# CHEMISTRY TEACHERS' ABILITY TO DESIGN CLASSROOM ACTION RESEARCH IN HYBRID LEARNING PROGRAM

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**Abstract:** This research examines chemistry teachers' understanding on Classroom Action Research (CAR) and their ability to design CAR in hybrid learning-based self-development program. The research employed one group pretest posttest design.Fifteen high school chemistry teachers in Sleman were involved. The program was carried out through course work and training following In-On-In format (face to face, practice, and face to face meetings). It was supported by the use of Tinular website (http://dikkitinular.wix.com/titinular). The research findings show that the increase of chemistry teachers' understanding on CAR can be categorized as 'medium'. Their ability to design a CAR can be categorized as 'good'. The appropriateness of the action and data collection instrument constitute the ability with the lowest score. Continuous implementation of the program, appropriate supervision and scaffolding from the tutor significantly enhance teachers'self-development.

**Key words:** ***action research, hybrid learning, chemistry teachers, self-development***

# KEMAMPUAN MERANCANG PENELITIAN TINDAKAN KELAS GURU KIMIA DALAM PROGRAM BERBASIS *HYBRID LEARNING*

**Abstrak:** Penelitian ini bertujuan untuk menganalisis pemahaman guru kimia tentang penelitian tindakan kelas (PTK) dan kemampuan mereka dalam merancang PTK dalam program pengembangan diri berbasis *hybrid learning.* Desain penelitian yang digunakan *one group pretest posttest design*. Subjek penelitian adalah 15 orang guru kimia SMA di Kabupaten Sleman. Program pengembangan diri berbasis *hybrid learning* dilaksanakan melalui kegiatan pendidikan dan pelatihan dengan pola *In-On-In*. Program diawali dengan tatap muka, praktik dan ditutup dengan tatap muka. Selama pelaksanaan program didukung penggunaan website Tinular (http://dikkitinular.wix.com/titinular). Hasil penelitian menunjukkan bahwa pemahaman seluruh guru kimia tentang PTK mengalami peningkatan dengan kategori peningkatan "sedang". Guru kimia memiliki kemampuan dalam merancang PTK dengan kategori baik. Ketepatan rancangan tindakan dan ketepatan instrumen pengambilan data merupakan indikator kemampuan dengan pencapaian terendah. Implementasi program yang kontinyu serta bimbingan dan *scaffolding* yang tepat dari tutor memberikan dukungan yang kuat bagi guru untuk pengembangan diri.

**Kata kunci:** ***action research, hybrid learning, guru kimia, pengembangandiri***

## INTRODUCTION

Teacher has become an important human component in education that plays a role in controlling the classroom learning process. Their role is inevitably central in supporting the success of a study program. Some studies have revealed that the role of chemistry teacher is believed to be crucial in achieving qualified learning (Khasawneh *et al*., 2008:27; Rohaan, *et al*., 2009:334; Adodo & Gbore, 2012:69; Karaman, 2012:58, Ghazi *et al*., 2013:458). Thus, it is central to develop the professionalism of chemistry teachers.

Teachers havevital functions, role, and position for accomplishing the 2025 education vision as mandated in UU No.14 Tahun 2005. They ought to continuously develop their professionalism, through which they are able to improve pedagogic, professional, social and personal development. Teachers' continuous professionalism development or *Pengembangan keprofesionalan berkelanjutan* (PKB) is manifested in teachers' main task, that is to meet the requirements and demand in relation to their teaching profession. However, it has been believed that their performance is still below the

minimum standard (Khodijah, 2013:95). Thus, it is necessary to design various activities to facilitate their PKB from various perspectives.

Permenneg PAN and RB Nomor 16 Tahun 2009 suggests that self-development is one aspect of PKB. Learning innovation emerging from CAR constitutes one material emphasized in PKB. This PKB has become one point in teachers' assessment which has motivated them to do research and write scientific paper.

