Accuracy decoding of nonverbal behavior based on verbal descriptions of nonverbal signs

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Abstract

Nonverbal communication literacy is a system of knowledge and skills that enables a person to understand (decode) nonverbal signs in various communication situations and to use (encode) appropriate nonverbal signs. Nonverbal signs decoding accuracy is one of the nonverbal communication literacy indicators. The questionnaire of Reading NonVerbal Signs was used. The sample consists of 172 undergraduate engineering students. The students decoded nonverbal behaviour described verbally in a different way than the experts did (experts' assessment as a criterion). The decoding nonverbal signs accuracy coefficient is low. These variations in the students' nonverbal behaviour decoding and low accuracy reflect a holistic approach to the coding of nonverbal behaviour described verbally which emphasized the importance of the impression of nonverbal behaviours rather than the cognitive processing.

Keywords: decoding nonverbal behaviour; accuracy of decoding; nonverbal communication competence; nonverbal literacy.

1. Introduction: nonverbal communication and coding

Communication literacy is an important factor in social interaction effectiveness. Based on "the interaction on the simultaneously spontaneous and symbolic levels" (Buck & VanLear, 2002, p. 536), human communication demands integration of the encoding and decoding of verbal and nonverbal behaviour. Researchers emphasized that the nonverbal communication skills (or decoding and encoding nonverbal cues effectively, especially interpreting nonverbal emotional cues) are important parts of social competence (Klinzing & Gerada-Aloiso, 2004). These skills are the basis of successful relationships and healthy psychological functioning (Carton et al., 1999, p. 91) and have a crucial role in fluid interactions (Mullins & Duke, 2004). Nonverbal communication skills and accurately (or inaccurately) decoding of nonverbal behavior are related to several theoretical approaches within personality and social psychology (Murphy et al., 2016).

Nonverbal behaviours provide a lot of information about different forms of interactions. As the form of the transfer of information through the use of body language including eye contact, facial expressions, gestures, postures, tones of voice, and the other nonverbal behavioural signs, nonverbal communication has central importance to the expression of emotions. "Inaccurate recognition of displays of emotion can disrupt the ebb and flow of social exchanges and may lead to uneasy feelings and avoidance of subsequent interactions with the offender" (Nowicki & Duke, 1992, cited in Mullins & Duke, 2004, p. 3).

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Investigations of the importance of nonverbal literacy and nonverbal decoding skills to mental health confirmed the following: nonverbal decoding accuracy is significantly related to relationship well-being even after controlling for depression (Carton et al., 1999): errors in decoding facial expression and tones of voice were associated with less relationship well-being and greater depression; the people who are the most effective in their social interactions are successful at decoding the nonverbal behaviour of others and also can encode nonverbally in a manner that others can understand (Feldman et al., 1991).

The complex system of nonverbal communication involves paralinguistic communication and extralinguistic communication (Rot, 1983, cited in Bjekić et al., 2017a, p. 490). As the form of the transfer of information, nonverbal communication has central importance to the expression. Nonverbal communication literacy, as a process of coding, includes nonverbal encoding and nonverbal decoding. Most authors emphasized the teachability and learnability of nonverbal communication through interpersonal interaction (Hinchcliff-Pelias, 2012).

Bjekić, Bojović & Stojković (2017a) considered a holistic and analytical approach to nonverbal coding. The holistic approach considers nonverbal signs as an integrated comprehensive feature. According to this approach, nonverbal literacy (both decoding and encoding) is reflected in the impression of nonverbal behaviour. The analytical approach differentiates components of nonverbal literacy based on the nonverbal communication signs: voice posture, voice volume, speed of speech; posture – body position (directed toward a collocutor, or turned away from a collocutor); eye direction, eyebrow position, mouth position (as elements of facial expression); head position (head up or head down); personal space, distance, etc. According to the analytical approach, nonverbal literacy is reflected in the processing and recognition of separate nonverbal communication signs. As a very important component of nonverbal communication, facial expression is a universal emotional sign, especially in conversational situations (Ershadi et al., 2017; Mandal & Awasthi, 2015).

Different processes can support people's ability to decode facial expressions and the meaning of the nonverbal signs (Niedenthal et al., 2010). The intertwining of social and emotional learning, and academic learning in cognitive domain (Buzgar & Giurgiuman, 2019), should be an educational context for improving nonverbal coding accuracy. The drama method in the process of learning and teaching social communication skills is one of the teaching methodology approaches, too (Batdi & Elalldi, 2020).

