J. Appl. Environ. Biol. Sci., 4(2)181-186, 2014

ISSN: 2090-4274
Journal of Applied Environmental and Biological Sciences
www.textroad.com

Influencing Factors in the Communication Skills of Basic Sciences Teachers: An Explanatory Factor Analysis

Ebrahim Ezzati[1], Rabiollah Farmanbar[2], Soomeyeh Khaleghizadeh[3]

[1]Department of linguistics and foreign languages, Payame Noor University, PO BOX: 19395-3697, Tehran, Iran
[2]Health education and health promotion department, health school, Guilan University of medical sciences, Rasht, Iran
[3]Department of Mathematics, Payame Noor University, PO BOX: 19395-3697, Tehran, Iran

Received: December 12 2013
Accepted: January 25 2014

ABSTRACT

This study concerns determining the effective factors related to the communication skills of basic sciences university teachers. Therefore, a conceptual model of communication skill has been devised by reviewing the related literature, as point of departure. Next, this model was given to an expert panel to evaluate its content validity. Then the model was transformed into a translated Persian questionnaire. After that, it was given to the subjects of the study, around 64, university teachers. Once the reliability of the study was confirmed by the obtained responses, they were fed into SPSS software in order to run Explanatory Factor Analysis. To enclose, it has been explained that there were 2 factors entitled as *verbal* and *visual*. The first one comprised 9 variables and the second one is consisted of 6 variables.

KEY WORDS: Explanatory factor Analysis, communication skills, Persian, basic sciences teachers

1. INTRODUCTION

Even though the idea of speaking before an audience fills many with feelings of dread, a public speaking opportunity, if well-planned and practiced, can be a memorable and pleasurable event for both the speaker and the audience. The purpose of communication is to transmit a message about our experiences or perceptions and to express our point of view about those experiences and perceptions. A speaker attempts to aid the audience in understanding the meaning of the message through the use of verbal and nonverbal communication. Language and words are symbolic – they represent ideas and things – and are the verbal tools the speaker uses to convey the true message– the meaning of the words – to the audience. The speaker also uses nonverbal tools – attitude, actions, and appearance – to share the meaning with the audience. An inspired presentation leaves the audience imbued with a real understanding of the meaning of the speaker's message, not merely superficial comprehension of the words used. (Hamm, 2006: 6-11).

2. Statement of the problem

As far as the communication skill is of concern, teachers are on top of an effective relationship. Moreover, the notion that states teaching and learning signify the two sides of a single coin has always been the main objective in education. Furthermore, the possibility of organizing teaching in such a way as to cultivate better learning has been one of the main premises of education since Comenius (1592-1604). On the other hand, when dealing with the teaching execution process in classrooms, we find teachers who may or may not have the necessary skills to communicate with their students, skills that can facilitate or preclude the achievement of the teaching plan, (Capecchi and Carvalho 2006).

In general, teaching science courses has gained many researchers' attention both in theory and practice. That is to say, teachers who are involved in the process of teaching scientific courses such as mathematics, physics, chemistry and biology are expected to be proficient in both conversational skills and scientific language of teaching. Besides, it has been endorsed by many scholars that science can be understood as a culture that has its own rules, principles and language, and that science teaching and learning should be seen as a process of enculturation, as well (Sutton 1998; Driver and Newton 1997; Roth 1999; Jiménez Aleixandre 2005; Carvalho 2005; Capecchi and Carvalho 2006).

As matter of fact, the researchers in this study are to develop a model in which the communication skill factors of Iranian basic sciences teachers will be depicted. Accordingly, a conceptual model of communication skill was designed by reviewing the books and articles related to the field of teachers' communication skills. This basic and conceptual model has been selected based on Spitzberg's conversational skills rating scale (2006). This

*** Corresponding Author:** Rabiollah Farmanbar, Health education and health promotion department, health school, Guilan university of medical sciences, Rasht, Iran. Email:rabi_1345@yahoo.com

questionnaire is consisted of 4 sub-skills and 25 questions revolving around the nucleus of conversational skill as follows:

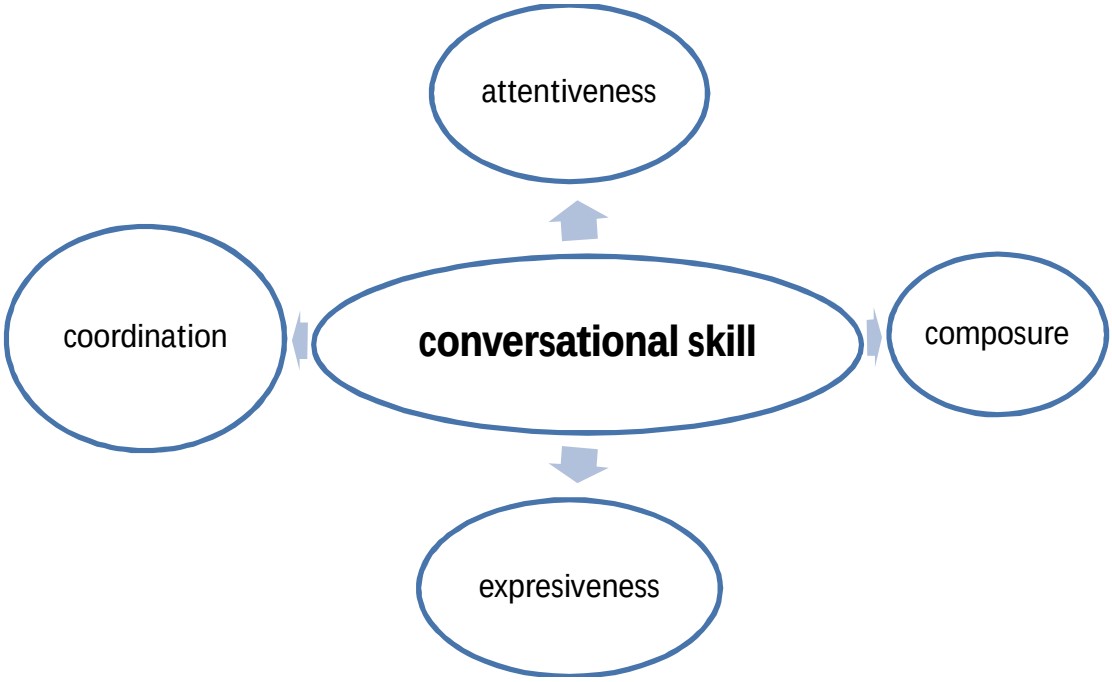

Diagram 1: conversational skills model

To put this model into a simple language, *attentiveness* refers to being altruistic; *composure* specifies calmness and confidence; *expressiveness* is related to verbal and non-verbal aspects of conversation and *coordination* concerns managing and controlling the flow of the conversation or interaction. Accordingly, the question that the researchers are seeking to be answered is:

What are the factors and variables included in a model concerning basic sciences teachers' communication skills in a Persian context?

What it means is that the present study attempts to determine factors and variables constituting university teachers' conversational skills in classroom but with this difference and significance that it categorically concerns **basic sciences teachers' conversational skills** in a **Persian context.**

3. METHODOLOGY

a. Data collection

The geographic research scope of this study mostly conformed to universities supervised by Ministry of Sciences, Researches and Technology in Guilan province such as Guilan University, Guilan University of medical sciences, Payam Noor university of Guilan and Islamic Azad University, a northern state of Iran. To facilitate, the number of the basic sciences faculty members of the mentioned four universities were retrieved from their websites[1] as follows:

Table 1: Number of faculty members

Rank/University	Total
Guilan University	74
Guilan University of medical sciences	56
Islamic Azad University	44
PNU university	18
Total	**192**

[1] www.guilan.ac.ir; www.gums.ac.ir; www.guilan.pnu.ac.ir; www.iaurasht.ac.ir

In accordance with the information in the given table, the subjects of this research were collected based on a stratified random selection. In other words, university teachers were, firstly, classified into four groups as "Guilan University, Guilan Medical Sciences University, Azad University and Payam Noor University. Secondly, Cochran formula (1977) was employed to determine the sample size of the population. As a consequence, 64 subjects out of 192 were totally supposed to be in the sample of the study. As a final step, in proportion to the total number of each group in the population (GU, **%38.5**, GMSU, **%29.1**, AU, **%22.9** and PNU, **%9.3**), the sample size of each group in the total sample has been verified as follows: 25 GU teachers, 18 GMSU teachers, 15 AU teachers, 6 PNU teachers.

