

Development of Laboratory Management Based on Local Bali Wisdom to Improve the Quality of Services in Laboratory

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Abstract

This study was aimed to develop laboratory management model based on Bali local wisdom to improve quality of laboratory service. This research was the development research by adopting of research and development model in education. The research was done at 2016. The limited scale trial was conducted with 50 students from the Chemistry Department of Education, Ganesha University of Education in 2016 with Kurt Lewin's classroom action research model. Fifty students were divided into 7 groups for physical chemistry laboratory practice and 7 groups for analytic chemistry laboratory practice. The instruments of this study were observation sheets and questionnaires. Observations and questionnaires were analyzed descriptively. Results of the study are: Bali local wisdom relating to the laboratory management, a laboratory management model based on Bali local wisdom to improve quality of laboratory service, a laboratory management model was developed very effective, the model can be applied, and the student response to the laboratory management model based on Bali local wisdom is very positive.

Keywords: Bali local wisdom, laboratory management model, quality of service

1. Introduction

The laboratory has an important role in science learning. Theoretically, the existence of the laboratory is expected to support skills centered activities, such as process skills, motor skills, and the formation of scientific attitudes, particularly the development of interest to investigate, research, and interest in studying nature more deeply (Hudha, 2002: 2). These skills can be built through the laboratory practice. Laboratory practice can improve the psychomotor, cognitive, and affective aspects. Laboratory practice can also increase in group and between group interaction so that attitudes arise appreciate the work of others. The important role of the laboratory practice is reinforced by the mandate of Permendikbud RI. 65 year 2013 which emphasizes scientific approach in discovery / inquiry learning. This means allowing learners to navigate across the learning sphere (cognitive, affective, and psychomotor), and to develop their whole intelligence (emotional, spiritual, social, etc.) (Mursid, 2013: 27).

Scientific approach in chemistry is done through the skills of the process of science. Scientific approach is possessed skills by scientists to acquire and develop chemical products that include observing, classifying, measuring, inferring, predicting, and communicating. One of the science process skills can be done through laboratory practice. Laboratory practice can foster self confidence, skill, and sensitivity to the environment (Sudiatmika, 2013: 18). The role of laboratory practice is very important to develop the potential learners. An important role of laboratory practice in learning can be accomplished if supported by a good laboratory. The role of laboratory management has a strategic position to create a good laboratory.

Laboratory management that facilitates education should pay attention to the condition factor and quality of the facility. These two factors can directly affect the educational process. Laboratory facilities should be maximally utilized for laboratory activities. Laboratory development is carried out continuously to improve the service function in accordance with user demands and quality improvement (Peniati & Purwantoyo, 2013: 109). In this regard, Katz shares three management skills that are absolutely necessary for laboratory management: technical skills, personal skills, and conceptual skills. Technical skills are

related to the ability to apply specific knowledge or skills. Personal skills relate to the ability to cooperate, understand, and motivate others. Conceptual skills are related to the mental ability to analyze and diagnose complex situations (Robbins, 2001: 4-5). Regulation of MENPENNAS and Head of BKN No. 02 / V / PB 2010 No. 13 year 2013 states that laboratory management includes the design of laboratory activities, equipment operation and using of material, maintenance / maintenance of equipment and materials, evaluation of laboratory work system, and the development of laboratory activities.

Expectations to make the laboratory as a center for science process skills development are constrained by limited laboratory facilities and infrastructure, in the case of significant differences in science process skills between experimental and experimental methods with demonstration methods. Mindarti (2009: 7) reported that students who were given learning using process skill approach through experimental method had better cognitive ability than demonstration method and students who possessed high degree of laboratory tools have better cognitive ability than students who have mastery low laboratory apparatus. Thus, there is a correlation between the completeness of facilities and infrastructure in the laboratory with the skills of the process of science. To overcome these problems required good laboratory management techniques, so the role of the laboratory to function properly.

