

## **Development of Biochemistry Teaching Material on Carbohydrate Through Problem Based Learning Model according to KKNI Curriculum**

Ersalinda<sup>1</sup>, Murniaty Simorangkir<sup>2</sup>, Saronom Silaban<sup>3</sup>

<sup>1</sup>(Department of Chemistry Education on Post Graduate Program, State University of Medan, Indonesia)

<sup>2</sup>(Lecturer in Department of Chemistry Education on Post Graduate Program, State University of Medan, Indonesia)

<sup>3</sup>(Lecturer in Department of Chemistry Education on Post Graduate Program, State University of Medan, Indonesia)

Corresponding Author: Ersalinda, [ersalinda25@gmail.com](mailto:ersalinda25@gmail.com)

---

**Abstract:** *This study aims to obtain Biochemistry teaching materials on carbohydrate integrated with problem based learning (PBL) model in accordance with the KKNI curriculum in agrotechnology study program faculty of Agriculture Graha Nusantara University. The research population is all biochemistry books used in agrotechnology study program, all lecturers of biochemistry in Unimed and UGN, and agrotechnology study program students of semester II who take biochemistry courses of 25 people. This research is a research and development (R & D) consisting of; (1) the early stages of biochemical book analysis; (2) development stage of integrated teaching materials of PBL according to KKNI curriculum; (3) validation stage according to BSNP feasibility standard (modification); (4) Revision and (5) test phase. Data were analyzed descriptively. The results of the early stages of biochemistry study obtained the average value of feasibility of 3.09 including decent category, but not yet integrated PBL and not yet in accordance with KKNI curriculum. The validation's result of the feasibility in developed learning materials obtained an average score of 3.28 including the category is very feasible and student response obtained 3.28 including very decent category. The results of experimental material test developed showed the average of student activity amounted to 66.04 including the active category and the average student learning outcomes which showed the gain value obtained by 0.65 including the medium category.*

**Keywords:** *Teaching materials, carbohydrate material biochemistry, problem based learning model, KKNI curriculum.*

---

Date of Submission: 05-08-2017

Date of acceptance: 25-08-2017

---

### **I. Introduction**

Education is a conscious and planned effort to create an atmosphere of learning and learning process so that students actively develop the potential to have spiritual strength, self-control, personality, intelligence, noble character, and skills necessary for students, society, nation and state. The active role of the student is crucial in the formation of a creative generation, capable of producing something for himself and others. Given the importance of chemistry in everyday life as well as in various sciences, it is necessary to improve the quality of chemistry learning in college. It is important to note the lecturers is how to create appropriate and interesting learning in order to make the lesson in progress more interested by students in accordance with the KKNI curriculum.

The Indonesian National Qualification Framework Curriculum (KKNI) expects that the profile of graduates to be generated from the study program must be elaborated briefly and detail which will then become the learning achievement that will be produced by the students. Learning achievement is the internalization and accumulation of science, skills, attitudes, and competencies achieved through a structured education process and encompasses a particular field of knowledge / expertise or through work experience [1]. Teaching materials is one of the learning devices that influence the process of achieving learning. Sanjaya [2] defines that learning materials are everything that the curriculum content should be mastered by students with basic components in order to achieve the standard of competence of each subject in a particular education. The types of teaching materials must be adapted to the curriculum and then the learning design.

Based on the results of preliminary analysis conducted on five biochemistry books of carbohydrate in UGN agriculture faculty of biochemistry of writers Iswari & Yuniastuti [3]; Ngili [4]; Koolman & Roehm [5]; Armstrong [6], and Gajeva et al., [7] have not met the BSNP standard feasibility indicators for integrated

problem-based learning (PBL) models. Biochemistry course based on curriculum of Agrotechnology Faculty of Agriculture UGN is taught in semester two. According to the results of the questionnaires students who have followed the biochemistry lectures obtained some findings, including: (a) most students (59%) have difficulty in learning about biochemistry; (B) only a small percentage of students (30%) can understand the teaching of the lecturer, and (c) the lecturers still use conventional learning (88%) and cooperative (12%) [8]. The result of preliminary analysis indicates that the availability of biochemical material of carbohydrate material according to standard of BSNP is still very less, so it is needed the material of biochemistry of carbohydrate material according to BSNP standard to improve the achievement of learning achievement.