Nonverbal communication is recognized in various situations (Bjekić et al., 2017a, pp. 490–491). In some cases, it is recognized in understanding those texts that present various conversational situations (e.g., dialogues, discussions, lecturing), bearing in mind that the precision of decoding nonverbal communication signs such as paralinguistic and extralinguistic signs is based on description decoding (i.e., decoding of nonverbal communication signs expressed by words). Using words to decode nonverbal signs is important to improve awareness of nonverbal behaviour. In the language and literature teaching nonverbal communication signs recognition is based on the description of nonverbal behaviour (i.e., text reading), but not on direct perception of nonverbal signs. Nonverbal decoding may serve both as a valuable guide in any real-world social interaction, and "their role may also translate to the world of literature and storytelling" (Brück et al., 2016).

In the language and literature instruction (teaching) at all levels of education and all school/educational systems, analysis of literature characters is based on the interpretation of nonverbal behaviour and reading of nonverbal communication cues, and on the analysis and interpretation of the characters' verbal messages. By this approach, language and literature courses realize not only educational informative and formative goals, but also educational socialization goals and outcomes. The language and literature courses make a wider transfer of the values and influence the formation of students' personalities, and make an impact on their communication skills development and successful social interaction.

2. Verbal description of nonverbal signs in the literature

The verbal representation of nonverbal behaviour in the literature is interesting topic (Brück et al., 2016; Gernsbacher et al., 1992; Harmash et al., 2019; Taylor, 2008).

In the study of gestures as semiotic units of communication, Harmash et al. (2019), tried to determine the main ways of encoding and decoding nonverbal behaviour in a literary text (novel "The Master of Petersburg", by the Nobel Laureate J. M. Coetzee). Their study aimed to identify and analyze gestures in the selected novel as markers of the characters' emotional state, correlate with their psychological portraits, convey their feelings, experiences, and reveal their personal qualities. They considered "the relevance of studying the features of verbal representations of nonverbal semiotics units on the material of literary texts is due to the fact that today the research centre has shifted from the description of the gesture as a separate unit of nonverbal communication to the description and interpretation of communication as a holistic system, which includes both verbal and nonverbal behavior" (Harmash et al., 2019, p. 253); the analyzed specificities of verbal display of meanings transmitted by a nonverbal way.

In the study of decoding described vocal and facial cues, Brück et al. (2016) present a series of three experiments aimed at investigating the processing of emotional facial expressions and nonverbal vocal signals (e.g., prosody, laughter) described in the literature. Results obtained in these studies indicated that not only the codes and symbols used to convey emotional information in literature may resemble real-life experiences, but similarities may also emerge concerning the perceptual mechanisms used to derive meaning from described emotional cues.

The focus of our paper is the measurement of competence in nonverbal communication by decoding nonverbal communication signs (e.g., facial expressions, postural expression, paralinguistic signs, voice tones) based on the description of nonverbal behaviour in the text. The central topic is the accuracy of nonverbal decoding based on the verbal description of nonverbal behaviour.

3. Nonverbal communication literacy: accuracy and measurement

Researchers considered the concept of nonverbal communication competence and the concept of nonverbal communication literacy or nonverbal literacy as similar or have the same meaning.

Nonverbal communication competence is considered in the context of interpersonal sensitivity (Hall et al., 2008). Interpersonal sensitivity is defined "as the accurate recall of another person's nonverbal behaviour" (Hall et al., 2006). Nonverbal communication competence integrates cognitive and behavioural abilities for decoding messages (comprehension/interpretation) and encoding messages (creation/transmission), and emotional drives to share information (Hinchcliff-Pelias, 2012). According to the prior statement, nonverbally competent persons are ready to "understand the rules and codes of human communication; possess the skills to receive, produce, and share meaningful messages; must be willing to do so" (Hinchcliff-Pelias, 2012, p. 5963).

Generally, nonverbal literacy is defined as "the skillful interpretation of nonverbal behaviours (facial expressions, hand and arm gestures, posture, and other body movements) by an individual" (Ciampa, 1972, p. 62). "Nonverbal communication literacy is a system of knowledge and skills that enables a person to understand (decode) nonverbal signs in various communication situations and to use (encode) appropriate nonverbal signs in a particular situation" (Bjekić et al., 2017a, 2017b). Therefore, it is composed of two processes: nonverbal decoding (nonverbal reading) and nonverbal encoding (Bjekić et al., 2017a, p. 492). Nonverbal communication literacy is one of the support bases of successful verbal communication. Nonverbal communication signs are more effective than a verbal exchange in some cases. The cognitive dimension of communication competence is a basis of verbal communication (Bjekić et al. 2017a, 2017b). Nonverbal communication literacy (a

central part of nonverbal communication competence) includes both behavioural and emotional dimensions and cognitive dimensions. Nonverbal sign decoding accuracy is one of the nonverbal communication literacy indicators.

Including a wider meaning of the concept "nonverbal communication competence" in the practice, in this study we will use in the term "nonverbal communication literacy" and "nonverbal literacy" for specific competence component: for nonverbal coding especially in the situation when the nonverbal signs were described verbally.

