

The Effectiveness of an Instructor's Intervention Using Questioning Strategy in Physiology Class

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Abstract

This study was done to analyze students' learning and its lasting effect by teaching strategy involving questioning. This study was performed with 68 students who were enrolled in a physiology class of the Yonsei University College of Medicine in Seoul, Korea, in 2003. The students were randomly divided into 2 groups. One group was taught in a way where students asked questions and the instructor answered the questions. For the other group of students, the instructor asked questions, and the students answered the questions. We performed a pre-test before the study begins and post-tests immediately, 3 weeks, and 6 weeks after the study. The results were analyzed by using analysis of covariance and repeated measures analysis of variance. A higher learning effect was observed in a group where questions were asked by students compared with the other group. The post-test results showed no significant difference in the lasting effect of learning according to the teaching strategy. Students' learning significantly improved when students asked questions and the instructor answered the questions compared with the strategy of the instructor asking questions and students answering to the questions.

Key Words: Questioning strategy, Meaningful learning, Learning effect

Introduction

The teaching methods providing students with persisting and meaningful learning have been studied for long time. Shulman(1986) analyzed that the teaching paradigm has changed from the area of process-product to mediating, classroom ecology, and cognitive science. Guba & Lincoln(1989) recently added the constructivism in the teaching paradigm. Looking from the point of view of constructivism, meaningful learning is possible when the learner grants the meaning for a piece of new knowledge based

on his/her experience(Ausubel & Novak, 1978). And, it has relevance to active participation, strategic learning, self-control, reflective thinking, understanding rather than memorization, learning encouragement for transition, provision of sufficient time for learning, and learning motivation and so on(Vosniadou, 2001). On the other hand, Kumar(2003) pointed out that the lecture without interaction is not appropriate to promote meaningful learning. Gulpinar & Yegen(2005) reported that students tend to be passive in lecture-oriented classes and criticized that the attention span for meaningful learning is only about 20

min at maximum in these classes. Stenert & Snell(1999) stressed the interaction between teacher and learner for meaningful learning. Legan(2001) proposed the use of various teaching strategy for meaningful learning.

It is important issue how to provide the meaningful learning for students in schools. Conflicting views exist on whether students could apply the acquired knowledge in actual patients even after the students memorize and reproduce knowledge fully(Michael, 2001). Students may be able to fully memorize and reproduce a piece of knowledge but do not understand how to incorporate the new knowledge into one concept structure using a cause-effect relationship(Rovick & Michael, 1992). Thus, the issue of how to maximize meaningful learning is an important topic of research. Assuming that there is no teaching strategy effective for all settings, Borich(2000) stated that more than anything else, it is up to each individual instructor to come up with an optimal teaching strategy. In this regard, he proposed the use of questioning strategy for interactive teaching.

Related with the effectiveness of questioning strategy for meaningful learning, Sachdeva(1996) and Michael(2001) pointed out that the learning effect is increased significantly by studying with others rather than alone and that it is helpful in learning when the learner utters what is being learned or questions and answers himself/herself. Chi and colleagues(1994) reported that it is effective teaching strategy for meaningful learning to provide learning partners

with opportunities to participate and asking the student to talk. Given these opinions, instructor's questioning strategy would be significant to promote meaningful learning for learners.

The purpose of this study is to analyze the learning effect and its continuation depending upon the type of instructor's questioning strategy. The specific questions examined in this study were 1) whether there is a difference in learning effect based on the type of instructor's questioning strategy and 2) what the relationship is between the type of instructor's intervention and learning effect continuation.

Methods

A total of 68 students who enrolled in physiology class in 2003 at Yonsei University College of Medicine in Seoul, Korea were examined in this study. The subjects were randomly divided into 2 groups to compare the learning effect and its continuation based on the type of instructor's questioning strategy. Table I shows the study design.

The students in two groups were provided with an e-book related with electronic physiology and allowed with a 5-hour for self-directed learning. Each group was treated differently. The students in Group 1 were asked questions by the instructor(Treatment A). The students in Group 2 asked questions to the instructor(Treatment B). One instructor was provided groups with questions or answers to maintain consistency of questions and answers. A pretest

Table I. Experimental Designs: Pretest and Posttest Group Design

Group	Total (N=68)	N Female (N=26)	Male (N=42)	Pretest	Treatment*	Posttest I	Posttest II	Posttest III
1	34	15	19	○	A	○	○	○
2	34	11	23	○	B	○	○	○

*Treatment

A: The students went through self-directed learning first using the e-book related with electronic physiology and then the instructor asked questions to the students.

