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Sizhi: Self-Dialogue Training through Reflective Case-Writing for Medical Service Education

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Abstract: In this research, by developing the learning support system for medical services, we will establish an approach that supports the medical profession novices to improve the proficiency of view of patient-centered medical services. In this paper, as a first step of the project, we organized a learning model which promotes reflective learning the case-method for medical service education. As an implementation of the learning model, a learning environment that support learners to reflect on their thinking process in their experiences by a learning strategy which consists of three case-writing phases: the description phase, the cognitive conflict phase, the knowledge building phase.

Keywords: Case-Method, Ontology, Medical Service Education

Introduction

There are always many difficult problems continually appearing in various viewpoints in medical practice. Actually, the medical staffs always feel a vague anxiety that their dedicated efforts could not catch up with the increasing amount of the problems. Moreover, to provide the high quality medical services that can respond to the various and high-degree increasing patients' demand is becoming an important and urgent issue in medical service practice. The subjects in medical service education in a broad sense include both the medical knowledge/skills for the medical diagnosis or the treatment and one for the interpersonal skill to facilitate the prompt and smooth implementation of medical services. In this research, we focus on the latter as the matter of medical service sciences in a narrow sense, while we address the former as the matter of "medical education" and will not be deeply involved in it.

We believe that the service science approaches can make a contribution to establishing a methodology to improve the quality of Medical Services in a narrow sense. The one of the pioneers in the field of Service Science, Yoshikawa has proposed that the model for service improvement is that the knowledge circulation of intellectual collaboration by the persons concerned in the service promotes to create and refine the service knowledge. Moreover, he implies that the knowledge circulation will cause the ideal of society innovation [1]. In the medical viewpoint, we think it is necessary to refine the education approaches for supporting the medical knowledge circulation by improving the medical practitioners' thinking ability to collaboratively create and refine the medical service knowledge.

In this research, by developing the learning support system for medical services, we will establish an approach that supports the medical profession novices to improve the proficiency of view of patient-centered medical services. The current goal of this research is to make a rational learning model for medical service education and try to establish a methodology to conduct the design loop for the medical service educational program development but not to make strong contributions to technological medical service education.

1. The Difficulties in Medical Service Education

In the recent medical practice, the traditional apprenticeship-style on-the-job training system, so-called, "seniors train novices strictly on the job" is vanishing gradually because of the mental resistance for novices to accept the evidence-lacked, experience-based guidance of implicit medical service knowledge from seniors. Moreover, the newcomers who have poor insight and sensitivity to people are increasing and there appears the increasing pronounced tendency for the medical staff to unable to learn the medical service knowledge or skills to understand patients' mind through the communication with other medical staff.

For example, when a novice nurse takes charge of pediatrics, he may puzzled by the complexity of emotional engagement among the child patients who are weaker than himself, their parents who are exceptionally anxious about their children's health and the doctors who conducts a medical treatment. In order to have an acute insight into the complex structure of emotional engagement, it is necessary to have a rich sensitivity for understanding the others' mind, a rational attitude of the acceptance of and respect to the immature hearts of the pediatric patients. That is a typical tacit knowledge which is not easy to acquire for novice medical staff.

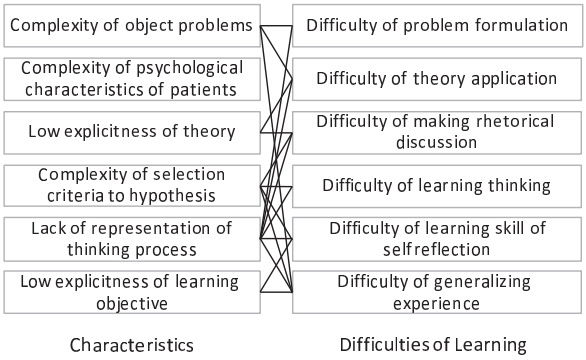

Figure 1. The characteristics of medical service and difficulties of learning the knowledge required for it

