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DOCTORAL THESIS SUMMARY

THE CONTRIBUTION OF PSYCHOLINGUISTICS  
IN CALIBRATING ELEARNING PROGRAMS WITH  
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# TABLE OF CONTENTS



|  |             |
|--|-------------|
| <b>CONTENTS</b>  | <b>i</b>    |
| <b>CONTENTS</b>  | <b>iii</b>  |
| <b>PREFACE</b>   | <b>viii</b> |
| <b>INTRODUCTION</b>  | <b>1</b>    |
| 1.1. Statement of the problem  | 3           |
| 1.1.1. The "emoji" sign as a real language element                                     | 5           |
| 1.1.2. Research question   | 9           |
| 1.1.3. Research hypothesis   | 9           |
| 1.2. The motivation, purpose and importance of the study                               | 10          |
| <b>CHAPTER 1. EVALUATION OF THE SCIENTIFIC LITERATURE</b>                              | <b>12</b>   |
| 1.1. Identification and definition of concepts   | 13          |
| 1.1.1. The context level   | 13          |
| 1.1.1.1. The importance of context   | 13          |
| 1.1.1.2. Language as an expression of the context                                      | 14          |
| 1.1.1.3. Contextual - dynamic acceptance   | 15          |
| 1.1.1.3.1. Contextual levels   | 15          |
| 1.1.1.3.2. Style as a dimension of the context   | 16          |
| 1.1.1.4. Acceptance of cadres  | 17          |
| 1.1.2. The discourse level. Scientific discourse - pedagogical discourse paradigm      | 21          |
| 1.1.3. The text level. A discursive-linguistic perspective                             | 24          |
| 1.1.4. The language level  | 30          |
| 1.1.4.1. Conceptual language disputes. Bühlerian and Jacobsonian perspectives          | 30          |
| 1.1.4.2. A semiotic perspective. Hemispheric language associations                     | 31          |
| 1.1.4.3. Paradigm mathematical language - denotative and poetic language - connotative | 33          |
| 1.1.5. The sign level  | 42          |
| 1.1.5.1. Dictionary and conceptual   | 42          |
| 1.1.5.1.1. Dictionary disputes of the linguistic sign                                  | 42          |
| 1.1.5.1.2. Theoretical disputes of the linguistic sign                                 | 44          |
| 1.1.5.2. The founders and conceptualizers of modern semiotics                          | 45          |
| 1.1.5.2.1. Ferdinand de Saussure   | 46          |
| 1.1.5.2.2. Charles Sanders Peirce  | 50          |

|   |           |
|---|-----------|
| 1.1.5.2.3. Charles Morris and Umberto Eco   | 52        |
| 1.1.5.3. Functions of the sign  | 54        |
| 1.1.5.3.1. Signal   | 54        |
| 1.1.5.3.2. Symptom  | 55        |
| 1.1.5.3.3. Icon   | 56        |
| 1.1.5.3.4. Index  | 58        |
| 1.1.5.3.5. Symbol   | 60        |
| 1.1.5.3.6. Metaphor   | 65        |
| 1.1.6. The level of semiosis  | 68        |
| 1.1.6.1. Semiotic directions  | 70        |
| 1.1.6.2. Meaning  | 72        |
| 1.2. The social evolution of the sign - "emoji" symbol  | 73        |
| 1.2.1. Textual - contextual functions of "emoji" signs  | 74        |
| 1.2.2. Case studies. Context and User Sculpture   | 77        |
| 1.2.2.1. Interactive non-academic context. Pleasant and intuitive versus<br>distracting and overwhelming  | 77        |
| 1.2.2.2. Transactional academic background. Practical and convenient versus<br>confusing and hypocritical | 82        |
| 1.3. Edmodo. Educational elearning platform   | 84        |
| 1.3.1. Introduction. From SNS to SLS. Edmodo as SLS   | 84        |
| 1.3.2. Philosophical principle of the Edmodo platform. Social - connectivist theory                       | 86        |
| 1.3.3. Pedagogical architecture. Technical framework and general functionalities                          | 88        |
| 1.3.4. Communication architecture. The hexagonal circuit model  | 89        |
| 1.3.5. Edmodo as an experimental pedagogical architecture   | 90        |
| 1.3.6. Learning typologies and the learner's psychological sculpture                                      | 91        |
| 1.3.7. The impact of affective factors on the digital pedagogical process                                 | 93        |
| <b>CHAPTER 2. RESEARCH METHODOLOGY</b>  | <b>95</b> |
| 2.1. Methodological aspects related to sign, language, text, discourse                                    | 95        |
| 2.1.1. The relevance of the object of psycholinguistics   | 96        |
| 2.1.2. Anchoring the study in the psycholinguistic methodology  | 98        |
| 2.1.3. Linguistic framing of the study in the field of philology  | 101       |
| 2.2. The motivation of the integrative psycholinguistic methodology                                       | 103       |
| 2.2.1. Transdisciplinary implications and disciplinary approaches   | 103       |
| 2.2.2. An applied experimental psycholinguistic research  | 105       |
| 2.2.3. Statistical inferential methodology  | 107       |
| 2.2.3.1. "Emoji" as performance indicators and measurement tools  | 107       |
| 2.2.3.2. The legitimacy of "emoji" symbols as measurement tools   | 109       |

|  |            |
|--|------------|
| 2.2.3.3. Notions of style, genre, register   | 111        |
| 2.2.3.4. Language and active communication in elearning platforms                    | 113        |
| 2.3. The motivation of the depth semiotic methodology                                | 114        |
| 2.3.1. Closed semiosis   | 114        |
| 2.3.2. Open semiosis   | 115        |
| 2.3.3. Applied semiotic methodology  | 117        |
| 2.3.3.1. Structural analysis of the macrosign  | 118        |
| 2.3.3.1.1. About the "functional structure" of signs                                 | 118        |
| 2.3.3.1.2. About the structural analysis of the text / linguistic discourse          | 120        |
| 2.3.3.2. The triadic examination   | 122        |
| 2.3.3.2.1. Syntactic examination   | 122        |
| 2.3.3.2.2. Semantic examination  | 122        |
| 2.3.3.2.3. Pragmatic examination   | 123        |
| 2.3.3.3. The semiotic hexad or situational examination                               | 124        |
| 2.3.3.3.1. Structural examination  | 124        |
| 2.3.3.3.2. Functional examination  | 126        |
| 2.3.3.3.3. The stage of optimizing / stimulating the communication situation         | 126        |
| 2.3.3.4. The semiotic situation - the pedagogical situation                          | 127        |
| <b>CHAPTER 3. THE STRUCTURE AND STAGES OF THE EXPERIMENT</b>                         | <b>129</b> |
| 3.1. Experimental format. Control group - Experimental group                         | 129        |
| 3.2. Data collection and processing tools and procedures.                            |            |
| Anonymization and coding   | 130        |
| 3.3. Data collection, analysis and interpretation                                    | 131        |
| 3.3.1. Data collection and processing tools and procedures                           | 131        |
| 3.3.2. Selection of analysis types   | 131        |
| 3.3.3. Key performance indicators  | 132        |
| 3.4. Data analysis tools and procedures  | 132        |
| 3.4.1. Data analysis tools   | 132        |
| 3.4.2. Data analysis procedures  | 133        |
| 3.5. Data analysis and interpretation technique                                      | 133        |
| 3.5.1. Data analysis. Statistical inference model                                    | 133        |
| 3.5.2. Data interpretation   | 135        |
| 3.6. Anticipation of results   | 135        |
| 3.6.1. The impact of the emotional factor on the teacher-student power ratio         | 135        |
| 3.6.2. The impact of communication methods and media on data interpretation          | 136        |
| 3.6.3. Synchronous versus asynchronous and interactional versus transactional impact | 138        |

