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Educational transformation to PBL- what has changed

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Abstract

Since 1960th, PBL(problem based learning) has gradually become one appealing education model in a series of fields like medical education and engineering education. Currently, PBL is being initiated and implemented in various higher education institutions worldwide. The necessity of ensuring a successful and sustainable change to PBL calls for a deep understanding and appreciation of different elements of the change and the relationships between them.

The aim of this article is to develop a conceptual framework for the change to PBL by combining current change models, with a special focus on the elements of change. As a theoretical departure, this study begins with presenting the essential principles of PBL which primarily attempts to reconstruct the relationships between discipline and problems to be solved, students and teachers, different individuals, and different disciplines. Four underlying principles can be generalized correspondingly as: problem based learning, student directed learning, social approach, as well as interdisciplinary learning

In this paper, the establishment of the theoretical framework for change is primarily inspired by two distinct change models. The first one is the didactic model, mainly dealing with the relationship between different elements of the curriculum in change from a curriculum aspect, whereas the second one focuses on different levels of change. By integrating two models we formulate a framework of change to PBL, focusing on organizational level. Theoretically, a successful change should include four interrelated aspects: curriculum, organizational structure and regulation, infrastructure and resources, and culture.

The case of Victoria University, Melbourne, Australia , which is in the transition process from traditional *lecture based learning* to *problem based learning,* is discussed in this paper to illustrate the theoretical framework.

Keywords: PBL, problem based learning, change, theoretical framework, principle

1. INTRODUCTION

As an innovative way of teaching and learning, PBL (problem based learning), has a history of more than forty years. Currently, it has been implemented as an promising instruction model in numerous education institutions. Additionally, many more universities and colleges are in the process of changing to PBL. To facilitate the change in an institution, a lot of issues should be taken into consideration such as the reasons for change, the change strategy, as well as the aspects and process of change.

The aim of this paper is to formulate a theoretical framework to address the elements of change in the organization which is implementing PBL, with a particular focus on the organizational level. In other

words, "what has changed while one institution carries out PBL model" is the main question of this study. For the purpose, this paper first generalizes the primary principles of PBL. Then, a theoretical framework is formulated by reviewing two models of organizational change to PBL. Finally, the Victoria University case is examined here to illustrate our framework.

2. PRINCIPLES OF PBL

During the last four decades, PBL evolves from the early stages with relatively simple and clear meaning into a terminology with enormous complexity. At the practice level, the form of PBL is intensively contextual dependent, varying according to the concrete individual, curriculum, disciplinary, organizational or national context, and therefore various kinds of PBL forms or models are developed worldwide, such as different PBL curricula [1](p.35-45). With the increasing complexity of PBL in practice, the definition and the understanding of PBL characteristic also become diversified. The complexity of PBL in practice and theoretical level generates a great many perspectives and understandings about the definition and features of PBL. One of early attempt generalizes five essential principles of PBL as problem orientation, project organization, interdisciplinary considerations, participant control and exemplary practice(Berthelsen et al.,1977, quoted from [2]). Walton and Matthews (1989) state that PBL can be understood from three aspects: the essential characteristics such as curricula organized around problems rather than disciplines, an integrated curriculum and an emphasis on cognitive skills; the condition facilitating PBL such as small groups, tutorial instruction; the outcome such as such as the development of skills and motivation, as well as the ability to be lifelong learners(quoted from [2] (p.6)). Graaff and Kolmos argue that there are three levels of understanding PBL features: from the *theoretical level*, PBL encompasses a set of distinguished principles: problem setting as the learning departure; participants direct learning process; experience learning; activity based; inter-disciplinary; exemplary practice; group based learning; PBL also is a myriad of *educational models* sharing same principles while differing in concrete methods; at the *practice level*, PBL refers to different practices within the guidelines of traditional educational models [3]. Further, Kolmos, de Graaff and Du propose a model of PBL as three approaches: 1*Cognitive approach:* learning organized around problems, carried out as projects, placed in context as well as based on experience; 2*Collaborative learning:* learning happens in the form of team or group; learning should be participant directed; 3*Content:* Interdisciplinary learning, exemplary to overall objectives and support theory-practice relation [4][5].

