

## **ACTION RESEARCH TO INCREASE TEACHER'S PROFESSIONALISM IN ENGINEERING**

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### **Abstract**

*Teacher's role in process of teaching & learning for engineering is very important, because the strategy that used is decisive for instructional successfulness. Therefore it is very important for the teacher as a practitioner to collaborate with another teachers or researchers to enrich his vision through educational action research (classroom action research). Educational action research is to fulfill teacher's need in class meeting, with aimed to encourage and motivate him to get aware to do self-reflection and self-critic about his professional activities and performances that used to increase level of teaching-learning climate in his work situation. Educational action research is a dynamic process in spiral form, which consist of: planning, acting, observing, reflecting, and reviewing. It purposes is to conform between contextual and practical dimension with constrution and reconstruction dimension, so that of practical and understanding levels can be achieved systematically, responsively, and reflectively. This kind of educational action research had been widely implemented in Indonesia, as the result is conclude that it is increase teacher's profesionalism in : making instructional design, using multi method teaching, using discussion method, evaluating student center oriented, evaluating student competence, gaining the better of student learning result, making collaboration among teacher and students, organizing subject-matter of studies, playing the role of teacher as facilitator and moderator in teaching-learning.*

### **Introduction**

Classroom action research has been flourishing in many societies of Teacher Education College as such as in societies of School Teacher. This circumstance is stimulated by the fact that many earlier formal researches which being implemented, up to now, could not exactly explaining yet many problems in teaching-learning activities. Formal researches that being implemented earlier, up to now, with quantitative approach just could rise up and exposed mere quantitative facts. Meanwhile, another important facts in teaching-learning activities, which should be used as result to fix some

weaknesses in teaching-learning process, sometimes, are denying. The phenomena as such as students who have difficulties in learning, how to manage classroom situation, or many other cases in learning activities in the classroom, eventually, could not be discovered or may be just accounted as casualty and then tend to be denied.

Many efforts had been carrying out to increase quality levels of learning. It begins from arranging educational design and ended with doing effective evaluation. Besides, There must be some kind of mutual relationship between social research implementation and human needs. In the narrower context, especially in educational research context, researchers should put a teacher as central in educational research process. This is very obvious and could be understood because a classroom could be accounted as a laboratory, the place that is used for researching and testing a vast of educational theories. This, in turn, results of the researches be more improved and disseminated to the teachers to increase quality levels of their teaching skills. For that, educational research could be noticed as the base of teaching activities.

Rudduck and Hopkins (1989) said that research contribution in increasing level of teaching is very considerable. They said that research could increase teaching quality levels through implementing advices that resulted by the research to the teachers so that they could make some justification in teaching-learning processes. Then, they appointed that research could improve teaching process if it: (1) offering hypothesis, which can be verified in classroom (2) giving clear description about cases, or deep and detail retrospectives generalizations, to point out comparative context. Therefore, Robust of research capacity to enrich quality of teaching depends on results of research that rendered and teacher professional justification. One kind of research is action research. Action research defined as a study of social situation to improve quality of action in that situation (Elliot 1993).

In accordance with action research, John Elliot said that theory cannot be validated independently and then it practiced but it validated by practice. Based on The Experts, It is clear that a classroom as place where teacher doing activity of teaching-learning can be accounted as a place which can describe as atmosphere of social situation, so that all effort to improve teaching qualities that doing by a teacher through implementation of action research in the classroom, that be his responsibility, is an action that must he do and he should do as a professional teacher. In accordance with above description, a teacher should be accounted had done his teaching activities based on the currently teaching theories that it validated in classroom by his experiences in teaching and not merely based on application of subject matter of teaching practice session. Because of action research has character as described above and meanwhile technical (or engineering) teaching mostly involve physical action, so that action

research is seem suitable to become fundamental action to improve design quality and implementation of technical or engineering teaching.