|   |            |
|---|------------|
| 3.7. Sample size. Sampling method and sample size   | 143        |
| 3.8. Limitations  | 144        |
| 3.8.1. Anticipated limitations  | 144        |
| 3.8.1.1. Limitations related to the typology of the sample  | 145        |
| 3.8.1.2. Limitations related to data analysis   | 145        |
| 3.8.1.2.1. Timeline analysis  | 146        |
| 3.8.1.2.2. Analysis of the technological acceptance threshold   | 146        |
| 3.8.1.3. Limitations related to data interpretation   | 146        |
| 3.8.2. Unanticipated limitations. Partial fulfillment of the participation instruction                          | 147        |
| 3.9. Instructions related to participating in the experiment  | 147        |
| 3.9.1. Introducing the experiment on the Edmodo platform  | 147        |
| 3.9.2. Conducting the experiment  | 148        |
| 3.10. Participants  | 149        |
| <b>CHAPTER 4. DATA ANALYSIS</b>   | <b>150</b> |
| 4.1. Macro-semiotic analysis of surface structures  | 150        |
| 4.1.1. ICdP01. The semiotic mean of the scores of polarity and magnitude of feeling for both groups             | 152        |
| 4.1.2. ICdP02. Semiotic distribution of social symbols for both groups  | 154        |
| 4.1.3. ICdP03. The semiotic distribution of the objectivity of power factors                                    | 157        |
| 4.1.4. ICdP04. The semiotic distribution of social engagements in the classroom                                 | 161        |
| 4.1.5. ICdP05. The impact of the experimental linguistic treatment on the polarity and magnitude of the feeling | 162        |
| 4.1.5.1. The distribution of sentiment polarity. Control group versus experimental group                        | 167        |
| 4.1.5.2. Analysis of standard deviations for both groups  | 170        |
| 4.1.5.2.1. Gaussian distribution of sentiment. Control group versus experimental group                          | 171        |
| 4.1.5.2.2. Gaussian distribution of magnitude. Control group versus experimental group                          | 173        |
| 4.1.5.2.3. Standard error of mean sentiment and magnitude for both groups                                       | 176        |
| 4.1.6. ICdP06. The kilobyte distribution of the linguistic content for both groups                              | 178        |
| 4.1.7. ICdP07. The distribution of the polarities and the magnitude of the feeling by gender                    | 181        |
| 4.1.8. ICdP08. Analysis of the use of course content and resources  | 184        |
| 4.1.9. ICdP09. Distribution of discussion initiators differentiated by gender                                   | 186        |
| 4.1.10. ICdP10. Distribution of the total number of posts for both groups                                       | 188        |

|   |            |
|---|------------|
| 4.1.11. ICdP11. Distribution of the degree of class participation for the criterion of enrolled students versus unique visitors | 191        |
| 4.1.12. ICdP12. Distribution of participation averages and final learning   | 193        |
| 4.1.13. Semiotic distribution of experimental posts P1-P4   | 194        |
| 4.1.13.1. Experimental post P1  | 195        |
| 4.1.13.2. Experimental post P2  | 199        |
| 4.1.13.3. Experimental post P3  | 201        |
| 4.1.13.4. Experimental post P4  | 203        |
| 4.1.14. ICdP13. The kilobit distribution of the degree of interest in the experimental posts P1-P4                              | 205        |
| 4.1.15. ICdP14. Semiotic distribution of administrative content   | 207        |
| 4.1.16. ICdP15. The kilobit distribution for both groups  | 209        |
| 4.2. Macro-semiotic analysis of depth structures  | 211        |
| 4.2.1. Analysis of grammatical behavior   | 216        |
| 4.2.1.1. Syntactic analysis   | 217        |
| 4.2.1.2. Semantic analysis  | 219        |
| 4.2.1.3. Pragmatic analysis   | 224        |
| 4.2.2. Analysis of semiotic behavior  | 224        |
| 4.2.2.1. Semiotic analysis of the pedagogical situation   | 232        |
| <b>CHAPTER 5. INTERPRETATION OF THE RESULTS</b>   | <b>236</b> |
| 5.1. Interpretation of experimental results   | 236        |
| 5.1.1. Affective-kinetic symbolic behavior  | 236        |
| 5.1.1.1. Determination of statistical significance  | 237        |
| 5.1.1.1.1. Interpretation of global sentiment and magnitude scores  | 238        |
| 5.1.1.1.1.1. The "feeling score" criterion in the control group - experimental group  | 238        |
| 5.1.1.1.1.2. The "magnitude score" criterion in the control group - experimental group  | 238        |
| 5.1.2. Grammatical behavior   | 239        |
| 5.1.3. Semiotic behavior  | 241        |
| 5.1.4. The implications of pedagogical language   | 242        |
| 5.2. Discussion of the experiment results   | 243        |
| <b>CHAPTER 6. FUTURE RESEARCH DIRECTIONS</b>  | <b>247</b> |
| 6.1. Content-based recommendation   | 248        |
| 6.1.1. Theoretical and technical foundation   | 248        |
| 6.1.1.1. Theoretical foundation   | 249        |

|   |            |
|---|------------|
| 6.1.1.2. Technical foundation                     | 252        |
| 6.1.2. Development                                | 252        |
| 6.1.3. Implementation                             | 253        |
| 6.1.4. Benefits                                   | 254        |
| <b>CHAPTER 7. CONCLUSIONS AND RECOMMENDATIONS</b> | <b>258</b> |
| <b>REFERENCES</b>                                 | <b>271</b> |
| <b>ADDENDUM</b>                                   | <b>286</b> |

## EXTENDED SUMMARY

Keywords: digital pedagogical discourse, stylometry, *semiotic phaneroscopy*, *grammatical behavior*, *elearning educational platforms*, *edmodo*, *personalized social learning*, *fuzzy logic*, *poetic language*, *scientific language*, *multilevel semiosis*

**The topic overview** incorporates introductory notions related to the technologization of communication contexts and the impact of this phenomenon on formal communication in the educational space.

This academic expedition starts from the premise that the written linguistic act transmitted in digital format becomes a measurable element. Unlike the text printed on paper, its digital expression widens the scope of inclusion of the linguistic act by introducing emotional factors. If in the traditional way of communication through text the emotional content is implicitly transmitted through text, in the area of computerized mediatized communication the emotional expression is explicit and is expressed through dedicated emotional symbols. These are categorized as "emoji" symbols, which together with kinesic symbols form an ecosystem for augmenting the linguistic content expressed through text.

The present investigation takes the form of an inductive empirical study that evaluates through stylometric measurements the psycholinguistic impact of the social sign - symbols "emoji" on the digital educational discourse. The experimental study is semiotic-centered and takes place on the paradigm of control group - experimental group. Testing the statistical significance of the results by means of the Ttest method, which checks whether there is a significant difference between the means of the two groups, indicates that there is no significant difference between the two sets of data. The author therefore concludes that the data did not provide sufficient evidence to confirm the existence of the phenomenon. Therefore, the  $p = 0.455$  fails to reject the null hypothesis  $H_0$  which postulates that written expression with emoji has no impact on the educational act. The lack of evidence also does not necessarily reject the alternative hypothesis  $H_1$ , which argues that written expression with emoji has a significant impact on the educational act.