3.1. Nonverbal communication accuracy

There are different criteria of the assessment of nonverbal communication competence expressed as nonverbal communication literacy. Accuracy of coding of verbally described nonverbal cues is one of the nonverbal literacy manifestations. The authors considered: nonverbal sending accuracy or nonverbal encoding accuracy, and nonverbal receiving accuracy or nonverbal decoding accuracy.

According to Buck et al. (1980, p. 522) "nonverbal sending accuracy is defined as an individual's spontaneous tendency to accurately communicate his or her emotional state to others via such nonverbal behaviours as facial expressions, gestures, and body movements."

Sometimes, researchers considered two concepts as intertwining concepts: the concept of interpersonal sensitivity, as a broader concept, and the concept of communication accuracy which part is nonverbal communication accuracy.

Considerations of interpersonal sensitivity are based on the recognition of the concept as a broad construct (Rosenthal et al., 2013). This construct is including perceiving others accurately and engaging in interpersonally appropriate behaviour.

In the interpersonal sensitivity literature (Hall & Bernieri, 2001; Rosenthal et al., 1979; Nowicki & Duke, 1994; cited in Hall et al., 2006, p. 141), accuracy has mainly been defined as the correct interpretation of cues indicative of emotion, roles, relationships, deception, and personality (Hall & Bernieri, 2001, cited in Hall et al., 2006, p. 152). Rosenthal et al. (2013) accepted that interpersonal sensitivity has been defined "as accuracy in noticing and recalling another's nonverbal cues, speech content, or physical appearance". Nonverbal behaviour accuracy "plays an important role in everyday functioning and should be included both conceptually and empirically in discussions of interpersonal sensitivity" (Hall et al., 2006, p. 153). Considerations of the interpretation involvement in the measures of the interpersonal sensitivity to nonverbal signs (does interpretation involve or not involve?) are actual (Hall et al., 2006, pp. 141–142). Rosenthal et al. (2013) concluded that "interpersonal sensitivity tests measure accuracy in judging affective states or personality traits, though many other areas of content can be, and/or have been, tested". These measures of interpersonal sensitivity are based on the perceivers' assessments/estimates of the behaviour and on the comparison of these estimates with the criterion estimates.

In the literature on communication research, communication verbal and nonverbal sensitivity, communication verbal and nonverbal accuracy, there are a number of instruments and procedures for measuring this accuracy (Heinerichs et al., 2013; Lausic, 2009; Riggio & Darloy, 2016; Rubin et al., 2014).

Riggio and Darloy (2016) reviewed the various means that nonverbal communication researchers have used to assess nonverbal sensitivity, which involves abilities to read and decode nonverbal cues in others. They considered: (I) performance-based measures of nonverbal sensitivity; (II) self-report measures of nonverbal sensitivity; (III) methods designed to assess nonverbal cues of personality and attitudes as well as the construct of empathic accuracy.

Lausic (2009) reviewed three procedures to assess nonverbal skills: (a) standardized performance measures; (b) individualized performance measures, and (c) self-report measures. For example, one of the standardized performance measures is Profile of Nonverbal Sensitivity (Rosenthal et al., 1979, cited in Lausic, 2009, p. 13), which include audio and/or video presentations about which the respondent makes a conclusion about aperceived message, interpersonal relationship and the presence of

deception; the respondent is tested on accuracy in recognizing emotional communication by face, body and voice.

Heinerichs et al. (2013) developed a procedure of assessing nonverbal communication skills through video recording and debriefing of clinical skill simulation exams. They found that the combination of video recording and debriefing clinical simulation exams are appropriate methods for athletic students' training to learn and evaluate their nonverbal communication skills.

3.2. Review of the researches on the accuracy of the nonverbal coding

Accuracy as a property of nonverbal sensitivity, especially nonverbal decoding, is a topic of a number of researchers.

Hall et al. (2006) confirmed the following: the attentional patterns underlying nonverbal accuracy have a zero-sum quality; more attention to one aspect of the stimulus person's nonverbal behavior implies less attention to some other aspect; women's nonverbal accuracy was higher than men's; higher nonverbal accuracy was associated significantly, though rather weakly, with higher scores on tests of inferring the meanings of nonverbal cues; nonverbal accuracy also increased in correspondence with the degree of participants' positive involvement with the partner; correlations between nonverbal accuracy and other investigated variables in that research were small to modest magnitude, and sometimes achieved significance only when combined across samples using meta-analysis; very well established gender difference in nonverbal sensitivity has an aggregate effect of about $r=0.20$ and the entire collection of validity coefficients available for the PONS test (Profile of nonverbal Sensitivity) at the time it was published had an average absolute value of $r=0.22$. Hall et al. (2006) considered their own researches and projected the following future research steps: to establish a wider network to correlate nonverbal accuracy; to develop alternative measurement approaches; to establish the generality of findings across different stimulus persons and for different kinds of content.