### **Research Contribution in Education Research Development**

According to Burgess (1993), researchers encounter educational cases in many sides. First, There are many activities that doing by individual or groups, which will become research subject. Second, process of research it self involve learning experiences. Third, result of research always tested by what is its contribution to knowledge according to educational knowledge discipline. From three cases that described above, it can concluded that research doing on educational background contribute to: (a) improve educational process (b) increase educational result, and (c) expand educational research method.

Educational practitioners, always, attempt to improve educational process. In this case, research has undeniable position to achieve it. Researchers simultaneously attempt to develop method of research in education. Earlier, educational research tent to be limited on qualitative approach. Later, educational research developed not only limited by quantitative approach but, mostly, by qualitative approach.

Stigler and Hiebert (1992: 122) said that learning process in the classroom depend on complexity of teaching and systemic condition, beside of knowledge transferring that could not immediately used. Therefore, In United States, a teacher development program has been developed to get a knowledge from a define context for example a knowledge from educational researcher and that knowledge is studied to implemented in classroom which it situation is complex and not pleasant. Educational research merit contributes in bridging a gap between educational researcher and educational practitioner (teacher). Teachers in Japan functioning their selves as teachers as well as researchers, and this action result are very specific and difficult to implemented in other counties. According to the case above, a learning process must be continuously developed, and this seems relevant to learning condition in classroom because it interlaced with teaching sources and how to transfer it as a unit that need to be analyzed and improved.

Teacher role in a learning process is very important, because the strategy that used by the teacher mostly ascertain successfulness of learning process in a classroom. Different teachers may have different knowledge about strategy that used to implemented a teaching design. For that, a teacher as a practitioner needs to collaborate with another teachers or researchers to enrich his vision that used to improve his teaching skill quality level. According to Stigler and Hiebert (1999: 125), by collaborating with researchers or another teachers, teachers in Japan could improve their professionalism by making work group for teachers of same subject matter, training, discussion and seminar. Teaching as a profession need continuous

improving as well as from theoretical or implementation aspect in the classroom. Teaching-learning in the classroom should be constantly improved so as teacher do not trapped in routinely boring situation.

There are six methods of research that using qualitative approach, i.e. ethnography, case study, grounded research, interactive research, ecological research, and futuristic research. Interactive research can be divided as two division, i.e.: action research and participatory research. Action research used to solve specific, practice, group or individual problems that could be founded in society, for example in social committee, school, classroom, or in researcher his self. Meanwhile, participatory research could use to strengthen a society in politic through group participation, which mean giving political knowledge to widespread society.

### **Classroom Action Research in Teaching-learning Process**

Stephen Kemmis and robin Mc Taggart (Eds) (1998: 5) described that:

*“Action Research is a form of collective self-reflective enquiry undertaken by participants in social situation in order to improve the rationality and justice of their own social or educational practices, as well as their understanding of this practices are carried out. Groups of participants can be teachers, students, principals, parents and the community members.”*

Definition above pointed out that action research is not only restricted in the classroom but including any social situation and the most important is action research in this educational aspect including: (a) educational practices (b) understanding of the educational research and (c) situation which that educational practices running.

There are two terms that according to this action research first of them called as “Classroom research” and the second is “Action research”. To simplify both would name as “Classroom action research” or in Indonesian as “Penelitian Tindakan Kelas”. Though both had combined but in some later discussion both of these two terms would be discuss at a glance. To simplify, in remaining discussion would use the term of “Classroom Action Research” or in Indonesian as “Penelitian Tindakan Kelas”.

“Classroom research” meaning is research activities that taken by the teacher to estimate and revise his teaching performance. So that, focus of this research is to do an effort in order to improve teaching qualities by increasing teacher professionalism skill. The problems that overcome by doing classroom action research are the problem that related to teacher daily teaching-learning process. The problems just could overcome if teacher his-

self taking the action as a person who directly goes through this teaching experience in the class.

