

HIGH COGNITIVE QUESTIONS IN NON-NATIVE STUDENT GROUP CLASSROOM DISCUSSION: DO THEY FACILITATE COMPREHENSION AND WRITTEN PRODUCTION OF THE FOREIGN LANGUAGE?

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This article is based on a study which attempted to examine the use of high cognitive questions in non-native student group classroom discussions. The main purpose of the study was to determine if a higher frequency of high cognitive questions in NNS group classroom discussions had an effect on foreign language learning. Two groups of non-native Spanish students and four non-native English teachers participated. One of the groups was trained in incorporating high cognitive questions in student-student discussions; the other group was not provided with such training. After the training, both groups listened to a narrative told by a non-native teacher, discussed it, and then wrote the story they had heard. Results indicated that the trained group asked more high cognitive questions than the control group. The quantity of verbal interaction was not different between the groups, but the understanding and written production of the foreign language was higher in the treatment group than in the control group. The higher achievement in the trained group indicates that the use of high cognitive questions, demonstrated and adopted in NNS group classroom discussions, promotes the kind of verbal interaction which facilitates comprehension and written production of the foreign language.

A great deal of research has been done on the nature of peer interaction and its effect on student achievement. On the one hand, there is psycholinguistic evidence for group work in SL teaching: Varonis and Gass (1985), Long and Porter (1985), Pica and Doughty (1985), Rulon and MacCreary (1986), among others. This research has focused on the role of comprehensible input in SLA, and the ways in which the nature of non-

native/non native conversation affects the learners' production of the L2. On the other hand, since approximately two thirds of all classroom communication falls into soliciting and reacting moves (Bellack *et al.* 1966), one could well imagine that a great deal of research has been conducted on questions and answers in the second language classroom.

However, although much research has been done on questions in first language classrooms (Stevens 1912; Kearsly 1976; Dillon 1981, 1982, 1985, 1988), and some has been done in foreign or second language classrooms (Gass and Madden 1985; Pica *et. al.* 1986, 1987), no study seems to have been done on higher-order questions in non native student (NNS) group discussions. Studies on questions in second language classrooms have focused on teacher questioning behaviour, as a classroom process variable possibly related to second language acquisition: Long and Sato (1983), White and Lightbown (1984), and Brock (1986). More recently Rost and Ross (1991) and Alcón and Guzman (1991) studied the learners' questioning strategies in teacher-student interaction and their effect on oral comprehension.

Student-student interaction through reciprocal questions has been analyzed by King (1989, 1990). King considers the use of reciprocal questions one of the ways in which students in small groups negotiate the meaning of a given message and interact with each other. Thus he focused on the effects of a reciprocal peer-questioning strategy on student achievement. In this study students were trained to generate generic questions such as "*how does . . . differ from . . . ?*", "*what is a possible solution to . . . ?*" to create their own questions related to the material presented in class. Then, working in small groups, they posed their questions to their peers establishing a context to self and peer testing. Students who used this reciprocal peer-questioning strategy scored better on achievement tests than those using unstructured discussion in small groups.

The achievement effects observed in King's studies can be explained by theories of the social construction of knowledge (Mugny and Doise 1978; Vygotsky 1978). These theories emphasize the cognitive advantages of peer interaction. The resolution of the socio-cognitive conflicts, arising in a social context, is viewed as producing more cognitive benefit for an individual than the cognitive conflicts that an individual may experience alone.

From the theories of the social construction of knowledge, as well as from the ways in which negotiation of input (Long 1981), and learners' production (Swain 1985) of L2 may affect SLA, using reciprocal peer questions could be expected to:

- (i) provide a context for the emergence and resolution of socio-cognitive conflicts,
- (ii) provide opportunities to negotiate new input,
- (iii) provide opportunities to produce the target language,
- (iv) promote the understanding and production of the L2.