The inferential and semiotic analysis of the results indicates that the use of socio-emotional symbolism as an individual mechanism of feedback and control of the quality of the educational process is not viable. The results indicate that the development of such a mechanism must include both social symbols and textual content. In this sense, the development at the concept level of a recommendation application that employs the principles of "fuzzy logic" and "Levenshtein's distance" is initiated. These criteria are suitable for evaluating the polarity, magnitude, frequency and kilobit values of the content. The implementation of such a design is based on the analysis of digital educational data. The first stage of this structure is exemplified in the form of a recommendation engine for academic support that operates according to personalized learning models. In this sense, the present research confirms the importance of the text as the "new gold" and the necessity of developing a Romanian digital educational corpus. The advantage of such an application is that it draws conclusions through key performance indicators and avoids the subjectivity of deliberate reporting.

Related to the use of emotional symbols in the elearning space, the semiotic analysis of the results indicates a language conflict. Tensions of use between the informal nature of the symbol and the formal character of generating academic content are therefore identifiable. While



the presence of social symbols is prominent in the case of synchronous interactions, their presence is rarefied in the area of asynchronous interactions where deep learning generally occurs. Against the background of language oppositions, it is therefore theorized that the educational register can exert an inhibitory effect on the elements belonging to the social register, in this case the "emojis". The positive anomaly reflected by the enrolled students - unique visitor relationship confirms both the viability of the social constructivist-connectivist learning theory and the predisposition of digital natives towards learning in a platformized educational format.

The digital pedagogical discourse becomes, therefore, a strategic resource for the technologization of academic success.

The target population of this experimental study is represented by members of the generational group "Z." The study investigates the predisposition of digital natives to use language specific to social platforms within educational platforms. The participants are structured in the format of a control group and an experimental group, of which the latter group is given the experimental treatment. The groups are made up of male and female students who are enrolled in the first and second year at the philology section of the "Lucian Blaga" university in Sibiu. Essentially, this study linguistically investigates the users' (ie students') experience with the academic product (ie the platformed educational content).

One of the primary advantages of this type of investigation is the possibility of repeatability of the experiment and extension of the research within other specializations. Thus, the experimental format can be extended to include mobile devices and content interaction maps for platform courses, and for face-to-face courses to include information provided by presence sensors.

The coupling of computational stylometry measurements with the experimental format facilitates the discovery of semiotic-grammatical patterns generated by the users of the educational platforms, which by their specificity would otherwise remain invisible to traditional approaches. The measured linguistic parameters reflect the cognitive-emotional reactions of the learners towards the educational content. The obtained results are intended to verify if and in what way the emotional expressions within the discussion forums facilitate the generation of relevant educational content.

These observations can help design and develop better recommendation engines that can address personalized learning. The justification for this research initiative is based on the widespread digitization of the main economic sectors, which are gradually reinventing themselves as intelligent transport, intelligent environmental monitoring systems, intelligent medical services, intelligent security, fintech, intelligent automation of production processes, intelligent administration, etc. Connecting to the new *modus operandi* involves the gradual opening of the traditional educational environment to the intelligent educational format. In this new ecosystem, traditional data silos are turning into information flows, and data mining is gaining a level of strategic importance. Just as big data is considered the new gold of the twenty-first century, text and emotional symbols are becoming the "new gold" of the platformed educational environment.

This research acknowledges the scientific contributions of scholars such as Tatiana Slama - Cazacu, Daniela Roventă - Frumușani, Eugen Coșeriu, Solomon Marcus, Traian Stănculescu, Petru Ioan and Ștefan Odobleja.

*The introduction* acquaints the reader with the research question that investigates "to what extent can symbols function as a linguistic sign and become key performance indicators of the digital pedagogical discourse?", but also with the hypothesis testing framework:

- ❑ **H<sub>0</sub> - The expression written with "emoji" has no impact on the educational act**
- ❑ **H<sub>1</sub> - The written expression with "emoji" has a significant impact on the educational act**
  - ❑ H<sub>1a</sub> – The use of "emoji" will generate a higher level of student involvement in the educational process
  - ❑ H<sub>1b</sub> – Female students will have more affective posts than male students
  - ❑ H<sub>1c</sub> – The text-emoji combination will be strong enough to develop the creation of an academic learning genre or style
  - ❑ H<sub>1d</sub> – Calibrating academic programs through emotional feedback will be of sufficient relevance to be integrated into an economic model

The prediction is that the results will reject the null hypothesis and therefore, they will support the alternative hypothesis.

*The first chapter* does a review of the scientific literature related to the researched topic. The first level consists of the cascading distillation of concepts, starting with context, discourse, text, language, sign and semiosis. The second level looks over the social evolution of sign-symbol within the educational and non-educational experimental studies. The third level brings to the fore information related to the "Edmodo" educational platform for pedagogical and communication architecture.

The fundamental premises of the use of digital signs and icons are significantly motivated. Primary among them is the immediate reduction of structural-syntactic ambiguity<sup>1</sup> and, implicitly, that of increasing the degree of precision of the transmitted message. These symbols are also very important because they usually bring contextual clarity to the generated content.

An essential aspect is the *theoretical anchoring of "emojis" in linguistic research methods*. In this context, in addition to the *legitimacy of "emojis" as key performance indicators and as measurement tools*, also becomes relevant *the semiotic approach*. While emoji symbols can be expressed through statistical coefficients measuring emotional polarity, "emoji" sign-symbols are independent linguistic units that possess individual meaning and contextual meaning.

The discipline specialized in the analysis of signs, symbols and the interpretation of their meanings is semiotics.

Due to the fact that emoji emotional symbols can constitute a text, they fall under the semiotic mode of qualitative data analysis. The scientific literature highlights the existence of two semiotic schools, the European one, represented by the Swiss linguist Ferdinand de Saussure, and the North American one, represented by Charles Sanders Peirce. At the beginning of the

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<sup>1</sup> Victoria Fromkin et.al, *Syntax: The Sentence Pattern of Language*, An Introduction to Language – International Edition (9<sup>th</sup> Ed.), Wadsworth Press, London 2011, p. 82; Matthew J. Traxler & Morton Ann Gernsbacher, Eds, *Lexical Ambiguity, Handbook of Psycholinguistics*, 2nd Ed., Elsevier Press, Oxford 2006, p. 381.

20th century, the Swiss linguist argues that all communication between people is done through signs. Later, researchers extended this theorizing to symbols as well. While the works of Ferdinand de Saussure focus extensively on the role of signs as part of social life, the philosopher, logician and mathematician Charles Sanders Peirce elaborates the formal doctrine of signs. Ferdinand de Saussure argues that the interpretation of signs involves the relationship between two concepts, that of signified (ie signified), indicative of what the sign or symbol represents in the interpretation of the receiver, and that of signifier (ie signifier), indicative of a sign or symbol that can represent something else. In order for the receiver to correctly understand the sender's message, it is necessary that all participants in the communication use the same type of signs and symbols. Charles Sanders Peirce, extends the interpretation procedure to three concepts and includes the sign (ie sign), the object (ie object) and the interpretant (ie interpretant). In this formulation, the interpreter is the person or human factor who performs the interpretation of the sign that represents the object.<sup>2</sup>

One of the continuations of the North American semiotic school, Charles W. Morris, refers to iconic signs and symbols as addressable language elements through the semiotic theory of communication formulated by Charles Sanders Peirce. The mechanics of this concept work as an interaction between sign or symbol, object and interpretant.<sup>3</sup>

In addition to the analyzed case studies, the chapter details the role of digital linguistics in platform education.

