from lecturers/supervisors.

The fifth and sixth aspects assessed, namely maintaining cleanliness, tidiness, security and group collaboration, received a maximum average score of 100. The average score for all aspects at this implementation stage was 80, which shows that sub-CPMK 7 has been achieved through the lecture process. and assessment of the PBP model with a blended learning system. Based on the results of data analysis and studies at this implementation stage, it shows that, most of the skills that students must possess still need to receive a maximum portion of guidance from lecturers/supervisors. Thus, this becomes a recommendation for maximizing student laboratory skills in every course that requires mastery of skills in laboratory experiments.

d. Reporting Stage to See Achievement of Sub CPMK 8 and 9

Written reports are prepared by students after the planning, design and implementation stages. The report is then submitted via Cellwira and assessed by the lecturer using a written report assessment sheet instrument. The first aspect assessed was the abstract, with an average percentage of 66. Based on the results of data analysis, it can be revealed that there were 21 students who got a score of 3 and 12 other students who got a score of 2. The assessment criteria for writing abstracts were a maximum of 200 words, written in

Jurnal PAJAR (Pendidikan dan Pengajaran)
Volume 8 Nomor 2 March 2024 | ISSN Cetak : 2580 - 8435 | ISSN Online : 2614 - 1337
DOI : http://dx.doi.org/10.33578/pjr.v8i2.8906

paragraph form, there are problems, objectives, methods or procedures, and findings. Where a score of 3 is if one of the criteria has not been met, and a score of 2 is because there are 2 criteria that have not been met.

The second aspect, namely the study of theory or theoretical basis, obtained an average percentage of 57. There were 9 students who received a score of 3 and 24 others who received a score of 2. The assessment criteria in this aspect are that there is theory, relevant experimental results, and a framework for thinking in building arguments. theoretically that the experiments carried out can solve the problem. Scores of 3 and 2 mean that there are 1 and 2 criteria that have not been met in the theoretical study.

The third aspect, namely the experimental procedure, obtained a maximum average percentage of 100. In this case, all students received a score of 4, which means that in writing scientific project reports students wrote correctly or according to the problem formulation, hypothesis formulation, experimental variables, tools and materials used. , as well as experimental design.

The fourth aspect, namely results and discussion, obtained an average percentage of 66. In this case, there were 12 students who got a score of 2, and 21 others got a score of 3. The criteria assessed in the results and discussion were that students had to fully explain the results of the data analysis. which includes the use of appropriate techniques/methods, taking into account the level of measurement error/accuracy, written according to the rules of significant figures, written along with the units used, presented in graph/table form and given correct explanations, carried out comparisons between experimental data and actual values. theory. Scores of 2 and 3 mean that there are four aspects and two aspects that have not been fulfilled.

The fifth, sixth and seventh aspects, namely conclusions and suggestions, bibliography and appendices, received a maximum average score of 100. This shows that all students received a score of 4 for these three aspects. Assessment of the aspects of conclusions and suggestions includes conclusions that are valid, namely written based on analysis of experimental data, there is a comparison between the conclusions from the experimental results and literature/theory, there is an explanation regarding the relationship between the conclusions and the hypothesis statement, there are suggestions that are in accordance with the findings that can be used to improve the experiment next. Assessment of the bibliography aspect includes that the bibliography is written according to the rules, is consistent, and contains all the literature in the report. Assessment of the attachment aspects includes whether there is original interim report data and important analysis process data.

Aspects of implementing the presentation of the results of the investigation project/oral report. After the written report is collected, the next thing to do is for students to present the results of the investigation project they have carried out. When students present these results, the lecturer carries out an assessment using the student presentation assessment instrument. This activity is carried out online via zoom media. The first aspect that was assessed was the skill of explaining the material which included correctness of concepts and mastery of the material with an average percentage of 66. The results of data analysis showed that there were 12 students who got a score of 2, and 21 others who got a score of 3. The criteria assessed in this aspect were: Students can explain the following criteria according to the correct concept. These criteria are problems, variables, experimental steps for data collection for scientific investigation projects, data analysis, and relevant theories/concepts. Scores of 2 and 3 obtained by students mean that there are 3 to 4 aspects and 1 to 2 aspects that cannot be explained well by students.

The second aspect assessed, namely seminar media, received an average score of 75. Based on the results of data analysis, all students received a score of 3. The criteria used in assessing this aspect include material presented in interesting media and consisting of the use of power point presentations, in The form of tables/graphs, writing/fonts, images displayed can be seen and read properly by all participants. A score of 3 means that there is one criterion that is not met in the seminar media.

The third aspect assessed, namely cooperation or group cohesiveness, received an average percentage of 91. Based on the results of data analysis, there were 12 students who received a score of 3 and 21 others who received a score of 4. The criteria for assessing this aspect were that all group members were present simultaneously virtually in Zoom media, shows good coordination/distribution of tasks, answering questions

alternately until all group members have a turn to answer. A score of 4 means all criteria are met, and a score of 3 means there is one criterion that has not been fulfilled properly.

The average scores for the written report and oral report aspects are 84 and 77, this shows that sub CPMK 8 and 9 have been achieved through the process and assessment of written reports and oral reports. Thus, the implementation of the learning process and assessment process in the analytical chemistry 1 course which applies the PBP model using e-learning has succeeded in directing students to fulfill the CPL of general skills and specific skills studied in this research.