First of all, being required to ask generic or high cognitive questions, as we call them, forces students to think about and present the material in different ways, in order to produce messages accessible to other members in the group. At the same time, answering a member of the group enhances understanding for the one giving the explanation, because, as Webb (1989) reported, the explainer often has to translate vocabulary into familiar items, generate new examples, and establish a relationship between ideas. As a result, a better understanding and elaboration of the L2 is expected.

The present investigation, based on King's studies, attempts to modify the questioning strategies in such a way as to force foreign students to think about and present their ideas in different and creative ways, to determine whether they actually do so, and, if so, to study its effect on the comprehension and written production of the L2.¹

Method

Subjects and Design

There were 30 subjects, all between seventeen and eighteen years of age. They were in the same class and in the last year of their secondary education in a state high school in Castellón (Spain). Also serving as subjects for the study were four non-native English teachers, each with at least 5 years of ESL teaching experience and a Master's degree in ESL. Teachers W and X scored the written summaries separately and then reached an agreement on the grade of each summary. They also designed the treatment for group A. Teacher Y, who conducted the treatment, met both groups of students three hours per week, and taught English as a compulsory subject. Finally, teacher Z observed the whole treatment in order to indicate any bias, if detected, of teacher Y for or against the treatment.

¹ The terms SLA and L2 are not intended to contrast with foreign language acquisition. Both of them are used in this article as general terms that embrace FLA and FL. See Ellis (1985, 5).

Two groups of 15 subjects were formed using a randomized block designed to control the differences in proficiency among students. Group A (treatment group) was randomly assigned to the questioning treatment and group B (control group) to the discussion condition. In group A we had eight females and seven males. In group B (control group) we had eight females and seven males. The two groups did not appear to differ with regard to student ethnicity, social class, or academic background.

Procedure and Material

Both groups used *Unsolved Mysteries* written by McCallum (1990) as their regular textbook. Students in the trained group were taught to generate generic or high cognitive questions from written texts, and then practised them in group discussions. Students in the control group did not receive any treatment on questioning, but used group discussion in their lessons. After three months' training, both groups listened to an unsolved mystery from the McCallum textbook (Appendix A). After listening to the mystery, and without being allowed to ask questions or take notes, students discussed it. Later they were instructed to write individual summaries of the mystery. During the discussion both groups of students were encouraged to formulate questions, emphasizing their importance for comprehension. All verbal interaction during small group discussion was recorded and the summaries were scored (Appendix B) for further statistical analysis.

Training

The set of high cognitive questions designed to elicit highly elaborated responses are based on the application, analysis, and evaluation levels of Bloom's taxonomy (1956). The high cognitive questions in the training, as detailed in the following list, were considered those that could explain an idea or relationship, apply a concept to a new situation, relate new material to known material, justify an opinion, or conclude.

Generic Questions Used during the Treatment

Explain why . . .

What do you think would happen if . . . ?

What do you think will happen if . . . ?

- What is the difference between . . . and . . . ?
- How similar are . . . ?
- What is a possible solution to . . . ?
- What conclusions can you draw from?
- In your opinion . . . why/ when/ where/ how/ What/ . . . ?
- Do you agree or disagree with . . . ? Support your answer
- How is . . . related to . . . ?
- What are the advantages and disadvantages of . . . ?

First of all, the use of high cognitive questions was explained to the students in the treatment group. Such questions not only require the learner to recall the facts, but also to evaluate them. Having seen the difference between yes or no questions and high cognitive questions, students generated high cognitive questions for three different texts from their textbook. In the first phase the teacher provided the structure as well as examples from the text. For instance: structure = *what is a possible explanation for . . .* ; examples: *what is a possible explanation for the existence of Atlantis?*, *what is a possible explanation for the loss of the Miaoan Empire's power*, *what is a possible explanation for the enormous speculation about Atlantis?*

In the second phase students had the structures and one example of each. Finally, in the third phase, only the structure was provided, and the students had to create the questions. The students wrote the questions and shared them with their partners. After practising in pairs, whole classroom practice was provided. The teacher read a text and individual students asked one or two questions to be answered by any student. Comments about the choice of a question and its aim were provided by students.