As an important activity for a school teacher, this classroom action research doing by a teacher not simply to point out that a teacher must do this thing but the most important is teacher could use this method to understanding his situation where he becomes the focus of this activity of teaching-learning in class-setting. Classroom for a teacher is same as a field of research to other social researcher. From this action research taken by a teacher, it is expected, could become a consideration source to reflecting what should be done in improving or increasing his teaching quality.

Now we will discuss other term i.e. *Classroom action research*. *Classroom action research* is a reflective study by a teacher to improve his rational consideration in taking some action in his teaching activities. By this ability in doing a kind of research as well as other researchers do, a teacher through his successfulness in making research of classroom action research, this will build a self-confidence and trustworthy to succeed in his teaching-learning process.

As an important activity for school teacher, classroom action research must have this characteristic (Rayastuti Winarno, et-al, 2000 in Darmawan (2003)): (1) The problem that inquired is problem of daily learning in the classroom that faced by a teacher; (2) There are some current action to resolve the problem that raised, so this can influence a teacher to improve and increase his teaching quality; (3) There are difference situation before and after that Classroom action research had done; (4) Teacher as individual or as a group take a role as researcher, meanwhile, in other side principals, watchers, and college teachers taking a role as work colleagues.

Even some part of descriptions about action research and classroom action research explain that teacher as a profession is "*a lonely profession*" but in performing classroom action he even could find some work colleagues who can help him to spreading spectrum of his research and analysis so that some problems that can not resolve by merely teacher's self-inquiry, can be elucidated by doing collaborative research as had explained above. Collaboration can be rendered with another work colleagues or teachers. Therefore, Hopkins (1993) described "...it seems to be pivotal activity that links together reflection for the individual teacher and collaborative enquiry for pair of groups of teachers".

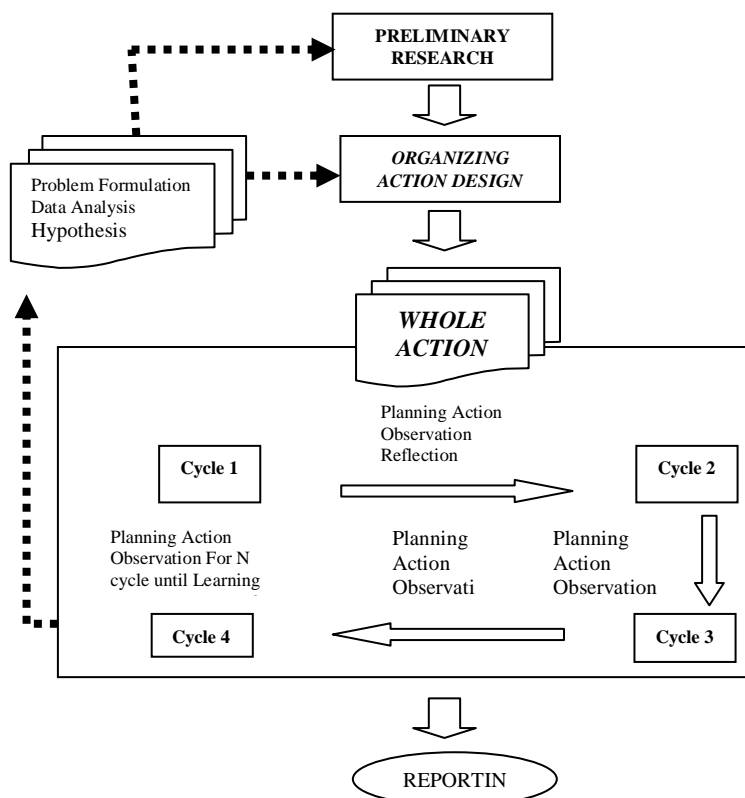
How to do action research explained by Mac Taggart (1991) as: This is a spirally dynamic process consists of planning, acting, observing and reflecting. This process is aimed to interact between context and practice dimensions with construction and reconstruction dimensions, so improving in practice and understanding systematically, responsively, and reflectively could be achieved. Interaction between the dimensions above can be seen on matrix of table 1 (Ahmad Sonhaji K. Hasan 1999).