Responding to the problem is needed a means of the development of teaching materials by integrating problem based learning model conducted to achieve student competence according to KKNi curriculum up to level 6. Level stages in the KKNi is the determination of the graduation profile, formulate learning outcomes, formulate the competence of study materials, learning outcomes. Teaching materials, packaging subjects, curriculum framework compilation, arrangement of lecture plans [9]. The development of biochemistry material on carbohydrate material with PBL model and according to KKNi curriculum becomes necessary to support the shift of conventional learning into learning centered on student activities. Development of biochemistry materials integrated with problem based learning (PBL) model according to KKNi curriculum also become the basic thing that is believed to increase student activity and learning outcomes.

The provision of standard teaching materials can realize a complete learning approach and is expected to master the competencies in full, in accordance with the speed of learning. For that the teaching materials should be arranged and make students are more active in learning activities to achieve competence. According to Brooks & Warren [10] criteria of teaching materials that impress students is a teaching material that contains persuasive text. Teaching materials are very important in the learning process because it can strengthen and support information teaching materials delivered by lecturers. Teaching materials help understand the concept of science to achieve the desired competencies so easy to remember and can be repeated [11]. According to Sitorus et al. [12] innovative and interactive teaching materials can improve students' learning motivation to learn independently.

For the achievement of learning and the active role of students required the availability of teaching materials that use student-centered learning model. One of the learner-centered learning models is the PBL model, a learning model that emphasizes the need for students to investigate and build their own knowledge and have problem-solving skills. According Mutiara et al., [13] that the learning of problem based learning combined with learning media in the learning process shows improvement of learning outcomes and character of learners.

Based on the above description, this study aims to: (1) produce a valid biochemistry teaching materials on carbohydrate material through problem based learning model according to KKNi curriculum; (2) to analyze the improvement of students' learning outcomes and student activities by applying biochemistry teaching materials on carbohydrate material through problem based learning model according to curriculum KKNi.

## **II. Literature**

### **Teaching Material**

Teaching material are all forms of materials or materials that are systematically prepared to help teachers or instructors in teaching and learning activities to create an environment or atmosphere that allows students to learn. Teaching materials or instructional materials are broadly composed of knowledge, skills, and attitudes that students must learn in order to achieve a defined standard of competence [14]. Learning innovation can be poured in chemistry to be memorable and lessons are remembered by students [15].

### **Problem Based Learning Model**

Problem Based Learning is a learning model that involves learners to solve a problem through the stages of scientific method so that learners can learn the knowledge related to the problem and sekaligus have the skills to solve the problem [16].

Problem Based Learning (PBL) is a learning that uses real-time (ill-structured) and open-minded problems as a context for learners to develop problem-solving skills and critical thinking as well as building new knowledge.

### **Competency Based National Curriculum Referring to KKNi**

KKNi is a manifestation of the quality and identity of the Indonesian nation related to the national education system and training owned by the State of Indonesia. KKNi provides equal amount of formal, non-formal and informal education or work experience in the framework of providing job competence recognition in accordance with the structure of work in various sectors. With the KKNi one's competence is not seen from the certificate, but it is seen from the national agreed-upon qualification framework so that the recognition of the educational outcome of a person is transparent and accountable [17].

### III. Research Methodology

The research method used is research and development (R & D) which is a study of various research findings related to the product to be developed. The steps of research modification Sugiyono (2010) consists of five stages: the stage of analysis, development, validation, revision and testing. This research develops on biochemistry teaching materials through model of problem based learning according to KKNI curriculum on carbohydrate material. The sample of this research is five biochemistry books from different writer and publisher, lecturer's sample that is two lecturer of biochemistry and one lecturer of chemistry Unimed, and sample of student is total sample that is all of second semester student who take Biochemistry course majoring Agroteknologi UGN Faculty of Agriculture counted 25 people . Technique of data analysis conducted in this research is validation questionnaire analysis of teaching materials based on BSNP, observation analysis of learning activity, and analysis of learning result test.

