A Program Evaluation of PBL Tutorial
-Score Evaluation Method by means of SBOs and ARCS Motivation Model-

Yumiko Matsui

Abstract

Recently, the educational method of PBL tutorial education program has begun to be implemented in nursing curriculum. In the field of Pediatric Nursing, it has been practiced for the past two years. PBL education tutorial program is effective for heuristic education whereby the learners take initiative in their study and develop their own problem-solving methods. Besides independent learning skills, it is said that PBL is effective for promoting critical thinking and communicative skills. In the first year, the effects of learning were qualitatively evaluated by analyzing students' reports. The results showed that some students acquired knowledge and skills relevant to the learning objectives and some did not, and it was uncertain whether the case study had any motivational role in promoting the learning process. After the second year, the present research performed quantitative evaluation by means of SBOs and ARCS motivation model. The results suggested that although the case study was fascinating and motivating, it was insufficient to promote confidence and satisfaction of the students. With reference to SBOs, it was revealed that studies in regard to "examination" and "complication" were insufficient.

"Observation" and "complication" were observed to have a significant correlation with an ARCS category - namely "confidence" - and this indicated that accomplishment of these study objectives had positive influence on confidence.

Introduction

PBL Tutorial is a system of education which combines two learning methods: Problem-Based Learning (PBL) whereby an individual learner finds a study topic for herself and collects relevant information to solve the problem on her own; and Tutorial, in which small number of learners find solution to problems through discussion with the help of a tutor. McMaster University (Canada) first introduced PBL Tutorial into Medical studies. In Japan, Tokyo Women's Medical University was the first to practice it, and since then the system had been incorporated more widely, especially in medical education. PBL Tutorial education (hereafter referred to as PBL) is said to be a suitable education method for developing desirable skills of doctors, such as flexible problem solving skills in treating particular cases (Yoshioka, 2006, p.85). In nursing education too, PBL has attracted attention for its effectiveness in regard to the development of problem solving skills and heuristic learning; also, there have been recent reports that PBL is effective in developing various skills such as

Department of Nursing, Niigata University of Health and Welfare
1398 Shimami-cho, Kita-ku, Niigata, 950-3198, JAPAN
Tel/Fax: +81-25-257-4592
URL: http://www.nuhw.ac.jp
E-mail: matsui@nuhw.ac.jp

critical thinking and communication (Onishi & Tone, 2003, pp.61-7).

In the curriculum of Nursing Department at Niigata University of Health and Welfare, PBL has been implemented since the foundation of the department as an effective educational method for the development of problem-solving skills, independent study and communication skills. In the field of Pediatric Nursing, two cases - Kawasaki disease and leukemia - were framed, and in 2008, asthma was newly added.

In PBL, promotion of autonomous study behavior is essential; and for developing autonomy, the key is to determine how best to induce motivation. ARCS motivation model is a model inaugurated by Keller, (an American educational engineer,) which consists in contemplating the problem of "lack of motivation for learning" from four perspectives - Attention, Relevance, Confidence, and Satisfaction (Kishida & Shiozaki, 2007, pp.8-14). Recently, ARCS Motivation Model is being used for assessing the effects of teaching materials on English reading and comprehension (Ishikawa, 2001, pp.73-80) and textbooks on Japanese language (Kujima & Suzuki, 2003, pp.347-56). Thus, ARCS Motivation Model can be expected to yield a valid evaluation of PBL (Okuda & Kondo, 2005, pp.83-91). In addition, according to PBL evaluation, it has been reported that, there are methods to measure the changes before and after the learning process (Tokiwa & Takahashi, 2006, pp.69-74) by means of evaluation on the students' performance. Those methods are based on study objectives through self-evaluation or otherwise pre-established criteria. In the first year, "Kawasaki disease" case was evaluated through content analysis of the portfolio sheet (Matsui, 2008, p.582). There were reports of both successful and unsuccessful performance with regard to the SBOs. On the other hand, the students paid greater attention to the low level study objectives such as "psychology of child-

patients and their family members" than to the high level study objectives. In fact, it was unclear whether the case study had any influence on motivation to learning.

In the present research, ARCS Motivation Model and SBOs were used to gain the evaluations of these objectives. The objective of this study is to determine whether "Kawasaki disease" case had any influence on students' motivation to learning. Through various evaluations, this research will clarify the effects and problems of PBL, and discuss this future development.