Several studies related to the management of laboratories have been developed, among others, the management of chemical laboratory at SMA Negeri in Singaraja City (Wiratma dan Subagia, 2014: 425), laboratory development strategy of Industrial Engineering Program at Al Azhar Indonesia University (Nunung Nurhasanah dan Octrivia Deliani, 2013: 9-10), and the development of the laboratory as an effort to improve the quality of PKK School students (Salindeho, 2010: 525). None of these studies are in accordance with the Joint Regulation of MENPENNAS and the Head of BKN. 02 / V / PB 2010 No. 13 of 2013 relating to laboratory management.

Research on the values of local wisdom in Bali related to the education world has been done, such as: development of learning model of problem-solving oriented local wisdom in junior high school students in Singaraja City (Parwati, 2015: 612), science education based on *tri kaya parisudha* (Sudiatmika, , 2013: 15), and a model of physics learning to develop the creativity of thinking and character of the nation based on local wisdom of Bali (Suastra, IW & Budi Yasmini, L Pt, 2013: 221). In addition, Suja (2011: 84) has also examined the local wisdom of Bali through an analysis of the need for the development of textbooks on elementary schools with Balinese cultural pedagogy.

The success of Bali's local wisdom values in learning can be used for laboratory management. Based on the best implementation of local wisdom of Bali in learning, then the best of local Bali wisdom is used in the management laboratory. This is in line with modern management which states that modern management is built on the best management practices (Riantono, 2014). To that end, in this study developed a model of laboratory management based on Bali local wisdom to improve service quality in the laboratory. The management model developed is tailored to the management of the laboratory based on the joint Regulation of MENPENNAS and the Head of BKN. 02 / V / PB 2010 No. 13 year 2013. Thus, the laboratory management model developed can be used as reference laboratory management.

2. Methods

The research and development method used is a research and development model that has been simplified by the Center for Policy Research and Innovation Education of the Ministry of National Education of RI (Depdiknas, 2008: 10-12). The models adopted include initial research, initial product development, expert validation, and small-scale field trials. This research was conducted in 2016. Initial research was conducted through literature studies and interviews with community leaders in Bali until the data obtained saturated.

Expert validity test conducted by 2 people, namely laboratory practitioners and academics. The test results were analyzed by Gregory technique. Decisions are made by comparing the percentage of agrees with the disagreed aspects. The percentage of agrees indicates that the developed model can be applied.

A limited-scale trial was conducted 4 cycles through a classroom action study developed by Kurt Lewin. Classroom action research includes: planning, action, observation, and reflection (Suharsimi, 2002: 83). The sample of research was 50 students of Chemical Education Department in 2016, consisting of 7 groups of chemistry physics laboratory practice and 7 groups of analytic chemistry laboratory practice. Each group consists of 2-3 people. The experimental test of laboratory management model based on local wisdom of Bali to improve the quality of service in laboratory is done on physics chemistry laboratory practice, namely: determination of calorimeter constant, determination of reaction heat, determination of surface tension with surface tension gauge du nouy, and isotherm freunlich adsorption. While experimental laboratory model testing was developed against the analytic chemistry laboratory practice: wet cation test, wet anion test, acid-base titration, and titration of permanganate.

The data and information collected in the initial research are the local wisdom of Bali related to laboratory management, including: planning, implementation, maintenance, evaluation, and development. While the data required in the limited trial is the effectiveness of laboratory management model based on local wisdom of Bali in terms of effectiveness of the process of laboratory practice and quality of service in the laboratory practice. The effectiveness of the laboratory practice process was observed for 4 meetings and recorded in the observation sheets. The effectiveness of the laboratory practice process includes planning, implementation, maintenance, evaluation, and development. While the quality of service is obtained from the questionnaire given to the students after the application of laboratory management model based on local wisdom of Bali. All data obtained were analyzed descriptively.

3. Results And Discussion

Preliminary research results show that all activities performed in Bali based on *dewasa ayu* (good day). *Dewasa ayu* can be adapted to the *desa* (place), *kala* (time), and *patra* (state). The suitability is based on empirical experiences that have occurred in a village/place. The empirical experience becomes a belief and is carried on for generations. If examined more deeply, there are similarities in activity management. A summary of the preliminary research on local Balinese wisdom management tailored to laboratory management is presented in Table 1.

