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Development of Guided Project Based Learning (G-PJBL) Inte-grated Contextual Teaching and Learning (I-CTL) Models to Im-prove Science Process Skills and Strengthen Characters of High School Students/SMA

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Abstract: *This research is motivated by the low student learning outcomes due to the low understanding of chemical concepts and the lack of student interest in learning. In studying chemistry, students are faced with three worlds, namely the real world (macroscopic), the atomic world (submicroscopic), and the world of symbols. This study aims to produce a G-PJBL I-CTL model to improve the science process skills of SMA that are valid, practical, and effective. This research is research and development or what is known as research and development and is usually abbreviated as R&D. The development of the G-PJBL I-CTL model in chemistry learning in high school follows the steps of the Plomp development model which consists of three developments. the steps, namely: preliminary research, the development or prototyping phase, and the appraisal phase. The results showed that the G-PJBL I-CTL model was valid, practical, and effectively used in high school chemistry learning.*

Keyword: *PBL I-CTL Model, Science, Students, High School Students.*

INTRODUCTION

The learning process in educational units should be held interactively, inspiring, fun, challenging, motivating students to participate actively, and providing sufficient space for the initiative, creativity, and independence by the talents, interests, and physical and psychological development of students. Chemistry is a science that is closely related to everyday life. The whole process of human life always involves chemical reactions. Along with the development of the era towards the era of technology, chemistry is also increasingly needed to solve various problems. However, the facts show that the number of students who are interested in chemistry has decreased. In many countries including Sweden, many students find chemistry unpopular, difficult, and abstract, and there has been a decline in the number of chemistry students at the university level (Risch, 2010).

Learning becomes more meaningful if students are motivated and interested in learning chemistry. Chemistry subjects as a branch of science have two inseparable things, namely, chemistry as a product (chemical knowledge in the form of facts, concepts, principles, laws, and theories) scientific findings, and chemistry as a process (scientific work) (Komisia, 2012). Learning that activates student activities in scientific work to solve problems related to the context of everyday life is contextual learning (CTL). The

CTL system is an educational process that aims to help students see meaning in academic material and the context of their daily lives (Johnson, 2009).

CTL is a strategy that fully involves students in the learning process. Students are encouraged to be active in studying learning materials according to the topics to be studied. Learning in the context of CTL is not just listening and taking notes, but learning is an experienced process that directly makes learning more meaningful (Sanjaya, 2010). The strategy and implementation of five contextual science learning activities in achieving students' science concepts can open up more memorable learning opportunities so that contextual learning is expected to affect achievement and chemistry learning activities (Sun, & Fah, 2013).

The low learning outcomes of students are due to the low understanding of chemical concepts and the lack of interest of students in learning. In studying chemistry, students are faced with three worlds, namely the real world (macroscopic), the atomic world (submicroscopic), and the world of symbols. There are three levels of chemical representation (Chemistry Triangle) namely the macroscopic level, the submicroscopic level, and the symbolic level (Chittleborough, 2014). The macroscopic level is a chemical representation obtained through real observations of a phenomenon, seen and felt by the five senses that can be obtained through experimental/project activities (Talanquer, 2011; Chandra et al., 2021). The submicroscopic level concerns the arrangement and structure of the particles that make up matter (molecules, atoms, and ions) and their changes. The symbolic level is a qualitative and quantitative chemical representation.

Chemistry learning that involves three levels of representation can improve students' understanding (Silberberg, 2010; Talanquer, 2011; Zumdahl & Zumdahl, 2010). Abstract chemical concepts become concrete by involving students in the discovery process through experiments/projects (macroscopic level), and linking the macroscopic level with the submicroscopic level can help students improve their understanding (Sunyono, 2012). However, most educators teach chemistry concepts only at two levels of representation and have not taught 3 levels in a balanced way.

The PJBL model that is integrated with CTL is a chemistry learning approach that is linked to real objects so that in addition to studying theory, students can learn the process of processing material into a useful product, has economic value, and fosters interest in entrepreneurship, thus learning will be more enjoyable. One of the thinking skills that are expected to achieve optimal learning outcomes is science process skills (KPS). With these thinking skills, students can construct meaning and confirm their understanding of a conceptual phenomenon, as well as emphasize the importance of direct experience involvement in the learning process (Ibrahim & Nur, 2005).

