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NONVERBAL COMPONENT OF ENGINEER'S COMMUNICATIVE COMPETENCE

Elena G. Tareva (a), Tatiana A. Polushkina (b)*
*Corresponding author

(a) Dr.Sc. (Education), Professor, Head of the Department of the French Language and Linguodidactics, Institute of Foreign Languages, Moscow City University, Moscow, Russia, elenatareva@mail.ru
(b) Senior lecturer of the Department of Foreign Languages, Moscow Institute of Physics and Technology, Dolgoprudny, Moscow region, Russia, polushkina.ta@mipt.ru

Abstract

This paper explores the communicative competence of engineering professionals engaging in global communication. The authors highlight the need for expanding knowledge of the elements that constitute the second language (L2) communicative competence in global encounters within engineering practice. Among the least emphasized components are non-verbal vocal characteristics of a technical speaker that count the most for the message to be accepted at all the stages of any engineering project. The research sets a twofold aim: to evaluate and increase the level of engineering students' self-knowledge of their non-verbal features specific for a technical presentation. As a first step, the presentations from Russian learners of both undergraduate and postgraduate level were recorded and rated by IT professionals for a number of vocal characteristics. As a second step, the students engaged in self-reflective practice on the survey data and took part in the critical listening of models and anti-models of technical presentations. As a result, a set of specific oral challenges for engineering students was identified, as well as the lack of students' awareness of vocal tools to convey an adequate and clear message. The study's implications for teaching and future research include that more emphasis should be placed on the development of oral skills with a special focus on non-verbal delivery techniques being an integral part of effective intercultural technical communication and a key to professional success, previously ignored in the curriculum planning.

Keywords: English of science and engineering, L2 professional communicative competence, oral communication skills, student learning, technical communication.

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1. Introduction

The profession of engineering in the 21st century is undergoing numerous changes due to the combination of information maelstrom, societal megatrends (globalization, technological advances) and the shift from centralized and hierarchical business structures to entrepreneurship ecosystems, geographically distributed and virtual teams, multidisciplinary professional groups (Aladyshkin, Kulik, Michurin, & Anosova, 2017; Kolomeyzev & Shipunova, 2017). One of the most remarkable trends has been the coming of era Industry 4.0, characterized by the rise of complex interactive and integrated manufacturing systems (Roblek, Meško, & Krapež, 2016; Tareva & Tarev, 2018). This interconnectedness is creating new opportunities for cross-industry relationships and entails collaborative engineering practices (Cleary, Slattery, Flammia, & Minacori, 2018; Jeyaraj, 2017). The idea behind the collaborative nature of gaining knowledge is that it is "never a solitary act but a community affair" (Rifkin, 2013, p. 247). It is apparent that the new professional environment requires new modes of inter-, intraprofessional communication. Nowadays "it is both the responsibility of engineers and important to the image of the profession that engineers increase their ability to *eloquently articulate* the relevance of engineering to many public policy issues" (National Academy of Engineering, 2006, p. 11). Thus, since cross industry relationships include the interaction with a much wider amount of stakeholders, communicating professionals get involved in sophisticated forms of workplace and public communication: "with sophisticated knowledge comes the need for sophisticated conversational skills" (Freeman, 2003, p. 165). So, the modern epoch has deserved to be called "the golden age of technical communication" (Kimball, 2016), which requires training technical communicators as "discourse workers" (Wilson & Wolford, 2016). Clearly, to complete professional tasks successfully in today's demanding workplace, a modern engineer is expected to demonstrate a greater degree of communicative flexibility.

These dramatic shifts in the practice of doing engineering and the kind of problems that engineers solve have urged both the education policy-makers and technological community to re-examine and redefine the skill sets that engineers must now have in communication and teamwork. The present-day global initiatives in STEM-education include the adoption of highly acclaimed professional standards (e.g. CDIO) (Crawley, Malmqvist, Östlund, Brodeur, & Edström, 2014). By taking a broad look at the requested professional communicative competence, we can see that in a wide range of potential typical situations, at every stage of an engineering project (*Concept – Design – Implementation – Operation*), engineers get involved in a number of core communicative acts: *description, explanation, discussion*. As can be observed, for the first time ever, oral communication skills have come to the foreground of technical communication. In line with the expansion of engineering communicative competence, it seems logical that standards in engineering education have been upgraded to include "the ability to communicate *logically and persuasively* in *spoken*, written, numerical, and visual forms" (National Academy of Engineering, 2006, p. 104). The greater emphasis placed on speaking skills by employers and the government is believed to be a very significant aspect of addressing the advanced challenges of professional engineering interaction (Small, 2017).