Table 1. Summary of local Balinese wisdom with laboratory practice management

The values of local wisdom of Bali	Aspects of laboratory management
Notice 3 days before the event, <i>ketelunan</i>	Planning
<i>Menyame braya, selulungsebayan taka, tri kaya parisudha</i>	Implementation
<i>Mereresik</i>	Maintenance
<i>Silakramaning aguron-guron</i>	Maintenance
<i>Mulat sarira</i>	Evaluation
<i>Lek ati, jengah</i>	Development

Based on preliminary research, a local laboratory based wisdom laboratory practice model was developed to improve the quality of service in the laboratory. The laboratory management model based on local wisdom of Bali consists of: the syntax of laboratory management, social system, reaction principle, instructional output, and nurturant effect. The syntax of laboratory management model based on local wisdom of Bali is integrating the values of local wisdom of Bali in the management of laboratory practice. Table 2 shows the syntax of laboratory management model based on local wisdom of Bali.

Table 2. Syntax model of laboratory management based on local wisdom of Bali

Laboratory management activities	Activity of practitioners
Phase I Planning: <i>ngetelunan</i> Inform the practitioner to deliver the order of the equipment and materials no later than 3 days prior to the activity	1. ractitioner compiles a list of equipment and materials needs with clear amounts and specifications 2. ractitioner submit a list of equipment and materials needs no later than 3 days before laboratory practice activities
Phase II Implementation: <i>menyame braya, selung sebayan taka, and trikaya parisudha</i> 1. onvey to the practitioner in order to cooperate and help each other in a familial way by courtesy/ <i>tri kaya parisuda</i> (think, say, and do good) 2. uiding and supervising the activities of practitioner with full kinship and courtesy/ <i>tri kaya parisuda</i> (think, say, and do good))	1. Practitioner in group and between group collaboration with full kinship politely and politely based <i>tri kaya parisudha</i> (think, say, and do good) 2. Practitioner conveys the problems of laboratory practice without any sense of shame to the supervisor)
Stage III Maintenance: <i>mereresik, silakraming aguron-guron</i> 1. o convey to the practitioner about SOP of laboratory practice related to work safety in laboratory (practitioner, tools, and materials) 2. ell the practitioner about the importance of cleaning equipment, workplace, and laboratory environment 3. uiding and supervising the use of tools and materials in accordance with SOP)	1. Practitioner cleans tools, workplace, and laboratory environment 2. Practitioner operates the tool in accordance with SOP 3. ractitioner uses materials based on SOP 4. ractitioner puts the tools and materials in a safe position
Stage IV Evaluation: <i>mulat sarira</i> 1. Evaluate the events in the laboratory 2. earch for a practicable failure solution)	1. ractitioner finds the cause of the failure of the laboratory practice 2. Practitioner finds failure solutions)
Stage V Development: <i>lek ati, jengah</i> Finding, creating, modifying tools, materials, and laboratory practice procedures, as well as looking for practical / research alternatives to achieve practical / research objectives	1. odify the laboratory practice that is not in the laboratory 2. sing other materials instead of materials that are not in the laboratory practice / research procedure 3. odify the laboratory practice / research procedure to achieve the goal

The social system of laboratory management model based on local wisdom of Bali to improve the quality of service in the laboratory is characterized by laboratory practice activities take place in groups. Group activities provide an opportunity for the practitioner to interact between and in group with full courtesy in the *tri kaya parisudha* without distinction of social status. This opportunity can shape the character of practitioner to be open to criticism, other practitioner ideas, sharing with kinship and respect for each other. In addition,

interaction within the group builds cooperation to solve problems encountered during the laboratory practice.

Instructional output expected from the laboratory practice management model based on local wisdom of Bali to improve the quality of service in the laboratory is the mastery of science process skills, communication skills, and problem solving skills laboratory practice. Meanwhile, the nurturance effect that is expected by practitioner is able to preserve the values of local wisdom of Bali in the midst of global challenges; acting and behaving positively; and able to solve problems encountered.