"Project-Based Learning Model" (PJBL) is a learning model that involves students in a project based on a problem and in the end, students can produce real work (Colley, 2008). The PJBL model emphasizes a learning model that focuses on students (student-centered) where students as subjects of learning activities are more independent in completing authentic works as learning outcomes (Hodgin, 2010). However, based on research of Aiedah & Lee (2012) there are challenges in implementing the PJBL model such as the gap in commitment among students and it takes a long time. Therefore, it is important to develop a modification of the guided PJBL model that is related to everyday life, namely the Guided Project-Based Learning (G-PJBL) Model Integrated Contextual Teaching and Learning (CTL).

Many education experts put forward the notion of processes and process skills in Science. The term science process (Science Process) is very widely used in England, used by educators in discussing material (content) which refers to the process (Devi, 2010). Science process skills are the skills possessed by scientists to acquire and develop scientific products (Anitah et al, 2007; Dahar 2011; Tawil & Lilisari, 2014; Poppy, 2010; Suasti et al, 2018; Hermon et al, 2021). The application of the science process skills

approach requires physical involvement and mental-intellectual learners. This can be used to train and develop facts, concepts, and principles of science.

METHODS

This research is research and development or known as research and development and commonly abbreviated as R & D. The development of the G-PJBL I-CTL model in chemistry learning in high school follows the steps of the Plomp development model which consists of three development steps, namely: preliminary research. The development or prototyping phase, and the assessment phase. A summary of the steps for developing the G-PJBL I-CTL model based on the Plomp development stages can be seen in Table 1 below.

Table 1. Relation of Product Quality Criteria with Development Stage

Development Phase	Evaluation Criteria	Activity Description
Preliminary research	Emphasis on content validation	Problem analysis and literature study
Development or prototyping stage	Initially focused on consistency (construct validity) and practicality. Furthermore, prioritizing practicality gradually leads to effectiveness.	Development of a prototype that will be tested and revised based on the formative evaluation. Expert assessment to get the expected practicality.
Assessment phase	Practicality and effectiveness	To assess whether you can use the product (intervention) (practical) and are willing to apply it (effective)

Source : Plomp (2013).

The trials carried out were aimed at perfecting the prototype II of the G-PJBL I-CTL model and the learning tools from the validation stage. Product trials are carried out through limited trials at the assessment phase. The subjects in this study were educators and students. The validators (expert group) in this study are ICT experts, language learning strategies, and chemistry. For a limited trial to see the practicality of the G-PJBL I-CTL model given to chemistry subject educators and SMA, namely SMA 1 Bukittingi. The research data is the result of validation, practicality, and effectiveness tests. The data in this study consisted of qualitative and quantitative data. Data from validation, practicality, and effectiveness were obtained from research instruments developed based on product quality from Nieveen.

RESULTS

In the G-PJBL-I-CTL model, the learning model is centered on students building and applying the concepts of the resulting project. By exploring and solving problems in the real world, where students can also see the meaning in the material they are studying by connecting the academic subjects they study with the context in their daily lives, namely in the context of their personal, social and cultural. So, it is hoped that students will find the meaning of the learning activities they do. recommend that the project-based contextual learning approach model in learning is effective for increasing creativity. The needs analysis in this research includes: the rational development of the G-PJBL integrated CTL model in science learning in high school and analysis of student characteristics. The response of educators and students to the environment-based Contextual Chemistry Learning (PKKBL) model is in the good and very good category. The proposed learning framework can be seen in Table 2 below.

