

The Model of Politechnic Machining Workshop Management with Occupational Health and Safety Character

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Article Info

Article History:

Received 23 September
2016

Accepted 24 October
2016

Published 24 February
2017

Keywords:

*health, safety, work,
management, model*

Abstract

As a practice, the Polytechnic machining workshop should also be a safe workplace for students. The lack of the manager's attention in setting the safe way of working and the use of personal protective equipment for the students' work show the substandard implementation of the occupational health and safety. This study aims to find out a factual management model, analyze the shortcomings, and design a hypothetical model for the Polytechnic machining workshop management characterized by health and safety. Students, lecturers, laboratory assistants, and technicians are directly related to the activities of the Polytechnic machining workshop as data sources. This study implemented research and development methodology, with data collection techniques that include observational studies, interviews, and questionnaires. Using indicators for safe machining workshop management, the result of each indicator shows merely 20% of the expectation. It was concluded that the factual management model to provide a safe workplace for students is still bad. The disadvantage of this management model is the lack of in-depth preparation for implementing occupational health and safety regulations. Therefore, the model still requires a development to become a model of machining workshop management with health and safety character. The success of the implementation of this management model requires leadership support and active participation of all those involved in the students' practice activities in the Polytechnic machining workshop.

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p-ISSN 2085-4943

e-ISSN 2502-4469

INTRODUCTION

In addition to being prospective workers who are skilled in the field of machinery, mechanical engineering students of the Polytechnic should also have a safe work habit. Working safely is not included in the practice course material, but it is done through work habits. Safe work habits will shape the character of each student. The Ministry of National Education (2011) defines the character education in an effort to implant good habits (habituation) so that learners are able to behave and act on the basis of the values that have become his personality. Safe work habits and personality are a capability of forming values for each student needs the support of the working environment. To create a safe working environment, students practicing in the machining workshop require sound management of health and safety. The machining workshop management like this is a management system that implements health and safety regulations.

The management policy requires a collective agreement to implement occupational health and safety regulations. Mutual agreement between the personnel involved in the activities of the student practice is very important. The head of the workshop, lecturers, students, and technicians as laboratory assistant personnel involved in it should take active roles. Their respective roles in implementing the occupational health and safety management in the machining workshop are, among other things, to understand and implement occupational health and safety regulations. Their compliance in implementing the occupational health and safety regulations for work in the machining workshop is the implementation of their knowledge of health and safety itself. How deep is the knowledge of the health and safety of lecturers, students, laboratory workers and technicians in laboratories and Polytechnic workshops, particularly in the Polytechnic of Sriwijaya that has been investigated by Indrayani and Ika Sulianti (2014). In their conclusion, the researchers stated that their

knowledge of health and safety among the lecturers, students and laboratory assistants/technicians at the State Polytechnic of Sriwijaya, in particular, has not reached 50% of the expectation. These results indicate that their knowledge of occupational health and safety is still below the expectation.

The lack of knowledge will certainly affect the way they attend the students' practice. Their knowledge of health and safety in the machining workshop is a step to prevent the risk of injury in the workplace. Errors affecting the risk of injury in the workplace are caused by human's lack of attention to the risk of the work they do. For example, workers who move goods from one place to another by lifting faces the risk of backbone injury. The risk of backbone injuries caused by lifting something is common within and beyond workshop. According to the D. Choi, James G. Borchardt and Travis L. Proksch (2012), working out the research object in a workplace construction, it can be concluded that the backbone injury is often experienced by workers due to errors in the way of lifting.

The risk of injury due to work accidents can be caused by poor management of the workplace. A good management should be capable of controlling man, machine and work environment into a safe workplace. Differences in the management of a workplace can be influential to the occurrence of accidents. According to Wei Guiling (2011) who conducted his research at two different locations, namely the coal mining companies in China and the United States. The conclusion was that the coal mining industry in China was still prone to accidents, and China should learn from the experience of the management of American coal mining industry. The safe workplace management needs to be applied in the Polytechnic machining workshop. Therefore, the Polytechnic machining workshop requires management to control practices in order to become a safe working place for the students. It motivates researchers to undertake the development of a factual management into a machining workshop management characterized

by occupational health and safety. The development is based on the theories supporting the establishment of management models that include: theoretical models interpreted as a representation of the actual system.