Riggio and Riggio (2001) investigated people's self-insight into their ability to recall nonverbal cues and the relationships between nonverbal accuracy and test performance. They concluded that "people's self-reports of ability to judge the meanings of nonverbal cues are negligibly related to their tested performance on such tasks indicating that people have poor insight into their own nonverbal decoding skills" (Riggio & Riggio, 2001, p. 139).

Isenhart (1980) presented the research on the ability to decode nonverbal cues. Some studies of nonverbal decoding tested sex differences in decoding ability. Results do not consistently favor the ability of one sex over the other, but, when differences do appear, they indicate greater sensitivity for females; when the differences existed, that variability may be related to sex roles. Some of the explanations of the sex differences in nonverbal decoding accuracy are the following: femininity may be associated with better nonverbal decoding because of practice gained in traditionally feminine occupations; or certain traits, such as submissiveness and expressiveness, are linked to both femininity and nonverbal sensitivity.

Sabatelli et al. (1983) studied the relationship between locus of control, interpersonal trust, and nonverbal communication abilities of the couples. The results are as follows: there aren't relations between either control or trust expectancies and sending accuracy; trust expectancies covaried with nonverbal receiving abilities for both men and women, with high trust being associated with increased sensitivity; control expectancies covaried with general nonverbal receiving abilities differently for both men and women, with internal women scoring higher and internal-low-trust men scoring lowest on these measures.

Mullins and Duke (2004) investigated the effects of social anxiety on nonverbal accuracy in decoding facial expressions. Contrary to traditional expectations, they "found no significant relationship between social anxiety and errors in identifying facial expressions of emotion, regardless of the level of situational anxiety experienced. However, social anxiety scores were found to be significantly related to

response times to identify facial expressions, but the relationship varied depending on the level of state anxiety experience" (Mullins & Duke, 2004, p. 26-27).

The role of dynamic information in identifying facial expressions of emotion was investigated (Kamachi et al., 2001). Dynamic expression sequences were created by generating and displaying morph sequences which changed the face from neutral to a peak expression in different numbers of intervening intermediate stages, to create fast (6 frames), medium (26 frames), and slow (101 frames) sequences. Sadness was more accurately identified when slow sequences were shown. Happiness, and to some extent surprising, was better from faster sequences, while anger was most accurately detected from the sequences of medium pace. With static images, accuracies of expression judgments were derived from the rated intensities and the results were similar. The effect of display time was found only for dynamic expressions and not for static ones, suggesting that it was speed, not time, which was responsible for these effects. These results suggest that representations of basic emotion expressions encode information about dynamic as well as static properties.

Pitterman and Nowicki (2004) studied the introduction of the diagnostic analysis of nonverbal accuracy for postures (DANVA2-POS) – an instrument for measuring an individual ability to identify emotion in human standing and sitting postures. They described the process of instrument construction (Two men and two women portraying standing and sitting postures were photographed; an empirical norming procedure was used to select 32 high- and low-intensity standing and sitting postures representing happiness, sadness, anger, and fear; then, they tested construct validity of the test). Data from 243 participants showed that DANVA2-POS scores increased in accuracy with age, were internally consistent and reliable over time, and were related to self-reported loneliness, fear of negative evaluation, and locus of control.

Assessment of nonverbal literacy (procedure and accuracy) and the correlations of the nonverbal communication competence with the other communication competencies are in the focus of our research opus on communication education (Bjekić et al., 2017a, 2017b, Bjekić M., Bjekić & Zlatić, 2015; Bjekić & Zlatić, 2012; Zlatić & Bjekić, 2015, 2017; Zlatić et al., 2013; Zlatić et al., 2014; etc.). In the research of engineering students reading/decoding nonverbal competence, we developed an instrument for measuring nonverbal communication literacy Questionnaire of Reading NonVerbal Signs. The purpose of the QRNVS is decoding nonverbal behaviour based on reading/interpretation of nonverbal signs in conversation from the drama text with photos of the participants' faces and description of the behaviour with the list of 68 words/ properties (it is described in part 4.3) (Bjekić et al., 2017a).

In the prior research with the same instrument (Bjekić et al., 2017a, p. 488), the nonverbal communication literacy and interaction involvement of students with and without communication education are the focus. In this research, interaction involvement was investigated by the Interaction Involvement Scale (Cegala et al. 1982). Nonverbal communication literacy was investigated by the Questionnaire of Reading NonVerbal Signs (Bjekić et al., 2017a). The sample consists of 116 students (future engineers and future teachers of engineering courses): half of them attended communication courses at the beginning of their university education. The results indicate the existing differences between students who attended and the students who did not attend these courses: the students in the first group have a higher level of interaction involvement (the factor: attentiveness) and interpret nonverbal signs more precisely and with more details than the students in the second group (who did not attend communication courses). Both groups develop a moderate level of interaction involvement and a relatively low level of nonverbal communication literacy. The authors concluded that it is necessary to strengthen engineering students' communication competence and nonverbal communication literacy.