It can be noticed that it is almost impossible to reach one generally accepted single definition of PBL due to the complexity of its meaning. However, we may discover that the majority attempts to define and understand PBL mainly deal with four types of relationships, which are specified as:

- Subject-problem;
- Teacher-student;
- Individual-social;
- Single discipline-inter discipline.

Therefore, we generalized four correspondent principles of PBL: problem centered, student directed learning, social approach as well as interdisciplinary learning.

2.1. Principle 1: problem centered

This is the most underlying principle of PBL which can be understood from two aspects: 1From the learning perspective, this principle means that PBL lies in the center of learning process. Problem serves as the starting point of learning process, and it directs and guides the learning process, which stresses the formulation of the problem rather than the answer. In this sense, problem offers students authentic context and experience to scaffolding learning, and assists students to relate the knowledge they learn in class to practical life. 2 PBL also implies a new way of designing and developing the curriculum. The curricula are not just constructed based on isolated disciplines and subjects, but

designed and integrated by and through problem and project. Therefore, a great many project courses or project related courses are developed in program in various higher education institutions.

2.2. Principle 2:student directed learning

The second important one is the leading role of students in the learning process. It lies its theoretical root in constructivism which highlights the significance of building meaning and understanding of the knowledge and the world by the students. In PBL scenario, students have the ownership of learning, direct the learning activities and process and thus they have the full responsibility for their learning, which is in contrast to the conventional learning whereby students are passive learners guided by teachers. In practice, this principle infers that students direct the formulation of problem, the participation in learning, as well as the approaches adopted in learning. Stressing the role of students in learning also enhances their learning motivation and hence results in better learning outcome. Some researches even extend students' directing role to learning assessment (Boud, 1985,quoted from [1]). This principle also calls for the change of role of teachers from instructors to facilitators.

2.3. Principle 3: social approach

The third one is a social approach of learning. The construction of meaning and understanding of the knowledge is not just an individual issue, but it is also a social process. Within the context of PBL, learning often takes the form of group work or teamwork whereby students collaborate with other members in the same group. In real work situation after graduation, people have to work together and cooperate with other individuals and thus the interpersonal communication skills are indispensable for them. One significant benefit from group work is that students are able to develop their communication and interpersonal skills by learning to manage the group process, present, argue, negotiate, cooperate, respect with each other. Compared with traditional way of individual learning, PBL requires a shift from conventionally individual work to interpersonal collaboration and cooperation.

2.4. Principle 4: interdisciplinary learning

The design of curriculum is often based on single discipline. In real situation, the problem is so complex that cannot be successfully dealt with by methods within one single subject or discipline. Therefore, the theoretical and methodological cooperation and collaboration of different disciplines are necessary. PBL encourages the interdisciplinary study involving content and method from various disciplines and subjects. This principle calls for the restructuring of traditional discipline based learning objectives, of the relationship between different disciplines and teachers from different subjects, and of the students who should change their conventional learning style.

The principles of PBL imply in some way what aspects of an educational institution should change when it starts to implement PBL model. For instance, since PBL places the problem in the center of curriculum design, it therefore calls for a new way of develop the curriculum or even the program. The student-directed learning process needs a culture change for both teachers and students. When students work in groups or teams, the design of physical space is an unavoidable issue. Though PBL characteristics offer some clues for organizational change, more powerful tools are in need to help us to understand organizational change comprehensively.

3. MODELS OF CHANGE TO PBL

PBL differs in many ways from traditional lecture based ways of teaching and learning. For an higher education institution which wishes to implement PBL as its education model, it should have some idea about what the organization consists, what aspects of the organization need to be changed, how to carry out the change process, and so forth. Without considering these relevant issues, the institution will probably change not in the same way as it expects. So far, a great number organizational models [6][7][8][9][10][11][12] have already been developed as a means to analyze the structure, the power struggle, the culture issue in the organization, the driving forces for the organization to change, change strategy as well as the phases. These models also are helpful to understand an educational institution which is in the process of change to PBL. First and foremost, when entering into the change, the educational institution should know what aspects of the organization need to change. For this purpose, we focuses in this paper on the elements in the change process and the relationships between them.