Taking into account the special status of oral communication in the new realities of doing engineering practice, it has become apparent that technically-oriented core communicative acts take on the characteristics of *directness, persuasiveness, logic, coherence, clarity, appropriateness, expressiveness,*

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effectiveness, etc. These are primarily ensured by the vocal features, projected by the speaker, also referred to as paralanguage, consisting of intonation patterns, loudness, stress, pitch, terminal junctures (Poyatos, 1993). Another non-verbal aspect – kinesics – was deliberately left outside the scope of the current study. The non-verbal communicative "enhancers" are central to ensuring intelligibility, to getting the message across with impact and to its adequate interpretation by the receiver (Common European Framework, 2017; Lyovina, 2003b; Wennerstrom, 2001). Once speakers fail to control any of these components, they certainly convey messages that work against their communicative intent. Therefore, it can be argued that the development of the engineering communicative competence has been due, in no small measure, to the burgeoning role of message delivery techniques. The ability to give technical presentations successful in *both* content and delivery, i.e. to operate at the optimum level of the communicative competence, is integral to corporate and individual success in a technology-based company.

2. Problem Statement

Though it has been for more than two decades that oral communication and presentation skills were viewed as one of the best *career enhancers* and the single biggest factor in determining an engineering student's career success or failure (Riemer, 2007; Rudskoy, Borovkov, Romanov, & Kolosova, 2018), the ability to communicative competence in the workplace, especially in English as a lingua franca, is claimed to receive insufficient research attention (Kong, 2014). On the one hand, in the context of developing L2 communicative competence by Russian engineering students, oral communication skills are recognized as necessary for all those going to work for transnational companies with permanent global encounters (Goldfarb, Krylov, & Elensky, 2013; Polyakova, 2015). On the other hand, the level of communicative competence in English demonstrated by future engineers in Russia is apparently modest (Millrood, 2014), not least due to the lack of training in non-verbal communication that traditionally remains strongly underemphasized or ignored in engineering curriculum planning. The inability to demonstrate the expected non-verbal and paralinguistic features is believed to result in shifting the audience attention from the message, in missing the point and cause miscommunication. The neglect of non-verbal aspect in developing L2 communicative competence, therefore, comes into conflict with the global trends in engineering education to design language programs driven by the associated skill sets that communicating professionals normally use in a wide range of workplace situations that they might encounter while working abroad or participating in a multinational team.

With the increased emphasis by both government and business on verbal technical communication, there is an obvious need to improve learners' performance in key areas of oral skills of engineers. Programs of effective English education and language support, particularly in terms of delivering plausible (i.e. audience-centered, clear, logical, coherent and persuasive) technical presentations in an accurate and fluent manner, are clearly called for.

3. Research questions

The research questions for this study are:

1. What is the degree of harmony between L2 non-verbal communication skills, demonstrated by Russian engineering students, and those requested by the stakeholders?

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2. What are the appropriate ways to maximize the engineering students' level of motivation to master their L2 non-verbal communication skills in the context of giving a presentation?

4. Purpose of the Study

Teaching non-native speaker (NNS) engineering students to communicate competently in today's fast-paced technological environments, it is necessary to recognize the pivotal role of vocal characteristics in getting across technical data and information, creating rapport and establishing credibility with communication partners. To address this issue, we defined the following research objectives:

1. to evaluate NNS engineering students' oral performance in terms of non-verbal skills appropriate for an effective presentation;
2. to expand the engineering students' awareness of the non-verbal features of the spoken engineering discourse and their salient role in fostering professional speaker-audience interaction;
3. to increase each student's self-knowledge of their use of non-verbal features specific for a technical presentation and to evaluate whether their choices are working well for them in their current environment;
4. to encourage the students to develop their L2 communicative competence to give plausible presentations and provide them with specific strategies that they can use.

5. Research Methods

5.1. Stakeholder survey

The online survey was conducted in January 2018 among 40 employees of a technologically-based corporation engaging in global communication. Our research can be characterized as comparative since we wanted to evaluate the level of the students' ability to communicate data and information with impact as perceived by a sample of internationally operating professionals in the engineering industry. The survey results were supposed to help to identify the areas of the students' improvement and trigger the students' self-reflection on their abilities to use non-verbal vocal features. The background information collected from the respondents included age, gender, nationality, education, native language, job title. Most of the respondents were under 40 years of age and the amount of male and female respondents was equal. The number of different native languages amounted to 10, the native tongue of 65% of the respondents was Russian. Western European languages (English, German, Dutch, Polish, Italian, Spanish) accounted for 30% of all native languages, while the number of Asian languages (Indian, Arab) was 5%. All the respondents had a university degree and their job titles included systems engineer (40%), account manager (30%), marketing manager (10%), business development manager (5%), systems architect (5%), sales director (2%) operations manager (2%), customer success manager (2%), chief executive officer (2%), and personal assistant (2%).