A previous study has shown that teachers pay less attention to research to enhance their performance post certification (Suparwoto*et al.*, 2011:67). In other words, they have not prioritized research to support learning quality at school. A study further claims that teachers are not engaged so much in CAR due to some factors, e.g. lack of knowledge, opportunity and support, physically and non-physically. This is in line with Zulfiani, Herlanti, dan Sofyan (2016:281) who state that the dominant reasons for not engaging in CAR are lack of time (43%), knowledge, and training or supervision on CAR (50%). The same problem was accountered by a group of chemistry teachers in Sleman, Yogyakarta district, as shown in a survey conducted before teachers' development program. Only 25% of the respondents have done CAR, while the rest 75% have not conducted any (Wiyarsi & Purtadi, 2013:18). These obstacles are due to limited references and teachers' willingness in identifying learning problems.

As a result, universities are required to be actively involved in developing science, chemistry particularly, teachers. Such development program is needed to build up teachers' research competence so as to improve chemistry learning quality. CAR is a class research aimed at improving the learning practice and process. Hine (2013:159) suggests that CAR has an important role in education and in developing teachers' professionalism. The knowledge about CAR and how to do it is crucial for teachers for designing a good CAR.

Creswell (2008:597) suggests four steps of CAR, namely problem identification and action planning; action, observation, and monitoring; reflection of observation results and revision planning for further development. CAR is also effective for improving learning literation, using various learning sources or methods, as well as for developing the habits of information sharing among colleagues to solve learning problems (Hong & Lawrence, 2011:13).

The model of self-development program In-On-Inthrough class meetings can motivate teachers in carrying out CAR yet it is not fruitful enough to improve teachers' knowledge (Pulungan, 2015:7). It is often found that teachers are not always able to manage their time to allocate a certain period of time for self-development program. The highly loaded chemistry subject and other school activities have made it difficult for themthem to gather at acertain place and time. Thus, hybrid learning-based self-development program may become a learning alternative which combines online and offline meetings (Boettcher & Conrad, 2010:10). The combination of such physical and web meetings can allow for flexible learning environment and unlimited relationship between tutor and participants (Hastie, Hung, Chen, & Kinshuk, 2010:17). Through such hybrid learning it is expected that the time and place obstacles could be overcome. The material and pedagogic aspects are delivered through the face to face meetings.

Wiyarsi & Purtadi (2016:208) develop hybrid learning-based self-development program with In-On-Informat and two ways of material transfer, i.e. through face to face and online meetings. The program covers material on research and CAR and academic writing. Two products are developed to support the program, namely handbook and Tinular website. This article, specifically, discusses chemistry teachers' understanding on CAR and their ability to design CAR so as to implement the hybrid learning-based self-development program which has been designed earlier.

## METHODS

This research adopted one group pretest posttest design.The subjects of the research were 15 out of 24 participants of hybrid learning program, who were selected through purposive sampling. They werehigh school chemistry teachers in Sleman District, Yogyakarta.The basis of the selection was the completeness of their CAR design, including clear procedure and instrument.

The hybrid learning program, which was aimed at improving chemistry teachers' ability to carry out CAR and to write academic paper, was validated by three experts to be implemented with the help of Tinular handbook and website. These two media were consecutively rated good

and fair. The book was assessed on the basis of instructional design, content, and technical design. The website was assessed based on the aspects of contiguity, modality, redundancy, coherence, interactivity, personification, simplicity, and specialty (Wiyarsi & Purtadi, 2016:209-211).

The program was carried out using *in service 1-on service-in service 2* patterns and was supported by Tinularwebsite (http://dikkitinular.wix.com/titinular) as a communication media between tutor and participants. *In-service 1* took place in five meetings and the materials included research and education, CAR, data instrument and analysis in CAR, and CAR proposal writing. *On-service* was conducted through the execution of CAR by the chemistry teachers at their school for 2 months. *In-service 2* was carried out in two meetings to discuss the CAR report and academic paper writing. Online training was carried out through out the program.