Research Method
Research subject and term

Research subjects were 28 sophomores who, among 84 students that completed "Theory of Child Developmental Health Education" course in 2008, studied the Kawasaki disease. Terms of research were from April to July, 2008.

Examination Method

Each group studied "Kawasaki disease" for three weeks. After that, self-evaluation chart (consisting of 14 SBOs categories and 6 categories from Suzuki's revised edition of ARCS model) (Suzuki, 1995, pp.50-61) and portfolio sheet were given to the subjects when they had finished all of this PBL sessions.

Specific Behavioral Objectives - 14 categories (Table 1)

The SBOs were classified into three ranks: A - required, B - strongly recommended, and C - optional. For each category, responses were rated using 4- Likert Scale from 1 - unaccomplished, to 4 - satisfactory.

ARCS - 6 categories

Research subjects were asked to answer the question, "What best describes your feeling regarding Kawasaki disease case?" On six

Table 1 Specific Behavioral Objectives (SBOs)

Rank	No.	SBO
A: Required	1	Ability to explain Kawasaki disease and its main symptoms.
	2	Ability to explain diagnosis criteria of Kawasaki disease
	3	Ability to state why Kawasaki disease needs to be examined.
	4	Ability to explain cure method of Kawasaki disease.
	5	Ability to explain complications of Kawasaki disease.
	6	Ability to explain characteristics of infancy and developmental stage of three-year old children.
	7	Ability to explain in detail how to care for Kawasaki disease patients at acute stage.
	8	Ability to explain in detail how to care for Kawasaki disease patients at recovery stage.
B: Recommended	9	Ability to assess psychological states and regression of infants at the time of hospitalization.
	10	Ability to assess psychological states and regression of family with a sick child
	11	Ability to contemplate safety of children.
	12	Ability to contemplate psychological support on children and their family.
C: Optional	13	Ability to contemplate on how to support children with serious complications and their family.
	14	Ability to make an instruction plan for daily life after release from hospital

categories - interesting, engaging, valuable, challenging, self-assuring, and satisfying - answers were rated using 5-Likert Scale from 1 - I strongly disagree, to 5 - I strongly agree.

Child PBL case and Method of development

While the 2007 tutorial series had 4 weeks, the 2008 series was reduced to 3 weeks. Cases and contents of each are shown in Table 2 and 3, respectively.

Ethical Consideration

An approval form containing details of the research objective and method was distributed to the students. Being explained that participation does not affect the course grade, that the results will not be used outside the present research, and that confidentiality will be guaranteed, consent from research subjects was obtained. It was explained that the time limit of the presentation was one week from the day of distribution of the self-evaluation sheet and its presentation was optional. Also, the research proposal was approved from the university ethics committee.

Method of Analysis

The results of 14 SBO categories in the self-evaluation chart and the 6 ARCS categories were descriptively and statistically analyzed in order to obtain the mean and the standard deviation. Since the number of samples was small (28), statistical inference with non-parametric examination was used. Correlation between ARCS and SBOs was observed by means of correlation coefficient. To process the statistics, PASW Statistics Base 18.0J was used.

Table 2 Development of Child PBL (Kawasaki disease case: "Absence from kindergarten")

Assignment Sheet Number	Case Scenario
1	Kei had continued fever at 40 degrees C since the beginning of July, 3 months into attending the first preschool grade class. On the second day of fever the mother had noticed a swell on the right lymph node, consulted a nearby clinic and had antibiotics prescribed. On the next day, a red rash appeared on the trunk. On the suspicion of measles, Kei received intervenis. But since the symptoms did not recede, he was taken to the pediatrics. Congestion in the eyes, reddening and dryness of lips were detected right away. With the addition of pain in the lymph node, Kei was distressed, crying and sobbing in the arms of the mother. Cooling and intervenis of antibiotics were given to treat the fever and swelling, but subsequently, signs of MCLS (Kawasaki disease) appeared in rapid succession; and since inflammation was detected from the blood test, aspirin and intervenis of benylin were given. After a week, the condition began to improve. Smile could be seen and Kei began to play actively on the bed and in the play room.
2	Kei's MCLS symptoms had receded, and with peri-ungual desquamation beginning to take place, the condition is entering into a recovery stage. Periodic echocardiography and ECG suggest that there are no worries for the time being. At play room Kei enjoys his time having picture books read by his mother, and when other children enter the room he tends to cling onto his mother even more. According to the mother, "Kei got hospitalized as he was beginning to get accustomed to the kindergarten environment. He says he doesn't want to go there anymore." She expresses her worry, continuing, "I heard Kei has to continue visit hospital regularly. And, he cannot do much activity, right?"