For the purpose of developing medical human resources with higher cognitive ability as shown in Figure 1, a variety of educational methods to foster the tacit knowledge or tacit skill by coaching the thinking process has been offered to the medical staff. For example, in the field of nursing education, the teaching approaches such as clinical conferences, reflective journals, narrative methods, case-method, etc. are conducted on a routine basis at many hospitals. However, in such a practical learning environment, it is said that the major difference between the learners who can learn what should be learned and the learners who cannot learn very well comes from differences of learners' sensibility or insight to others' mind. Moreover, even though learners has been successfully learned tacit knowledge in the practical learning environment, most of them face with more serious difficulties to assimilate the knowledge to their own existing knowledge and organize it as general

knowledge to be applicable to the future similar situations. The difficulties caused by lack of the experience of making "thinking about others' mind" as a subject to meta-level logical thinking, while most people guess others' mind only by intuition. Therefore, to foster the ability of meta-level logical thinking seems to be an accompanied by an essential difficulty caused by the essential nature of human. In addition, the complexity of the matters of mind, the low explicitness of theory, the complexity of selection criteria to hypothesis, a lack of representation of thinking process, etc. make it difficult for novices to learn the knowledge required for medical services(Figure 2).

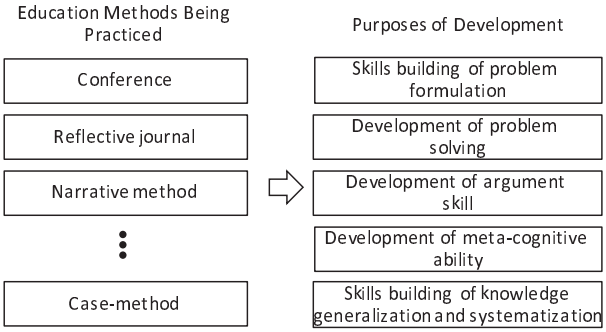

Figure 2. Fostering tacit knowledge/skills by coaching thinking process

In this research, we focus on the case-method as an approach to Medical Service Education. One of the educational principles behind the case-method in business management education is "if you want to teach how to deal with a new problem that you have not yet experienced, we should teach them how to think. In fact, the ability of thinking about thinking and the ability of dealing with new problems can be regarded as the different issues in principle but they are completely the same issue in practice." [2]

2. The Overview of Case-Method

In the case-method, in order to acquire "skills to deal with new problem that have not been experienced yet", the learners are assigned the task to think how to deal with the "real" problems that have occurred in their own practices and write their thought and behavior to cope with the problems as "cases". And then, they join the group discussion on the case with other learners to investigate the validity of their own thinking process from various viewpoints and co-create new solution to the "real" problem. Through these learning experiences, they could learn the learning ability to deal with the highly-non-deterministic and highly-complex practical problems [2].

The actual flows of the case-method in business management education are as follows: (1) the instructor distributes the prepared case materials to the learners in advance. (2) The learners organize the contents of the case to analyze and identify the core issues. The analysis should be made based on the facts in the case, the assertion inferred from the facts the insight into the thinking processes of the agents in the case and the learners' own knowledge. (3) According to the analysis, they think out their own solutions to the problem. After that, (4) the learners join the discussion on the validity of each learner's solution where the instructor will not join the discussion actively but just rise the topic to be discussed and lead the flow of the discussion [3].

When designing the learning materials for the case-method, it is necessary to (1) write down the events that actually occurred, (2) to consider how the learners think about the case and how they will discuss about it. Therefore, it is essentially how required for a case-writer to be able to estimate how learners think or how their discussion goes on from the deep understanding of written issues on the case [4].

2.1 The Learning in Case-Method

In the survey paper on the argument study, Maruno and Tomita [5] claims that most researchers focus on the argumentative skills to examine the rationality or validity of information or knowledge used in the discussion. On the other hand, the skills to produce or externalize the ideas in the discussion have not been studied in the research field. However, based on the empirical and the theoretical research so far, the former skills cannot be acquired without the latter ability. It implies that by participating in activities in which the latter skill in required repeatedly, the former skills can be acquired."
Moreover, they support the Kuhn(1991)'s model of internal thinking process as a dynamic internal dialogue base on the Billig's idea that "people engaged in problem solving or decisions making, try to make the best judgment of selecting one from the some possible options by justifying each of them from many different viewpoints and comparing the justifications to the options" [6] [7]. The reason why they strongly rely on Kuhn's model is that the model shows clear socio-cultural explanation on how the argument guides the thinking process, which is, it regards the thinking developing process as a more dynamic and clarify the tight relationship between individual internal process of thinking and social process of thinking such as exchanging the position with others and the individual process.
Standing on this viewpoint, the case-method can be used as a concrete educational approach for learning the internal dialogue. However, on the other hand, it is difficult to learn the dynamic internal dialogue associated with social interaction for the reason (shown in Figure 1) the particularly higher cognitive ability is required. In our research project, in parallel, we have been developing an educational program that can reduce the learner's load in learning the association between internal dialogue [8] and social interaction [9].