The survey instrument was designed in such a way that responding was easy: the survey was completed online and it was administered in English. The respondents were provided with a questionnaire accompanied by a video recording of a student's presentation (CEFR B1 – C1 levels). There were 40 individual questionnaires with 8 closed questions, each of which the respondents rated with values from

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"excellent" to "poor". To formulate the questions we used the recommended evaluation criteria of oral presentations (sections related to physical delivery and clarity) (Celce-Murcia, Brinton & Goodwin, 1996).

The respondents had to watch the recording of the student's presentation and answer the following questions: *1) The speaker's accent is completely native/near-native/slight/moderate/heavy; 2) Was the speaker enthusiastic and convincing? 3) Was the audience welcoming appropriate? 4) Did the speaker state the main points clearly? 5) Was the signposting effective? 6) Was the speaker's voice loud enough? 7) Was the speed okay? 8) Did the speaker emphasize key points?* The respondents had an opportunity to leave their own comments. The submitted responses described the listeners' perceptions of the students' ability to deliver their ideas with impact, confidence and enthusiasm using non-verbal vocal features. All survey responses were anonymous. The responses were analyzed, compared and visually presented to the students for a group discussion.

5.2. Critical listening

The online survey was designed to gather data of Russian engineering students' perceptions of the vocal characteristics projected by two model technical presenters (native speaker – NS and NNS) and one anti-model public speaker (NS). The threefold goal behind the survey was a) to implicitly provide the students with key vocal (non-verbal) qualities of a technical presentation, b) to assess the students' ability to identify them in a technically-oriented speech and c) to increase their understanding of the benefits to communicate data and information. The choice of a NNS as a model presenter and a NS as an anti-model was made to demonstrate that the speaker's ability to get the message across with impact does not depend on whether he is a NS or not. As for the speakers' background, they were technically educated individuals and engineers in the field of space and aviation – the field in which the students specialize. The speakers were middle-aged (age range: 30-60 years) males coming from different national backgrounds: France, Canada and the United States. About 40 Russian engineering students at the undergraduate and postgraduate levels completed a questionnaire in their compulsory English course in February 2018. The questions in the survey were the same as in the questionnaire for IT professionals. The responses were analyzed, compared and visually presented to the students for a group discussion.

5.3. Guided reflection

This productive indirect self-assessment tool was used to evaluate the students' growth in understanding the benefits of employing non-verbal delivery techniques and to assess their level of motivation to continue developing their oral skills. We chose this procedure for its problem-based nature, optimal for developing professional and communicative competence (Tareva & Tarev, 2018) so that students could recognize the growth they made and feel positive about it. Each student was provided with a meaningful personal feedback from an employee of IT-corporation and was asked to reflect on the responses and critiques it contained. In addition, it provided the students with an opportunity to recognize the importance of presentation abilities for workplace communication and to broaden the students' ideas about stakeholders' expectations of their non-verbal abilities.

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6. Findings

In what follows, we report on our findings of the stakeholder survey results. According to the IT industry professionals, in general, the students' non-verbal skills in terms of delivering a plausible presentation were classified in the following way: "excellent" – 20%, "good" – 40%, "average" – 30%, "poor" – 10%. Going into more details, the students' non-verbal abilities were characterized by a number of features: moderate and heavy accent, a good or an average level of persuasiveness and involvement, an acceptable level of audience engagement and clarity of the main points, the adequate use of pace and loudness, the relative success in emphasizing key ideas. Among the least developed skills are the ability to sound convincing, to get across the main points with a greater degree of clarity, to vary speech tempo, and highlight the main ideas.

In the open questions of the survey some respondents shared their overall impressions. Most respondents observed low levels of speaker-audience interaction ("the audience is not involved", "the speaker lacks enthusiasm", "the speaker failed to keep me focused", "it is worth working on persuasiveness and enthusiasm", "the speaker should take the audience into account", "the speaker does not seem to feel positive about what he reports").

In their rankings of the students' success in emphasizing key ideas the respondents also showed agreement ("it is highly desirable to vary pace, loudness of speech, emphasize important points", "the emphasis on main ideas in the conclusion could be more pronounced", "the speaker does not convey the importance of his work"). Some respondents noted the effect of the memorization, which created the effect of a formal attitude and lack of personal interest of the speaker in the subject of the presentation. Thus, the values given indicated the students' limited use of non-verbal components that affected such core features of engineering spoken discourse as directness, clarity and expressiveness and, as a result, jeopardized the success of communication (Lyovina, 2003a).