Expert assessment of the laboratory practice management model based on local wisdom of Bali to improve service quality in laboratories that have been developed is feasible to implemented. Two experts provide a consistent assessment of the developed laboratory management model.

The limited trial of the effectiveness of laboratory management models based on local wisdom of Bali is presented in Table 3. Based on Table 3, the total percentage of effectiveness from cycles I to IV shows more than 50%. The effectiveness of cycles I through IV shows improvement. Percentage of increase of cycles I to II, II to III, and III to IV respectively: 3.53; 2.33; and 2.07. Thus, the model of laboratory management based on local wisdom of Bali is effective.

Table 3. The effectiveness of laboratory management model based on local wisdom of Bali

Aspect of effectiveness	Percentage effectiveness cycle			
	I	II	III	IV
Planning				
1. Material identity completeness (type, concentration, and amount) on the bill)	85	90	90	95
2. Identity tools (type, size, quantity) on the bill)	80	85	90	90
3. Delivery of equipment / materials no later than 3 days)	85	98	100	100
Operation/using				
1. Cooperation in groups use tools/materials	80	85	90	92
2. Cooperation between groups use tools/materials	80	80	84	88
3. Operation of equipment (according to SOP, equipment safety, accuracy of use of tools))	65	70	75	75
4. Material use (accuracy, efficiency))	60	64	65	70
5. Safety of the practitioner	100	100	100	100
Maintenance				
1. Tools (cleanliness, security)	70	75	75	80
2. Material (cleanliness, contamination, security)	65	70	71	73
3. Laboratory and environmental hygiene	85	90	90	91
Evaluation				
1. Can look for the weakness of the experiment	55	55	60	63
2. Can find a failure solution	50	50	55	55
Development				
1. Can modify tool	54	55	55	60
2. Can look for alternative materials that do not exist	55	55	57	56
Percentage total	71,27	74,80	77,13	79,20

Reflection on the application of laboratory management model based on local wisdom of Bali to improve service quality in laboratory in cycle I found almost every aspect of laboratory practice management there has deficiency except in safety aspect of practitioner at part of operation of tool or material use.

Planning laboratory practice in cycle I, 15% filling material concentration and 20% tool size forgotten by practitioner. The affirmation of the inclusion of the concentration of the materials used and the size of the appliance becomes the center of attention to improve the implementation of cycle II. The impact of the cyclical shortage I emphasis, seen increasingly

the effectiveness of planning in cycle II. The same error also occurs in the second cycle, but the number decreases, so the planning of cycle III, and IV planning is getting better.

Part of the operation of the tool when laboratory practice, cycle I many groups that have not been able to operate the equipment in accordance with existing SOP, such as the du nouy surface tension tool in Physics Chemistry Laboratory practice and using of burette on analytic chemistry laboratory practice. In addition, the placement of the tools is often unsafe, so the tool breaks out due to bumping, colliding, and rolling. The use of materials in cycle I, students have not been able to use materials efficiently, because they view the practice procedure as a recipe can not be changed. The weaknesses are improved so as not to repeat in cycle II through *mulat sarira* (self evaluation) and guidance. Improvements made are the guidance of the importance of placement of tools and materials in a safe position, understanding the meaning of the practice procedure through the characteristics of chemical reactions. The result is an increase in efficiency in cycle II. However, in cycle II there is another error found, namely the use of the same pipette to take different solutions without washing first so that there are contaminated materials with other materials. Coaching is done so that in the third, and IV cycles did not happen the incident.

The maintenance part, the tool is not cleaned well in cycle I. This is evident from the many labels still attached to test tubes, glasses, and digital scales scattered in materials. Materials used are not closed as soon as possible after use, such as taking sodium hydroxide from primary bottles, taking iodine, and other dangerous and unstable materials. To anticipate the events in cycle II, the students are reminded of the importance of cleanliness of the tool, the properties of the material so that both aspects become a concern in laboratory practice. The impact of these directives, there is an increase in efficiency of cleanliness of tools and materials in cycle II, III, and IV.