3.1. Didactic model for curriculum change

One of the useful models of curriculum change to PBL is the didactic model, which is developed within Scandinavia context, dealing with the relationship between the essential elements of the curriculum (see Figure1) [13]. The curriculum in this perspective is a complex system. Three major arguments are:

1.   The model features two layers: curriculum and organizational layer;
2.   curriculum itself systematically includes six integrated elements: goals, assessment, teachers, teaching and learning methods, students, contents;
3.   organizational layer encompasses culture, value as well as physical space and resource.

The principle of alignment stands in the center of this model which infers that any curriculum change necessarily involves the change of overall curriculum elements and organizational layer. It can serve as a guidance for curriculum change when one institution plans to implement a curriculum reform. In addition, it also helps to explain the failure of some curriculum change which only transforms one element of the curriculum system while other elements remain static. However, it does not to offer a clear clarification of what the "organization layer" is.
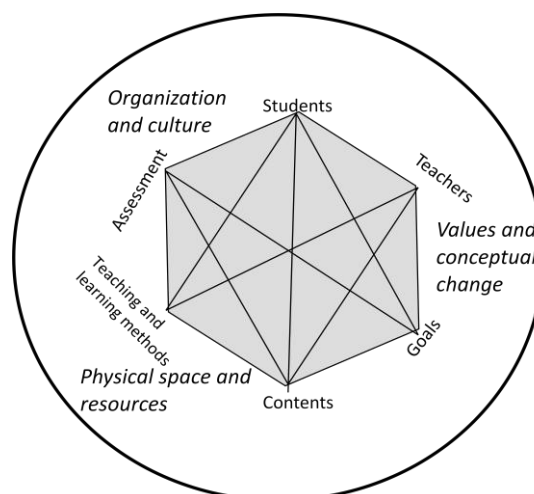

Figure1. didactic model for curriculum change

3.2. Levels of organizational change

Another inspiring model especially concerns the vertical aspect of the change in the organization, as Moesby [14] argues, change occurs at different levels: individual level, group/system level as well as the institutional level. (see Figure2)

The individual level refers to the isolated, personal behavior of implementing PBL, sometimes even without any conceptual or cultural awareness of PBL, both individually and institutionally. It has little impact on the organization. The assessment and evaluation methods are not changed either.

The group level is the transition process where the organization considers and starts to organize PBL-related activities in a systematic way.

The highest level is the institutional level which leads to the change of the entire organization. Within the context of institutional change to PBL [14] (p.271),

- Students take an active and collaborative role at the management level;
- Learning is contextual and experience-based;
- Projects are cross-disciplinary;
- Students are a direct part of the institutional planning and conduct;
- There is a change in the organizational culture;
- There is a change in the organization;
- There is a change in the examination format towards an assessment;
- Changes occur in evaluation methods and objectives.

Compared with the individual change and the system/group change, the institutional change involves the entire system of the organization. Particularly, it highlights the participation of students in decision-making process of the institution, the evaluation of teacher performance, as well as the organization and the resource. They are always missing or neglected in the curriculum model, but of great importance for continuous change for the organization.
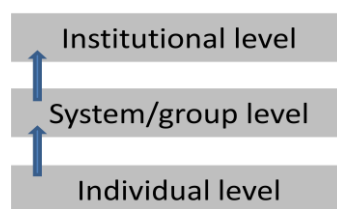

Figure2: Different levels of change in organization

Different levels of change do not preclude each other. Specifically, the change at the lower level is always indispensable for enacting and sustaining the change at the high level [15]. For instance, without the change of teachers' personal perception of teaching and learning, the institutional change is likely to transform into new format with old teaching style [16].

Though this model can assist us to identify if an institutional-level change occurs in an educational institution, we still need a more "systematic" tool to analyze the elements changing in the organization.