Edmodo, is a free educational platform that is part of the superclass "Human Computer Interaction" (ie HCI), the class "Information and Communication Technology" (ie ICT) and the subclass of technical framework, "Virtual Learning Environment" (ie VLE) or " Learning Management System" (ie LMS).<sup>4</sup> The latter allows teachers to manage large numbers of students, instructors, courses and online forums.<sup>5</sup>

Edmodo offers three main levels of functionality that ensure the integrated management of the digital educational process. In its basic formula, the platform incorporates both student, teacher and parent perspectives. As the range of educational courses diversifies, academic institutions are opting for ancillary modules such as system administrator and course manager modules. The teacher-student interaction is mainly coordinated by both the course design and the clear definition of expectations and end goals. The interactions enabled by the platform include multi-directional communication modalities. Thus, communication can be carried out in the

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<sup>2</sup> Michael D. Myers, *Qualitative Research in Business and Management*, SAGE Press, Los Angeles 2009, p. 198-201.

<sup>3</sup> Charles Peirce, în lucrarea "Collected Papers," oferă următoarea definiție a interpretantului: "Un semn ține locul la ceva în raport cu ideea pe care o produce sau o modifică. Lucrul căruia îi ține locul se numește obiectul său, cel care vehiculează, semnificatul său, iar ideea căreia îi dă naștere, interpretantul său." (apud., Eco, Umberto, Lector în fabula, București, Editura Univers, 1991, p. 51-52), în Ciocârlan & Drăgulescu, *Distorsionări ale Comunicării*, Cercetări de Psiholingvistică, Casa Cărții de Știință, Cluj-Napoca 2013, p. 48 – 49.

<sup>4</sup> Miguel Ángel Conde, Francisco García-Peñalvo J., Ángel Fidalgo-Blanco, María Luisa Sein-Echaluce, *Study of the flexibility of a Learning Analytics tool to evaluate teamwork competence acquisition in different contexts*, Department of Mechanics, Computer Science and Aerospace Engineering, Robotics Group, University of León, 2017, p. 2. O prezentare excepțională a platformelor educaționale digitale de dată recentă este succint realizată de Dr. Radu Drăgulescu, *Online Media and New Technologies in the Teaching of Linguistic Disciplines*, Education Sciences GIDNI, ULBS, 2017, p. 134 – 145.

<sup>5</sup> Dave E. Marcial, Mark B. Onte, Janice V. Forste Antoniette, Jonathan Te Mark N, Curativo Maria Lourdes S, *Developing Learning Management System in Sticks*, International Journal of Scientific Engineering and Science 2017, Vol. 1, Iss. 8, p. 40.

direction of teacher - student, teacher - students, student - student and student - teacher. These interactions are facilitated by text editing blocks through forum and live chat functionalities.

**The second chapter presents the research methodology.** The starting point is the *rise of big educational data and the evolution of affective computing tools*. The linguistic-inferential investigation procedure of educational data corpora is not new and during the last decade it is positioned on an upward trend. Therefore, the specific task of inferring new knowledge from data associated with emotional participation falls into the broad category of curriculum mining based on natural language processing. One of the special features of emotional data is related to both the rather diffuse delimitation boundaries of feelings and their precise representation. The distribution percentages of polarity within emotional symbols illustrate the high level of mathematization of sentiment analysis.<sup>6</sup> Analyzing and visualizing such linguistic complexities can be accomplished through sophisticated analytical learning tools. They can calculate and aggregate kilobit-affective reports that are illustrative of users' behavioral tendencies and immediately relevant to the micro-calibration procedures of successive educational stages.

The widespread use of LMSs creates a wealth of data that must be analyzed in real time so that results are visible in time to serve time-sensitive purposes (Luna et al., 2017; Romero et al., 2013; Xiao et al., 2017; Yassine et al., 2016).<sup>7</sup> The sector responsible for extracting value from psycholinguistic evaluations of text is known as affective computing or affective computation. This module belongs to a larger suite of risk assessment tools and has multiple industrial applications.

The legitimacy of emoji as measurement tools is addressed in a recent study by Lynne Hall et al. (2016), which indicates that sufficient scholarly momentum has been built up for the introduction of emoji-based summary Likert scale ratings. This new instrument originally proposed a simple emotional scale, equipped with two positive emotional values and two negative values. However, with the advent of computational methods for data dimensionality reduction, the scale also extends with the neutral level for a total of five main reference thresholds 🙌 😊 😐 😞 😡.<sup>8</sup>

Among the results of recent date applicable to this sphere of interest, we can list a series of correlations between the feelings of the subject, their expression through emotional graphic symbols related to the state and distinct classes of personalities.<sup>9</sup> [...] This study modeled on the "Big Five Questionnaire" tests the lexical hypothesis which claims that 'words and expressions commonly used by people tend to reflect individual differences.'<sup>10</sup>

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<sup>6</sup> <http://kt.ijs.si>, accesat 21.05.21 la 17.35 pm.

<sup>7</sup> Andreas Gkontzis, Christoforos Karachristos, Fotis Lazarinis, Elias Stavropoulos, Vassilios Verykios, *Assessing Student Performance by Learning Analytics Dashboards*, Proceedings of the 9th International Conference in Open & Distance Learning - November 2017, Athens, Greece, p. 101, 102.

<sup>8</sup> Lynne Hall, Colette Hume, Sarah Tazzyman, *Five Degrees of Happiness: Effective Smiley Face Likert Scales for Evaluating with Children*, Proceedings of the The 15th International Conference on Interaction Design and Children, June 2016, p. 313; Un model de patru valori emotionale, două negative și două pozitive este propus de Linda K. Kaye, Stephanie A. Malone, Helen J. Wall, *Emojis: Insights, Affordances And Possibilities for Psychological Science*, Trends in Cognitive Sciences, Cell PRes, Februarie, Vol 21, Nr. 2 2017, p. 67.

<sup>9</sup> Davide Marengo, Fabrizia Giannotta, Michele Settanni, *Assessing personality using emoji: An exploratory study*, Personality and Individual Differences, Elsevier, 112 (2017), p. 74–78.

<sup>10</sup> Caprara GV, Barbaranelli C., Borgogni L. & Perugini M., *The "Big Five Questionnaire": A new questionnaire to assess the five factor model*, Personality and Individual Differences (1993) 15 (3), 281–288, în Davide Marengo,

[...] The results demonstrate and support the viability of using emojis as accurate tools in the process of assessing individual personality. The correlation between degrees of identification with emoji and the Big Five personality traits is best shown in the Likert scale scores for agreeableness, extraversion, emotional stability, openness to new experiences, and conscientiousness. The use of 36 of the 91 emojis proved relevant in identifying three personality types. Agreeableness was positioned with the highest degree of correlation, followed by extraversion and emotional stability. Less significant correlations were identified in the relationship with openness to new experiences and conscientiousness.<sup>11</sup> (Pers. trans.).

