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Evaluation of Biochemistry Learning Based on OBE and KKNI in The Face of The World Of Work in Society 5.0

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ABSTRACT

This field study research was conducted to analyze Biochemistry lectures from the perspective of the Indonesian National Qualifications Framework (KKNI) and Outcome-Based Education (OBE) based college curriculum. KKNI emphasizes work readiness and competency development, as well as OBE which focuses on teaching results-driven processes. So it is important to analyze whether KKNI and OBE have been applied to biochemistry lectures. Data collection techniques were carried out through observation of learning implementation in Biochemistry courses, interviews with lecturers teaching Biochemistry courses, and analysis of semester lecture plan documents (RPS). The participants involved in this study were three lecturers and 83 students of the undergraduate science education program at one of the universities in Jember Regency. The Biochemistry course is in the upper level compulsory course group with the study of science concepts. From the KKNI perspective, this course needs to increase the Bloom level in the CPMK provided to match the profile of graduates of the science study program. From an OBE perspective, this course has a contribution to graduate learning outcomes in Specific Skills and supports the profile of graduates as Science Teachers.

Keywords: Biochemistry, KKNI, OBE

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1. INTRODUCTION

The swift development of the worldwide workplace, accelerated by technological advancements and changing societal expectations that define Society 5.0, requires a matching transformation in higher education courses (Azmi, 2019). This study centres on the application of the Indonesian National Qualifications Framework (KKNI) and Outcome Based Education (OBE) in biochemistry courses. It aims to assess the efficacy of both approaches in equipping students to tackle the demands of the present and future professional landscape.

A vision of a technology-integrated society known as Society 5.0 shows how cognitive computing and other cutting-edge technologies can improve human capabilities. It prioritises sustainable development by achieving a harmonious combination of economic progress and the solving of social issues. Simultaneously, the Fourth Industrial Revolution, often known as Industry 4.0, brings about a digital revolution marked by the implementation of automation, artificial intelligence, and the processing of real-time data. Both paradigms require a workforce that possesses new abilities, including digital literacy, critical thinking, creative problem-solving, and multidisciplinary teamwork (Shopova, 2014; Facione, 2011; Treffinger *et al.*, 2023; Thompson, 1993).

The abilities and skills needed in the world of work need to be trained to students. KKNI is designed to standardize educational qualifications across Indonesia with a clear emphasis on work readiness and competency development. KKNI aims to align educational outcomes with industry needs, ensuring that graduates have not only academic knowledge but also practical skills that can be applied in a dynamic job market (Maslahah, 2018; Masnun & Arifuddin, 2018). The framework encourages an outcome-based education (OBE) approach, where the focus shifts from traditional teaching methods to outcome-driven processes (Solikhah, 2015). This paradigm shift is very important for science education, especially in biochemistry courses, which traditionally emphasize theoretical knowledge rather than practical application.

Biochemistry, a field at the intersection of biology and chemistry, plays a crucial role in various sectors, including healthcare, pharmaceuticals, and environmental science (Wahyudi, 2020). The application of KKNI in biochemistry courses requires a curriculum that not only covers fundamental scientific knowledge but also integrates skills necessary for innovative problem-solving and research in these sectors. However, the transition from a predominantly theory-based curriculum to one that is more aligned with KKNI's competency-based approach presents significant challenges. These include curriculum redesign, faculty training, and the integration of new teaching technologies and methodologies.

An in-depth study of the implementation of the KKNI and OBE-based curriculum in Biochemistry lectures will provide a comprehensive understanding of the efforts of universities in producing graduates who not only have in-depth theoretical knowledge, but also the ability to apply that knowledge in real-life scenarios. The problem is whether the current biochemistry lectures have implemented KKNI and OBE in the process, so that these goals can be achieved. This article will discuss the importance of IQF and OBE-based curriculum in helping students understand the principles of biochemistry and preparing

them for their future careers as science teachers. The author seeks to understand the integration of Biochemistry lectures in the Field and its role in the Science Education Undergraduate Curriculum, as viewed from the perspectives of KKNI and OBE.

2. RESEARCH METHODS

The method used in this research is a field study. The field study was conducted at one of the universities in Jember Regency. The participants in this field study were three lecturers and 83 students of the Science Education study program at the college. Data were collected through learning observations, interviews, and document analysis. The documents analyzed were the curriculum book and Semester Lecture Plan (RPS) of Biochemistry course. Learning observations were conducted in the Biochemistry course for one full meeting. While the interview was conducted to the lecturer teaching the course.