b. Data analysis

To start with, the Spitzberg's conversational skills model (comprising 4 factors and 25 variables) has been given to an expert panel consisting of 10 experienced and professional university full professors specialized in the field of basic sciences education in order to determine its content validity regarding university teachers' conversational skills in a Persian context. Therefore, they were asked to evaluate each factor from the least to the most important one. Having revised and ranked the factors, the expert panel was requested to transform their model into a questionnaire in which both factors and their variables were included. Afterwards, this questionnaire was translated from English to Persian. Once, the translated questionnaire has been confirmed by the expert panel, it was submitted to the subjects. The obtained data were fed into SPSS software, in order to conduct Explanatory Factor Analysis.

4- RESULTS AND CONCLUSION

Once the conceptual model was given to the expert panel, they were asked to evaluate the model based on the scores 5 as the highest rank, 4 as the high rank, 3 as the middle, 2 as the low one and 1 as lowest. The mean of the ranked factors were as follows: expressiveness (4.75), attentive(4.16), composure(3.16) and coordination(2.83). It is also worth mentioning that they have introduced another factor named as science teaching skill in which some variables such as arousing argumentation in the classroom, transforming everyday language into scientific language and getting students familiar with the mathematical terms such as tables, graphs, equations. Therefore, the conceptual model has been changed into a different ranked model in which there were 5 factors and 28 variables. This revised model has been transformed into a questionnaire, and then this questionnaire was translated from English into Persian. After the translated questionnaire was confirmed by the expert panel, it was submitted to the basic science university teachers in Guilan province, a northern state of Iran. For each question, the university teachers were asked to give a score of evaluation from 1 (as the lowest) to 5 (as the highest) to themselves. On the whole, 64 complete questionnaires have been obtained. Consequently, the responses were presently fed into SPSS software 16.00 in order to conduct Explanatory Factor Analysis. Before EFA was run, the reliability of the questionnaire had been calculated as a coefficient of **0.84** not to mention it was revealed that the data were normally distributed based on Kolmograph-Smirnov normality test. While running EFA, two methods were used "Principle component analysis" and "Varimax Rotation Method". As a result, the outputs received by EFA revealed two different findings: one, the adequacy of the sample size and the other, the correlated groups of communication skills of basic sciences teachers. The first output is shown in the following table in which the size of the sample has been verified:

Table 2: KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.812
Bartlett's Test of Sphericity	Approx. Chi-Square	7825.002
	Df	823
	Sig.	.000

In the next stage of EFA, it has been explained that there were two main groups in the category of basic sciences teachers' communication skills: the groups were named as verbal and visual skills.

Table3: EFA proposed model of basic sciences teachers' communication skill

Factor	Eigen value	Explained variance	Cronbach's Alpha	Related variables	Loading extent
				4. being articulate (to be clear in pronunciation and linguistic expression)	.995
				3.having a confident voice	.995
				26. persuade students to take part in argumentations in class	.995
Verbal skill	7.993	28.983	.989	14.to use humor and stories while speaking	.995
				2. Speaking fluency (pauses, silences, "uh", etc.	.973
				17. to raise questions while Having a conversation	.973
				5.Vocal variety (neither overly monotone nor dramatic voice)	.867
				27. changing usual language into a scientific language	.773
				18.speaking about partner (involvement of partner as a topic of conversation)	.723
				11. to show appropriate mimic	.990
				13.to use body language to emphasize what is being said	.990
				12. Nodding of head in response to partner's statements	.985
Visual skill	6.677	27.233	.969	28. getting students familiar with mathematical terms – tables, graphs, equations	.985
				16. to use appropriate eye contact	.875
				7. appropriate posture	.775