The students in the discussion condition (control group) used the same textbook, used discussion to recall the same written and oral texts, had the same teacher as the ones in group A, but they had not received the training on high cognitive questioning that the students in group A had received.

Analysis

In the first phase of the study the effects of training on students' questions were analyzed. King's set of generic questions (1990) was used to identify those questions which we have called high cognitive questions: questions which require elaboration, evaluation or conclusion. Low cognitive questions, often referred to as display or known information questions

(Long and Sato 1983), have also been considered. The total number of high cognitive questions observed and recorded during 15 minutes of discussion in group A (trained group) was compared to those produced in group B (control group). The same was done with the low cognitive questions. The interaction was coded by two NNS English teachers independently. A 90% agreement was reached and the remaining differences were resolved at a later meeting.

The second phase of the study was designed to see if the participation of students from the trained group, on being forced to produce highly elaborated responses, differed from that of the control group. An analysis of the turn taking of both groups was conducted. The system adopted was Allwright's classification (1980) for the turn taking analysis, but no distinction was made between turn taking and turn giving.²

The last analysis, the "product" analysis, was used to determine if the training on high cognitive questions was associated with differences in understanding and written production of the L2. In this last phase of the analysis, students' summaries of the narrative they had listened to and discussed in groups were scored according to the number of words per summary, number of ideas about the text, level of proficiency, and comprehension (Appendix B).

Results and Discussion

As expected, the number of high cognitive questions was higher in the trained group than in the control group (Table 1).

The students in the control group asked a total of 54 questions, 43 of which were low cognitive questions, and only 11 of which were high cognitive questions. The trained group students, on the other hand, asked a total of 106 questions (1.96 times as many total questions as the control group), 62 of them were high cognitive questions (5.63 times as many as the control group), and 44 were low cognitive questions (with no difference with the control group).

If the trained group used more high cognitive questions which in turn were supposed to compel students to externalize their thoughts, we

² The reason for considering the total number of turns was motivated by our intention to compare the whole interactive atmosphere in both groups, rather than the contribution of particular subjects to the process of classroom interaction.

Table 1

CHI SQUARE TEST FOR HETEROGENEITY OR INDEPENDENCE			
QUESTIONS	CONTROL	TREATMENT	
HIGH OBSERVED	11	62	73
HIGH EXPECTED	24,64	48,36	
CHI-SQUARE	7,55	3,85	
LOW OBSERVED	43	44	87
LOW EXPECTED	29,36	57,64	
CHI-SQUARE	6,34	3,24	
TOTAL NUMBER QUESTIONS	54	106	160
OVERALL CHI SQUARE	20,96		
P VALUE	0,0000		
DEGREES OF FREEDOM	1		
YATES' CORRECTED CHI SQ	19,45		

Table 2

One way AOV for: trained group T.T/ control group T.T					
SOURCE	DF	SS	MS	F	P
BETWEEN	1	104.5	104.5	3.61	0.0678
WITHIN	28	810.7	28.95		
TOTAL	29	915.2			

AOV = Analysis of Variance. T.T= turn taking. DF = degrees of freedom.
 SS = sum of squares MS= mean square. F = cumulative frequency.
 P = probability that the data can be obtained if the null hypothesis is true.

hypothesized that more participation was likely to take place in the trained group than in the control group. A comparison of the turn taking of both groups was carried out using one way analysis of variance (Table 2).

The results indicate that although there is a tendency to increase participation in the trained group, the difference in oral participation was not significant: P= 0.0678. It seems that by using high cognitive questions students do not get more turns than those making nearly no use of this type of

questions. As a result, the study indicates no relationship between the use of high cognitive questions and the quantity of student participation in NNS group classroom discussions.