B: The students went through self-directed learning first using the e-book related with electronic physiology and then students asked questions to the instructor.

was done before the study was taken place to evaluate the degree of prior knowledge in electronic physiology. Posttest took place immediately, 3 weeks and 6 weeks after the instructor intervention. The questions used in the pretest and posttest were actual lab questions used in electronic physiology in which a total score of these 15 multiple-choice questions was 15 points. To evaluate whether there is a difference in the learning effect based on the type of instructor's questioning strategy, the analysis of covariance was performed using the score from the pretest. The posttest score was analyzed using repeated analysis of variance to analyze the continuance of learning effect based on the type of instructor's intervention.

Results

Table II summarizes the results of pretest and posttest according to the type of instructor's questioning strategy (Treatments A and B). The average score of pretest was 5.97, that of posttest I was 9.81, that of posttest II was 8.82, and that of posttest III was 9.38. In the pretest, the score of group 1 is higher than another group and the score of

group 2 is higher than group 1 in the posttest.

The learning effect was compared by the analysis of covariance. Table III shows that after removing the effect of pretest in each treatment group, the learning effect differed according to the type of instructor's questioning strategy. In order to analyze which type of instructor intervention was effective, the treatment B was assigned as the contrast group and the parameter of treatment effect was estimated. The difference between treatment A and B in posttest I was -3.20, in posttest II was -2.97, and in posttest III was -2.95. The learning effect was higher when instructor answered to the students' questions (Treatment B) compared with when the instructor asked and students answered (Treatment A).

Table IV shows the results of analyzing continuation of learning effect. Learning effect showed a significant difference according to the stage of posttest and the type of instructor's intervention. In both groups, there are decreased the score of posttest II than posttest I significantly. And there are no difference between posttest II and III.

Awareness of students on the questioning strategy was surveyed. In overall, the students were positive about the fact that learning could take place through questions and

Table II. Descriptive Statistics of the Results of Pretest and Posttest by Treatment

Treatment	Pretest		Posttest I		Posttest II		Posttest III	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
A(N=34)	6.32	1.92	8.32	1.79	7.44	1.97	8.06	1.81
B(N=34)	5.62	2.59	11.29	1.31	10.21	1.98	10.71	2.28
Total	5.97	2.29	9.81	2.16	8.82	2.41	9.38	2.44

Table III. Results of Covariance Analysis Examining the Effect of Treatment

Posttest	Source of variable	df	SS	MS	F	Treatment effect (A B)
I	Pretest	1	38.01	38.01	19.85*	
	Treatment(A, B)	1	170.46	170.46	89.01*	-3.20
II	Pretest	1	29.59	29.59	8.42*	
	Treatment(A, B)	1	146.53	146.53	41.71*	-2.97
III	Pretest	1	65.97	65.97	20.13*	
	Treatment(A, B)	1	145.01	145.01	44.26*	-2.95

*P: < 0.05, **P<0.01

Table IV. Comparison of Continuation of Learning Effect between Posttest Variables

Treatment	Contrast	df	SS	MS	F
A	Posttest I vs. Posttest II	1	26.47	26.47	10.98**
	Posttest II vs. Posttest III	1	12.97	12.97	2.35
	Posttest I vs. Posttest III	1	2.38	2.38	0.46
B	Posttest I vs. Posttest II	1	40.26	40.26	11.38**
	Posttest II vs. Posttest III	1	8.50	8.50	1.01
	Posttest I vs. Posttest III	1	11.76	11.76	1.94

*P: < 0.05, **P<0.01

answers by the instructor and students. Especially, students answered that they could increase their understanding through self-study before the actual class. Students evaluated instructor-student interaction positive such as the method of instructor questioning and students answering and the other way around.

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Discussion and Conclusions

The primary purpose in teaching is providing students with meaningful learning experiences. Thus, the issue of how to intervene during the teaching and learning process is very important thing for instructors. From this vein, this study was conducted to examine the effectiveness of instructor's intervention using questioning strategy.