This table confirms that Eigen value plays an indispensible role in EFA. This is because of the fact that it is the total extraction sums of squared loadings of factors. Moreover, Eigen value describes to what extent each factor is effective to explain the common variance underlying the variables. In fact, Eigen value is one of the most necessary reasons in deciding the ultimate extracted factors. To put it into simple language, if the Eigen value of a factor drops significantly, the factor is more likely to be eliminated. As a consequence, the five-factor model of basic sciences teachers' communication skill was changed into a two-factor model in which the Eigen value of the selected factors were more 1 such that the first group entitled as *verbal skill* comprised questions*: 4, 3, 26, 14, 2, 17, 5, 27 and18* and the second group entitled as *visual skill* is consisted of questions*; 11, 13, 12. 28, 16 and 7.* Generally, the proposed model of EFA entails two factors (skills), the verbal skill with 9 variables and the visual factor engaging 6 variables. In this newly-designed model, the cumulative extraction sum of squared loadings seems to be 56.216 percent. The total variance explained for each group concerns 28.983 percent in favor of verbal skill and 27.233 in support of visual skill. Similarly, in order to choose the proposed variables, the loading extent more than 0.5 percent has been considered as the acceptable level. As a result, some variables such as 15 (*smiling and laughing),* 22 *(Initiation of new topics),* 24 (Interruption of partner speaking turns) and 19 *(Speaking about self)* were omitted from the questionnaire because they did not meet the required loading level. Additionally, to facilitate verifying the reliability of the proposed model, a Cronbach`s Alpha was used. The following table shows the total reliability statistics:

Table 4: EFA total reliability o the proposed model

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.982	.971	15

As it can be seen, in comparison to the reliability of the revised model of expert panel(0.84), this proposed model gained a higher reliability coefficient **(0.982).**

According to what has been found, it can be concluded that while science is taught, a variety of languages are expected to be used. That is to say, it is a necessity for a science teacher to be not only dexterous in verbal communication but he/she is also supposed to be skillful in employing gestures, facial expressions and written languages accompanied by tables and graphs, the idea which is consistent with Lemke (1998).

To recapitulate, in order to study the communication skills required for teaching that intends to introduce students to the universe of the sciences, a university teacher should merge the verbal skills typically found in a class to the other modes of communication that will help students in the assembly of scientific comprehension.

Acknowledgment

The authors declare that they have no conflicts of interest in the research.