The results of this research support what was studied by Abidin, et al (2020), which revealed that online learning which is synergized with the right learning base will provide a more optimal learning effect. One learning approach that can improve student competency from various research that has been carried out is project-based learning. Interaction can occur effectively in project-based learning by utilizing the inquiry process by directing students to create or develop products that are applicable and related to everyday life. Sahin also emphasized in Abidin, et al (2020) that specifically, project-based learning consists of inquiry-based tasks that help students develop the importance of technology, social and the core of the curriculum.

CONCLUSIONS AND RECOMMENDATION

Based on the research results discussed previously, it can be concluded: 1) The PBP model with a blended learning system in the analytical chemistry I course was implemented well according to the planning, design, implementation and reporting stages. 2) CPL KU and KK are declared achieved based on the assessment of sub CPMK 6, 7, 8, 9 with an average percentage of achievement respectively 100, 78, 80, 84, 77 and in general the percentage of achievement of CPl KU 5 and KK 4 are 100% and 79.75%.

REFERENCES

Abidin Zainal, dkk. (2020). Pembelelajaran Online Berbasis Proyek salah satu Solusi Kegiatan Belajar Mengajar di Tengah Pandemi Covid-19. Jurnal Ilmiah Profesi Pendidikan. P-ISSN 2502-7069, E-ISSN 2620-8326, Volume 5 Nomor 1 tahun 2020.

Aji Rizqon Halal Syah. (2020). Dampak Covid-19 pada Pendidikan di Indonesia Sekolah, Keterampilan, dan Proses Pembelajaran. Jurnal Sosial dan Budaya Syar-I, P-ISSN 2356-1459, E-ISSN 2654-9050, Volume 7, Nomor 5 tahun 2020.

Fahmi Fahmi, dan Wuryandini Wuryandini. (2020). Analisis Keterampilan Berpikir Kreatif Pada Model Pembelajaran Berbasis Proyek Pada Peserta Didik SMA. Jurnal Inovasi Pendidikan Kimia [ISSN Print 1979-0503 | ISSN Online 2503-1244] volume 14 nomor 2 tahun 2020

Kurniawan dkk. (2015). Pengembangan Aplikasi Sistem Pembelajaran Klasifikasi (Taksonomi) dan Tata Nama Ilmiah (Binomial Nomenklatur) pada Kingdom Plantae (Tumbuhan) Berbasis Android. Jurnal Komputasi P-ISSN 2541-0296, e-ISSN 2541-0350. Volume 3 nomor 2 tahun 2015

Mulia Dini Siswani, Suwarno. (2016). PTK (Penelitian Tindakan Kelas) dengan pembelajaran Berbasis Kearifan Lokal dan PENulisan Artikel Ilmiah di SDN Kalisube Banyumas. Jurnal Ilmiah Pendidikan Khazanah Pendidikan. ISSN 1979-6668. Volume IX, Nomor 2 tahun 2016.

Putra Rizki Suhendar , Nanik Wijayati, F. Widhi Mahatmanti. (2017). Pengaruh Penggunaan Media Pembelajaran Berbasis Aplikasi Android Terhadap Hasil Belajar Siswa. Jurnal Inovasi Pendidikan Kimia [ISSN Print 1979-0503 | ISSN Online 2503-1244] volume 11 No 2 tahun 2017

Kristanti Yulita Diah dkk. (2016). Model Pembelajaran Berbasis Proyek (Project Based Learning Model). Jurnal Pembelajaran Fisika, Vol. 5 No. 2, September 2016, hal 122 – 128

Lestari, E,K. Yudhanegara, R, M. 2015. Penelitian Pendidikan Matematika. Bandung. PT Revika Aditama.

Ubaidillah Mujib. (2017). Pembelajaran Berbasis Proyek Untuk Mengembangkan Ensiklopedia Berbasis Bioedupreneurship. Jurnal Pendidikan Sains, ISSN: P-2339-0786, e-2502-1443, Volumen 5 nomor 1 Maret 2017

Susilo dan Rohman. (2019). Sistem Pembelajaran Online Berbasis Aplikasi Web Menggunakan Framework Codeigniter. Jurnal Joutica ISSN: 2503-071X E-ISSN Jurnal 2621-511X Volume 4 nomor 2 tahun 2019

Tinenti Yanti Rosinda. (2018). Model dan penerapan Pembelajaran Berbasis Proyek (PBP). ISBN 978-602-475-612-3 Deepublish. Yogyakarta https://penerbitbukudeepublish.com/penulis/yanti-rosinda-tinenti

Widayati, Ani. (2008). Penelitian Tindakan Kelas. Jurnal Pendidikan Akuntansi Indonesia, P-ISSN 0853-9472, E-ISSN 25025104, Volume 6, Nomor 1 tahun 2008.

Zulfadhilah Muhammad dan Hidayah Nur. (2019). Aplikasi Penyusunan Ikatan Kimia Berbasis Android Sebagai Media Pembelajaran. Jurnal EdikInformatika, ISSN 2407-0942, E-ISSN 2541-3716. Volume 6 nomor 1 tahun 2019.