According to this study, the learning effect was greater in instructor answering to students' questions rather than students answering to instructor's questions. This result suggests that the effects of meaningful learning occur different-

ly depending on who forms questions and the students themselves asking would promote effective learning. Many researchers reported the relationship between forming of questions and meaningful learning. Borich(2000) pointed out meaningful learning could take place in students who would connect a new piece of information by incorporating into the existing cognitive structure. Redfield & Rousseau (1981) reported positive effects of students forming questions on meaningful learning. Sitko & Slemon(1982) also described that meaningful learning is promoted when students ask questions and instructor answers. Thus, the questioning by the learner himself or herself is constructing new knowledge from the constructivism point of view(Guba & Lincoln, 1989). Tobin & Capie(1980) stated that the type of interaction between the instructor and learners is related with the learning effect in the questioning strategy.

The type of instructor's intervention where the instructor asked questions and the students answered showed lower learning effect compared with the other way around. This result is different from that reported by Redfield & Rousseau(1981) who stated that high-level cognitive questions posed by the instructor affect positively for learners academic achievements. However, Shuck(1985) reported that this result could differ depending on the questioning technique by the instructor. Sitko & Slemon(1982) analyzed that the level of learner response and learning effect are closely related in the questioning strategy where the instructor asks and the learner answers.

In conclusion, the type of intervention where the instructor asks questions and the learner answers make the students act passively when answering to questions. The learning effect was greater in the questioning by students rather than the other way around. However, the results found in this study suggest the need for further study on the level of questions asked by the instructor or students.

References

- Ausubel, D.P., Novak, J.D. & Hanesian, H.(1978). Educational psychology: A cognitive view(2nd ed.). New York: Rinehart and Winston.
- Borich, G.D. & Stollenwerk, D.A.(2000). Effective teaching methods(4th ed.). Upper Saddle River, N.J: Merrill.
- Chi, M.T.H., Leeuw, N.D., Chiu, M.H. & Lavancher, C.(1994). Eliciting self-explanations improves understanding. *Cognitive Science*, 18, 439-477.
- Guba, E.G. & Lincoln, Y.S.(1989). Fourth generation evaluation. Newbury Park, California: Sage Publications.
- Gulpinar, M.A. & Yegen, B.C.(2005). Interactive lecturing for meaningful learning in large groups. *Med Teach*, 27, 590-594.
- Kumar, S.(2003). An innovative method to enhance interaction during lecture sessions. *Adv Physiol Educ*, 27, 20-25.
- Legan, S.J.(2001). Multiple-format sessions for teaching endocrine physiology. *Adv Physiol Educ*, 25, 228-232.
- Michael, J.(2001). The Claude Bernard Distinguished Lecture: In pursuit of meaningful learning. *Adv Physiol Educ*, 25, 145-158.
- Redfield, D.L. & Rousseau, E.W.(1981). A meta-analysis of experimental research on teacher questioning behavior. *Review of Educational Research*, 51, 237-245.
- Rovick, A.A. & Michael, J.A.(1992). The Predictions Table: a tool for assessing students' knowledge. *Am J Physiol*, 263, S33-S36.
- Sachdeva, A.K.(1996). Use of effective questioning to enhance the cognitive abilities of students. *J Cancer Educ*, 11, 17-24.
- Shuck, R.F.(1985). An empirical analysis of the power of set induction and systematic questioning as instructional strategies. *Journal of Teacher Education*, 36, 38-43.
- Shulman, L.S.(1986). Paradigms and research programs in the study of teaching: A contemporary perspective. In Wittrock MC, ed. *Handbook of Research on Teaching* (3rd ed.). New York: MacMillan Publishing Company.
- Sitko, M.C. & Slemon, A.L.(1982). Developing teachers' questioning skills: The efficacy of delayed feedback. *Canadian Journal of Education*, 7, 109-121.
- Stenert, Y. & Snell, L.S.(1999). Interactive lecturing: Strategies for increasing participation in large group presentations. *Med Teach*, 21, 37-42.
- Tobin, K.G. & Capie, W.(1980). The effects of teacher wait time and questioning quality on middle school science achievement. The Annual Meeting of the American Psychological Association, Montreal.
- Vosniadou, S.(2001). How children learn: Educational Practices Series 7. The International Academy of Education(IAE) and the International Bureau of Education(UNESCO).

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