As it appears from an article published by *The Guardian newspaper*, Paula Coccozza brings to the fore the news that for the first time in history the word of the year in the Oxford Dictionary is not actually a word, but an emotional symbol portraying a laughing face with tears 😂.<sup>12</sup> Emojis belong to the written graphic representation and belong to the general psycholinguistic sphere, because they operate in the area of interest of "linguistic performance."<sup>13</sup> They are present almost exclusively in the digital environment, their presence being quite rare in the written format printed on paper. Emojis are part of a controlled digital symbol system that manifests itself through an artificial language that subscribes to computational linguistics.<sup>14</sup>

This way of linguistic expression has the advantage facilitated by the algorithmic management of artificial intelligence networks.<sup>15</sup> The broader spectrum of framing these visual markers belongs equally to psycholinguistics, computational linguistics and the theory of sentiment analysis.<sup>16</sup> The last two entities form a binary complex, in which the first element studies encoding, while the second one has the role of interpretation. The latter extracts the emotional message intended by the author-sender<sup>17</sup> and provides a more accurate assessment of the original textual meaning. The more the understanding of the word-emoji relationship progresses, the more accurate the output of social listening and analysis tools increases.<sup>18</sup>

***Chapter three details the structure and stages of the experiment.*** Chapter illustrates the conduct of the experiment and the analysis of the data generated by each step. The initial steps

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Fabrizia Giannotta, Michele Settanni, *Assessing personality using emoji: An exploratory study*, Personality and Individual Differences, Elsevier, 112 (2017), p. 75.

<sup>11</sup> Davide Marengo, Fabrizia Giannotta, Michele Settanni, *Assessing personality using emoji: An exploratory study*, Personality and Individual Differences, Elsevier, 112 (2017), p. 75 - 76.

<sup>12</sup> Paula Coccozza, *Crying with laughter - How we learned how to speak emoji*, The Guardian: np, accesat în 07.03.16 la 3.15 pm, în Carley B. Durante, *Redefining Nonverbal Communication*, Adapting nonverbal coding theory to mobile mediated communication – An analysis of emoji and other digital nonverbals, Liberty University Press, Lynchburg, VA, 2016, p. 10.

<sup>13</sup> Victoria Fromkin et. al, *The Human Mind at Work – Human Language Processing*, în Philipp Strazny Ed., Encyclopedia of Linguistics, V1, Acquisition Theories, Fitzroy Dearborn Press, NY 2005, p. 375.

<sup>14</sup> Philip Strazny Ed., *Computational Linguistics*, Encyclopedia of Linguistics, V1, Acquisition Theories, Fitzroy Dearborn Press, NY, 2005, p. 226, 228.

<sup>15</sup> Philip Strazny Ed., *Artificial Intelligence – Artificial Languages*, Encyclopedia of Linguistics, V1, Acquisition Theories, Fitzroy Dearborn Press, NY 2005, p. 90.

<sup>16</sup> <https://plato.stanford.edu>, accesat în 29.01.17 la 3.55 pm.

<sup>17</sup> <https://plato.stanford.edu>, accesat în 29.01.17 la 4.00 pm.

<sup>18</sup> <https://blog.rocketsoftware.com>, accesat în 29.01.17 la 4.15 pm.

include introducing the experiment into the classroom and the Edmodo platform, while the subsequent steps refer to the actual experimental posts. Experimental posts P1-P4 consist of a number of four questions addressing the course material. The question posting interval is designed in such a way as to avoid the students' cognitive overload. Recommended steps for participating and interacting with posted content are intended to create a collaborative and friendly learning environment.

The total number of participants in the experiment has the following gender classification:

| Criterion | Control group | Experimental group |
|-----------|---------------|--------------------|
| Males     | 6             | 6                  |
| Females   | 53            | 59                 |

*Chapter four concentrates on data processing and analysis.* This part focuses on the inferential analysis of the key performance indicators within both groups for the criteria of polarity and magnitude of feeling, an analysis completed by the linguistic branch which focuses on the analysis of semiotic structures and textual sequences within the digital pedagogical discourse.

The main analysis tools are Google's NLP natural language processing program, Voyant and Tropes. Other filters of the structural - functional analysis of the sign but also the semiotic hexad. Dacă primul program este implementat pentru calcularea coeficienților de polaritate și de magnitudine al conținutului, cel de-al doilea este implementat pentru identificarea asocierilor de cuvinte, a frecvenței cuvintelor și pentru efectuarea unor operațiuni de minerire a textului. Programul Tropes este dedicat descoperirii paradigmelor faneroscopice asociate comportamentului semiotic și gramatical.

Data analysis runs on the statistical inference model. This analysis scenario reflected in the main body of study analysis incorporates custom statistical measurements for both polarity and magnitude criteria, as well as frequency and kilobit criteria. Stylometric and register analyzes are addressed through the analysis of the formal language specific to the traditional educational environment and through the informal language specific to platform social communication.

...] the methods used to determine the sentiment class appear in different forms such as sentiment analysis, sentiment extraction or affective evaluation. The 'opinion mining' method includes all these variants and fully incorporates the philosophy and tools used by them.<sup>19</sup> This is a subdiscipline of computational linguistics that explores the idea expressed by the document. Sentiment classification refers to determining the

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<sup>19</sup> Wilson T., *Just how mad are you? Finding strong and weak opinion clauses*, presented at In Proc. 19th National Conference on Artificial Intelligence. 2004; SF Esuli A, *Determining the semantic orientation of terms through gloss classification*, presented at Proceedings of the 14<sup>th</sup> ACM international conference on Information and knowledge management, Bremen, Germany 2005, în Haji Binali, Vidyasagar Potdar, Chen Wu, *A State Of The Art Opinion Mining And Its Application Domains*, Digital Ecosystems and Business Intelligence Institute, Curtin University of Technology, Australia 2009, p. 1.

subjectivity, positive and negative polarity, polarity strength, weakly positive, medium positive and strongly positive, of an opinion text.<sup>20</sup> It is a computational study of opinions, feelings and emotions, expressed in a text [...] with the main purpose of identifying statements of agreement or disagreement with a view to capturing positive and negative sentiments in comments and ratings [...] and possibly detecting a paradigm which illustrates the preferences and the driving elements in the changing attitude of the students.<sup>21</sup>

This type of analysis, which is recognized in the profile industries as *sentiment analysis*, is known as an approach that allows the formulation of preliminary strategies for collecting, analyzing and making a forecast table related to the calibration of academic programs.

Data analysis takes into account both the synchronous-informal and asynchronous-formal specifics of the written contributions as well as the temporal chronology of the unfolding of events. Unaggregated and aggregated metadata analysis of students' time spent on the platform reveals both preference for topics discussed differentially by gender and the longitudinal impact of the tutor on forum discussions.

The main reason why new platform education systems are emerging and developing rapidly on the contemporary learning and teaching horizon is mainly due to the accelerated pace of technological progress. The high speed and fluidity of information flows generate new opportunities for investigation and exploitation of data of educational origin. In order for them to remain permanently relevant, they must be verifiable by means of real-time employable processing and analysis mechanisms. Therefore, the freshness of data influences its relevance, and the relevance of data is conditioned by its freshness.