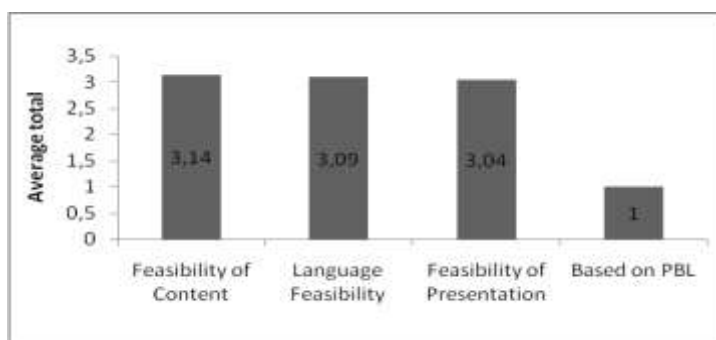
### IV. Results

The results of the initial analysis of the five biochemistry books used indicate that each book biochemistry has not matched the course syllabus biochemistry on carbohydrate material Agrotechnology study program refers to the KKNI curriculum integrated PBL model. Therefore required a teaching material Biochemistry on carbohydrate material in accordance with the syllabus of the course Biochemistry Carbohydrate material in Prodi Agrotechnology which refers to the curriculum of KKNI integrated PBL model. The following assessment of Biochemistry book results from various authors and publishers used by UGN students are presented in Table 1.

**Table 1.** Average Feasibility of Fill, Feasibility of Language, and Feasibility of Presentation for Books Analyzed by Researchers

Component Assessment	Book Code					Average total	Criteria
	A	B	C	D	E		
Feasibility of Content	3,25	3,15	3,00	3,15	3,15	3.14	Feasible
Language Feasibility	3,15	3,15	3,00	3,00	3,15	3.09	Feasible
Feasibility of Presentation	3,00	3,15	3,00	3,00	3,05	3.04	Feasible
<b>Average feasibility according to BNSP</b>	3.13	3.15	3.00	3.05	3.08	3.09	Feasible
Feasibility Based on PBL Developed	1,00	1,00	1,00	1,00	1,00	1.00	Unfeasible
<b>Average</b>	<b>2,60</b>	<b>2,61</b>	<b>2,50</b>	<b>2,54</b>	<b>2,59</b>	<b>2.63</b>	<b>Feasible</b>

In the form of data diagram the total feasibility of the five books Biochemistry can be seen in Figure 1.



**Figure 1.** Diagram of Average Total Feasibility

Development of biochemistry teaching materials on carbohydrate material is done in accordance with the syllabus of Biochemistry course in Agrotechnology study program which refers to the curriculum of KKNI integrated PBL model. The biochemistry material of the developed carbohydrate material consists of subcategories: carbohydrates, carbohydrate classification, carbohydrate metabolism, carbohydrate identification, carbohydrate function, and carbohydrate-related diseases. Carbohydrate material developed according to material coverage, material accuracy, upgrades, stimulating curiosity, and developing life skills.

The validation's result of biochemistry teaching materials on carbohydrate material developed is done by expert validator. The developed biochemistry teaching material on carbohydrate materials validated based on the feasibility of BSNP include content feasibility, language feasibility, and feasibility of presentation by using scale 4 and validity criteria; criterion 4 = very feasible, 3 = feasible, 2 = poor, and 1 = unfeasible. The results of the assessment of teaching materials Biochemistry on carbohydrate materials that have been developed based on

feasibility aspects of content, feasibility of presentation, and language feasibility (according to BSNP standards) can be seen in Table 2 and integrated PBL model in Table 3.

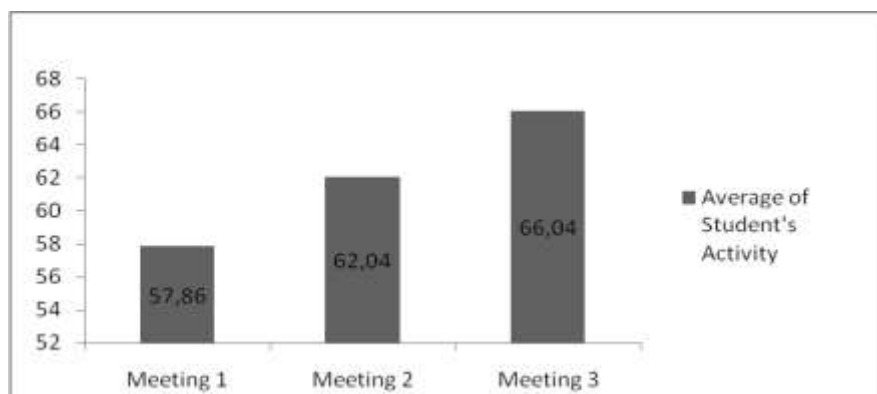
**Table 2** Lecturer Validation Result on Biochemistry Teaching Material on Carbohydrate Material Developed Based on BSNP