2.2 The Learning by Designing Case Learning Materials

Ito proposed, by analyzing of the effect of the verbalization as a learning strategy, a model of the learning goals achievement by verbalization as an integrated model of three learning mechanisms, that is, the tutoring that focuses on the learning effect of the teaching activities, the self-explanatory of learning activities, and collaborative learning among learners [10].
We believe that the learners can be active entities who can find a meaningful entity for the goal of knowledge acquisition by themselves, and they can achieve the goal by externalizing their self-explanatory of their thinking process to other learners. The externalization processes consist of the two phases of the knowledge description phase and knowledge building phase and the cognitive conflict can be bridging activities of the two phases as shown in Figure 3. We will discuss the three phases in detail below.
The description phase is an iteration of the internal learning activities to achieve the goal of verbalization by externalizing one's thought in his own experiences. The cognitive conflict is a trigger cognitive process for learners to go into knowledge building phase by facing the conflict states (realization of cognitive gap among learners' mental models, cognitive differences with other learners, or errors in their knowledge) through the verbalization of their thought and the interaction with others. And then, in the knowledge building phase the learners aim at achieving the goal of resolving those conflict states. The goal of verbalization in the knowledge building phase is to resolve the conflicts and is essentially different from the goal of verbalization in the knowledge description phase. This goal achievement model can be regarded as a learning model that includes the model of thought for dynamic internal dialogue mentioned above.
As it mentioned at the beginning of this chapter, the design of the case materials requires: (1) writing case, (2) the content what should be thought and the set of branch points to discussion. In this research, we aim at developing learners' meta-cognitive skills by

imposing the design tasks of case-method learning materials on the learners and promoting the cognitive interaction with others.
In particular, as an educational program for the medical professions (the nurses in this paper), we developed a learning environment for realizing a model of the learning goals achievement by verbalization. Using the environment, the nurses write down (the description) their own thinking process in his experience as cases, guess others' different thoughts, find a cognitive conflict among the thoughts and try to resolve the conflicts by building new knowledge [11] [12].

3. The Environment Supporting Learning in Design Learning Materials

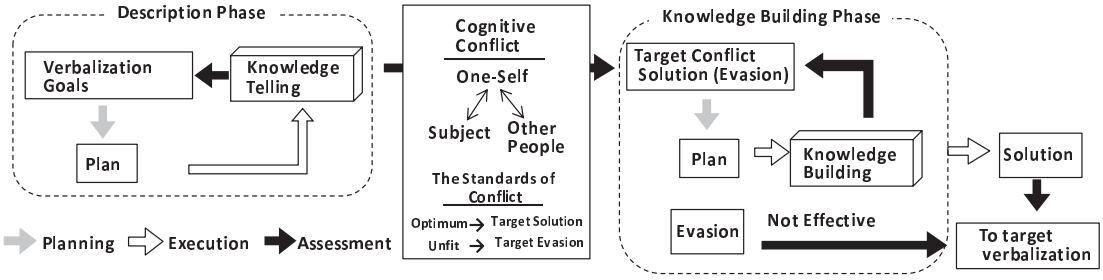

Figure 3. A goal-attainment model of verbalization as a learning strategy

In Figure 3, in the learning strategy, learners engage with verbalization activities in the description phase and the knowledge building phase and the activities are externally observable at behavioral level. Meanwhile, the activities of making goal, plan, cognitive conflict, resolving conflicts etc., are not externally observable internal cognitive activities. Since those activities are relatively abstract and ambiguous, it is difficult for the learners to achieve the learning goals. The difficulties of learning shown as Figure 1 can also be considered as the reason to this ambiguity and abstraction. Our idea of a leaning model to reduce the cognitive load for the learners to achieve the learning goal is to provide a easy-to-use environment to support learners to reflect his thinking process in his medical services practices. The ontology for patient psychology, medical services, thinking activities and learning activities are incorporated in the environment. And a user-friendly interface for writing case learning materials is provided [13].