Sugianto (2010) states the model as a representation or abstraction of an object or actual situation. Furthermore, from the perspective of management theory of vocational education, it refers to a science of how to organize the resources of a set of activities to achieve the main goal to prepare students to work with a certain applied skill effectively and efficiently. According to Kozma, Belle, and Williams (1978) in Sunhadji Ahmad (2002), laboratories and workshops are the places which are used for teaching activities that require certain skills and practices or direct experiences for learners. In acquiring such skills direct experience will encourage the emergence of work habits. The formation of work habits is influenced by the work environment. A healthy and safe working environment will establish safe work habits as well. The work habits which are practiced over and over again will shape the work culture among the people involved in it. The lecturers, students, laboratory workers and technicians' habit of working safely in the Polytechnic machining workshop is expected to form the character of health and safety in the students' mind. This research aims to find factual management model, analyze the weaknesses, and design a hypothetical model of Polytechnic machining workshop management characterized by occupational health and safety.

METHODS

This research implemented the research and development methodology offered by Borg and Gall (2003), in which the development of a model can be done in ten stages including research and information collecting, planning, developing preliminary form of product, preliminary field testing, main product revision, main field testing, operational product revision, operational field testing, final product revision, dissemination, and implementation. This

methodology has been used primarily for physics and engineering. Many products from these two fields have been generated from research and development by such companies as the aircraft, ships, automobiles, motorcycles, electrical appliances, medical equipment companies and so on. Nevertheless, it is not only the two areas mentioned above which use such methodology, this research and development methodology can also be used for the field of social sciences, such as psychology, sociology, education, management and the like. Sugiyono (2010) explains that the method of research and development is used to produce a particular product, and test its effectiveness. Therefore, the research conducted in the field of educational management science also uses the research and development methodology introduced by Borg & Gall to produce a hypothetical machining workshop management model characterized by health and safety.

This hypothetical model is obtained in step five of the ten steps, after a limited test and experts' judgment. This type of study uses primary data brawn directly from the data source consisting of students, lecturers, staff, and laboratory technicians. They are actors who are directly involved in the practice activities of students in the Polytechnic machining workshop. The students are those who at the time of the research were taking a course in the Polytechnic machining workshop practices. Lecturers are those who teach the students during practice at the Polytechnic machining workshop, and at the time of this study served as a lecturer and the department head, head of the workshop and head of a study program majoring in mechanical engineering. Laboratory assistant and technician are those in support of the implementation process of student practice, in supplying raw materials and lending cutting tools as well as other practice equipment in the process of student practice in the Polytechnic machining workshop.

Data collection used observational studies, interviews, and questionnaires distributed in the two locations of the Polytechnic machining workshop as samples,

namely Semarang State Polytechnic and Bandung State Polytechnic. Implementing participant observation, data were drawn by observing the available facilities, the students' behavior, the lecturers, and laboratory assistants/ technicians involved in practice in the Polytechnic machining workshop. Interviews were conducted with the lecturers as the official head of the department, the head of the workshop, and the head of the study program. Questionnaires were distributed to respondents consisting of lecturers, students, and laboratory assistants/technicians who were directly involved in the students' practice activities in the Polytechnic machining workshop. The variable measurement scale used in this study was the Likert scale for the respondents' answers, whose gradation is from very positive to very negative. The results of the questionnaire were analyzed using the calculation for each variable by dividing the total amount of scores as the results of the study by the ideal score to obtain the percentage of the actual outcomes as expected. The results of the data analysis were presented in a descriptive narrative to support the conclusion.

RESULTS AND DISCUSSION

The buildings of the Polytechnic machining workshop have been specifically constructed as a place for student practice. The buildings are furnished with equipment ranging from lighting to air circulation. Similarly, as the foundation of the floor for machines and practice facilities have been well prepared. The machines have been grouped according to their types. Observations show that the machines have been placed in the work area well enough. Lecturers' rooms and storage for cutting tools have been provided and their location is near the area of the student practice. As a student practice, the Polytechnic machining workshop must be a safe workplace for the students. To make the workplace safe, it needs proper management and is in accordance with the purpose, namely a management which not only regulates how practice activities can take place

but, moreover, it should be able to provide security for the students.