No	The assessed component	Average total	Criteria
1	Aspect of eligibility of content		
	a. Material coverage	3,12	Feasible
	b. Material accuracy	3,25	Feasible
	c. Updates	3,33	Very Feasible
	d. Stimulate curiosity	3,25	Feasible
	e. Develop life skills	3,35	Very Feasible
	<b>Average</b>	<b>3,26</b>	<b>Very Feasible</b>
2	Aspects of language eligibility		
	f. In accordance with the development of learners	3,25	Feasible
	g. Communicative	3,33	Very Feasible
	h. Dialogic and interactive	3,25	Feasible
	i. Straightforward	3,00	Feasible
	j. Coherence and sequence of thought lines	3,33	Very Feasible
	k. Compatibility with correct Indonesian rules		
	l. Use of terms and symbols / symbols	3,15	Feasible
		3,37	Very Feasible
		<b>Average</b>	<b>3,24</b>
3	Aspect of feasibility of presentation		
	m. Presentation techniques	3,50	Very Feasible
	n. Supporting presentation	3,25	Feasible
	o. Presentation of learning	3,27	Very Feasible
	<b>Average</b>	<b>3,33</b>	<b>Very Feasible</b>
<b>Average total of three component</b>		<b>3,28</b>	<b>Very Feasible</b>

Measurement of student learning activity on learning Biochemistry on carbohydrate material by filling student activity observation. Observation of activities to find out student activities during the use of developed teaching materials. Observation of the developed activity contains 10 indicators related to the use of Biochemistry teaching materials on carbohydrate material with PBL model.

Observation aims to observe student learning activities during learning with biochemistry teaching materials through problem based learning model. Observations were made during three teaching-learning activities. The development of student activity has increased during receiving learning with the material of biochemistry on carbohydrate material through learning model of PBL.

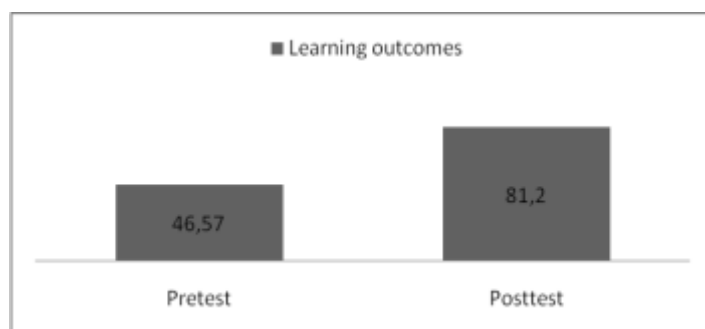
At the meeting I obtained the average student activity 57.86, at meeting II obtained the average activity 62.04, and at the third meeting obtained the average activity 66.04. The average value of student learning activities is  $62.60 \pm 5.15$  with the criteria of active assessment. Here the data on the average value of student activities consisting of 25 students can be seen in Figure 2.



**Figure 2.** Diagram of student's activity average

Biochemistry teaching materials on carbohydrate material with problem based learning model that has been developed after validated by expert validator and has been revised next experimental material tested to the students. The test was conducted to find out the students' learning result after using the material of biochemistry on carbohydrate material through problem based learning model that has been developed. The question of being used as an instrument is a validated essay.

Data obtained from pretest and posttest result are used to calculate N gain of student which show improvement of student learning result after using biochemistry material on carbohydrate material through problem based learning model according to KKNi curriculum. Result of pre-test and post-test of learning given to student, The average score of pre-test students was 46.57 with the highest score of 63 and the lowest score of 31. While the average score of the student's post-test was 81.20 with the highest score of 100 and the lowest score of 56. N-gain Of the pre-test and post-test scores were 0.65 in the moderate category. Results of analysis of student learning outcomes in detail can be seen in figure 3.



**Figure 3.** Learning outcomes of prestes and posttest

The results of experimental test of Biochemical material of carbohydrate developed to the learning result showed in the preliminary test (pre test) the average score was 46,57. The value of post test (final score) obtained an average score of 81.20. Test n gain indicates increased influence student results biochemistry teaching materials using carbohydrate material with the appropriate model of problem based learning curriculum developed KKNi Based on the calculation results of student learning-gain values of n obtained 0.64 (medium category), there was an increase, though not high it is possible because of the other factors one of which adaptation to changes in the curriculum, but the concepts are obtained will be longer stored in memory for the students actively involved in learning to find the concept independently. It is in line with the opinions Killey (2005) states that the problem based learning model has advantages in terms of helping students to sort out the problem, develop critical thinking skills, oral and written communication and teamwork develop.