The instrument used refers to KKNI Presidential Regulation No. 8 of 2012 and Permendikbud No. 3 of 2020 Part Four regarding Learning Process Standards. This preliminary analysis is grounded in the presidential regulations and ministerial regulations discussed in the methodology section. This legal framework serves as a point of reference in the development of research tools. The extent of observations as outlined in KKNI Presidential Regulation No. 8 of 2012 is displayed in Table 1 below.

Table 1. Scope of Observation of Higher Education Curriculum Implementation Based on Presidential Regulation No. 8 of 2012.

Aspect (Data Collection)	Description
RPS (Document Analysis CPL/CPMK/Sub CPMK)	• Proficient in applying their specialized knowledge and leveraging scientific and technological advancements to solve problems, while being adaptable to the current circumstances. • Proficient in comprehending the theoretical principles of specific domains of knowledge in a comprehensive manner, as well as the theoretical principles of specific subdomains within those domains, and capable of formulating systematic approaches to problem-solving. • Capable of making sound decisions by analyzing information and data, and able to offer guidance in selecting from a range of alternative solutions both individually and in collaborative settings. • Accountable for individual tasks and capable of assuming responsibility for accomplishing organizational objectives.

The description of qualifications on the KKNI is to reflect the learning outcomes that a person obtains through the education, training, work experience, and independent learning. Permendikbud No. 3 of 2020 incorporates and utilizes the previously mentioned principles as the primary framework for evaluating the instructional procedures in higher education. This can be seen in table 2.

Table 2. Scope of Observation of Higher Education Curriculum Implementation Based on Permendikbud No.3 of 2020.

Aspect (Data Collection)	Standard Minimal
Characteristics (Classroom Observation)	Interactive, holistic, integrative, scientific, contextual, thematic, effective, collaborative, and student-centered.
Planning (Document Analysis)	• RPS is developed by lecturers independently / team • The minimal RPS includes the Study Program's name, course name and code, semester, SKS (credit hours), and lecturer's name, CPL, CPMK, study materials, learning methods, time, student learning experience, indicator criteria and assessment weight, list of references used. • RPS must be reviewed and adjusted periodically.
Implementation (Document Analysis and Interview)	• The learning process uses effective learning methods • Methods include: group discussions, simulations, case studies, collaborative learning, cooperative learning, project-based learning, problem-based learning, or other learning methods, which can effectively facilitate the fulfillment of graduate learning outcomes. • Forms of learning: lectures; receptions and tutorials; seminars; practicum, studio practice, workshop practice, field practice, work practice; research, design, or development; military training; student exchange; internships; entrepreneurship; and/or other forms of community service.
Student Study Load (Document Analysis)	• Learning load is expressed as credits • Minimum 16 weeks learning process (including UTS and UAS) • The maximum undergraduate study period is 7 years with a minimum load of 144 credits. • Maximum learning load of 40 credits (2 semesters) outside the study program

3. RESULTS AND DISCUSSION

The analyzed curriculum papers relevant to this research include graduate profiles, graduate learning outcomes (CPL), study materials, course learning outcomes (CPMK), KKNI policies, and semester learning plans (RPS). The analysis focused particularly on the use of CPMK and RPS in Biochemistry courses. The profile of science education graduates along with the profile description can be seen in Table 3.

Table 3. Profile of Graduates of S1 Science Education Study Program.

Profile	Graduates
1	Mastering science knowledge and science learning so as to support his duties as a science educator, especially in SMP/MTs schools located in agro-industrial areas.
2	Research assistant who can contribute to solving science education problems, especially those in agro-industrial areas.
3	Entrepreneurs who are able to develop science knowledge and learning into business opportunities either independently or in collaboration with other people.

Graduates are required to possess a wide range of abilities, including professional attitudes, extensive knowledge in science and education, general skills applicable in the workforce, and specific skills relevant to the field of science and education. These abilities enable them to make effective contributions in the areas of science education, research, and the management of educational laboratories. This aligns with the requirements for teacher proficiency in the 21st century (Abraham *et al*., 2021).

The learning outcomes of this study program comprise four components, specifically attitude (S), knowledge (P), general skills (KU), and specific skills (KK). The CPL (Expected Learning Outcomes) for attitude and general skills align precisely with the requirements outlined in Permendikbud Number 3 of 2020. These standards encompass 1 CPL for attitude, 2 CPL for knowledge, 5 CPL for specific skills, and 2 CPL for general skills. The precise competencies and expertise can be observed in the Table 4.