4. The Thinking Representation in Case Design

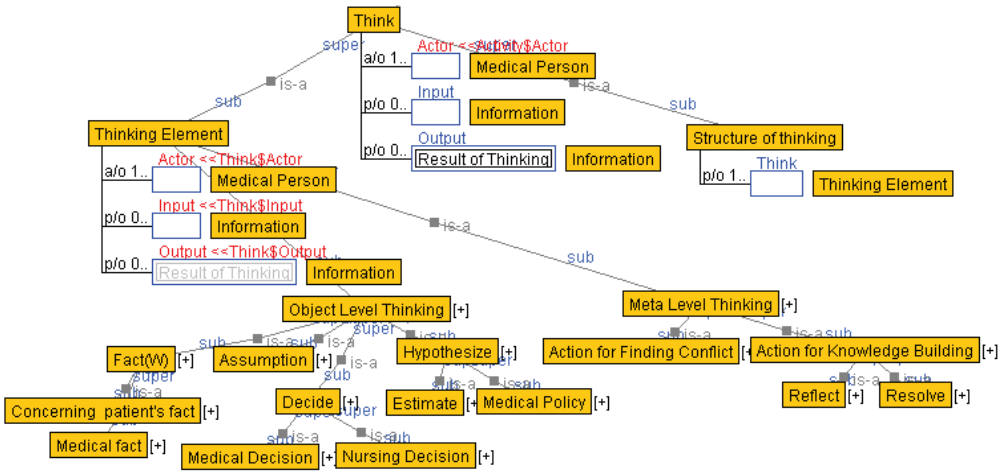

Figure 4. Thinking skill ontology (partially)

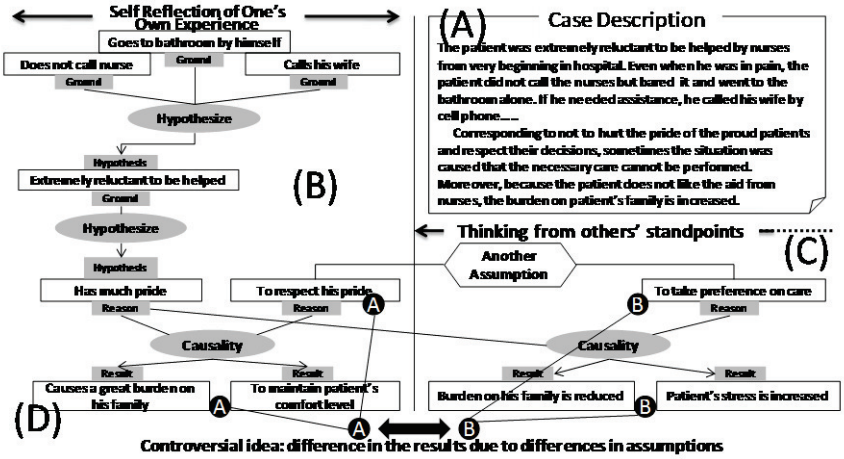

Figure 5. An example of thinking representation in case learning material designing

Figure 4 shows an overview of a part of the ontology for thinking process in medical services [8]. Using the concepts in the ontology, the learners externalize the reflection of their thinking process in their experiences in the graphic representation as shown in Figure 5.

Figure 5(A) shows the reflection description of thinking in one's own experience and Figure 5(B) shows its graphic representation. The square nodes represent the assertions and the elliptic nodes represent thinking activities such as "hypothesizing", "finding cause and effect" and so on. Figure 5(C) shows the guessed thinking process of another nurse with different stance from the learner. Figure 5(D) shows the intended issues (cognitive conflict) to be discussed in the case materials, thought that she should not care the patient too much and respects the patients feeling because the patient does not want it because of his too much pride, even though it is unavoidable to increase the load of the family to take care of the patient. Meanwhile, she guesses that there may be a nurse who thinks, on the assumption of "care priority", that she should provide the enough care to the patients even though it may cause the strong stress on the patient's mind. And then the learner investigated the advantages and disadvantages of the results of different assumptions.

Associating with the discussion in the previous chapter, (B) the visualization of one's own self-reflection can correspond to the description phase. And (C) according to the assumptions at different standpoint, (D) the discussion setting up can correspond to the evocation of knowledge building by cognitive conflicts.