## V. Conclusion And suggestion

Based on the analysis and discussion in this study, it can be concluded that: 1) the teaching materials through problem based learning models have valid criteria with the results of the feasibility validation lecturers biochemistry teaching materials on carbohydrate material according to standard integrated BSNP appropriate model of PBL according to KKNi curriculum the mean including a category average is very feasible with total of 3.28 and results of the validation professor as an expert validator to feasibility PBL-based presentation on teaching materials developed biochemistry carbohydrate material derived average value of 3.31 (very worthy), which shows a model of integration with PBL in teaching materials ; 2) There is an increase in student learning outcomes obtained from the data value of n-gain of 0.64 including the category of being. And student activity after using the developed learning material obtained score 62,60 which mean including the active category.

Based on the above conclusions, it can be given suggestions on some of the following: 1) to further research if you want to develop teaching materials, it is recommended to further expand the book analyzed to enrich the teaching materials developed and added components other lessons that can make teaching materials more effectively and making it easier for students to learn; 2) For the next researcher is expected to make a more appropriate instrument in accordance with the applied learning model and choose the learning model in accordance with the achievement of learning.

## References

- [1] Kopertis, 2013. Alternative-Preparation-Curriculum-Referring to KKNi. [www.kopertis12.or.id/Alternative-Collution-Curriculum-Referring-KKNi-LS-2013](http://www.kopertis12.or.id/Alternative-Collution-Curriculum-Referring-KKNi-LS-2013)(collected on 8th November 2016)
- [2] Sanjaya, W. 2008. Learning Strategy-Oriented Learning Process Standards. Jakarta: Kencana
- [3] Iswari, R.S. & Yuniastuti, A. 2006. Biochemistry. Graha Science
- [4] Ngili, Y., 2009. Biochemical Structure & Function of Biomolecules, Graha Science, pp. 1-32.
- [5] Koolman, J. & Roehm, K.H., 2005. Color Atlas of Biochemistry. Thieme Stuttgart, New York, p: 34-44.
- [6] Armstrong, F. B., 1985. Biochemistry, third edition, Book Publisher of Medicine, EGC, p: 128-165.
- [7] Gajeva, H.P., Patel, S.V., & Golakiya, B.A., 2008. Fundamentals of Biochemistry. International Book Dietributy Co., India, p: 43-67
- [8] Ersalinda, 2016. Mini Biochemical Research Materials Higher Education, Semester II, (unpublish)
- [9] Research and Technology of Dikti, 2013. File: [/// C: / Users / Windows8 / Downloads / CurriculumNational Competency Based on KKNi.htm](file:///C:/Users/Windows8/Downloads/CurriculumNational%20Competency%20Based%20on%20KKNi.htm), Maluku, North Maluku (accessed November 8, 2016)

- [10] Brooks, C., & Warren, R.P., 1972. *Modern rhetoric* (3rd ed), New York, Harcourt Brace Javanovich.
- [11] Situmorang, M., Sitorus, M., Hutabarat, W., Situmorang, Z. 2015. The Development of Innovative Chemistry Learning Materials For Bilingual High School Students in Indonesia, *International Education Studies*. 8 (10)
- [12] Sitorus, M., Situmorang, Z., & Situmorang, M. 2016. *Development of Inovative Multimedia and Interactive Multimedia Based Instructional Materials*. Semirata 2015.
- [13] Pearl, Agustina. 2015. *Application of Learning Model to Improve Haisl Learning Chemistry and Communicative Character and Confidence in Chemical Material of Solution in SMA*. Thesis. Unimed PPS. Field
- [14] Hamdani, 2011. *Learning Teaching Strategy*. Bandung, Pustaka Setia
- [15] Bain, R., Jacobsen, J.J., Mainard, J.H., and Moore, J.W., 2005. Chemistry Comes Alive, *Journal of Chemical Education*, 82 (7): 1102-1104
- [16] Arends. 2008. *Learning To Teach Volume 2*, Pustaka Belajar, Yogyakarta
- [17] Narimo, S., 2015. Building the Competitiveness of Higher Education (Accounting) graduates is based on Strengthening KKNI-Based Curriculum. *Proceedings of the National Seminar on Accounting and Finance Education* (accessed January 10, 2017)
- [18] Sugiyono, 2010. *Qualitative Research Methods, Quantitative and R & D*. Alfabeta, Bandung

Ersalinda. "Development of Biochemistry Teaching Material on Carbohydrate Through Problem Based Learning Model according to KKNI Curriculum." *IOSR Journal of Research & Method in Education (IOSR-JRME)* , vol. 7, no. 4, 2017, pp. 01–06.