Table 2. Deskripsi Model G-PJBLI-CTL

Fase	Learning Stage	Description of Model G-PJBL I-CTL
1	Determination of fundamental questions (start with essential questions)	Educators have determined project themes according to indicators and procedures until the project is finished. However, the teacher designs as if the students found the theme of the project. The teacher directs with essential questions. Questions are structured by taking topics that are in accordance with real-world reality.
2	Constructivism	Educators encourage students to construct their knowledge through a process of reflection, observation, and experience.
3	design purpose	Educators assist students in setting goals. The first step in designing the process is to determine the design problem. The three important steps in this first step are: a. The Problem and The Need, students describe the reasons that motivate them to choose the project. They also define the problem and determine the need for a solution to the problem. b. The Target Clientele and Restrictions, students describe the target clientele and define the restrictions they take into account. c. The design goals, students determine the needs they expect.
4	Monitoring the students and progress of project	Educators are responsible for monitoring the activities of students while completing the project. Monitoring is done by facilitating students in each process. In other words, educators play a role as mentors for student activities. To simplify the monitoring process, a rubric is created that can record all important activities.
5	Communication	Every project in making products/solutions by communicating between friends and the scope of the class. Presentation is an important step in the learning process to develop communication and collaboration skills as well as the ability to receive and apply constructive feedback.
6	evaluation the experience	Educators and students reflect on the activities and project results that have been presented. The reflection process is carried out individually or in groups. At this stage, students are asked to express their feelings and experiences while completing the project. Educators and students develop discussions to improve performance during the learning process so that in the end a new inquiry is found to answer the problems posed in the first stage of learning.

Source: (MoEC, 2014) Modified according to research needs

Exploring and empowering the potential of the nation's wealth, is necessary, whether it has been crystallized as a legacy of the past (heritage) or the potential resources currently owned. In addition, it is also required to be sensitive and wise to respond intelligently to all the dynamics of life, science, and technology as well as fast-paced information. After the initial product design is prepared, then evaluation is carried out. The evaluation in this study was carried out following the sequence of the formative

evaluation stages which began with self-evaluation or self-evaluation. Evaluation needs to be done by the researcher himself as an initial correction to the product design that has been prepared.

3.1 Expert Assessment of the I-CTL. PBL Model Book

Table 1. Expert Assessment Validation Results on Products

No	Assessment Aspect	Average	Category
1	Rational and Supporting Theories	4.43	Very Valid
2	Syntax Model G-PJBL I-CTL	4.45	Very Valid
3	Social System	4.48	Very Valid
4	Reaction Principle	4.50	Very Valid
5	Support System	4.51	Very Valid
6	Instructional Impact and Accompaniment Impact	4.55	Very Valid
7	Learning Implementation	4.45	Very Valid
Description		4.48	Very Valid

Based on Table 3. It is known that the expert's assessment of the model book product is classified as very valid. Therefore, the criteria in this development for the valid category have been met.

3.2 Expert Assessment on G-PJBL I-CTL educator books

Table 2. Validation Results of Expert Assessment of Products

No	Assessment Aspect	Average	Category
1	Model Component	4.67	Very Valid
2	Description of the syntax of the G-PJBL I-CTL model	4.50	Very Valid
3	G-PJBL I-CTL model scenario	4.50	Very Valid
4	Instructions for implementing the G-PJBL I-CTL model.	4.33	Very Valid
5	Learning Implementation Plan (RPP)	4.50	Very Valid
6	Assessment technique.	4.39	Very Valid
7	Language	4.67	Very Valid
8	Physical form.	4.33	Very Valid
9	Benefits	4.45	Very Valid
Description		4.48	Very Valid

Based on Table 4, it is known that the expert's assessment of the educator's book product is classified as very valid. Therefore, the criteria in this development for the valid category have been met.

3.3. Expert Assessment on G-PJBL I-CTL Learners book

Table 3. Expert Assessment Validation Results on Products

No	Assessment Aspect	Average	Category
1	Content Eligibility	4.57	Very Valid
2	Construction Eligibility	4.71	Very Valid
3	Language Component	4.67	Very Valid
4	Graphics Component	4.53	Very Valid
Description		4.62	Very Valid

Based on

Table 3, it is known that the expert's assessment of student book products is classified as very valid. Therefore, the criteria in this development for the valid category have been met.

CONCLUSIONS

In realizing these goals, it is necessary to have quality and effective learning that can stimulate the creativity of students. Quality and effective learning is essentially the achievement of learning outcomes that need to be mastered by students through a learning process designed by model development. Thus, to improve the quality of learning in chemistry subjects, efforts are needed that can stimulate the creativity of students as an effort to improve and renew the learning process continuously in a better, quality, and meaningful direction. In connection with efforts to realize quality learning, chemistry learning so far has not been optimal because the learning system has not provided opportunities for students to develop their potential so that they are less motivated and students' independence is also still low. The G-PJBL I-CTL model is expected to improve process skills and strengthen the character of students.