Evaluation of laboratory practice management focused on the factors that fail laboratory practice and the solution of the failure. Cycle I, both aspects are still very low, ie 55% and 50% respectively. Efforts are made to remind students reactions that occur on the materials used, the physical properties that occur, consider every aspect done in laboratory practice, and discuss problems with his friends or lecturers course. Although the effort has been done, the efficiency of student evaluation in the laboratory practice is still low. However, there is an increase in evaluation efficiency in cycle II, III, and IV.

The ability of students in the development of laboratory practice in using tools and materials is still very limited. The limitation is due of understanding of chemical matter of laboratory practice is very weak. Laboratory practice development that can be done by students, among others; replacing the adsorbent on the physical chemistry laboratory practice, and the acids or bases with natural substances in the analytical chemistry laboratory practice. However, there has been an increase in student development abilities from cycles 1 to 4.

The effectiveness of service quality in the laboratory using management model based on local wisdom of Bali was obtained from the student response through the questionnaire. The effectiveness is presented in Table 4.

Table 4. Student response to service quality in laboratory using a laboratory management model based on local wisdom of Bali

No	Aspects of research	Percentage	
		Effective	Ineffective
1	Level of readiness of tools and materials	91	9
2	Number of materials used	92	8
3	Safety of practitioner, tools, materials	91	9
4	The success of practitioner in practice	85	15
5	Cleaning tools and workplace	92	8
6	Time spent in the experiment	94	6
	Average	90.83	9.17

Table 4 shows the level of effectiveness of the implementation of local wisdom values Bali shows an average of 90.83%. The effectiveness of time used in laboratory practice occupies the highest position (94%) and the success of practitioner in laboratory practice occupy the lowest position (85%).

Student responses to the application of laboratory management model based on local wisdom of Bali are presented in Table 5. The response states whether or not students agree on the application of laboratory management model based on local wisdom of Bali.

Table 5. Student response to the application of laboratory management model based on local wisdom of Bali

Aspects of laboratory management	Statement	Response (%)	
		Agree	Disagree
Planning	The level of readiness of the tool is getting better	95	5
	The level of readiness of the material the better	95	5
	Level of readiness to carry out laboratory practice	90	10
	Average	93.33	6.67
Implementation	Leisure in groups	95	5
	Leisure between groups	90	10
	Increasing laboratory practice motivation	85	15
	The problem in the experiment is solved	95	5
	Understand more about experiment material	85	15
Average	90	10	
Maintenance	Awareness to maintain the cleanliness of tools, laboratories and surrounding areas are growing	90	10
Maintenance	Obedience to the discipline of experiments is increasingly important	95	5
	Increasing concern for others guarding safety in experiments	95	5
	Average	93,33	6,73
Evaluation	Be more aware of how to make a laboratory practice preparation	90	10
	Be more aware of the cause of errors in laboratory practice	80	20
	Average	85	15
Development	Trained to find alternative substitute materials for the experiment	85	15
	Trained to modify laboratory practice tools	80	20
	Average	82.50	17.50
Average total		89.67	10.33

Based on Table 5, the number of students who agree with the implementation of laboratory management model based on local wisdom of Bali averages 89.67%. When viewed every component, then the average student who agreed to the implementation of laboratory management model based on local wisdom reached 93.33% planning; 90% implementation; 93.33% maintenance; 85% evaluation; and 82.50% development. This data indicates that students have the ability to self evaluation through the implementation of the values of local wisdom of Bali (*mulat sarira*) the lowest compared with other laboratory management. Nevertheless, an agreeable 85% response indicates excellent value from the implementation of laboratory management models based on local wisdom in Bali to improve the quality of services in the laboratory.