**Table 1: Action Research Momentum**

	<b>Reconstruction</b>	<b>Construction</b>
Discourse (Among Participants)	4. <b>Reflection</b> Retrospective to Observation	1. <b>Plan</b> Prospective to action
Practice (In social context)	3. <b>Observation</b> Prospective to Reflect	2. <b>Action</b> Retrospective to Plan

Table 1 above describes that the discourse is developed by examination in practice, all of proposition in the discourse can be checked by practice and other parts of discourse. A plan can be tested by real action that included in construction area. In reconstruction area, the action is checked by observation, and then continued with making a reflection on observation results. Four of these steps are doing in some cycles (planning, action, observation, reflection and so on). Because there be such paths, action research from that process seems like a spiral that consists of: planning, action, observation, and reflection.

If these steps that describe in every action cycle in a research are visualized, we will get a spiral form as drawn in picture 1, it had been integrated in a path of classroom action research planning.



To understand further more of this classroom action research, some of the principles should be carried out here. Hopkins (1993) describing principles of classroom action research as: (1) every method that used in classroom action research should not affect to aggravate teacher commitment that teacher's duty is teaching; (2) Method of collecting data do not spend teacher's extra times that can exaggerate teaching-learning activities; (3) Model that used in the classroom action research must be reliable enough so enabling teacher in identifying the problem, formulating hypothesis, and developing proper strategy to evidence the his hypothesis; (4) The problem that will be solved by the research must be factual and dissolute enough and based on responsibility of teacher professionalism; (5) Teacher must be consistent and has high awareness on ethics and procedures that related to his works; and (6) in doing classroom action research as possible as he can must based on "*Classroom exceeding perspective*", it means that problems of research is not limited by one of subject matter context but based on perspective mission of the school as a whole.

### **Characteristic of Teaching for Engineering**

Teaching for Engineering has special characteristics that more emphasizing in psychomotor area based on three objectives of teaching schematics area, i.e.: cognition, psychomotor, and affection. Referred to Paul Harmon, Finch and Crunkilton (1989) work that associated psychomotor area with physical performance objectives. Objectives of the performance including (1) Physical Identifying, (2) To do simple physical action, (3) to do complex physical action, (4) to do physical skills, (5) To define appropriate physical action in solving a case, and (6) Defining appropriate physical product qualities. Besides, cognitive area is associated with verbal performance objectives that consisted of; (1) Representing the names, making list of the names, describing simple fact or order, (2) Describing a series of action in order, (3) Response to a vast of statements and questions, (4) Solving a specific symbolic case, and (5) Solving an ordinary symbolic case. Meanwhile, affective area is associated with attitude performance objectives, including of: (1) represent feasible consequence of an action, (2) Memorizing true social response in the range of time, and (3) Facing a certain situation by definite and controlled attitude.

According to Finch and Crunkilton, even in teaching for engineering emphasized on psychomotor area, actually this three areas or objectives of performance are hard to separated. For example, defining objective that regard to "Finding malfunction in car dynamo" topic, can use the fifth of physical performance objectives i.e. "To define appropriate physical action in solving a case". In this case, the choice is related to the third of attitude performance objectives i.e. "Facing a certain situation by definite and controlled attitude". Physical performance has a direct

correlation with controlling malfunction; meanwhile, attitude performance has a correlation with safety practice that being following trouble-shooting process.

To improve professionalism in teaching for engineering, teachers need to follow the rapid and complex technology progress, and the technical experts must be more skilful and trained. This demand is reflected in education and training programs for the experts and technician. Calboun and Finch (1982) pointed out those instructional programs for this field need to be more flexible, in order to response the changes of advanced technology.

According to Miller (1985: 81) the teacher is a most important and rigid element because teacher's role is very decisive whether objective of technology education is achievable or not.