The management is expected to allocate all the available practice facilities, those who are engaged, and the working environment. The harmonious way of arranging the machinery/equipment, people, and environment aims to condition the workshop as a safe workplace because practice activities undertaken by students, lecturers, staff and laboratory technicians in the Polytechnic machining workshop potentially cause accidents. Occupational accidents can be dangerous to humans, machinery/equipment, and the environment. Potential accidents may be caused by activities involving the machines as a practice facility, where machines are driven by electric motors both for the rotational motion and the translational motion. The main motion of the machine is equipped with cutting tools and used for making engine components in accordance with working drawings. Because it involves motions and the use of cutting tools, the work done by the students to make the workplace has the risk of accidents.

Many causes can trigger accidents during student practice is taking place. The cause may come from the machinery/equipment, human, and workplace involved in the student practice. One of the causes of workplace accidents can be the use of machines/tools as practice facilities. This is caused by the improper condition of the machines. The condition may also be caused by lack of attention to the maintenance of the machines/tools which are used for the student practice. The engineering practice facilities available at the Polytechnic machining workshop need care so that it is always ready for use. Moreover, these machines are used interchangeably to train different groups of students. Treatment is also done to minimize the damage, especially the production machine.

According to Ahmad et al. (2011), for production purpose, machines require preventive maintenance. Preventive maintenance should be done prior production machine breakage. This treatment requires strategies in order to achieve the intended goal.

The preventive maintenance strategies that are used affect the condition of the machines. If done regularly, this preventive treatment has the advantage of understanding the current condition of the machines. Do these machines require subsequent treatment or can it be used without it. Such preventive maintenance needs to be applied to maintain the machines functioning as student practice facilities in the Polytechnic machining workshop to control whether the machines can be used for practice or not. Therefore, we are able to minimize the risk of accidents caused by the condition of the machines which are unfit for use. Similarly, the environment in which the students practice can also be the cause of accidents. For example, the floor that is slippery due to oil spills, poor lighting, the heat due to lack of ventilation, the air in the machining workshop which causes less smooth airflow, and so forth. Therefore, the machining workshop manager should be able to anticipate accidents caused by such conditions.

The effort is also expected to condition the work practice into a workplace that does not endanger the students' safety. Polytechnic machining workshop requires a management model that can manage a practice into a safe workplace for students. In order to condition the practice to become a safe workshop, there are requirements that must be fulfilled. Such requirements can then be used as an indicator for the management of a machining workshop as a safe workplace. According to Yasin et al (2012) the secure laboratory engineering management requires four indicators, namely, the documentation management, safety management, environmental management, and equipment management. Furthermore, The Occupational Safety and Health Administration (2011) also recommend that in order to manage a safe laboratory requires a certain amount of control. There are at least three controls as the basis for a safe laboratory management, i.e. engineering controls, administrative controls, and personal protective equipment.

Engineering controls which are carried out by deleting, negating or reducing the use of chemicals, thereby, reduce the danger to the

presence of chemicals or also in the form of physical appearance using or replacing other materials that are safe for humans and machines/equipment for practices and environment. The administrative controls or the control of practice work implementation involves actions to always change and develop working procedures in order to protect the students, lecturers, staff and technicians in the laboratory doing practice work.

Personal protective equipment is all tools/equipment used for protecting oneself from anything that can endanger or threaten the health or safety of any person. The three bases which are used as a guideline for controlling the management of the safe laboratory of OSHA is then implemented as an indicator for planning the management model of the Polytechnic machining workshop which is characterized by occupational health and safety. The indicator was also used to analyze the shortcomings of the actual machining workshop management model used until this study took place. As an indicator to analyze the shortcomings of the actual management model, the indicators were used as variables of the study. The instruments for collecting data were in the form of questionnaires, observation guides, and interview guide which were developed using the three variables. The results of the research in the form of opinions from each respondent gave different answers. The variable controlling the technical engineering shows 20% of the expectation.

These results indicate that the indicators of technical engineering control are still poor. When analyzed, the poor rating was caused partly by the lack of regulations stipulating the use of materials that are harmful to humans and the environment such as the use of coolants and lubricants for the machining processes that may be used by students. This has caused the delivery of information about the use and treatment of the waste material to students not to be optimum. There are differences among lecturers in addressing the importance of conveying information to the students. As a result, there are differences among students in perceiving the use

of coolants and lubricants when operating machines so that there are still many students who would not treat the rest of such materials appropriately. For example, the disposal of cooling materials by students is not well controlled. It can cause a bad impact on humans and the environment. Adverse consequences of the use of materials that are harmful to human health and the environment should be a serious concern even if the material is used as a raw material for production purposes. Avoiding or replacing hazardous substances with more environmentally friendly ones is not an easy thing to do if the material is the raw material of a product. For example, the use of polyethylene by manufacturers for producing plastic products.