Table 3 Development mode of PBL (The program for 3 weeks in the 2nd year [2008])

Class	Week		
	1	2	3
3 (with tutor)	Sheet1 distributed Problems picked	Problems picked Objectives established Plan drafted	Joint presentation Discussion
4 (without tutor)	Research study Prepare the materials	Prepare the presentation Assessment	Portfolio entry Self-evaluation reporting

*Contents of assignment sheet 1, 2 have been combined into one..

Results

SBOs - 14 categories (Table 4)

The mean score (SD) of all categories was 3.10 (±0.68). The category of "treatment", one of the A objectives (i.e. required), was 3.25 (±0.52) and had the highest among 14 SBOs. "Examination", even though it was among the A objectives, was 2.96 (±0.84) and had the second lowest score, just above "release guidance" from C objectives (i.e. optional) at 2.68 (±0.77). All A objectives except

"examination" had high scores in "accomplishment". P-values (*p<0.05 or p<0.01*) were determined in accordance with Kolmogorov-Smirnov examination (hereafter referred to as KS examination) and was indicated in Table 4.

ARCS - 6 categories (Table 5 and 6):

All categories had high scores, greater than 4 on average, except "confidence", which was 3.68 (±0.91). Particularly, the "satisfaction" score averaged at 4.21, and the categories "interesting", "engaging", and "valuable" were found to be significant by KS examination (*p<0.01*). Statistical significances were not found in "challenging", "confidence" and "satisfaction". Correlations among ARCS categories were indicated in table 6. "Challenging" was observed to have significant correlations (*p<0.01*) with all five categories, especially with "confidence" and

Table 4 Learning target 14 items scores (SBO; n = 28)

Item	Mean	S. D.	*K-S test Z value	*p* value
1 Disease and Symptom	3.11	.567	1.908	.001**
2 Standard of diagnosis	3.11	.629	1.681	.007**
3 Examination	2.96	.637	1.630	.010*
4 Treatment	3.25	.518	2.114	.000**
5 Complication	3.07	.663	1.550	.016*
6 Developmental stage	3.11	.916	1.395	.041*
7 Acute period	3.18	.723	1.272	.079
8 Recovery period	3.18	.670	1.501	.022*
9 Child psychology	3.18	.670	1.501	.022*
10 Family psychology	3.21	.630	1.649	.009**
11 Safety	3.04	.693	1.432	.033*
12 Psychological support	3.25	.701	1.327	.059
13 Complication support	3.00	.770	1.134	.153
14 Post-discharge instruction	2.68	.772	1.610	.153

* Kolmogorov-Smirnov test; Significant difference: *(*p<0.05*), **(*p<0.01*)

Table 5 ARCS motivation model 6 items scores (n = 28)

Item	Mean	S. D.	*K-S test Z value	*p* value
interesting	4.39	.567	1.732	.005**
engaging	4.46	.637	1.775	.004**
valuable	4.50	.694	1.777	.004**
challenging	4.11	.737	1.251	.088
confidence	3.68	.905	1.257	.085
satisfaction	4.11	.737	1.251	.088

* Kolmogorov-Smirnov test; Significant difference: **(*p<0.01*)

Table 6 ARCS motivation model 6items correlation table (n = 28)

		Item		
		challenging	confidence	satisfaction
interesting	*r	.604	.327	.339
	p	.001**	.089	.078
engaging	*r	.521	.397	.678
	p	.004**	.037*	.000**
valuable	*r	.543	.265	.253
	p	.003**	.172	.193

PEASON product-moment correlation coefficient   Significant difference($p<0.05$), **($p<0.01$)

"satisfaction" ($p<0.01$).