Basically, competence of engineering teachers as same as competence of other teachers, but there are special character that must be possessed by engineering or technical teachers. Generally, teachers' competence including: (1) Pedagogical content knowledge that consisted of optioning, arranging, packaging, and presenting subject matter of appropriate knowledge and skills that proper with students needs; (2) Understanding that the students as individual are unique both physically or mentally; including difficulties and invalidities that they have, in socio-cultural context of families and multifaceted societies environments; (3) Represent a dialogically and educationally process of teaching-learning, learning management that oriented to students needs as a preliminary reference and performing entire human potentialities physically and mentally as a further reference, which is begun from performing self-learning capabilities based on perfect personalities; (4) Developing perfect personality and professionalism as a teacher.

According to that possession of teacher general competence, in particular, engineering teacher is expected able to taste experience and practice of work cultural in work global environment whereas in the future the students will be a part of it. By understanding and realizing that cultural-work, thus, engineering teachers need to posses of work experiences in real companies and industries based on their specialization.

### **Role of Teaching-Learning Strategy In Implementing Teaching Plan**

Teaching design is a systematical effort to analyze the problems, identify, select, plan, and evaluate the solution. The effort is mean to produce a complete teaching system, oriented, premeditated, and controlled to achieve definite objective. Developing teaching design has three basic principles that: focused on the students, use of system approach, and optimally utilize all learning resources in order to create an effective and efficient teaching-learning process. As a plan, teaching design has numbers of component i.e.;



1) will-achieved teaching objective, 2) Teaching resources and it organized orders, 3) Teaching-learning activity, and 4) evaluation.

The components of teaching-order activities as exposed above, describing what would be done during a teaching-learning process. In other words, it becomes the way to go through by a teacher since beginning of teaching process until the end. Further more, students involving levels both intellectually and mentally will determine occurrence of learning event on the students. The components of teaching-learning activities consist of: opening (preliminary), interaction (presentation or main activity), and closing. Gagne (1985:304) proposed nine steps of teaching-learning that named as instructional event which consist of: 1) attracting, 2) bringing teaching objective forward, 3) repeating the last subject, 4) presenting subject matter, 5) preparing learning guidance, 6) tracing progressive of students knowledge, 7) preparing feedback, 8) evaluating students competences, and 9) Strengthening memory and transferring. Step 1, 2, and 3 that proposed by Gagne are opening activities, step 4, 5, 6, and 7 are main activities or interaction, step 8,9, are closing and ending activities. Gagne related these activities with learning process, which always beginning with attracting students interests to teaching-learning activity and ending with some exercises to strengthen their memories.

After teaching objective, giving a vast of teaching-learning tasks, organizing learning resources orders, and evaluating determined by the teacher, then the next problem emerges that is how to select the strategy of teaching-learning. Strategy can be defined as a process that performance of mind activities based on. Strategy usually planned before, so that, more better quality of activity performance can be achieved. Basically, strategy is a method to perform a task or to achieve a goal. All strategies based on some processes to operate. Strategy can be divided in two, these are 1) Micro-strategies, including specific tasks, especially that related to knowledge and capability to do a certain performance, and have responsive character to respond a instruction, 2) Macro-strategies, usually absorbed in a group and usually involving emotional and motivation factor, this is more related to life style and culture, then is hard to be changed by instructions. According to description above, then teaching-learning strategy is classified as Micro-strategy.

In teaching-learning process, strategy usually is not merely oriented to an objective or an end-goal, but more emphasized on reflection of teaching-learning process, that engaging the teachers and students participation. Furthermore, teaching-learning strategy consist of 3 stages those are: 1) Preparation to determine an objective and correlate previous subject matter to the next; 2) Planning, in order to determine the best way to achieve teaching-learning objective; 3) Reflection, to redeem what results that had been achieved, and what matter can be reexamined, and what aspect can be reused. That for, in strategy of teaching-learning should

clearly describe teaching stages, learning situation that should be improved, teachers' and students' activities, and resources of learning.