4. Methodology of the research

The research of accuracy decoding of nonverbal signs described verbally is exploratory research developed as a part of the project of communication competence of different professional groups.

4.1. Objective, variables, and hypotheses

Objective: The nonverbal communication competence expressed by nonverbal communication literacy as the accuracy of the decoding of nonverbal signs based on their verbal description is explored in the paper. Assessment of nonverbal literacy of the engineering students (procedure and accuracy) is the focus of this research.

Variable: The following variables are included in the research:
 • accuracy of nonverbal communication decoding based on verbal description;
 • fields of the university engineering education;
 • gender: female and male.
The central research variable is the accuracy of nonverbal communication coding (as a manifestation of nonverbal communication literacy). Nonverbal accuracy is based on the socially agreed meanings of nonverbal cues (Klinzig & Gerada-Aloiso, 2004). Accuracy of nonverbal communication literacy expressed as decoding from description and visualization of nonverbal behaviour (obtained from QRNVS) include the following components: sum of properties decoding properties based on the verbal description of nonverbal behaviour (selected properties); correctly decoding based on the verbal description of nonverbal behaviour (correctly selected properties - personal characteristics and/or emotions); incorrectly decoding based on the verbal description of nonverbal behaviour (incorrectly selected properties); the coefficient of students' decoding accuracy; the coefficient of students' total accuracy.
The fields of engineering education: engineering management, information technology engineering, and entrepreneurship engineering management.

Hypotheses: The research examines the following hypotheses:
Hypothesis 1: The undergraduate engineering students have a low level of accuracy in decoding nonverbal behaviour based on the verbal description of nonverbal signs. This assumption is based on the prior research (Bjekić et al., 2017a) with engineering students that showed that students develop a moderate level of interaction involvement and a relatively low level of nonverbal communication literacy.
Hypothesis 2. There are differences in the accuracy of decoding nonverbal behaviour between students from different fields of education. The students with managerial courses have a better level of accuracy than the students in the other fields of engineering education. The assumption is based on the evidence of communication differences in different professional communities and professional practices (Bjekić M. et al., 2015; Linvill, Tallapragada & Kaye, 2019).
Hypothesis 3: There are differences in the accuracy of decoding nonverbal behaviour between female and male students: female students have a better level of decoding accuracy in the communication field. The assumption is based on different researches on gender differences in communication behaviour (Greenwood, 2017; Hall, 1984; Isenhart, 1980; Merchant, 2012), especially on Hall's "findings of women's tendency to be more effective decoders than men" (Hall, 1998, cited in Klinzig & Gerada-Aloiso, 2004, p. 4) and Isenhart (1980) findings of female's better nonverbal decoding.

4.2. Participants

The sample consists of 172 undergraduate engineering students at the University of Kragujevac – Faculty of Technical Sciences in Čačak, in Serbia: 103 students of information technology engineering, 48 students of engineering management, and 21 students of entrepreneurship engineering management.

The experts' assessment was obtained in the project of nonverbal decoding as a part of a wider project on engineering students and students-teachers communication competence (Bjekić et al., 2017a, 2017b). Five experts in the communication field are the teachers of communication courses and trainers of communication skills. They completed QRNVS independently. The level of accuracy in decoding nonverbal behaviour from the description of the nonverbal behaviour is based on their assessment and intersubjective compliance (intersubjective consensus). The verbal codes of nonverbal signs are derived from their consensus.

4.3. Instrument

One instrument is used in this study. Questionnaire of Reading NonVerbal Signs (QRNVS) in conversational situations – reading and decoding of some nonverbal signs based on the verbal description. QRNSV was created for the prior research of interaction involvement and nonverbal communication literacy of preservice engineers (Bjekić et al. 2017a) and used for the following researches and in this paper. QRNVS (table 1 – part of QRNVS) consists of 3 components (Bjekić et al., 2017a, p. 493–494):

- Text in drama form (table 1a): the dialogue between two persons and descriptions of some nonverbal signs (gestures, paralinguistic signs, movements and postures, personal spaces, and other proxemic signs); it is a dialogue in the office between a novice at work (the first working day) and a working senior;
- Photos: photos of the dialogue participants' faces at one moment in the conversation described in the text;
- Questionnaire (table 1b): inquiry to select the meanings of nonverbal signs of the central person in the dialogue from the list of personal characteristics, emotions, and reactions which is the part of the questionnaire (68 properties); the subjects of the research have to select some features of the participants' dialogue based on nonverbal signs.