Correlation between SBOs and ARCS categories (Table 7)

The correlations between SBOs and ARCS categories were indicated in chart 6. "Satisfaction" was observed to have significant positive correlation with "examination" and "complication" ($p≤0.01$). As for "complication", significant positive correlations with "interesting", "challenging" and "satisfaction" were observed; and for "complication support", significant positive correlations with "interesting" and "confidence" were found ($p≤0.01$).

Discussion

Among SBOs A, B and C, it is desirable that A be adequately accomplished. The reason why "examination" in the A categories scored below the average may be due to difficulties pertaining to interpretation and understanding of the data gathered from examination. As compared to those of adults, children's data are difficult to interpret because reference materials are limited. Moreover, literatures are not unanimous about the standard value and this could cause confusion for the students. Kujima reports in his ARCS evaluation of Japanese studies that

"accomplishment of difficult tasks lead to new satisfaction" (Kujima & Suzuki, 2003, p.353). It can be thought that overcoming one's weaknesses may give a sense of accomplishment to the students, and the latter in turn leads to satisfaction. "Examination" has a significant relation with "satisfaction"; hence it can be thought that progress in their study in "examination" helps elevate satisfaction. "Psychological support" from B-objectives had high average but was not significant. "Psychological support" had significant correlations with "challenging" and "satisfaction" ($p<0.01$), and was among the important SBOs for motivating learning. "Child psychology", "family psychology" and "safety" all scored higher than the average of 3.0, but no correlation with ARCS categories was observed.

Two categories of C-objectives, "complication support" and "instruction plan after release from hospital" both scored below the average, although they were attainable for some students. These two categories were placed among the lower study objectives. Because in this case, the patient did not have any complications and he couldn't leave the hospital. But as it was the case that "complication" and "complication support" had significant correlation with "interesting" and

Table 7 ARCS 6 items and Learning target 14 items correlation table (n = 28)

		*r/p	SBOs items												
			1	2	3	4	5	6	7	8	9	10	11	12	13	14
interesting	*r		.325	.501	.245	.410	.317	.201	.094	.101	.296	.170	.152	.303	.170	.384
	p		.091	.007	.208	.030	.100	.305	.636	.609	.126	.386	.442	.117	.388	.044
engaging	*r		.370	.333	.225	.196	.532	.546	.296	.232	.319	.297	.380	.394	.529	.390
	p		.053	.083	.250	.317	.004	.003	.126	.234	.098	.125	.046	.038	.004	.040
valuable	*r		.518	.382	.126	.258	.161	.087	.258	.040	.279	.169	.193	.343	.347	.380
	p		.005	.045	.524	.186	.413	.658	.184	.840	.151	.389	.326	.074	.071	.046
challenging	*r		.415	.454	.403	.509	.514	.311	.380	.335	.335	.268	.210	.448	.261	.258
	p		.028	.015	.034	.006	.005	.107	.046	.082	.082	.168	.284	.017	.180	.185
confidence	*r		.214	.453	.429	.336	.410	.266	.431	.465	.465	.320	.373	.365	.479	.589
	p		.274	.015	.023	.081	.030	.171	.022	.013	.013	.097	.050	.056	.010	.001
satisfaction	*r		.415	.454	.481	.412	.666	.421	.380	.410	.410	.268	.355	.376	.457	.453
	p		.028	.015	.009	.029	.000	.026	.046	.030	.030	.168	.064	.048	.015	.016

*PEASON product-moment correlation coefficient

"confidence"; hence the latter category played a role in motivating the study. Students generally tend not to concern themselves with issues that are not directly pertinent to the given case. Thus, it is important that they develop eagerness to expand on the case to consider issues such as "in case complications occur" and "advises on how to take care after leaving the hospital". But since the tutorial period has been shortened, accomplishment of all these skills was difficult.