Data were collected through two instruments, i.e. pretest-posttest questions and evaluation scale for measuring ability to design CAR. The questions used to reveal teachers' basic understanding on CAR were those of essay type questions. Six questions were developed based on CAR theories (Hine, 2013; William & Lawrence, 2011; Tomal, 2010), such as definition, characteristics, skills, instruments, tittle and problem formulation as well as components of CAR design. The evaluation scale comprised two aspects (William & Lawrence, 2011; Tomal, 2010), namely the ability to elicit the problems,which was manifested in four evaluation indicators, and the ability to formulate the problem, which was manifested in six evaluation indicators. Content validity was done through expert judgment by two experts on chemistry education research.

Analysis on the pretest-posttest scores was aimed at finding out whether there was difference between teachers' understanding on CAR before and that after the hybrid learning program. The data were analyzed using Wilcoxon test. After wards, analysis of the depth of their understanding was done through a *gain-test* which was adapted from Hake (1998:65) as follows.

$$n - gain = \frac{posttest\ score - pretest\ score}{\text{maximum score} - pretest\ \text{score}}$$

The increase of teachers' understanding was based on the value of n-gain, which was categorized into "high" if (n-gain) 0.7; "medium" if $0.7 \geq$ (n-gain) $\geq 0.3$; and "low" if (n-gain) $<$ 0.3.

The analytical technique used to examine the second data, their ability to design CAR, was descriptive qualitative method. The procedures included scoring, calculating the average, determining the ability categories, and responses. The guidelines for the assessment of those components are presented in table 1.

## FINDINGS AND DISCUSSION

### FINDINGS

Self-development program is focused on increasing teachers' understanding and ability to design CAR. CAR is a type of research suitable for teachers as they are the ones who know their class learning situation. In *In-service 1* teachers were given knowledge on how problems in chemistry learning can be solved by employing CAR. After face-to-face meetings, teachers could access various training materials and communicate with their tutor through website or Facebook (LaGuKiTa *Community*). The materials were more operational in nature and, thus, the teachers could ask questions to the trainers in relation to the problems they had as well as interact with other training participants. Figures 1, 2, and 3 show various looks of the online media.

The use of online media was expected to help teachers who were not able to attend in-person meetings and to support CAR designing supervision. However, in fact the website was not much accessed by the teachers to obtain training materials. Only 40% of the participants actively made use of the website to discuss and share ideas

**Table 1. Categorizations of teachers' ability and response**

| Range | Categories |
|---|---|
| **Mean > Mi + 1,6 SBi** | E (excellent) |
| **Mi + 0,8 SBi < mean ≤ Mi + 1,6 SBi** | G (good) |
| **Mi - 0,8 SBi <mean ≤ Mi + 0,8 SBi** | A (average) |
| **Mi – 1,6 SBi <mean ≤ Mi – 0,8 SBi** | F (fair) |
| **mean ≤ Mi - 1,6 SBi** | P (poor) |

(Widoyoko, 2009).

during the training. The rest of the participants tended to be passive with various reasons. The most common reasons were slow internet connection at school or home and unfamiliarity with the website.


**Figure 1. Front page of the online training website**


**Figure 2. Another page of the website**

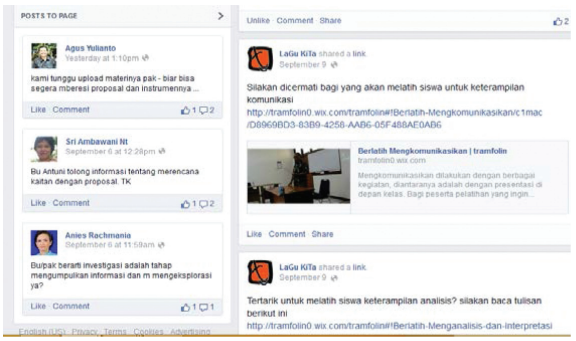


**Figure 3. Facebookpage for online interaction**

The analysis on the difference between the pretestand posttest was fruitful to reveal the difference with respect to teachers' understanding before and after the program. Table 2 demonstrates that the mean of the posttest is higher than that of the pretest. The Wilcoxon test indicates that the value of Z is -3.417 with the significance of 0.001. Therefore, it can be concluded that there is a significant difference inteachers' understanding as shown in the pretest and posttest.