Before completing the questionnaire the students had rather vague perceptions of non-verbal features. However, their implicit introduction through the survey questions enabled the students to formulate their ideas of delivery techniques and provide a number of strategies. The overwhelmingly most popular answer to the question "What are the criteria for a successful presentation?" was "clear and easy to understand". Among the barriers to clarity were mentioned "inappropriate pauses", especially pauses of hesitation (filled or non-filled), that affect the pace, resulting in the distraction of the listener's attention. According to the students, slower pace should be given priority, but care must be taken not to come across as a boring speaker. As for the more advanced techniques, such as varying of loudness and tempo on certain parts of the talk, there was made a suggestion that it "might be some special high-value technique to enhance understanding". Overall, the students were unanimous in recognizing the contributing role of non-verbal features in acting as core communicative "enhancers" in a technically-oriented presentation.

Turning to the findings in the students' critical assessment of model and anti-model speakers, we should admit, that, perhaps not unexpectedly, there was a fairly strong agreement about which speakers succeeded in demonstrating the power of their vocal characteristics. The first set of comments related to the strategies used by the NNS model, whose presentation was deemed "interesting and impressive", delivered "in a friendly manner". In their overall impressions the students noted that the presentation was "really comfortable to listen to, easy to understand, and, what is more important, the speaker looks really

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interested in his subject and successfully makes the audience interested too". The questions of the survey enabled them to be more specific in assessing the speakers' performance: "the pace, intonation and enthusiasm were perfect". The second set of comments related to the performance of the NS model: "very interesting, easy to understand, well-structured", "enthusiastic and charismatic speaker", "able to vary tempo and loudness", to be "convincing and make the audience trust him".

As for the anti-model speaker (NS), the students referred to his performance as unacceptable and came up with the suggestions about what might have caused miscommunication: *the speaker was nervous or tired, ill-prepared, did not rehearse, forgot the words, improvised*. What is important, the students admitted they have the same problems in delivering speeches as the anti-model speaker. The overall impression was negative: *frequent stuttering made it hard to listen, an uninteresting talk, boring because of a slow hesitant manner of speech, too many pauses took away the attention, the speaker lacked enthusiasm, frequent interruptions hampered the perception of information*. According to the students, the ways of improving might be the following: *to rehearse better, to be more confident, to emphasize the main ideas, to make adequate pauses, to avoid hesitation pauses, to vary pauses, to be more understandable, to slow down the pace, to have more speaking practice, to hire a speech coach, to speak more in a familiar setting, to avoid impromptu speaking.*

During the session of guided reflection, each student got acquainted with a personal feedback on their presentations. The overall students' reaction towards the ratings was positive and most students found them objective and fair. The learners admitted their failure to present data and information at the optimum level of their communicative ability and unanimously recognized the need to develop their non-verbal competence. As a result, the students set a list of priorities/identified the following areas for improvement:

1) we need to focus not on the content, but on the vocal projections, such as loudness, pauses, tempo, etc.;
2) to sound more persuasive and believable we must speak with confidence and impact;
3) we must develop fluency of speech and rehearse better;
4) we must achieve clarity through varying pace, loudness, emphasizing key points, and other underdeveloped skills that got low expert ratings;
5) we must learn to avoid being monotonous by emphasizing key ideas or new information against less significant, debatable data or shared knowledge with the help of non-verbal delivery techniques;
6) it is important not to sound unnatural, to avoid retelling the text since this affects the speaker's fluency and eye contact.
7) one should maintain contact with the audience, demonstrate enthusiasm and adapt the manner of speaking to the content;
8) we must avoid filler pauses, observe the moderate pace, not to speed up so that listener could process the information we produce.

7. Conclusion

In this paper we have reviewed the current trends in the international practice of engineering, including globalization, ever-increasing international and collaborative projects. These have been the key

prerequisites for the rethinking of the subsets of engineering communicative competence, bringing oral communication to the fore in achieving communicative success in a technological environment. The growing importance of oral skills has contributed to greater prominence of non-verbal (suprasegmental) features in typical workplace communicative scenarios. It has been shown that the adequate use of vocal cues in a technically-oriented presentation attributes to its clarity, directness, persuasiveness, logic, coherence and expressiveness.

In terms of acquisition of L2 skills in non-verbal communication by NNS engineering students, we pointed out to the previously unnoticed "white spots" in ESP curriculum, resulting from the inconsistency between the pressing requirements to engineering education and lack timely response from education community.

As a result of the research, we have obtained the findings that (1) identified the students' insufficient command of high-value delivery techniques from the viewpoint of the employer; (2) revealed the gaps in engineering students' prior knowledge about the specifics of non-verbal devices in a technical presentation; (3) indicated the students' recognition of the beneficial role of vocal cues in technical communication and showed their resolve to continue developing their non-verbal skills.

Our study bears some significant implications for practice and engineering education. This paper has shown that the learners' ability to evaluate the effectiveness of oral communication expands the students' willingness and ability to improve. Some factors of miscommunication can be avoided by providing students with a set of expectations that may not be all obvious to students. As students become aware of the non-verbal features of a technical presentation, they begin to understand some of the specific reasons why they are misunderstood and to modify their strategies in order to meet their goals.

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