Laboratory management has an important role in the success of the laboratory practice. The aspects of laboratory management are in accordance with the joint Rules of MENPENNAS and the Head of BKN. 02 / V / PB 2010 No. 13 of 2013 should be well actualized to create practical success. The laboratory management model based on the local wisdom of Bali to improve the quality of service in the laboratory is an attempt to actualize the joint regulation.

The laboratory management model based on local wisdom of Bali is the actualization of laboratory management based on social system. Learning based on the social system of society is in line with the idea of decentralization of education currently being echoed. Decentralization is one of the efforts to improve the effectiveness and efficiency of education. It is expected to foster the ability of regions to increase their potential independently through incentives from the application of community based social system models. In addition, to enable students to face global challenges, and also to bring students closer to their social environment (Mulbar, 2015: 279).

The application of a limited scale of laboratory management model based on local wisdom of Bali to improve service quality in the laboratory shows improvement. Percentage increase of cycle I to II, II to III, and III to IV respectively: 3.53; 2.33; And 2.07. The development of percentage increase of cycles I to II, II to III, and III to IV tends to decline. Increasingly of it is caused by complexity of the laboratory practice material, such as the determination of the surface tension is largely determined by careful observation and instrument operation, freundlich isotherm is largely determined by the timing of contact and shaking stability, and permanganometric titration is determined by temperature. However, the decline did not show significantly.

Application of laboratory management model based on local wisdom of Bali to improve service quality in laboratory get positive response from student (91,25% agree). This indicates that the applied laboratory management model can be accepted by the students. (Baker & Taylor, 1995: 123) states that learning does not pay attention to the local culture / wisdom of children, the consequences will be rejected or accepted in part by the learners. In addition, the applied laboratory management model can encourage active involvement of students in the management of laboratories, especially in laboratory practice. Such involvement may occur, because the values of Bali's local wisdom are integrated into laboratory management. Local wisdom of Bali has been able to create harmony in the heart practitioner, thus encouraging practitioner involved in laboratory management actively. This harmony creates an inner balance within and can provide stability (Djiwandono, 2003: 135).

The model of laboratory management based on local wisdom of Bali is able to encourage students to use reason in practice, because the applied lab management model is able to bind the students emotionally through the values of local wisdom of Bali. Emotional ties strongly influence the acceptability of concepts to be applied in a system (Baker & Taylor, 1995: 124). Emotional bonds that are built through the application of laboratory management model based on local wisdom of Bali can build emotional intelligence and motivate students to perform better laboratory practice. This is supported by research results Subagio (2015: 101) which states there is a correlation between emotional intelligence with work motivation.

Application of laboratory management based on local wisdom Bali is the application of modern management. In modern management it rests on the basis of thinking, such as: system concepts, decision analysis, the importance of human factors and human social responsibility in the organization. Modern management stems from the best thinking of management. Modern management is built on the best management practices, aided by new approaches, directions, techniques and attitudes (Riantono, 2014). Laboratory management based on local wisdom of Bali is also based on rational, thought and calculation, as well as validated analysis (Zubaidah, 2008). In addition, the management of Bali's local wisdom laboratories (Tables 1 and 2), globally is in accordance with the provisions set out in the National Accreditation Committee, among others: object management, organizational management, planning management, and recording management (Akreditasi, Komite, & Nasional, 2008).

4. Conclusions

Based on the results of the above research, it can be concluded that the laboratory management model has been developed based on local wisdom of Bali to improve the quality of service in laboratories that have characteristics: 1) social system with laboratory practice characteristics done in groups; 2) a reaction system characterized by laboratory practice managers acting as supervisors and tutors; 3) instructional output with the characteristics of strengthening the skills of the process of science, communication, and problem solving; and 4) preserving the values of Bali's local wisdom. Laboratory management model based on local wisdom of Bali to improve service quality in laboratory which developed very effective in laboratory management, can be applied, and get very positive response by the students.

Based on the results of the research it can be suggested: first, the laboratory managers to apply the laboratory management model based on local wisdom of Bali to improve the quality of service in the laboratory; second, members of each group of laboratory practice maximum 3 people; and thirdly, the local wisdom of Bali can be adapted to local local wisdom.

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