REFERENCES

1. Anitah, S. (2007). Strategi Pembelajaran di SD. Jakarta: Universitas. Terbuka.
2. Aiedah, A. K., & Lee, K. C. (2012). Application of project-based learning in students' engagement in Malaysian Studies and English Language. *Journal of Interdisciplinary Research in Education (JIRE)*, 2(1), 37-46.
3. Chittleborough, G. (2014). The development of theoretical frameworks for understanding the learning of chemistry. In *Learning with understanding in the chemistry classroom* (pp. 25-40). Springer, Dordrecht.
4. Chandra, D., Mariya, S., Nova, S., Edial, H., Rahmi, L., Putri, S., Novio, R., Nofrion., & Putra, A. (2021). Training in Making Interactive Learning Media (Cycle of Hydrology and Layers of the Atmosphere) SMAN 5 Pariaman and SMAN 1 Ulakan Tapakis, Padang Pariaman. *Sumatra Journal of Disaster, Geography and Geography Education*, 5(2), 126-130.
5. Colley, K. (2008). Project-based science instruction: A primer. *The Science Teacher*, 75(8), 23.
6. Dahar, R. W. (2011). Teori Belajar dan Pembelajaran. Jakarta : Penerbit. Erlangga.
7. Devi, N. (2010). Nutrition and Food. Kompas. Jakarta. Departemen Kesehatan RI.
8. Hermon, D., Erianjoni, E., & Putra, A. (2021). Dissemination of Disaster Preparedness Schools (SSB) in Pariaman City. *Science and Environmental Journal for Postgraduate*, 4(1), 8-16.
9. Hodgins. (2010). Project-Based Learning: What is it? http://www.yesnet.yk.ca/schools/wes/what_is_PJBL.html. diakses 21 Maret 2018.
10. Ibrahim & Nur. (2005). Pengajaran Berdasarkan Masalah. Surabaya: University Press.
11. Johnson, E. B. (2009). *Contextual Teaching and Learning: Menjadikan Kegiatan Belajar-mengajar Mengasyikkan dan Bermakna*. Terj. Ibnu Setiawan. Bandung: Mizan Learning Center.
12. Komisia, F. (2012). *Pengaruh Penerapan Pendekatan Contextual Teaching and Learning (CTL) dengan Metode Eksperimen dan Demonstrasi dalam Pembelajaran Kimia pada Pokok Bahasan Sistem Koloid terhadap Minat Berwirausaha dan Hasil Belajar Siswa di SMA*. Tesis. Medan: Program Studi Pendidikan Kimia Program Pascasarjana Universitas Negeri Medan.
13. Poppy, R. Y. (2010). E-Learning dan Alternatif Pembelajaran. Kontemporer. Bandung: Arfino Raya.
14. Risch B. (ed). (2010). Teaching chemistry around the world, Munster: Waxmann.

15. Sanjaya, W. (2010). *Strategi Pembelajaran Berorientasi Standar Proses Pendidikan*. Jakarta: Kencana Prenada Media Group, 78-266.
16. Suasti, Y., Barlian, E., Muchtar, B., Syah, N., & Putra, A. (2018). Insert Religious Model in the Construction Character of Care for the Environment to the Study of Geography in Padang City–Indonesia. *Journal of Islamic Studies and Culture*, 6(1), 67-70.
17. Sun, L. K. & Fah, L. Y. (2013). Perbandingan Pola Pembelajaran Kontekstual dan Tahap Pemahaman Sains Pelajar Sekolah Menengah Rendah di Malaysia dan Singapura. *Jurnal Teknologi (Social Science)*, 63 (2), 91-96.
18. Sunyono, D. (2012). *Manajemen Sumber Daya Manusia*. Jakarta: PT Buku.
19. Silberberg, S. M. (2010). *Principles of General Chemistry*, 2nd. Edition, McGraw-Hill Companies
20. Talanquer, V. (2011). Macro, submicron, and symbolic: The many faces of the chemistry “triplet”. *International Journal of Science Education*, 33(2), 179-195.
21. Tawil, M & Lilisari (2014). *Keterampilan-Keterampilan Sains dan Implementasinya dalam Pembelajaran IPA*. Makasar: Badan Penerbit UNM
22. Zumdahl, S. S & Zumdahl, S. L. (2010). *Chemistry (eighth edition)*. United States of America: Cengage Learning