Table 1a. The part of QRNVS

Part of the text and task: description of the nonverbal behaviour in specific situation in the office	Introduction: Read the following dialogue and pay attention to the parts of the text that describe **Person A.**
	The new employee **Person A** and one of the employees with whom he will work in the same office (Person B(participate in this dialogue. The office is large, with and area of about 60 m2 and 6 desks are set in a circle.
	Person A comes to work on the first day in the office where he/she starts working from that day and comes to the middle of the office.
	Person A stands in the middle of the office and turns around twice looking arount the workspace.
	Person A says softly: *Good afternoon!*
	(Person B) .....
	Person A turns around again and stands opposite (Person B). Both people look at each other. (Person B) fixates his gaze on **Person A**, and **Person A** slowly lowers his/her gaze.
	The description of the behaviour continues…
	Task: In the following list giving the different characteristics of people (traits, personal properties, feelings, experiences, etc.). UNDERLINE those characteristics that you have identified as characteristics of **Person A** ONLY based on the description of behaviour (movement, body position in space, manner and speed of pronunciation, and other descriptions) printed in bold, listed in the text. Underline only those characteristics of Person A that you were able to idendify based on the previous text and the behaiours listed.

Table 1b. The part of QRNVS

The list of personal properties – potential meaning of nonverbal signs	Unselfish	Ungrateful	Sad	Introvert	Interested
	Sociable	Desperate	Satisfied	Imaginative	Upset
	Compassionate	Decisive	Detailed	Confident	Noncommunicative
	Diffident	Witty	Astute	Defiant	Tense
	Flexible	Tolerant	Amazed	Spontaneous	withdrawn-person
	Patient	Cheerful	Intuitive	Warm	Suspicious
	Worried	Initiator	Angry	sharp-witted	Disgusted
	Communicative	Self-confident	Proud	Jealous	Adaptable
	Disappointed	Creative	Brave	Happy	Shy
	Cooperative	Curious	Amusing	Dissatisfied	non-confident
	Disorganized	Relaxed	Fearful	Rigid	Afraid
	Extravert	Ambitious	Arrogant	Organized	Intolerant
	Affective	Bold	Calm	Selfish	Grateful

Measures description (Bjekić et al., 2017a, pp. 494–495; 2017b): Accuracy of nonverbal decoding is compared with the assessment done by the communication experts and their intersubjective consensus of meanings of nonverbal signs (behaviour) in a conversational situation. Five experts in the communication field – the teachers of communication courses and trainers of communication skills – completed QRNVS independently. The criteria of the accuracy (correctness) of decoding/reading a person's nonverbal behaviour in the dialogue situation (described in QRNVS) is based on the experts' intersubjective consensus of the meaning of the nonverbal behaviour of the central person in the dialogue. The experts agreed on and recognized 11 properties (personal characteristics and/or emotions) of the central person in the situation described in the questionnaire. The experts used and agreed on the following descriptors of the central participant in the dialogue: adaptable, afraid, cooperative, diffident, initiator, grateful, interested, extravert, patient, upset, and warm. These characteristics served as criteria of decoding accuracy defined as the proportion between the students' correct decoding (the number of characteristics or/and emotions which are the same as experts' assessment) and the students' incorrect decoding (the number of characteristics or/and emotions which are not the same as experts' assessment).

Measures of decoding obtained from QRNVS include (Bjekić et al., 2017a):
- the number of selected properties (personal characteristics and/or emotions) which are selected from the list of properties);
- the number of correctly selected properties or correct decoding based on the verbal description of nonverbal behaviour (the properties the students selected identically as the experts);
- the number of incorrectly selected properties or incorrect decoding based on the verbal description of nonverbal behaviour (the properties the students selected differently from the experts);
- the coefficient of students' decoding accuracy of nonverbal decoding); and
- the coefficient of students' total accuracy of nonverbal decoding).

The coefficient of students' decoding accuracy is the proportion of correct and incorrect decoding (for example: 7 correct answers / 5 incorrect answers = 1.4). The coefficient of the students' total accuracy is the proportion of the number of correctly selected terms in QRNVS (correct decoding) and the sum of selected properties (the number of all selected terms in QRNVS) (Bjekić et al., 2017a, p. 494).

4.4. Procedure

The research was carried out in April, May, and November 2017, at the University of Kragujevac in Serbia, as a part of a wider project on engineering students' and students-teachers communication competence (Bjekić et al., 2017a, 2017b; Bjekić M. et al., 2015; Zlatić & Bjekić, 2015).

In this study, QRNVS was administrated to undergraduate engineering students in the groups in the classes.

The communication experts were provided with their version of QRNVS individually. Data were collected separately.

The authors of this research realized the final data comparison and assessed students' accuracy of the nonverbal decoding based on the comparison of students' answers using the criteria (criteria of the accuracy defined from the experts' intersubjective consensus).

4.5. Data analysis

Data processing was based on the measures of descriptive statistics, correlation statistics, and ANOVA.