REFERENCES

1. Capecchi, M.C.M. (2004) .*Aspectos da Cultura Científica em Atividades de Experimentaçãonas Aulas de Física*.Tese (Doutorado). Faculdade de Educação, Universidade de São Paulo.
2. Capecchi, M.C.M. e Carvalho A.M.P. (2006) Atividades de Laboratório como Instrumentos para a Abordagem de Aspectos da Cultura Científica em sala de aula, *Por-Posições*, v.17 n.1 (49), pp137-153.
3. Capecchi, M. C. V. M., Carvalho, A. M. P. e Silva, D. 2000. Argumentação dosalunos e o discurso do professor em uma aula de Física. *Ensaio*: pesquisa em educação em ciências, vol. 2, no. 2, dezembro de.
4. Carvalho, A M. P, Santos, E. I., Azevedo, M. C. P. S., Date, M. P. S., Fujii, S. R. S. eNascimento, V. B. *Termodinâmica: um ensino por investigação*. São Paulo, USP,1999.
5. Carvalho, A. M. P Introduzindo os Alunos no Universo das Ciências, in Werthein, J. e Cunha, C. *Educação científica e Desenvolvimento: o que pensam os cientistas,* UNESCO, 232 p. 2005.
6. Carvalho A.M.P. Enseñar física y fomentar uma enculturación científica. *Alambique*, 51, pp 66-75, 2007.
7. Driver, R.; Newton, P.; Osborne, J. The place of argumentation in the pedagogy of school science. *International Journal of Science Education*, vol. 21, no. 5, 556 – 576, 1999.
8. Driver, R.; Newton, P. (1997). *Establishing the norms of scientific argumentation in classrooms*. Paper prepared for presentation at the ESERA Conference, 2 - 6 September, 1997, Rome.
9. Duschl, D. A., Ellendogen, K. e Erduran, S. (1999). Promoting Argumentation in middle school science classrooms: a project Sepia. Evaluation. Artigo apresentado no Encontro Anual da *National Association for Research in Science Teaching (NARST)*.
10. Grandy, R. e Duschl, R. A. (2007). Reconsidering the Character and Role of Inquiry in School Science: Analysis of a Conference. *Science & Education,* 16, 141-166.
11. Hamm, H. P. (2006). *Teaching and persuasive communication: class presentation skills*. A handbook for faculty, teaching assistants and teaching fellows. Harriest W. Sheridan center for teaching and learning: Brown University.
12. Jimenez Aleixandre, M.P. (2005) A argumentação sobre questões sócio-científicas: processos de construção e justificação do conhecimento na aula, *Atas do Encontro Nacional de Pesquisa em Ensino de Ciências*. Bauru, ABRAPEC.
13. Jewitt, C.; Kress, G.; Ogborn, J. & Tsatsarelis, C. 2001. Exploring learning through visual, actional and linguistic communication: the multimodal environment of a science classroom. *Educational Review,* vol. 53, (1).
14. Jewitt, C. e Scott, P. H. Meaning making in science classrooms: a joint perspective drawing on multimodal and socio-cultural theoretical approaches. Artigo preparado para apresentação no *Language, action and communication in science education symposium* da International Society for Cultural Research and Activity Theory (ISCRAT), 2002.
15. Kress, G.; Ogborn, J.;Martins, I. A. (1998). Satellite view of language: some lessons from science classrooms. *Language Awareness*, vol. 7, no. 2&3,
16. Kress, G., Jewitt, C., Ogborn, J. e Tsatsarelis, C.(2001). *Multimodal teaching and* Lemke, J. L. (1990). *Aprender a Hablar Ciencia: lenguaje, aprendizaje y valores.* Espanha, Editora Paidós, 1997 (Originalmente publicado sob o título: Talking science: language, learning and values.
17. Lemke, J. (1998). Multiplying meaning: visual and verbal semiotics in scientific text. In: Martin, J. e Veel, R. (eds.), *Reading Science*. Londres, Routledge.
18. Lemke, J. 1999. Typological and Topological Meaning in Diagnostic Discourse. *Discourse Processes*, v.27, n.2, 173-185.

19. Lemke, J.(2000). Multimedia literacy demands of the scientific curriculum. *Linguistics and Education*, 10 (3): 247 – 271.
20. Lemke, J. 2003 Teaching all the languages of Science: words, symbols, images and actions.(no prelo, a ser publicado em *Metatemas*, Barcelona) http://academic.brooklyn.cuny.edu/education/jlemke/sci-ed.htm, consultado emfevereiro de.
21. Lemke, J. L. (1998). Teaching all the languages of science: words, symbols, images and actions. Paper presented at the Conference on Science Education in Barcelona.
22. Pessoca De Carvalho, M. A. (2010). Communication skills for teaching. Physics Research and teaching laboratory, university of São Paulo.
23. Ogborn, J.; Kress, G.; Martins, I. e McGillicuddy, K. 1996. *Explaining science in the classroom*, Buckingham: Open University Press.
24. Piccinini, C. L. *Análise da comunicação multimodal na sala de aula de ciências: um estudo envolvendo o conceito de célula.* Dissertação de mestrado Programa de Pós–graduação em Tecnologia Educacional para as Ciências da Saúde, NUTES da UFRJ, 2003.

26. Roth, W-M. 'Authentic science': Enculturation into the conceptual blind spots of a discipline. Artigo apresentado no Encontro Anual da. *American Educational Research Association*, Montréal, Québec, 1999.

27. Roth, W-M. (2002). Science, culture and the emergence of language. *Science Education*, vol. 86 (3): 368- 385.

28. Roth, W-M. 'Authentic science': Enculturation into the conceptual blind spots of a discipline. Artigo apresentado no Encontro Anual da *American Educational Research Association*, Montréal, Québec, 1999.

29. Sutton, C., (1998). New Perspectives on Language in Science. In: *International Handbook of Science Education*. Klower Academic Publishes. Editores: Fraser, B. e Tobin, K. G.