3.3. Model for organizational change to PBL

The didactic mode highlights the importance of alignment of different elements of curriculum in curriculum change, and the second model can help us to distinguish on which level an organization makes a change. However, the didactic model relatively misses the non-curriculum organizational elements. The second model, though enlightening in specifying the features of change at the institutional level, fails to clarify the relationship between the changing elements. By the inspiration from the above models and focusing on the organizational level, we propose an organizational model systematically involving four aspects (see Figure 3):
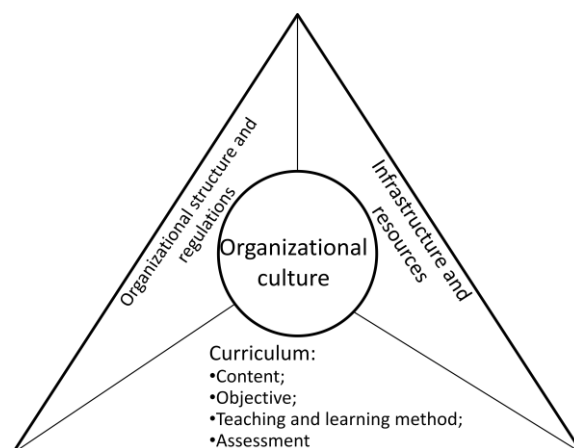
Figure3: model for organizational change to PBL

- **Curriculum**

For an educational institution, the curriculum part is always an essential issue when it plans any change since in most cases, one indispensable part of the organizational objective is to better cultivate students, and enhance teaching and learning quality and outcome. The curriculum change at the organizational level always involves the program structure, or the curriculum system, which is in sharp contrast to the change of a single course, or several isolated individual performance. It calls for the restructuring and redesign of curriculum objectives, contents, teaching and learning methods, as well as assessment of students' learning outcome. It should be aware that the principle of alignment from the didactic model can also be applied to curriculum change.

- **Organizational structure and regulation**

The structure and regulation of the organization guides how organization behaves and functions. Thus, the change of organization often requires transforming the organizational structure and regulation. The implementation of PBL often needs the support from the top management level, participation of students and teachers into decision making process, the reconstructing of relationship of faculty members from different departments and disciplines, as well as the system design (i.e.: awarding regulation) to motivate faculty members.

- **Infrastructure and resources**

The organizational change also involves the change of infrastructure and distribution of resource (financial and human) which are the basic supporting element of organizational functioning. For PBL which needs far more participation and involvement in learning and teaching from students and teachers, and favors work in the form of group or team, the adjustment and support of infrastructure and resources are indispensable.

- **Organizational culture**

Culture in higher education institution refers to "the collective, mutually shaping patterns of norms, values, practices, beliefs and assumptions that guide the behavior of individual and groups in an institute of higher education and provide a frame of reference within which to interpret the meaning of events and actions on and off campus" [17]. Moreover, organizational culture stratified into different levels and can be classified into different categories [1]. Here, we do not explore into depth of identifying the meaning of PBL. In the education institution, teachers sometimes get accustomed to and favor the traditional discipline culture and the teaching style, hence not easily accepting the rationale of PBL. In other instances, the organization may change the content of the curriculum, and meanwhile remains its old framework of assessment. For an institution implementing PBL model, it needs to take measures to justify the value of PBL, trigger discussions about PBL among teachers and students, address the skepticism and opposition from organizational members, alter its ways of thinking to develop the curricula system, and thus create supportive culture for PBL.

This research framework has following characteristics: 1Culture change centers in the organization. Without the change of organizational culture, the change will be superficial and cannot sustain since the value, attitude and behavior of the organizational member do not change; 2The principle of

alignment also applies to this framework. In order to implement organizational change, all aspects of the organization should be involved. 3 It could also help to explain the standstill and failure of organizational change in some education institutions. For instance, if the organization only changes its structure without creating supportive cultural atmosphere, the change itself would not last long.