It is hard for a plastic company not to use the material although it can cause a negative impact on the health of its workers. According to Sharanjeet-Kaur et al. (2004), polyethylene can cause visual impairments or color blind to workers compared to those who do not engage in the industrial manufacture of plastic products. As for the administrative control variables were only 20% of the expectation. This result demonstrates the poor ratings of the respondents concerning the indicator. The result of the analysis shows that the main cause is that up to now all the rules that have been used to carry out the student practice has not been administered properly. There were not any written regulations that have been properly documented. It was just the regulations stipulating the students to practice in the Polytechnic machining workshop that has been written. The implementation of the regulations stipulating the students' practice work should have been well written and documented in an orderly manner. Regulations that have been stipulated to organize the students' practice activities were required for the implementation of student practice to take place orderly and safely.

The implementation of students' practice activities requires many regulations. The regulations need to be created and determined as a guideline in conducting the student practice. For example, the regulation on how to operate

machines for practice facility properly and safely, how to maintain the machine that has been used during the student practices so that the machine can be reused by the next students, and so on. It is important for such regulations to be written and implemented properly not only for documentation purposes, but more than that, if needed, the regulations can be improved, refined, and appropriated to the needs at the time. The availability of regulation on how to operate the machine safely is very important.

Because students who operate the machine are always different, every new student using these machines needs explanation. An explanation of how to operate the machine properly and safely by the lecturers can be effective if prior to the practice activities, the students are able to learn them in advance from the job sheets. Furthermore, for the personal protective equipment variable, there is only 20% of the expectation. Such opinion implies that the respondents still poorly use personal protective equipment for student practice. The result of the analysis shows that the management of the Polytechnic machining workshop still pays less attention to the availability of personal protective equipment for the student practice. It can be seen from the maintenance and storage of the personal protective equipment that has already existed.

The personal protective equipment is still lacking and the condition of some of them is not usable any longer. There should have been a plan to replace personal protective equipment which is damaged or improperly used. Therefore, when operating machinery lecturers, students, laboratory assistants, and technicians are not constrained by the conditions of personal protective equipment. Similarly, the personal protective equipment is stored without good control. Putting personal protective equipment in a storage area inappropriately may cause damage to the tools. This has caused some lecturers and students do not use the personal protective equipment when doing practice activities. It shows that the manager's attention to the obligation to use personal protective equipment for the students' practice activities is

still poor. The results obtained from the three management indicators for secure workshop shows that the management of the machining workshop as a practice is still unsafe for students. Up to now, managers are still setting up machining workshop merely to carry out students' class schedule.

As the place for the students' practice activities, machining workshop is managed in accordance with the needs of practice learning.

In machining practice learning, students' skills are objectives to be achieved. Based on the practice learning objectives, the manager of the machining workshop manages the practice facility for the implementation of the student practice. From the description, it can be seen that the management model of the factual Polytechnic machining workshop is shown in Figure 1.