The research results suggest that there is an increase in all teachers' understanding on CAR after the program. The level of the increase is determined through the *n-gain of* the pretest and posttest scores. Table 3 demonstrates the n-gain of teachers' understanding, which indicates that the lowest pretest score is 23 and the lowest posttest score is 37. The value of *n-gain* ranges from 0.25 to 0.75 with the average of 0.46. Based on the data, it can be concluded that the increase of teachers' understanding can be categorized as 'medium'.

**Table 3. The n-gain of chemistry teachers' understanding**

| Participants | Pretest | Posttest | n-gain |
|---|---|---|---|
| A | 27 | 42 | 0.46 |
| B | 32 | 46 | 0.48 |
| C | 40 | 49 | 0.45 |
| D | 23 | 42 | 0.52 |
| E | 26 | 42 | 0.48 |
| F | 29 | 37 | 0.25 |
| G | 33 | 46 | 0.47 |
| H | 39 | 53 | 0.67 |
| I | 29 | 38 | 0.29 |
| J | 29 | 43 | 0.45 |
| K | 26 | 40 | 0.41 |
| L | 29 | 41 | 0.38 |
| M | 35 | 48 | 0.52 |
| N | 44 | 56 | 0.75 |
| O | 39 | 47 | 0.38 |
| *Mean* | *32* | *45* | *0.46* |

**Table 2. The difference between pretest and posttest scores**

| | Average | N | SD | Z | P | explanation |
|---|---|---|---|---|---|---|
| Pretes | 32 | 15 | 6,153 | -3,417 | 0,001 | Difference |
| Postes | 44 | 15 | 5,341 | | | found |

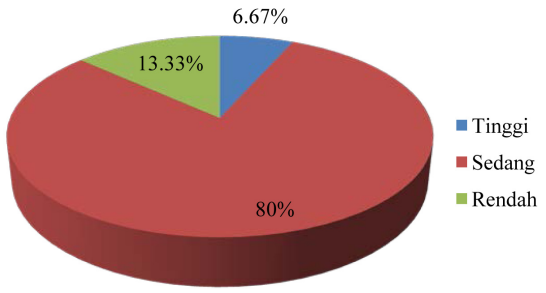


**Figure 4. The distribution of the *n-gain* of teachers' understanding**

As shown in Figure 4, it can be concluded that the understanding increase of most teachers (80%) is 'medium'. Two participants (13.33%) are categorized 'low' and only one participant (6.67%) is categorized 'high'. In general, based on the *n-gain* obtained, the hybrid learning program is able to increase teachers' understanding.

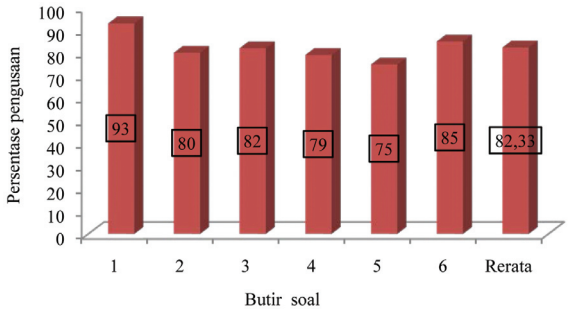


**Figure 5. The percentage of teachers' understanding for each question**

Another insight from the research is the mapping of the CAR materials being mastered by teachers at the end of the program. Each question represents one aspect of training materials. Those six questions consecutively ask about definition, characteristics, skills, instruments, title and problem formulation, and the components of CAR design. The maximum posttest score is 60. It can be seen in Figure 5 that the average of the percentage of teachers' mastery reaches 82.33%. when viewed from the concept of mastery learning, this increase is not ideal yet (85%). The lowest score takes place with respect to formulation of title and problem, i.e. as much as 75%.

The hybrid learning program was also implemented to equip teachers in CAR designing. The design should be presented in the form of proposal which was done collaboratively in a group of two teachers. Figure 6 demonstrates teachers' ability to design CAR. In general, participants have good ability to design CAR. Four (26.67%) teachers demonstrate excellent ability, where as 11 (73.33%) teachers have good ability. The highest score reaches 90 with the level of achievement as much as 90% when compared to the ideal score (50). The lowest score is 37 with the level of achievement as much as 74%.