If we consider Seliger's position (1977), which found a positive correlation between learners' participation in classroom interaction and learning outcomes, we must conclude that our trained students would not benefit more than the control-group students. However, although the quantity of interaction may be a factor affecting the acquisition of the L2, it is not simply the frequency of participation which influences acquisition (Aston 1986), but other factors such as the social context or the quality of the interaction must be considered. Another possible explanation could be that in recording interactions for this study, as well as in Seliger's (1977), no identification was given of differences in length or complexity.

In the last phase of our study a different result from turn taking analysis is obtained. When we compared the number of words in the summaries produced by the trained and control groups (Table 3), we realized that the difference in

Table 3

One way AOV for: trained group N.W/ control group N.W					
SOURCE	DF	SS	MS	F	P
BETWEEN	1	1.391E+04	1.391E+04	8.66	0.0065
WITHIN	28	4.496E+04	1.606E+03		
TOTAL	29	5.887E+04			

Table 4

One way AOV for: trained group N.I/ control group N.I					
SOURCE	DF	SS	MS	F	P
BETWEEN	1	64.53	64.53	17.90	0.0002
WITHIN	28	100.9	3.605		
TOTAL	29	165.5			

AOV = Analysis of Variance. N.I= number of ideas. N.W= number of words.
 DF = degrees of freedom. SS = sum of squares MS= mean square.
 F = cumulative frequency. P = probability that the data can be obtained if the null hypothesis is true.

number of words is statistically significant: $P < 0005$. So too is the number of ideas produced by both groups (Table 4). Thus, although the quantity of oral interaction is not different using high cognitive questions, the quality of interaction obtained by using high cognitive questions may account for the greater number of words and ideas produced by the learners.

Significant group differences were found with regard to achievement (Table 5), with the training group outperforming the control group in proficiency level. The summaries in the trained group outperformed the control

Table 5

One way AOV for: trained group ACHI/ control group ACHI					
SOURCE	DF	SS	MS	F	P
BETWEEN	1	30.00	30.00	16.200.	0004
WITHIN	28	51.87	1.852		
TOTAL	29	81.87			

AOV= Analysis of Variance. ACHI= achievement. DF = degrees of freedom.
 SS = sum of squares MS= mean square. F = cumulative frequency.
 P = probability that the data can be obtained if the null hypothesis is true.

group in semantic and syntactic complexity, especially in the use of connectives to relate new ideas to others already presented. As far as comprehension is concerned, the summaries also contained more information related to the narrative presented by the teacher and different alternatives on the student's part.

That high cognitive questions in NNS classroom discussions may increase the written production of the target language, as well as increase the understanding of a given message, is relevant to at least two theories of second language acquisition. On the one hand, Long (1981), in formulating the interaction hypothesis, argues that comprehension is made possible, and is even facilitated, when interactional adjustments are present. High cognitive questions indirectly get the learners involved in the process of negotiation of meaning, in which input is made comprehensible as a result of modification when communication problems arise. On the other hand, Swain (1985), in formulating the output hypothesis, claims that learners need the opportunity to produce in order to develop native speaker levels of grammatical proficiency. According to the summaries in the trained group, high

cognitive questions, although they may not increase the students' oral production, seem to force learners to produce responses in which learners have to pay attention to the means of expression in order to convey a message, as well as perform a syntactic and semantic analysis of the language.

Finally, since the difference in oral production between group A and B is not significant, Seliger's relationship between intensity of verbal interaction and language learning is questionable in our study. It should also be noted that it may not be the high cognitive questions per se that account for the effects obtained in this study, but the metacommunicative awareness of learners.³ Students in group A learnt during the three month training that high cognitive questions not only affect the quality of questions asked, but also improve the quality of responses given. In so doing, they carried out one of the most difficult tasks of learning a new language: acquiring new linguistic forms and learning how to use them.

Conclusion

High cognitive questions, demonstrated and adopted in NNS group classroom discussions, create a context for the resolution of socio-cognitive conflicts in which the learner, as an active element, benefits from different perspectives which arise in the process of peer interaction. This learning context encourages the learner to produce elaborated responses, reduces the possibility of no response and controls in some ways the effectiveness of peer interaction. In this study learners also gain a better understanding at the discourse level by testing their own hypotheses about a text, transforming old opinions into new ones and thinking and presenting their alternatives in new ways.