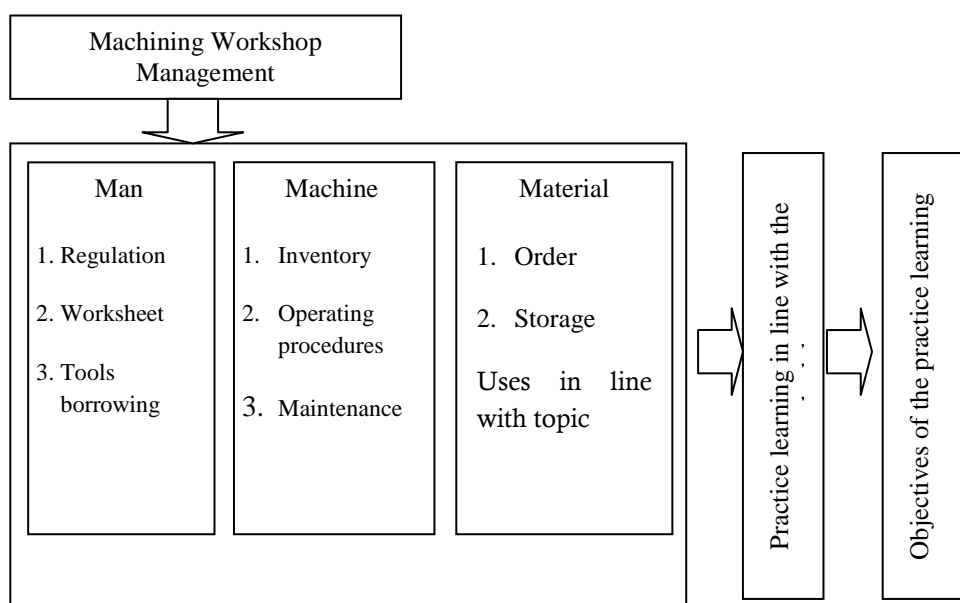


Figure 1. The factual machining workshop management

The actual machining workshop management model set human, machine, and material for the purposes of the students' practice activities. Workshop rules are made to organize those involved in students' practice activities. With the existence of the regulation in carrying out their activities they are regulated and the regulations bind anyone involved in it. Worksheets are prepared by lecturers for practice and used to guide learning practices. The tasks of the laboratory assistant and technician were preparing and serving the students' needs for practice in the machining workshop, including borrowing the cutting tools and other equipment supporting the practices. The engine management includes an inventory of each practice facility machines that were grouped according to type, such as the lathe, milling, grinding, and so on. Instructions on how to

operate each machine were delivered by the lecturers. If the practice facility machines were damaged, repair and maintenance were performed by the maintenance and repair task unit.

Material management arranged the ordering of raw materials for practice, the storage of raw material for practices, and the use of raw materials for practice in accordance with topics being taught. This factual management model was not prepared in depth in accordance with the rules on the implementation of occupational health and safety. Implementation of occupational health and safety regulations was still limited to the instructions for the use of personal protective equipment when operating the machine. Meanwhile, the many of the regulations supporting the implementation of the engineering and administrative controls have not

been made. The regulations stipulated the ways in which the implementation of students' practice activities do not involve material and do not create hazardous working conditions for humans, machines/tools, and the environment. Similarly, the regulations that support the implementation of the practice would have been recorded and documented correctly.

The deficiencies in the factual workshop management were overcome by improving the quality of the workshop to make it a safe workplace for the students. This development requires a management that is committed to creating safe working conditions in which the management should integratively support the

realization of a student workplace that is orderly and safe. The planning for machining workshop management development of characterized occupational health and safety requires policies related to workers' safety at work. In order for the machining workshop management to have occupational health and safety character, there are parts of the management systems which are important to note.

According to the Health and Safety Authority (2006), in the Workplace Safety and Health Management, there is an important part to note in the management system of work health and safety. Parts of the management system are shown in Figure 2.