5. Results

Engineering students were decoding nonverbal behaviour described verbally. They had a task to describe the central person in the conversation verbally, based on the description of his/her nonverbal beaviour in a drama dialogue text. They selected words about personal properties and emotions from the descriptor list. The students used (selected from the descriptor list) on average 10 words from 68 offered words (M=10.30; minimum selected words four, maximum selected words 34).

What terms did the students use? The students used 68 words from the list (in QRNVS) to decode nonverbal behaviour described verbally. Only 8 concepts are used by more than 40% of the students.

The most frequently selected word by the students to decode nonverbal behaviour (most frequent descriptors of the person in the dialogue) is concept tense person – 71.5% of students used this term to decode the behaviour of the person in the dialogue as a tense person. Then followed: withdrawn person – 68.6% of the students used this term, shy 57.0%, afraid 52.9%, worried 50.6%, fearful 49.4%, diffident 46.5%, upset 42.4%, grateful 40.7%.

Communication experts' decoding of the nonverbal behaviour of the central person in the text described verbally was used as a criterium of the accuracy of students' decoding. The communication experts agreed on the following terms for decoding of nonverbal behaviour of the central conversation/dialogue person described verbally: adaptable, afraid, cooperative, diffident, initiator, grateful, interested, extravert, patient, upset, warm (Bjekić et al., 2017a, 2017b).

The students used these 11 words in different ways than the communication experts. Students' most selected word, compared with the expert list, was afraid – 52.9% of the students used this word for decoding nonverbal behaviour described verbally in QWRNS; the less used word from the expert list is initiator – 9.3% of the students used this word to decoding nonverbal behavior described verbally (table 2).

Table 2. Terms of decoding of nonverbal behavior described verbally

Communication experts decoding terms	Students use of experts decoding terms
Adaptable	27.9%
Afraid	52.9%
Cooperative	32.6%
Diffident	46.5%
Initiator	9.3%
Grateful	40.7%
Interested	30.8%
Extravert	9.9%
Patient	19.8%
Upset	42.4%
Warm	18.6%

When the students used the same words as communication experts, we assessed that it is accurate decoding. If the students used different words than the communication experts, we assessed that it is inaccurate decoding (Table 3). The students selected the same 3.3 words (M=3.30) as the experts and 7 words (M=7.01) different from the experts. Generally, the students decoded a person's nonverbal behaviour from QRNVS in a different way than the experts did.

Table 3. Results of the accuracy of decoding of nonverbal behaviour described verbally

Measures of students decoding accuracy	Min	Max	M	SD	Skewness	Kurtosis
Number of selected properties/words from QRNVS	4	34	10.30	4.281	1.402	4.956
Same decoding as experts	0	9	3.30	1.693	0.349	0.225
Different decoding from experts	1	23	7.01	3.216	1.153	3.407
DAC - Decoding accuracy coefficient: ratio between same decoding and different decoding	0.00	4.00	0.56	0.455	3.726	21.929
Total decoding accuracy coefficient: ratio between same decoding and sum	0.00	0.71	0.32	0.136	0.101	0.639

Only one student has decoding accuracy as the experts (9-11 words and more use as the experts). Most students have partially accurate decoding of nonverbal behaviour described verbally: 44% of students use 4 to 8 words same as experts, and 51% of students use 1 to 3 words as experts. Only 4% of students didn't use any words as experts (all words are different).

Engineering students' accuracy in decoding nonverbal behaviour described verbally in a drama text in QRNVS was determined concerning the communication experts decoding. The decoding nonverbal sign accuracy coefficient is low: M=0.56. Lower than 1.0 is a low accuracy coefficient and 95.3% of engineering students have a low decoding accuracy coefficient; only 3.0% of engineering students have middle decoding accuracy coefficient (1.01-2.00), and only 1.7% of students have a higher nonverbal decoding accuracy coefficient (higher than 2.00).

Based on these results, the first hypothesis was confirmed: The undergraduate engineering students have a low level of accuracy of decoding nonverbal behaviour described verbally.

One of the central parts of this research is the comparison of the accuracy in decoding nonverbal behaviour described verbally (presented in the described conversational situations – drama text in QRNVS) between the engineering students of different educational and professional fields (Table 4).

Table 4. Differences in decoding accuracy of nonverbal behaviour described verbally between different groups of engineering students

Measures of students decoding accuracy	Entrepreneurship eng.management	Engineering management	Information technology	F	Sig
Number of selected properties/words from QRNVS	8.33	10.19	10.76	2.882	0.059
Same decoding as experts	2.90	3.38	3.35	0.660	0.518
Different decoding from experts	5.24	6.87	7.43	4.251	0.016*
Decoding accuracy coefficient: ratio between same and different decoding	0.73	0.56	0.52	1.845	0.161
Total decoding accuracy coefficient: ratio between same decoding and sum	0.34	0.34	0.31	0.770	0.465
N	21	48	103	*p<0,05	

Based on these results, the second hypothesis was not confirmed. There are no differences in the accuracy of decoding nonverbal behaviour between students from different fields of education. There is only one difference: decoding of the students of entrepreneurship management differs less from the experts than the students of the other fields (engineering management and information technology engineering). Most of the other accuracy indicators are the same or similar.