4. CASE: VICTORIA UNIVERSITY

We have so far formulate the theoretical framework to analyze the educational institution which is in the process of change. In this part, the case of Victoria University will be used to illustrate our framework.

In the year of 2005, Victoria University in Melbourne, Australia made the decision to deliver its engineering programs through PBL model so as to cultivate its students with more generic skills and soft skills and promote the employability of its graduates.

Take the first year program of SEE PBL model as an example (see Figure 4). The entire program can be divided into two integrated parts: the 12-credit unit of "Enabling Science" and "Electrical Fundamentals" and 24-credit "PBL and Engineering Practice". The former part of the curriculum aims to deliver fundamental science and engineering knowledge for problem solving to student, and is always conducted in traditional lecture based way. The second part allows students to work in groups, draw the knowledge from the lecture to solve the problem, and connect the knowledge they learn in the lecture to real problem and practical situation. Besides the curriculum design, SEE also developed a 9-step procedure for learning process which highlights the active engagement of students in learning and their responsibility.

The assessment method of PBL courses is a major issue in the change. PBL calls for an alignment between its objectives and its assessment method. Therefore, in the year of 2006, SEE utilized the Structure of Observed Learning Outcome taxonomy to examine if students achieved the expected learning outcome in the taxonomy. In practice, it is a combination of formative assessment and summative assessment. Student are required to submit portfolio as a summative report, accompanying some formative components as appendix such as team reports, individual journals, which aims to assess the learning process. However, this assessment method is quantitative oriented and has some weakness in identify individual contribution in a group. Therefore, in 2007, SEE altered its assessment method to facilitate supervisors to judge individual achievement.
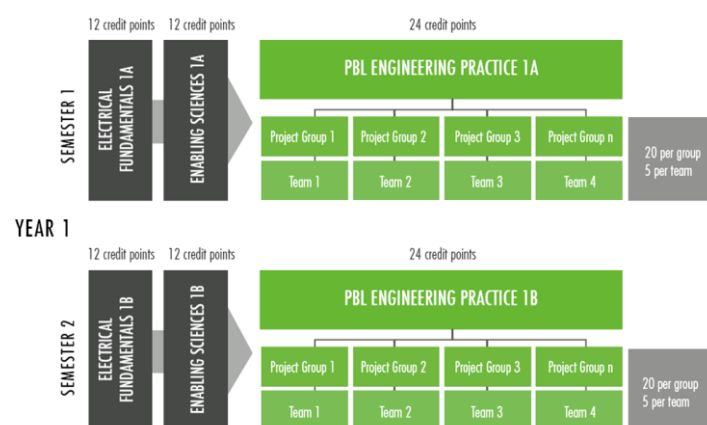

Figure4: first year program model[18]

As a new way of organizing teaching and learning, the School of Electrical Engineering also makes rearrangement of its infrastructure to better advance the implementation of PBL. PBL favors the environment of teamwork and group work; therefore, the space rearrangement of large lecture rooms and experimental laboratories is made to create PBL environment by adding whiteboard and PC

access and dividing seat positions into several groups. In addition, new PBL studios and group rooms are also constructed to fulfill PBL needs.

Still, the process of implementing PBL in Victoria University has some challenges: the willingness of teachers to practice PBL, the curriculum debate, administrative burden on staff, as well as the postponement of PBL studios construction [18].The institution needs to continue changing its culture, structure and regulation, as well as its infrastructure to create an increasing supportive environment for PBL implementation.

5. CONCLUSION

Problem based learning, as a promising education model, has been spreading to numerous educational institutions worldwide as a way to promote teaching and learning outcome and thus enhance students' competency. If a institution decides to implement PBL at the organizational level, it needs to change systematically several aspects in the organization: the curriculum part, the organizational structure and the regulation, the infrastructure and the resources, as well as the organizational culture. The Victoria University case could serve as a good example to illustrate this argument. Due to the limitation of space and the lack of relevant material, this paper does not discuss too much about structure, regulation, and culture in Victoria case. However, the alignment of its curriculum, organization structure and regulation, infrastructure and resources, as well as the culture in the change process can also be recognized.

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