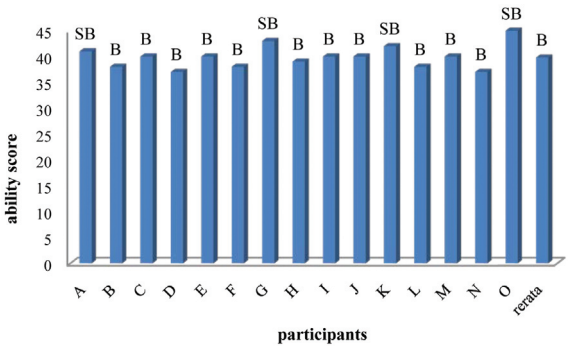


**Figure 6. Teachers' ability to design CAR**

Their ability to design CAR was further analyzed in relation to the achievement in each ability aspect as shown in Figure 7. The ability to elicit problems which reaches 85% (good) is considered more realistic for it is related to the real world teachers experience every day. The ability to plan problem resolution which reaches76.22% (medium) is considered as the lowest score since it requires various background knowledge and is anticipative in nature.

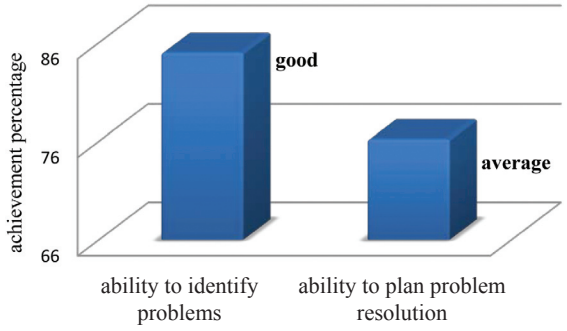


**Figure 7. The ability to design each aspect of CAR**

The aspect of problem resolution planning comprises six indicators of assessment. They are the appropriateness of the planning purposes to the given problem, appropriateness of the design, the clarity of the design, the correct use of references, and the appropriateness of the data collection techniques and that of data collection instruments. The lowest score goes to the appropriateness of the design and that of the instruments.

**Discussion**

The transfer of CAR materials through in-person classes which is supported by the use of website has facilitated teachers to obtain as much as information they need to have a better understanding on CAR. The website has also become a platform for the teachers to share and discuss ideas with their tutor so as to widen their perspective on CAR. The self-development program, which is not only carried out through material transfer but is also followed up by designing and carrying out a CAR, has motivated teachers to put in better effort in practicingCAR. This result is in line with a previous research which suggests that teacher training has been ineffective because the training is heavily loaded by theories (Duncan-Howell, 2010:330).

In general, based on the n-gain obtained, the hybrid learning-based self-development program has increased teachers' understanding on CAR. The analysis of their understanding on every aspect of CAR materials has demonstrated that the characteristics of CAR reach the highest point. This shows that most of chemistry teachers have understood basic concepts of CAR. On the other hand, they still need further guidance in formulating title and problems.The title should convey the clear effort which will be taken to resolve the learning problems in the classroom. This is also true with the problem formulation. Sukidjo (2014:377) concludes that teachers still encounter many problems in conducting CAR, such as in formulating the problems and analyzing the data.

Good understanding of CAR constitutes a foundation for developing professionalism. Training methods, learning sources, and intensive supervision play a crucial role to help teachers succeed in designing CAR. During the program supervision was done through website, telephone communication and face-to-face meetings at school. Face-face-face meetings were carried out only when needed outside classes. During the implementation of the program, face-to-face supervision was done six times, i.e. two times at chemistry teachers' association (*Musyawarah Guru Mata Pelajaran* or MGMP) meetings, two times done on campus with several teachers, and two times done at two schools.

The mostly discussed aspects were those on designing the actions and developing the data collection instruments. Although most teachers understood title and problem formulation, they still had difficulty in designing the actions to address the given problems. The main issue was cycle development, thatwas what to do to respond to the results of the previous cycle. In this phase, teachers were encouraged to predict and anticipate any necessary action during the process. With respect to instrument development, supervision was given in relation to the aspects of observation and criteria of assessment rubric. This was done by providing them with examples. They were also equipped with relevant information such as how to access sources on instrument development, examples of standardized instruments validated by previous researchers, as well as how to adopt such instrument.