For students to intuitively navigate socio-economic ecosystems that are separated by increasingly diffuse boundaries, educational content must be positively correlated with dynamic updates in the real economy. But in order for the student to have the real opportunity to adapt in such a relevant way, it is important that educational institutions can collect and process educational data in time intervals as close as possible to the real ones, which they can then synchronize in record time with the needs of the labor market. An essential factor in this calibration process is the quality of the information or the value of the teaching-learning content. To maintain the accuracy of the information, the data must maintain an extended "shelf life" freshness by constantly updating and refreshing it. This can be achieved through digital tools for collecting data directly from dynamic data streams. Relative to the objective of this paper, the freshness of educational data streams is therefore ensured by regular postings by students in response to work tasks. The accumulation of these contributions in a digital corpus of the class allows, by means of the evaluation of the key performance indicators by linguistic chain, the formulation of progress notes that include cognitive-affective maps both for each class hour, separately and for all course hours taught over a whole semester.

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<sup>20</sup> A. Esuli and F. Sebastiani, *Determining Term Subjectivity and Term Orientation for Opinion Mining*, presented at Proceedings of the EACL 2006, 2006; SF Esuli A, *SENTIWORD NET: A Publicly Available Lexical Resource for Opinion Mining*, presented at Proceedings of LREC, 2006, 2006, in Haji Binali et al, *A State Of The Art Opinion Mining And Its Application Domains*, Digital Ecosystems and Business Intelligence Institute, Curtin University of Technology, Australia 2009, p. 1

<sup>21</sup> F. Colace, M. De Santo, L. Greco, G. Guerriero, *Sentiment Analysis and E-Learning: a Proposal*, DIEM – University of Salerno, Fisciano, Italia 2014, p. 268 - 269.

Integrating cognitive-affective cues into automated feedback and control systems can computationally inform the adaptive design of curricula based on real-time information flows. Usually, these cognitive-affective parameters take the form of key performance indicators. These types of integrations support the development of intelligent course models that can accurately detect, compute, and suggest optimal collaborative learning paradigms. Often, these paradigms are hard to perceive, but the aggregation of individual educational data can reveal observable and measurable semiotic-grammatical behaviors, thus explaining the functioning of contextually conditioned paradigms.

AI systems allow precision measurements of both syntactic and semantic dimensions. The introduction of natural language processing systems in digital educational architectures facilitates both deep data mining and a series of diversified ways of exploiting, visualizing and modeling them. Platformed educational systems can incorporate extensive pedagogic reporting and analysis capabilities through the combination of educational data mining, learning analytics, and diagnostic processes.<sup>22</sup> The innovation brought by this approach consists in the high degree of comprehensiveness of the analysis and in the speed of response, characteristics specific to architectures dedicated to improving teaching-learning performance.

The additional benefit provided by this concept of linguistic-inferential analysis is that of the possibility of integrating into the educational formula both performance indicators associated with the instructor and those associated with group interactions between students. Aggregating the contributions of all users per instance and event provides a clear picture of the overall relevance of the content, while providing real-world visualizations of cognitive-affective quotients.

The type of the data requires a mixed analysis model incorporating both quantitative and qualitative tools. Thus, within both groups, data of both a categorical nature, which includes nominal and ordinal subclasses in the case of words and emojis, and a numerical nature, which include intervals and ratios that are identifiable in the time sequences of forum contributions, are identified. and by the semantic and magnitude scores associated with primary and secondary reactions.

In the quantitative area, this analysis model will pay particular attention to the ratios between the semantic and magnitude scores of both groups without relating these calculations to the time intervals in which they occur. Therefore, if in the part of continuous quantitative data the analysis is limited to the ratio between the two reference classes, in the qualitative area, both nominal and ordinal data receive special attention through the situational - hexadecimal analysis model. While for the analysis of social symbols, only the statistical aggregation of the polarity and magnitude coefficients is sufficient, for the contouring of an image of depth, the inclusion of the text in the analysis process of the kinesic-affective symbols is required.

The analysis procedures include both the aggregate analysis of emotional and kinesic symbols and the quantification of qualitative data by transforming text-symbol strings into numerical parameters. This quantification of qualitative data is designed as a first mechanism to verify the degree of objectivity of the analysis. This procedure allows checking the degree of subjectivity of the content by including in the analysis both the emotional symbols and the

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<sup>22</sup> Tuomi Ilkka, *The Impact of Artificial Intelligence on Learning, Teaching, and Education. Policies for the future*, Eds. Cabrera, M., Vuorikari, R & Punie, Y., EUR 29442 EN, Publications Office of the European Union, JRC Science for Policy Report, Luxembourg 2018, p. 32.



context through the associated textual content. This combination provides a much more accurate picture of how emotional factors stimulate or inhibit the creation of new content. Therefore, this procedure exclusively aims at observations related to the fluctuations of the linguistic act in relation to emotional factors.

Another measure to verify the degree of subjectivity is introduced by including the "like" symbols in the calculation. This measure has the role of checking the nominal satisfaction coefficients expressed by likes in relation to the ordinal satisfaction coefficients, expressed by means of emoji symbols. Since the platform does not offer dislike buttons, kinesic gestural elements sometimes complement and sometimes compensate for the lack of emoticons. Thus, the presence or absence of "like" symbols adds clarity to the emotional context through the precision offered to the polarity of the feeling in the absence of emoji symbols. The measurement of text and emoticons by numerical coefficients is done through the Natural Language Processing cloud application provided by Google.<sup>23</sup> Thus, the negative, neutral and positive polarity of the textual and emotional parameters becomes measurable by obtaining a cumulative polarity score. This procedure also gives a magnitude or magnitude score associated with the emotional polarity score. The extent or magnitude score reflects the degree of overall strength or force of the emotion on a reference spectrum ranging from 0.0 to +infinity.

| Values and Intervals of Emotional Polarity |                     |                   |
|--|---------------------|-------------------|
| Negative                                   | Neutral             | Positive          |
| <b>-1.0 — -0.25</b>                        | <b>-0.25 — 0.25</b> | <b>0.25 — 1.0</b> |
| Values and Intervals of Magnitude          |                     |                   |
| <b>0.0 — +infinity</b>                     |                     |                   |

The coefficient legend for emotional polarity and magnitude

Data analysis investigates the differences in the experimental group control group relationship for the following criteria: sentiment analysis polarity and magnitude for the entire document, analysis of social symbols and identification of key performance indicators, analysis of factors influencing objectivity, analysis of student satisfaction, treatment impact on sentiment polarity and magnitude, analysis of standard deviations, standard error of mean of sentiment polarity and magnitude, calculations to identify subjectivity by kilobitic measurements, polarity and magnitude distribution of sentiment by sex, analysis of content and course resources use, distribution of discussion initiators by gender, comparative analysis of the total number of posts, comparative analysis of the degree of participation in the course, comparative analysis of participation means and final learning outcomes, analysis of the social symbols in the experimental posts P1-P4, the measurement of the degree of interest in the experimental posts P1-P4 in kilobytes, the analysis of social symbols in the exclusively administrative content, the measurement of generated kilobytes for the entire document.

<sup>23</sup> <https://cloud.google.com/natural-language>, accesat în 25.05.21 la 0.45 am.

**Chapter five is dedicated to results interpretation.** The chapter guides the investigation in the area of interpretation of the results for both quantitative and qualitative criteria.