A limitation of the study is the number of subjects and the shortness of the treatment. A longitudinal study of the use of high cognitive questions by different proficiency learners, and how these questions influence their growth in production and understanding of the L2 may shed more light on the issue. Further research is also needed to analyze the length and complexity of turns which high cognitive questions are likely to produce in foreign language classrooms.

³ The observation and reflection of a variety of questions used by their peers offer the trained group the possibility to evaluate their interaction. See Alcón and Guzmán. (1992, 53-54).

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Appendix A

THE MARY CELESTE: why did the people on board disappear?

Selected and adapted from *Unsolved Mysteries* (1990)

The name given to the ship when it was built in 1861 was *The Amazon*. Bad luck seemed to be with *The Amazon* from the start. During its first voyage in 1862 it was badly damaged. Then the ship caught fire. Similar accidents followed in the next several years. Finally *The Amazon* was sold and its name was changed to *Mary Celeste*.

The owners had difficulty finding men to sail on the newly-named ship because, the sailors said, it was unlucky. In the end enough sailors were found to make up a crew. On the morning of 4 November, 1872, with a cargo of 1700 barrels of crude alcohol, it left New York and headed for Genova, Italy. The weather that day was perfect.

Up to the time the *Mary Celeste* reached the Azores the trip was uneventful. Once past the Azores, however, the weather changed. Captain Briggs recorded in his logbook that there was a heavy wind storm, although it was not strong enough to alarm such an experienced sailor as Briggs.

Ten days later, on 5 December, captain Morehouse of the *Dei Gratia*, another ship sailing to Europe, observed a dark spot on the horizon. They soon saw that it was a ship but something about it was rather strange. Captain Morehouse began to study the other ship through his telescope. He saw immediately that no one was steering the ship. In fact he saw no sign of life at all!

Morehouse sent three men to discover what was wrong. As they approached the other ship the sailors were able to make out the name painted on the side: *Mary Celeste*. They realized that the ship was deserted. There were no signs of any kind of violence aboard, however. They noticed, too, that the ship's one lifeboat was gone.

Something had to be done with the deserted ship. Captain Morehouse ordered the three sailors to sail it to nearby Gibraltar. The *Dei Gratia* was ahead and was already there when they arrived. At Gibraltar the British authorities took charge of the ship and ordered a public enquiry. They questioned Captain Morehouse and his crew closely. Was it possible, they asked, that pirates had taken over the ship? If so, where were they? Nine barrels of alcohol were empty. Had the crew been drinking this crude alcohol and gone crazy? Perhaps they had forced everyone aboard to jump into the sea and then, in their madness, jumped in themselves. What about the missing lifeboat? where was it? . . .

On 10 March, 1873, the case of the *Mary Celeste* was officially closed. The missing lifeboat had not turned up anywhere. The eleven people who had supposedly been in it were never found. Although the case was officially closed, interest in the *Mary Celeste* did not let up. People continued to talk about what might have happened.

Appendix B

Summary scoring protocol

The level of proficiency of each summary was scored considering both production and comprehension of the L2. The production of the L2 was analyzed at four different levels:

- Syntactic level
- Semantic level
- Creativity
- Grammatical accuracy

Learners could be graded in each level up to ten.

As far as comprehension is concerned, these are the propositions that were to be included in the minimally acceptable summaries:

In 1861 a ship named *The Amazon* was built; later its name was changed to *Mary Celeste*.

Weather conditions were good until they reached the Azores.

When Captain Morehouse arrived to the *Mary Celeste* everything was in perfect order.

Captain Morehouse's men sailed the *Mary Celeste* to Gibraltar.

British investigators carried out a public inquiry.

After the case was officially closed, interest in the *Mary Celeste* did not let up.