5. Sizhi: A Learning Environment for Externalizing the Reflection on Thinking Processes for Internal Dialogue

Combining the learning strategies based on the goal-attainment model of verbalization (Chapter 3) and the thinking representation in case design (Chapter 4), we developed a learning environment named Sizhi. The Sizhi is designed for developing the learner's ability to conduct logical thinking for internal dialogue and to appropriately reflect on ones' thinking process by one's own. In order to improve the quality of discussions, we designed a model of thinking process for self-dialogue consists of three phases, where the learners are required to be able to conduct high quality thinking for self-dialogue, to describe high quality of reflection on ones' own thinking, to find meaningful conflicts, to create high quality knowledge in order to overcome the conflicts, by continuously developing their ability using the Sizhi tags.

Figure 6 shows an example of a case written by a nurse with Sizhi. As shown in the figure, there are three tabs that correspond to the description phase, the cognitive conflict and the

knowledge building phase in learning strategies. Each line consists of a statement ID (number), a Sizhi tag, and statement, and may have an additional tag and ID's that refer the logical foundation of the statement in the line.

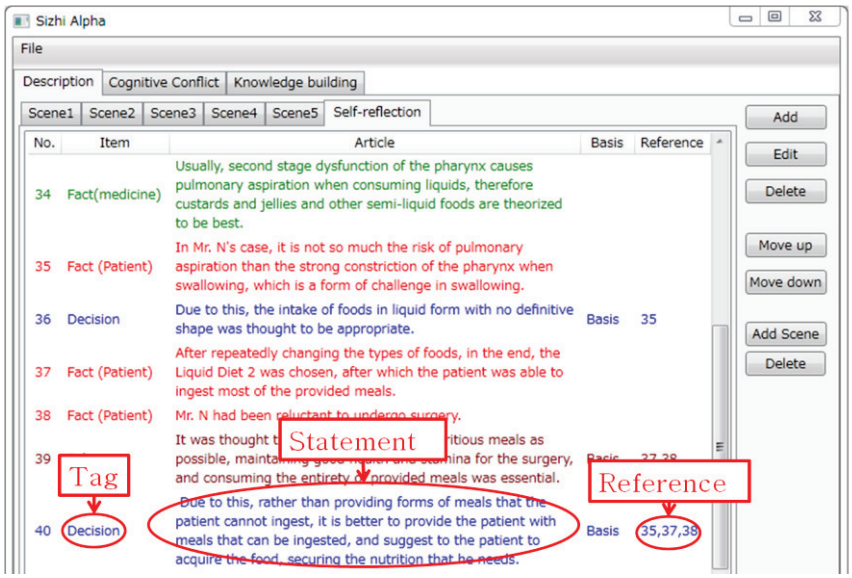

Figure 6. The description phase

Sizhi refers the thinking ontology mentioned in the above section to clarify the logical structure of learners' thoughts by Sizhi tags, and the learners is required to express the thinking processes using a set of Sizhi tags. The set of Sizhi tags is designed for nurses to reflect on their thinking process for internal dialogue and consists of nine tags: fact (patient), fact (medical), policy/principle, assumption, decision, medical decision, conflicts, reflect and resolve. The nurses' learning task in the case writing is to reflect on their own thinking process and clarify the structure of the thinking process using the Sizhi tags.

The most important aspect in designing Sizhi is for learners to clearly write ones' own case by reflecting on their thinking process using Sizhi tags, and reflect on the thinking process to find meaningful conflicts. To promote learners to gain deep insight into conflicts, for instance, Sizhi encourages learners to find conflicts between the statements with policy/principle tag, because the policy/principle tag implies the statement is one of logical foundation of the thinking process.

A preliminary experiment was conducted with the help of medical specialists from Faculty of Medicine, Miyazaki University and Juntendo University Hospital Group. In order to investigate the participants' motivation and their self-evaluation, we conducted two questionnaires, before and after using Sizhi. The Figure 7 (left) describes the mean difference in the target (related with self-dialogue process) column and the distractor (not related with self-dialogue process) column before and after using Sizhi. As a result, we found that as the preliminary experiment progressed, the target became higher and the distractor became lower. This result suggests that the understanding of the importance of thinking skills increased by using Sizhi. Moreover, we asked the learners for a self-evaluation of their thinking ability. And we split the learners into 3 groups according to the magnitude of the change in cognition of importance when analyzing the results and found that the self-evaluation of medium and small growth groups improved after using Sizhi (Figure 7 right).