The *quantitative analysis* section investigates the statistical relevance, evaluates the “sentiment score” for the criterion control group versus experimental group and identifies the “magnitude score” for the same criterion. Determining the statistical significance includes the standard demarcation threshold of statistical significance  $\alpha = 0.05$ , a value corresponding to the 95% confidence interval. Regarding the level of statistical significance, this is often expressed by the p-value coefficient which can record values between 0 and 1. The lower the p-value, the stronger the evidence that the null hypothesis must be rejected. A p-value less than 0.05, usually expressed by  $p \leq 0.05$  indicates the presence of statistical significance. If the value p is higher than the alpha threshold,  $p > \alpha$ , then the null hypothesis is accepted. To perform the analysis, the researcher implements the "two tailed Ttest" calculation method. This model allows the incorporation of both positive and negative data tails. Unlike the single-tailed Ttest which can only be used to determine the difference between groups in one direction, the two-tailed t-test uses both the positive and negative tails of the distribution and allows testing for the positive and negative values. Ttests are calculations used to test a hypothesis, but are most useful when it is necessary to identify a statistically significant difference between two groups of independent samples. The t-score is a conversion of raw data to the standard score when the conversion is based on the sample mean and the standard deviation of the sample, and the score resulting from a t-test calculation is represented by a critical value.

The degrees of freedom are also relevant in the case of the Ttests. They represent the number of values in the final calculation that are free to vary and refer to the maximum number of logically independent values. Usually the calculation of the degrees of freedom is achieved by extracting from the sample population the number one. Therefore the formula for calculating the degrees of freedom applicable to this scenario is that of  $n-1 = df$ . In the case of a Ttest with two samples, the degrees of freedom of the number of independent values is calculated according to the formula  $n_1 + n_2 - 2 = df$ . Specific to the present experiment, the sample population is represented by the totality of the primary and secondary contributions generated by unique visitors participating in the forum discussions. The results for the degrees of freedom identify in the case of the control group a value  $n_1 = 41$ , and in the case of the experimental group a value  $n_2 = 67$ . The application of the calculation formula mentioned above indicates a cumulative degree of freedom result  $df = 106$ . For reference, the size of the general population from which the sample population is taken is represented by  $N =$  the total number of students enrolled in the course.

Regarding the “*sentiment score*” criterion for the control - experimental group relationship, data analysis indicates that for a significance level  $\alpha = 0.05$  and 106 degrees of freedom, the critical value for the t-test is 0.749. The result of converting the T score of 0.749 to a significance level of 0.05 with a 95% confidence interval and a two-tailed hypothesis, gives a p value = 0.455. This value related to the threshold  $p \leq 0.05$  is not statistically relevant, therefore the null hypothesis is not refuted. Therefore, this study does not identify a statistically relevant difference between the use of emoji symbols in the experimental group compared to the control group. By completely or partially refuting the H1a-H1d hypotheses, it can be deduced that compared to the studied population, encouraging the use of emotional symbols in the virtual academic space does not lead to the generation of a significant surplus of academic content. Consequently, the argument outlines that compared to the hybrid educational context, both emoji

and kinetic symbols do not significantly influence the written linguistic act by creating significant text quantities.

Regarding the “*magnitude score*” criterion for the control - experimental group relationship, data analysis indicates that for a significance level  $\alpha = 0.05$  and 106 degrees of freedom, the critical value for the t-test is 0.029. The result of converting the T score of 0.029 to a significance level of 0.05 with a 95% confidence interval and a two-tailed hypothesis, gives a p value = 0.976. This value relative to the threshold  $p \leq 0.05$  is not statistically relevant. Therefore, the null hypothesis is not refuted even in the case of the magnitude of the feeling. While the presence of emojis does not have a significant impact on the generation of new educational content, they tend to confirm and certify the relevance of the content. Thus, in connection with the scenario in which 41 unique visitors generated 74 posts and 67 unique visitors generated 111 posts and group interactions, the positive correlation becomes visible but does not certify the causality between social symbols, in this case emojis, and newly generated content. The educational corpus produced by the experimental posts P1-P4 was not generated as a direct reaction to the employed emojis, but appeared both as a compliance response to the recommended participation model and as a reaction towards the forum generated content. It can be argued therefore that in platformized education, the process of new information creation and fluidization with social symbols such as emojis, provide more of a confirmatory role and less of a stimulus function. The clustering of multiple symbols in certain portions of the text, can become a relevant anchor for guiding the course of forum discussions.

However, even when considering the lack of statistical significance resulting from the analysis of the results, it can be argued that the lack of evidence to invalidate the null hypothesis does not necessarily invalidate the existence of the phenomenon. The lack of evidence in this regard does not prove the non-existence of the phenomenon. Because classes are taught in a combined format, students can engage in much more cautious behavior in group interactions than in the case of the exclusively digital teaching-learning format. The study therefore concludes that the two data samples did not provide sufficient evidence to confirm the existence of the phenomenon.

The criterion for *qualitative analysis* is satisfied by implementing the evaluation of the macrosign and the pedagogical situation. This type of approach provides the theoretical analysis framework for identifying the relationships between the social context and the linguistic dynamics generated. It is therefore recognized the importance of developing an analysis aimed at identifying the forces exerted by the context on the participants.

In summary, a number of preliminary conclusions become relevant.. The textual metafunction is closely related to and significantly influences the interpersonal metafunction. Adherence to a coherent and cohesive discourse is one of the main criteria for discovering and constructing new knowledge. The use of cohesive devices at both lexical and grammatical level leads, in the case of experimental interactions, to the clustering of discussions around specific topics and contributors. Regarding the frequency of words, in the case of the experimental group, the first two positions are reserved for the words “and” and “like.” This type of frequency illustrates the transition from the administrative format of the class to the combined one. The most relevant aspect is represented by the frequency difference for the “and” criterion, of 32 in the case of the control group and of 106 in the case of the experimental group. Values more than three times higher in the case of the experimental group are reflected by the change of the grammatical value of the reference “and.” More precisely, if in the case of the control group, this

reference has the function of an adverb, in the case of the experimental group this function turns into a copulative coordinating conjunction. Unlike the control group where this reference denotes interpersonal addressing modes, in the case of the experimental group this reference reflects the architecture of argument construction. It is here that the textual metafunction becomes visible in action and where it reflects the language's ability to use cohesive devices both lexically and grammatically.

Thus, a series of quite different dynamics become observable in the case of the experimental group compared to the control group. Therefore, in the case of the control group, a close correlation is identified between the references of “cerce \*”, “temă \*” and “bună.\*” If the first two refer to the academic teaching and learning process, the third indicates a formal approach. The reference "bună" is variably followed by the references "dimineața," "ziua," or "seara." This type of connection illustrates the fact that there is a positive correlation between the formal mode of communication and the mode of debating personal study topics. However, the special feature is that as discussions related to the study topics amplify, the social engagements disseminated on both the kinetic and the emotional criterion decrease abruptly. Unlike emojis that remain in a close relationship with "cercetare" "temă" and "bună," the like symbols record a steep increase. Put differently, it can be concluded in a preliminary way that, in certain situations, the increase of the didactic character of the content leads to a reduction of the social engagements or that the reduction of the didactic character leads to the increase of the kinetic commitments. It can also be theorized both that increasing the formal nature of interactions leads to a decrease of the social factors present in written interactions, and that a decrease in the formal nature of written interactions leads to a steep increase in likes, but leaves emojis at an optimal level of symbol engagement.