The comparison of the accuracy of decoding nonverbal behaviour described verbally (presented in the described conversational situations – drama text in QRNVS) between the female engineering students and male engineering students confirmed only some differences (Table 5).

Table 5. Female and male engineering students' decoding accuracy of nonverbal behaviour described verbally

Measures of students decoding accuracy	Female eng. students	Male eng. students	F	Sig
Number of selected properties/words from QRNVS	10.16	10.46	0.221	0,639
Same decoding as experts	3.41	3.18	0.778	0.379
Different decoding from experts	6.68	7,37	1.975	0.162
Decoding accuracy coefficient: ratio between same and different decoding	0.60	0,51	1.980	0.172
Total decoding accuracy coefficient: ratio between same decoding and sum	0.34	0.31	2.352	0.127
N	90	82		

Based on these results, the third hypothesis was not confirmed. There are no statistically significant differences between female and male engineering students in decoding nonverbal behaviour described verbally.

6. Discussions

The decoding of nonverbal behaviour described verbally between engineering students and communication experts are very diverse.

Students used (selected from the descriptor list) on average 10 descriptors for the description of the central person in the dialogue based on conversation and description of nonverbal behaviour in QRNVS. They selected only three words the same as the experts (M=3.30) and approximately seven words different from the experts (M=7.01). The students decoded a person's nonverbal behaviour from QRNVS in a different way than the experts did. It can be concluded that the decoding nonverbal signs accuracy coefficient is low. Researchers confirmed that "individuals have low confidence in their intuitive social judgments" (Patterson et al., 2001).

What is the reason for students' low level of accuracy in decoding nonverbal behaviour described verbally?

According to their educational context and prospective professional engagement, understanding nonverbal behaviour is a very important transferable skill in the complex system of communication competence, and it is a part of their professional development (Bjekić et al., 2017) and development of professional identity (Linvill et al., 2019). University education of engineering students demands specialized courses for transferable skills development. However, the communication education of these students is not enough: it consists of some topics of social interaction and communication in the professional topics, only in one university course. According to the insight of the curricula for university engineering education, in most universities, the courses of professional communication, and some topics on professional communication are part of the other specific professional courses.

Based on the main results, and the necessity of engineers' communication competence in current engineering labour (Linvill et al., 2019), some educational implications of this research are important:

• improvement of communication skills of decoding nonverbal behaviour based on the prior education level as a part of the courses of language and literature (analysis of nonverbal behaviour described verbally in the literature – e.g., analysis of novels, the behaviour of the literary characters);

• development of the social and communication competence as an integral part of different professional university courses – developing the necessary transferable skills as a part of the professional courses: organizing a discussion of nonverbal behaviour in the professional and business situations (manifested and/or verbally described nonverbal behaviour); practicing observation of the nonverbal professional behaviour, describing nonverbal behaviour verbally (decoding) and manifesting/playing nonverbal sings and behaviour (encoding).

The results also open some methodological questions for future research. What is the validity of applied criterium of the accuracy of nonverbal behaviour decoding based on verbal descriptions? What is the reliability of the communication experts' decoding of the nonverbal behaviour described verbally?

What are generation differences? Because the students (young adulthood) are much younger than the experts (middle adulthood), the research opens the question about moderator effects of age on the accuracy of decoding nonverbal behaviour described verbally and suggests the investigation of decoding nonverbal behaviour accuracy of active engineers with similar age as experts.

The absence of gender differences in the decoding accuracy of nonverbal behaviour described verbally initiates the consideration of the importance of the professional orientation on nonverbal literacy as a stronger impact than the gender impact. What are the limitations of the study based on the relatively limited student sample?

Therefore, two main results are in the focus of the paper: (a) low level of the students' coefficients of the accuracy of decoding nonverbal signs described verbally (based on a verbal description of the nonverbal behaviour), and (b) similarities between the students of different educational engineering fields in their accuracy of decoding nonverbal behaviour described verbally. The low accuracy of nonverbal behaviour decoding reflects a holistic and intuitive approach to the coding of nonverbal behaviour described verbally which emphasized the importance of the first impression of nonverbal behaviours rather than the cognitive processing and analytic consideration. However, communication education and particularly learning how to code nonverbal behaviour must be based on the analytical approach to communication education. It is the step to improve nonverbal communication literacy and educate and develop nonverbally competent persons.

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