Table 4. CPL imposed on the ipa education study program.

CPL Element	CPL Description
Attitude	Students are able to internalize an attitude of devotion to God Almighty and love of the country
Knowledge	• Students are able to analyze science principles and concepts that are relevant to agroscience, mathematics, and technology. • Students can analyze educational concepts and curriculum in science learning
General skills	• Students possess the capability to utilize research technique in the field of science and scientific education. • Students possess the capability to exhibit proficiency in oral and written communication, as well as collaboration
Specific skills	• Students can autonomously conduct scientific laboratory work and outdoor projects while giving priority to ensuring work safety. • Students can effectively implement didactic-pedagogic ideas in the sphere of science. • Students possess the capability to utilize scientific knowledge and science education in entrepreneurial endeavors, either alone or collaboratively. • Students can utilize their scientific abilities and expertise to address environmental issues and engage in contextual and innovative learning centered around agroscience. • Students possess the capability to combine the concepts and principles of information and communication technology (ICT) in order to facilitate lifelong learning.

The Learning Outcomes (CPL) of the Bachelor of Science Education study program are a series of competencies that must be mastered by graduates, which include attitudes, knowledge, general skills, and specific skills. These CPL are designed to ensure that graduates not only have a strong theoretical understanding of science and its teaching methodologies, but are also able to apply that knowledge in effective and innovative educational practices. This is in accordance that the CPL must support the graduate profile (Yusrie *et al*., 2021).

Biochemistry courses choose 3 CPL in the form of knowledge, general skills, and specific skills. The CPMK of Biochemistry based on the analysis of RPS documents include:

- CPMK1 : Describe the principles of Biochemistry relevant to mathematics
- CPMK2 : Make observations in the science laboratory (Biochemistry) according to standardized procedures
- CPMK3 : Demonstrate the ability to communicate orally and in writing.

From the perspective of the CPMK, Biochemistry has played a significant role in attaining CPL in the third Special Skills component, which involves the ability to conduct scientific laboratory work and field research autonomously while giving priority to work safety. In addition, it also supports knowledge CPL, namely being able to analyze science principles relevant to technology, mathematics and agroscience. These two CPL are closely related to the professionalism of science teachers and the basis for continuing master's studies.

The results of the analysis of the RPS documents show that almost all the components required in Permendikbud Number 3 of 2020 are in it. However, there are some elements that are missing which can be seen in Figure 1.

Lembar Penilaian Administratif RPS

NO	Aspek Penilaian	Ketersediaan		Catatan Temuan Butir
		Ada	Tidak Ada	
1	**Identitas Perguruan Tinggi**			
	a. Logo Perguruan Tinggi	√		
	b. Nama Perguruan Tinggi	√		
	c. Nama Fakultas	√		
	d. Nama Jurusan/ Program Studi	√		
	e. Kode Dokumen RPS	√		
2	**Identitas Mata Kuliah**			
	a. Nama mata kuliah	√		
	b. Kode mata kuliah	√		
	c. Rumpun mata kuliah	√		
	d. Bobot sks mata kuliah	√		
	e. Semester/ Tahun akademik	√		
3	**Otoritas Pengesahan Dokumen**			
	a. Tanggal penyusunan dokumen RPS	√		
	b. Tanggal pengesahan dokumen RPS		√	
	c. Tanda tangan dosen pengampu mata kuliah		√	
	d. Nama dosen pengampu mata kuliah	√		
	e. Tanda tangan koordinator mata kuliah		√	
	f. Nama koordinator mata kuliah	√		
	g. Tanda tangan ketua program studi		√	
	h. Nama ketua program studi	√		
4	**Capaian Pembelajaran**			
	a. CPL Program studi yang di bebankan pada mata kuliah	√		
	b. Capaian pembelajaran mata kuliah (CPMK)	√		
	c. Kemampuan akhir yang diharapkan (sub-CPMK)	√		
	d. Matriks korelasi antara CPMK dengan sub-CPMK	√		
5	**Deskripsi mata kuliah**			
	a. Deskripsi mata kuliah	√		
6	**Mata kuliah prasyarat**			
	a. Nama Mata Kuliah Prasyarat	√		
	b. Kode Mata Kuliah Prasyarat		√	
	c. Bobot sks Mata kuliah Prasyarat		√	
7	**Bahan kajian/ materi perkuliahan**			
	a. Bahan kajian		√	
	b. Materi perkuliahan	√		
8	**Pustaka/ Referensi perkuliahan**			
	a. Referensi utama	√		
	b. Referensi pendukung	√		
9	**Media Perkuliahan**			
	a. Media software	√		
	b. Media hardware	√		