In summary, for visualizing the invisible, shapeless, complex structure of thinking process to support knowledge creation, Sizhi provides learners with the Sizhi tags which clarify various thinking processes, and the Sizhi tab which encourages the awareness of the three thinking phases of knowledge building process, and is designed with the intent to encourage externalization and careful investigation of ideas that follow those processes.

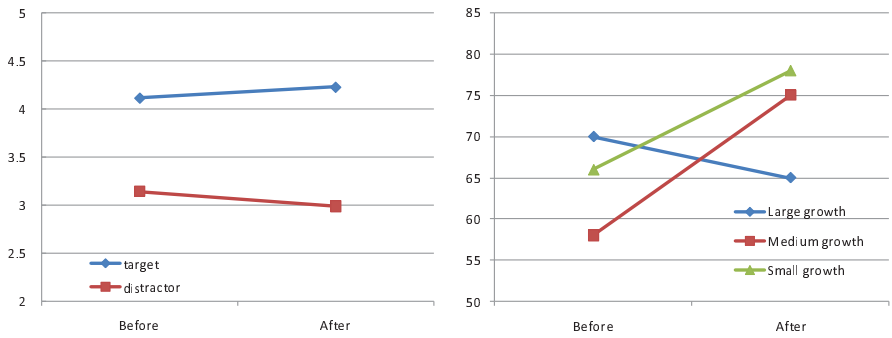

Figure 7. Changes in cognition of the importance of thinking skills (left) and changes in self-evaluation for each growing (right) before and after using Sizhi

6. Conclusion

In this paper, we organized a learning model which promotes reflective learning the case-method for medical service education. As an implementation of the learning model, a learning environment that support learners to reflect on their thinking process in their experiences by a learning strategy which consists of three case-writing phases: the description phase, the cognitive conflict phase, the knowledge building phase. The final goal of this research is not to make contributions to technological improvement in medical service education but to conduct a proposal of a rational learning model for medical service education. In the future, we will establish a methodology to the educational program that contains the scientific rationale for the continuous program procedures included the designing, executing, analyzing and revising for service education.

References

[1] Yoshikawa, H. (2008). Introduction to Service Science. *Journal of the Japanese Society for Artificial Intelligence*, *23*(6), 714-720. (In Japanese)
[2] Keio Business School. (1977). *Theory and Practice of Case Method*. Tokyo: Toyo Keizai Inc. (In Japanese)
[3] Hyakkai, S. (2009). *Learning by Case Method*. Tokyo: Gakubunsha Inc. (In Japanese)
[4] Ishida, H., Hoshino, H., & Okubo, T. (2007). *Case Book 1: Intorduaction to Case-Method*. Tokyo: Keio University Press (In Japanese)
[5] Tomida, E., &Maruno, J. (2004). Theoretical Background and Empirical Findings of Argument as Thinking. *Japanese Psychological Review*, 24(2), 187-209. (In Japanese)
[6] Billig, M.(1987). *Arguing and thinking: A rhetorical approach to social psychology*. Cambridge, UK: Cambridge University Press
[7] Kuhn, D. (1991). *The skills of argument*. Cambridge. UK: Cambridge University Press
[8] Cui, L. et al. (2011). Thinking Skill Development Program To Support Co-Creation Of Knowledge For Improving The Quality Of Medical Services. *Proceedings of Conference on Education and Education Management 2011*
[9] Morita, Y., Cui, L., & Kamiyama, M. (2011). Learning program that makes thinking the outside and presses knowledge collaboration skill development. *The Institute of Electronics, Information and Communication Engineers Technology Research Report.* 111(98), 7-12. (In Japanese)
[10] Ito, T. (2009). Effects of Verbalization as Learning Strategy: A Review. *Japanese Journal of Educational Psychology*, *57*, 237-251. (In Japanese)
[11] Argyris, C. & Schön, D. (1974). *Theory in Practice: Increasing Professional Effectiveness*. San Francisco: Jossey-Bass.
[12] Argyris, C. & Schön, D. (1978). *Organizational Learning*. Massachusetts: Addison-Wesley.
[13] Boud, D. & Walker, D. (1991). *Experiencing and Learning: Reflection at Work*. Geelong: Deakin University Press.