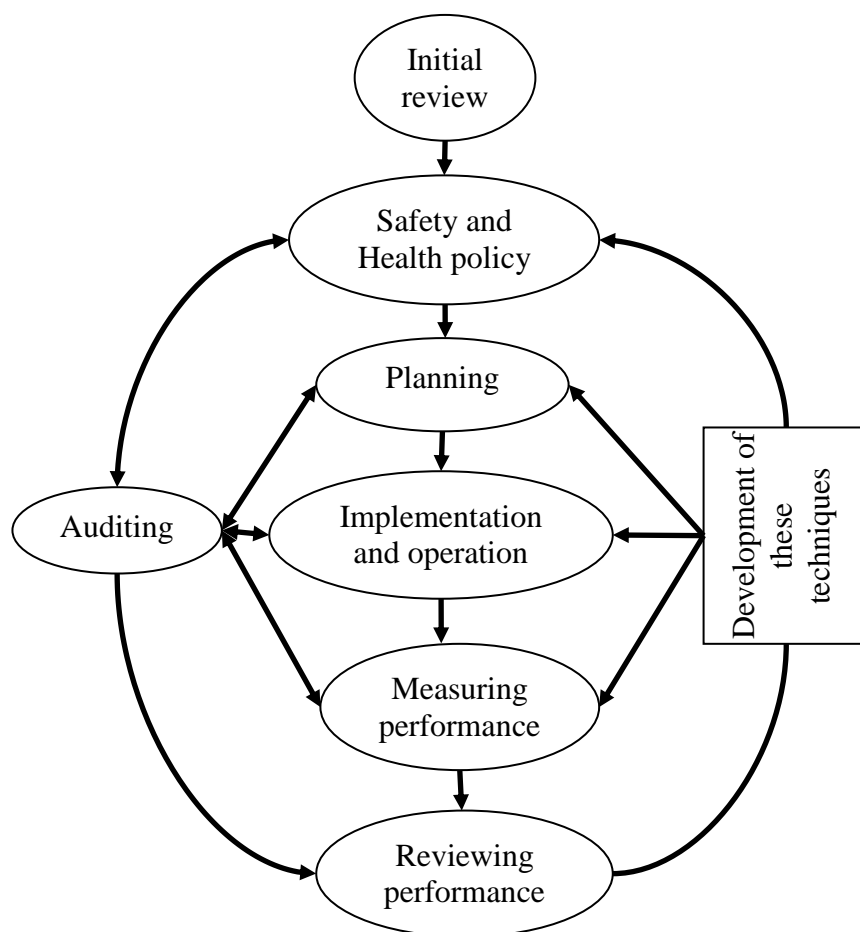


Figure 2. The important parts of the occupational health and safety management system (Source: *Workplace Safety and Health management*, 2006:10).

Part of the management system is determining the policy that is committed to the implementation of work health and safety consisting of planning, setting the

implementation and execution, measuring the level of achievement, and reviewing the achievements that have been reached. These activities must always be audited so that it is

easy to control. Development is always open for improvement in each section. The work health and safety management systems should be an important part of the machining workshop Polytechnic management because if the implementation is done consistently it can encourage the creation of a safe working environment. In such a setting, the students will become accustomed to it and then there will be self-development forming the working culture.

According to the ministry of national education of Indonesia (2010), in developing Cultural Values and National Character Education there is a relationship between subjects, self-development, and school culture. These relationships will form the values possessed by each student as a result of learning. The value will result in characters which then attach to the each of the students. The relationships are shown in Figure 3.

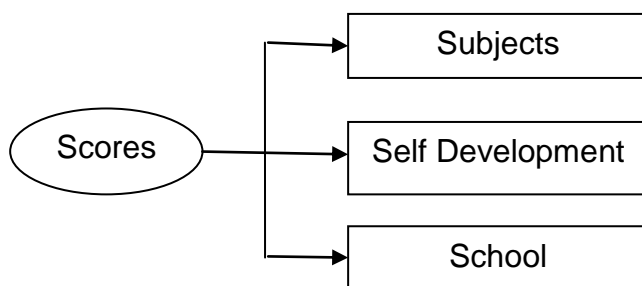


Figure 3. The development of cultural education and national character values (Source: Kementerian Pendidikan Nasional, 2010: 12)

Based on these opinions, the Polytechnic machining workshop management model for the management of a safe student workplace was made. Figure 4 shows a hypothetical model of the Polytechnic machining workshop management with health and safety character. The management model in the plan is based on the needs of the Polytechnic graduates who have the skills and safe work habits. The solution of this problem is the management of machining workshop that was implemented to manage the student practice safe place. The management was based on the needs analysis and educational goals.

Through effective coordination between the head of the workshop, practice lecturers, laboratory personnel, maintenance technicians and store technicians as executive management with health and safety character in order to

assign tasks, authority, and responsibility of each student in practice activities. If each has carried out his/her function, the cultural values of work involving humans, machines, and raw materials are formed to promote the goals of student practice. The achievement of the practice depends on the quality of learning practice, which is supported by the successful performance of the lecturers, laboratory personnel, maintenance and warehouse technicians, as well as skills and character assessment of the students' health and safety. The results of the practice learning assessment characterized by health and safety become the feedback to further improve the management of health and safety character.