ARCS scores showed that all categories except "confidence" had high scores, and that the case study was an appealing one for the students. Students are often not confident about a new assignment to which they are not accustomed, and are usually worried about it. From the correlations among the six categories, it was suggested that "confidence" had a highly significant correlation with "satisfaction". Thus it can be thought that improvement of "confidence" leads to that of "satisfaction". Koyasu, et al. suggest that "clear indication of goals of the day", "attainable goal setting", and "advises on how to

study effectively" contribute to promote confidence (Koyasu & Yamada, 1994, pp.176-196). Indication of specific goals by the tutor might be helpful to get students gain confidence. Moreover, as previously indicated, "confidence" has significant correlations with C-objectives such as "complication support" and "post-discharge instruction planning". From these results, it is thought that revision of problems in such a way as to promote motivation for study can be an effective strategy. For instance, modifying a problem from "Kawasaki disease" to "a case involving complications and leading to release from hospital" would be suggested. It is desirable that evaluations and meticulous assessments would be done continuously in the future.

Introduction of a new education method is a fresh encounter not only for the students but also for the instructors. Faculty Development for tutors to develop the required skills is occasionally provided. But it is still bewildering for instructors who are accustomed to the

traditional method of straightforward lecture style. Through the present research it was reconfirmed that accomplishment of SBOs had influence on students' motivation toward their studies. It is necessary that the instructors have a full grasp of the SBOs pertinent to the case study and must be clear about what the students are expected to learn. Also, it is important that instructors responsible for the same subject show their teaching methods concretely and share them among one another.

Conclusion

From the evaluations considered in the present research, it was indicated that the case study was interesting and motivating for the students, but it was not sufficient to give confidence and satisfaction. As regards to SBOs, it was shown that learning about "examination" and "complication" was relatively insufficient. Assessment of measures to help accomplish these SBOs, such as adjustment of case study and tutors' strategy for intervention, were pointed out as important for future research.

In the present research, PBL evaluation with statistical techniques was attempted. Because the number of "Kawasaki Disease" and the number of students were limited, the results of the present study would not be able to generalize. The future research should be planned using a longitudinal design, including comparison of performance before and after implementation of PBL. A comparative study with "child leukemia" and "child asthma" will be necessary, too.

References

Ishikawa, T. (2001). A Study of the Relevance of Listening Tasks : Evaluation of Junior College Students Based on ARCS Model. *The bulletin of the Junior Col*lege, Seitoku University ,34. 73-80.

Kishida, K., Shiozaki, Y., & Igarashi, A. (2007). Aiming at a class where students feel satisfied for study (<special edition> My practice (II)). *Journal of Japan Society of Mathematical Education*, 89(5), 8-14.

Koyasu, M., & Yamada, T. (Eds.). (1994). *Children of the New Media Era: How to get along with TV, TV Game, Computer*. Tokyo :Yuhikaku.

Kujima, H. & Suzuki Y. (2003). A Study on the Support of Self-directed Learning in Japanese as a Second Language : Procedure and Evaluation using the ARCS Motivation Model. *Japan journal of educational technology* . 27(3) ,347-356.

Kujima, H. & Suzuki, Y. (2003). A Study on the Support of Self-directed Learning in Japanese as a Second Language : Procedure and Evaluation using the ARCS Motivation Model. *Japan journal of educational technology* .27(3) ,353

Matsui, Y. (2008). Evaluation of "Exercise Sheet" of PBL Tutorial (second issue)- by using the ARCS Motivation Model. *The 28th Journal of Japan Academy of Nursing Science*. 582.

Okuda, K. & Kondo M. The ideal method of independent learning based on Problem-based Learning in care welfare education. *Bulletin of Setouchi Junior College*. 36, 83-91.

Onishi, J., Tone, Y., Nakamura S. & Et al. (2003). Changes in Internal Control, Autonomy of Nursing and Critical Thinking Before and After Clinical Practice : Self-evaluation of Students Who Have Had Problem Based Learning-Tutorial Education. *Nisseki Musashino Tandai Kiyo*. 16, 61-67.

Suzuki, K. (1995). On the Framework of Designing and Developing "Appealing Instruction": The ARCS Motivation Model. *Japanese journal of educational media research*. 1(1), 50-61.

Tokiwa, K., Takahashi, H. & Oba, R. (2006). Measuring the Effect of Problem-Based Tutorials on Student Learning: Examining

the Changes of the Critical Thinking Abilities and Learning Styles. *The bulletin of Saitama Prefectural University*. 8 , 69-74 .

Yoshioka, T. (2006). The present conditions and a problem of the PBL tutorial education in the medical education: An action in Tokyo Women's Medical College. *Journal of Saitama Medical School*; 33 (3,4), 85.