Based on the findings, the appropriateness of the design and instrument reaches the lowest score. The design encompasses appropriate problems, purposes, action planning, and data analysis. In the program, chemistry teachers were challenged with how to synchronize those aspects. This was particularly true given that the teachers tended to predetermine the next cycle after the earlier cycle was considered unsuccessful. The next cycle should actually be designed after reflection on the earlier cycle was done. This finding is in accordance with a previous research which suggests that the biggest challenge is on how to develop the process itself (Morales *et al.*, 2016:478). The continuous exposure to the theory and practice of CAR will sharpen teachers' intuition in tackling learning problems as well as to find the solution. This demand is inevitable to successfully conduct CAR, given that knowledge and skills are mutually needed (Cresswel, 2008:34).

The low score of the instrument development is in line with a research done by Rimando*et al*. (2015:2031) which claims that most teachers have difficulty in gathering valid and accurate information during research. They encounter problem when developing observation instruments and assesment rubrics. The aspects being observed are not clearly defined yet, e.g. responsibility, teamwork, and enthusiasm. The criteria of assessment rubrics is not clearly explained either.

The finding on teachers' ability to elicit problems in this research is better than that in previous research which concludes that their ability is less than 60% of the ideal score (Yamtinah,

Saputro & Masykuri, 2011:50). It is further explained that the main issue is on their ability to analyze problems which have been focused lately on students' low achievement, motivation, and activity in the learning process. Inhybrid learning program, more (general and specific) problems could be identified. Some of them are related to inquiry skills, such as questioning, investigating, analyzing, and communication skills, as well as high level thinking skills, scientific characters, and teamwork and skills of scientific science.

The various problems proposed by teachers are tightly linked to the handout and website Tinular. These two media mutually inform each other in providing CAR materials, particularly those on analyzing potential sources for identifying research problems. In every face-to-face meeting, the tutor also provided examples of the implementation of chemistry learning so that teachers could analyze factual problems. This is supported by Turkoguz (2012:406) who states that visual media-based learning can give advantages, such as in knowing individual's emotional honesty, creating effective communication, and giving flexibility in the learning process. In the program, the flexible learning time gave teachers more time for studying the materials. Website Tinularwas also helpful in providing a platform for teacher – tutor interaction. The combination of two learning settings in flexible learning environment may create unlimited tutor-participant relationship (Hastie, Hung, Chen, & Kinshuk, 2010:17).

Critical way of raising learning problems should be continually sharpened so that teachers can have foundations for preparing problem resolution. The continuous implementation of hybrid learningself-development program and the provision of appropriate scaffolding can support professionalism development. The face-to-face meetings can be integrated with MGMP program. On the other hand, the website should be optimally used as communication and sharing media and as the learning source completed with real examples of CAR. Tinular website should also be completed with scientific paper on CAR in order to widen teachers' perspective and knowledge.

## CONCLUSIONS

The advantages of hybrid learning-based self-development program with materials on CAR are threefold, namely increasing research abilityas well as developing learning quality, generating credit points, and infusing new mindset. The change of mindset from 'teaching is for teaching per se'to 'teaching for better researchand research for better teaching'. The program has minimalized the time wise challenges faced by teachers to meet in a particular training program at a certain time. The website can be used as a learning source and communication and supervision media in developing CAR beyond time and place limit. It is tus central to support the teachers with good internet connection and to build up teachers' willingness itself.

The results have demonstrated that the implementation of the program is able to increase teachers' understanding on CAR. The increase is indicated by the value of n-gain, which is categorized medium. The program is able to equip teachers in designing CAR, which is categorized as good. Continuous implementation of the program and strong scaffolding from the tutor can give better results.

## ACKNOWLEDGEMENT

Special thanks go to everyone who has supported the research, particularly teachers. May it bring blessings to those who have participated in the study.

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