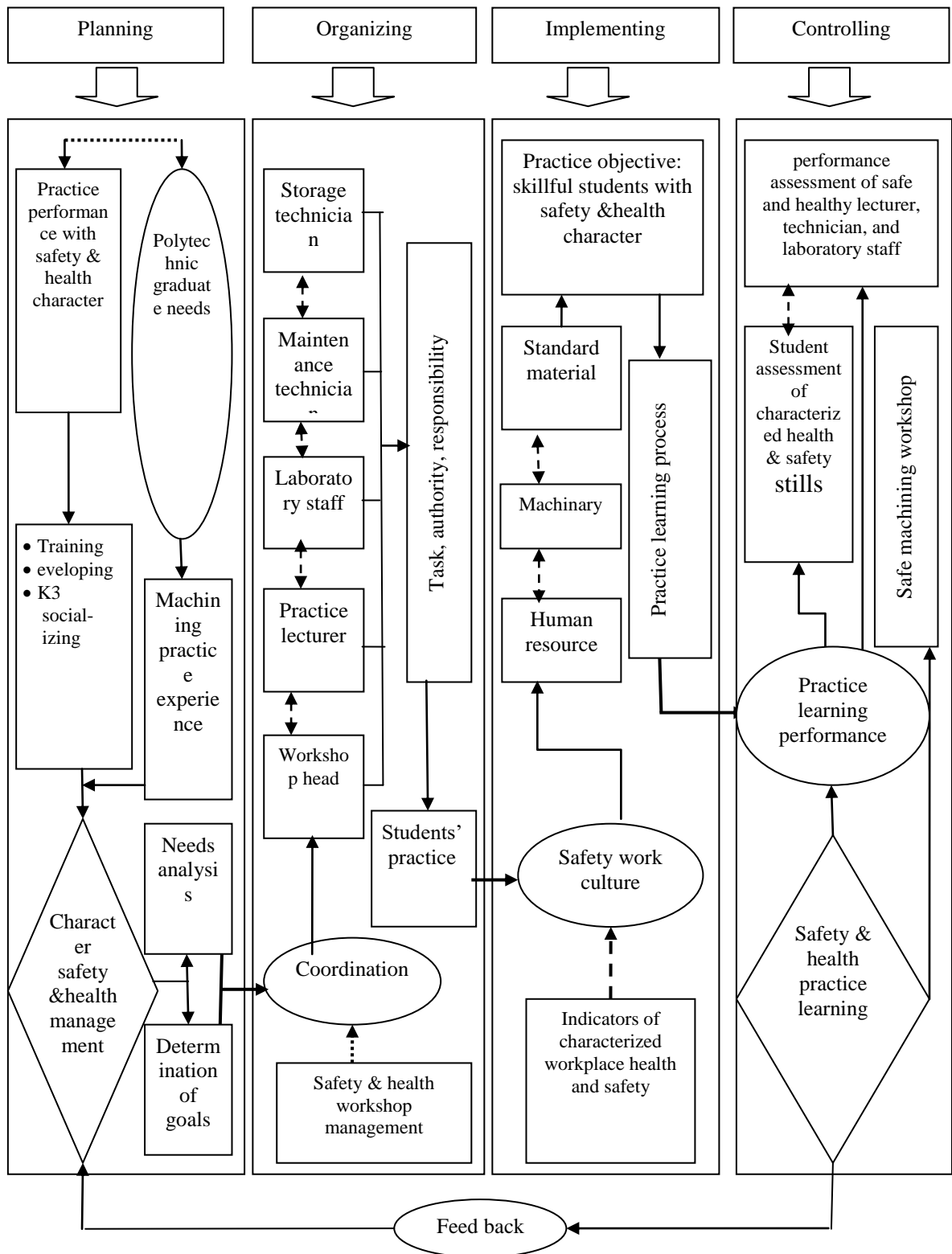


Figure 4. The hypothetical model of machining workshop management characterized by occupational health and safety.

CONCLUSIONS

The factual Polytechnic machining workshop management still manages workshop facilities merely as a venue for student practice. The machining workshop practice facilities at the Polytechnic were not optimally managed to be a safe workplace. The results of the analysis show that the management of the machining workshop has not been prepared for the implementation of health and safety regulations thoroughly. The hypothetical model of Polytechnic machining workshop management characterized by health and safety is the development of models to make the factual place of practice as a safe working place for students. The implementation of this hypothetical model requires the support of leadership as well as the active participation of all involved in the activities of student practice. Enforcement of discipline and observance to health and safety regulations need to be followed by the application of the awards for achievers and penalties for noncompliance. Therefore, safe workplace conditions will be achieved and are expected to form the character of students to work in accordance with the health and safety regulations.

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