Processes that used to establish structure of teaching-learning activities are more related to decide what teaching model will be used. Although, a teacher rigidly may be not using a single teaching model in his teaching-learning activities, but he can use a certain model as his main model. In the book of "Model of teaching", declared that teaching model widely is a technique, that not only taking place in library, but more in many setting that give a lot of merit to the teachers, teacher candidates, and students (Joyce, Weil & Shower, 1992-xv). Teaching model actually is a learning model. Therefore, teaching-learning process not just helps the students to gain information, ideas, values, skills, thinking method, but teaching the students how to learn, and as the results is the students able to improve their learning capabilities with easy and effective. Thus, Teaching model (and of course learning model) is a pattern, plan, technique, or a hint that arranged in one single teaching set. It used by the students in order to get information, knowledge, ideas, skills, attitude, and values, and in order to improve their mind and learning capabilities.

### **Classroom Action Research in Teaching Engineering Subject**

As discussed in previous pages, to do classroom Action Research in teaching activities is needed some stages. These stages could be classified in some cycles. The stages such as: plan, action, observation and reflection included in one cycle, these are in one cycle. And the other cycle, consist of stages such as: revised plan, action, observation, and reflection. And remain cycle, as same as the second cycle. Number of cycle that used is depended on research justification, which based on how far is the goal of research had been achieved.

Mc Niff (1992) giving an example from a study case that performed by Mike Parr in Bath Technical College, Bath, Avon, United Kingdom. General Description of teaching activities and student's characteristics is as follow: Two years study program, certification program in electronics subject, preliminary qualification is "3 CSE" minimum, most of them are in stage "0", number of students are 1- 15 per class, number of meeting are about 27 hour per week, age of the students are about 16-20 years, majority of students are male; and activities of practicum in the laboratory are 5-7 hours.

Process of classroom action research that performed by Mike Par can describes using Mc Niff Cycle Model as follow:

1. Mike Parr begins his research by identifying teaching problem that occurred. He feels not comfortable with teaching method that had been used. According to him, the students that follow his lecture pointing a passive attitude, caused many times are spent in writing.

- He feels worry that his students will feel uninterested and boring to his lecture. Parr wishes to do a change to resource-based learning approach. Thus, the obstacle is how to organize this electronic subject and how are his colleagues' attitudes to this problem. Then, he needs to plan how to know what are the students actually needed.
2. Next action that used in this research is asking some questions to the students, such as: Why do you take this electronic subject? Do you like or dislike this electronic subject? How is your experience in following this electronic subject if compared with the same subject in your previous college and what do you expect in this subject? Describe one of your good experience and one of your bad experiences in this college.
  3. As the result of the observation is found these responses as follow:  
(a) It become a pleasant if electronic subject is served attractively and the student could be given a chance to perform their tasks by their-selves; (b) Interrelationship between the teachers and the students is better if compared with interrelationship between the teachers and the student in their previous colleges, because in this college that relationship is more relax and equal, and more opened; (c) writing subject source in long times is very unpleasant, but the students feeling comfort if they engaged in the process that dynamically running, for example in group discussion and class discussion, and practicum; and (d) Teaching activity in this college is counted have more high point as compare as another colleges.
  4. As a reflection of the result of the observation, Parr formulated some statements about educational values, such as the following:  
(a) the students and the teachers should participate together and equally in the classroom activity; (b) the students should have more high awareness and responsibilities in teaching-learning process; (c) Teaching-learning activities should be a worthy experience and become pleasant experience especially for the students; and (d) Teaching-learning activities should engage social interaction between one student to another, and between the students and the teachers.
  5. Main Objective of transformation in teaching strategy is to attempt and realize educational worthy values that obtained from a reflection, with using teaching-learning approach that focused on students (student-centered learning approach). Through this approach the students can directly and actively involve in their learning process, then it can increase their self-confidence in resolving learning problems, and teacher giving positive response to the students as individual which have equally position.