Figure 1. the result of RPS document analysis based on OBE

The results of the analysis of RPS documents based on OBE some important notes are the need to add study materials, prerequisite course codes, credit weights of prerequisite courses, and increase supervision from the leadership authority related to the ratification of RPS documents that have been made. Shaheen has highlighted the importance of following up on this matter for future enhancements. According to Shaheen, Outcome-Based Education (OBE) is a curriculum development strategy that focuses on performance and is built around empowering learners for future success (Shaheen, 2019).

The results of the analysis of the RPS document show that almost all components required in Presidential Regulation No. 8 of 2012 concerning KKNI are included. However, there are some missing elements that can be seen in Figure 2.

No	Aspek yang diamati	Ketersediaan	
		Ada	Tidak
1	Sumber belajar	√	
2	Fasilitas pendukung	√	
3	Pedoman evaluasi	√	
4	Alokasi waktu	√	
5	CPMK sesuai dengan tingkatan taksnomi Bloom		√
6	Pengawasan dari pimpinan		√

Figure 2. the result of RPS document analysis based on KKNI

Some of the findings from the analysis of the RPS based on KKNI are the CPMK charged in the Biochemistry course with the demands of Bloom's learning taxonomy in setting learning objectives more specifically not in accordance with the expected level for ipa education graduates, besides that there has been no intensive supervision related to the making of RPS by the leadership. With the KKNI Curriculum, it is able to hone the potential of students in having broader competencies and having the appropriate abilities needed in the world of work and society. The existence of the KKNI curriculum can also make it easier for universities to determine the objectives of student outcomes while carrying out the learning process (Nurhayati *et al.*, 2021). In meeting the needs of creating graduates who have competitiveness both at national and international scope (Masykur *et al.*, 2018). Previous research has found that there are difficulties in preparing the KKNI-based curriculum. The difficulty is the demands of the community that need to be re-evaluated and reviewed (Casmini, 2014).

Learning observations in the Biochemistry course were carried out at the 9th meeting with the topic "Carbohydrate Biosynthesis". The learning approach is carried out by discussion, and question and answer oriented to case studies. The results of learning observations can be seen in Table 5.

Table 5. The results of learning observations.

Characteristic	Observation results	
	Yes	No
Integrative		√
Holistic	√	
Scientific	√	
Contextual	√	
Thematic		√
Effective	√	
Collaborative	√	
Emphasizing the advancement of creativity, aptitude, individuality, and student requirements		√

From the learning observation, it was found that there were three learning characteristics that were not seen. However, because learning observations were only made in one meeting, this cannot be used as a conclusion. Lecture observations must be carried out thoroughly in order to obtain a holistic picture (Rahmawati, 2018).

The results of interviews with lecturers teaching Biochemistry courses obtained the following notes.

- Lectures are mostly conducted using the expository method.

- Practical activities are carried out in the laboratory with simple topics
- The difficulties experienced by lecturers include visualizing abstract material, adjusting the material to the characteristics of students, facilities and infrastructure in practicum activities.
- Difficulties faced by students include understanding abstract concepts, many Latin / foreign terms that are difficult to understand, and others (such as media and teaching methods).

Based on the results of interviews with teaching lecturers, many difficulties are experienced in Biochemistry courses. Problems that are often found are students' difficulties in mastering biochemical concepts and solving chemical problems. Problems in biochemistry are often encountered by ipa students (Dewi, 2021). Low learning outcomes are one indication of learning difficulties (Rizki *et al.*, 2017). Wahyuni (2019) corroborates that students who experience learning difficulties are evidenced by low summative exam results.

4. CONCLUSION

The Biochemistry course is in the upper level compulsory course group with the study of science concepts. From the KKNI perspective, this course needs to increase the Bloom level in the CPMK provided to match the profile of science study program graduates. From an OBE perspective, this course has a contribution to graduate learning outcomes in Specific Skills and supports the profile of graduates as Science Teachers. This course supports CPL KK3 and P1. These CPL are related to the professionalism of science teachers and preparation for continuing master's studies.

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