6. Next action is offering some questions such as: Why the students are more pleased studying in the laboratory than in the classroom? Is this attitude become a sign that the student more capable in self-learning? Can teacher integrate that learning model as a part of electronic subject?
7. As result of observation and interview with this group of students had been acquired that: (a) Most of them come from local comprehensive school; (b) they have the same problem that they could not concentrate studying in "Theoretical" class, and they more excited in performing practical work in laboratory; and (c) Many of them feel suffering a loss studying in this college, but they feel successfulness in their studies and get more responsibilities so this teaching-learning activities in electronic subject are feel pleasant.
8. Reflection that can acquired from this observation are: (a) the students showing their apathies attitude and seem not motivated if they attend, in accordance with their selves-judgment, unexciting and unpleasant subject.  
Based on the reflection at first cycle of classroom action research above, teacher can collect educational value that could be a base to review implementation of teaching design for the next cycle. For example, one statement of reflection can be formulated, as "a learning activity must have a worthy value and must be an exciting experience". From this reflection can be defined and realized in second cycle action, that this teaching process is aimed to improve psychomotor capability.

The observation result from students' response on the question that offered in first cycle action concluded that the students would be exciting on electronic subject if it attractively preserved and they can do their learning activities by them-selves. Besides, the students feel less motivated and feel bored if must attend electronic lecture which filled with writing activity in long times. For example, there be an objective stating, "students capable to build parabolic antenna", then skill that should be learned is how the students capable to build the real parabolic antenna by them-selves not just knowing how to build parabolic antenna.

From that teaching objective, could be derived some formulations of performance and attitude objective, performance objective is a specific question. And result of student performance can be measured through evaluation. Therefore, objective of learning above can be detailed as (1) students can identify parts of parabolic antenna; (2) students can assemble parts of parabolic antenna; (3) students can precisely arrange position of parabolic antenna, and (4) students can operate parabolic receiver including how to program it.

According to area that related to performance objective, it needed to knowing levels of learning successfulness by offering some points of psychomotor test. That for, points of the test can be formulated as follow: (1) open box of parabolic antenna, (2) identify parts of it and check its devices, (3) construct a prop base, (4) assemble the parts, (5) check preciseness of the assembled parts, (6) connect antenna with receiver, (7) set television programs, and (8) watch and fix the channel.

### **Utilizing Classroom Action Research to Improve Teaching Quality**

Utilizing classroom action research activity is useful in structuring teaching-learning activity by arranging strategy and model of teaching then could contribute an improvement of teaching design implementation. As example is classroom action research that performed by Mike Parr above, hence could be get some question about educational value, such as: "The students and the teacher must have equal participation in the classroom". "The students must be granted more responsibility in their learning activity". "Learning must be an exciting and pleasant experience". Then, from these statements, teacher can arrange and implement teaching design that based on student's preconception not from the teacher side-view, having a strategy in using multi-method teaching especially discussion method and group work, balancing between theory and practice so teaching-learning that he does is enriched with practical knowledge, selecting contextually learning resource so principles and skills that he taught have a correlation with school curriculum, can use in daily application and suitable with the newest advanced technology.

In Indonesia, classroom action research have been using in educational department that socialized by *Direktorat Perguruan Tinggi* (2004:2) with *Program Penelitian Berbasis Tindakan (PBT)*. This program is aimed to improve quality of educators and educational personnel in *Departemen Pendidikan Nasional* environment so they can resolve encountered problems when they perform their professional duty, so: a) They can improving their capabilities in resolving real teaching-learning problems b) They can resolve the problems using controlled investigation that can improved quality of content, input, process, and learning result; c) Improving both capabilities should effect to enrich teachers professionalism.

### **Conclusion**

According to description and discussion above, can be concluded that: (1) Classroom action research that perform constantly planned and arranged must be encouraged in educational research atmosphere, because it's impact could influencing teacher professionalism in doing their tasks and could extend their teaching quality and revising processes of teaching-learning in

the classroom, (2) Results of Classroom action research could be used to increase quality of implementation of engineering teaching design, which has special characteristic that mainly engage psychomotor capabilities levels.

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