Unlike the administrative and informal character of the control group, the experimental group is defined by a much more formal character.

The formal surplus is added by the experimental posts and by the general treatment applied to the experimental group. Once the group enters a more intense academic engagement, social dynamics begin to differ significantly from those in the control group. Thus, with the exception of social symbols that register a series of higher initial peaks, the frequency of references associated with academic topics indicates a downward constant trend. Compared to the control group, the experimental group registers lower values in the area of formal communication, and the references “biblio\*” and “internet \*” in the first part of the corpus indicates a trend of convergent values. In terms of the social symbols engagement, the highest value peak is recorded by likes while the second position is taken by the emotional emoji symbols. Compared to the control group, for the criterion of kinetic symbols, the social interactions within the experimental group indicate close value levels. The essential difference between these two similarities lies in the different timeline in which they manifest themselves. More precisely, unlike the control group, where they occur in the second half of the corpus where the informal character increases, in the case of the experimental group, they occur in the first part of the corpus in the area strongly dominated by academic debates.

Regarding the emotional symbols, while they register a strong initial peak and significantly higher average values compared to those recorded in the case of the control group, in the second part of the experimental corpus, the emojis record minimum values. With the exception of the like symbols whose frequency fluctuates in an interval positioned above all other values, the references reflecting the formal addressing modes denoted by the word associations

related to the term “bună,\*” but also those with learning value of “biblio\*” and “internet,\*” descend on a path towards minimum values. Data analysis indicates that, in the case of the experimental group, the least affected reference is that of the kinetic symbols, that of the likes. Emotional symbols, on the other hand, tend to follow the general lines drawn by the cognitive type of engagements. Compared to the control group which is defined by a dominant informal character, it can be concluded that in the case of the experimental group which is defined by a much more formal interaction framework, thematic and social interactions register a common initial momentum and a downward trend in the second part of the corpus. Unlike the values identified within the control group, social interactions within the experimental group do not appear to be influenced by formal-type interactions.

A possible conclusion that can be drawn is that in the case of a combined teaching-learning format, the social symbol engagements converge with the momentum and general thematic flows of academic discourse. The analysis of a much larger data set solely dedicated to platformized teaching and learning, has a better chance of tracing in much more detail the central tendency of the social implications related to the generation of relevant content. The relationing of emojis with the linguistic framework is facilitated by text. This relationship is defined both by the combination of polarity and magnitude attributes associated with emotional symbols, and by the semiotic functions of the text.

By means of the negative and positive polarities, social symbols exert a positive and stimulating or negative and inhibiting impact on the dynamics of text generation. In turn, the educational register imposes the governing laws on how emotional symbols are used in the elearning educational format. The results also indicate a conflict between the educational register that promotes formal, impersonal, elaborate and precise discussions and the social media register, which promotes short, frequent and informal written interactions. The impact of emotional symbols on the generation of new educational content can also be measured with frequency and kilobyte criteria. While the frequency criterion addresses more the relationship of granularity of symbols and words, the kilobyte criterion addresses the quantitative measurements of the digital corpus. Due to the fact that the use of social symbols is governed by the registry variables, the results of the polarity, frequency and kilobyte measurements also require an explanation of the registry variables. This combination of procedures provides a balanced framework for assessing the dynamics of generation and evaluation of newly generated educational content.

On the central objective of assessing the impact of emoji emotional symbols on digital educational content, the results of the experiment confirm that emoji symbols do not have a significant impact on the platformized educational act.

Results also verify that the educational corpus produced by the experimental posts P1-P4 was not generated as a direct reaction to the emojis employed during forum interactions but rather as a response to the required participation structure and the ideas present in the content. It can be argued that in platformized education, social symbols and especially emojis have a higher frequency in written synchronous interactions, where they have a character of stimulation and fluidization of information in short discussions. The clustering of multiple symbols can become a visual confirmation and benchmark for more elaborate ideas that the user promotes in the context of asynchronous forum interactions.

Due to the fact that the use of emojis has a positive impact, but which is not strong enough, the  $H_{1a}$  hypothesis that argues that the use of emoji will generate a higher level of involvement of students in the educational process is not confirmed. However, if short written

interactions are able to make significant contributions to the in-depth learning process, social engagements of emotional symbols may prove conducive to the generation of new content. The  $H_{1b}$  hypothesis stating that female students will have more emotional posts than male students is confirmed. This is due both to the high degree of representativeness of the sample for the female gender and to the fact that the highest coefficients of polarity and magnitude are reached by the female participants. The  $H_{1c}$  hypothesis stating that the text-emoji paradigm will be strong enough to develop the creation of a genre or style of academic learning is not sustainable. This is due to the sets of forces that act simultaneously and asymmetrically on the digitalized teaching and learning process. Thus, the platformized learning spectrum is often found under the pressure of alternations between the governing principles of the social media register defined by synchronous - short - informal - interactive relationships which are presumably limited to surface learning, and the principles of the traditional educational register which promotes in-depth learning and is defined by asynchronous - long - formal - and transactional relationships. The  $H_{1d}$  hypothesis stating that the calibration of academic programs through emotional feedback will be relevant enough to be integrated into an economic model is sustainable under certain conditions.

Thus, on the one hand, the calibration module must include in the affective calculation both the emotional symbols and the polarity of the digital corpus, on the other hand, it must make an exact reference to the contextual frequency of the specific parameters of each register. Thus, the exploitation of information through a tool that interoperates the affective calculation with the register, kilobit and metadata architecture, can result in sufficient added value to justify its integration into an economic model.

***Chapter six brings into attention a set of possible future research directions. The*** series of conclusions encourages the thinking of automated solutions which unite the theoretical and the practical fields. Because educational platforms produce increasingly significant amounts of data, digital corpora can become the ideal resource for crafting customized solutions specific to each participant in the educational act. Following on this line of thinking, the researcher proposes the development of an educational content-based recommender engine.

This technical application belongs to the unsupervised automated microcalibration class and operates on the content-based recommendation architecture. Unlike Boolean logic, which allows for completely true or completely false answers, fuzzy logic indicates incrementally the degree of truth of a statement. Therefore, if Boolean logic can only respond with 0 or 1 type of results, fuzzy type logic can include any values in this range. This type of logic blends natively both with the digital content where the same concept can be manifested in a variety of textual expressions, and with the polarity coefficients of socio-emotional symbols.

Specifically, the application extends the search to areas with similar strings, but not necessarily identical to those generated by the user. The degree of truth of the statement is calculated by the Levenshtein distance, a measurement which offers a high degree of accuracy for spelling mistakes.

While the asynchronous environment is responsible for generating formal and most likely error-free content, synchronous content related to informal interactions is more prone to errors than asynchronous content. Levenshtein distance is a measure of text similarity that compares two words or two sets of words and returns a numerical value representing the distance between them. The first three values are the highest degree of similarity between the user-generated text string and the one identified in the external database. Recommended content delivery takes into

account the user's content preferences and the application may suggest research articles or readings based on certain benchmarks. Thus, based on the individual profile and the content generated, users can receive recommendations based on distinct keywords such as Eminescu for user X, or Sadoveanu for user Y. For example, the application identifies simple and composed proper nouns of individual forum contributions and looks for similar expressions in the title and abstract of scientific content platforms such as SAGE, Google Scholar, etc. The application then returns in the user's account the first three results for the keywords. This can be done both on the basis of each individual contribution and on the basis of the general contributions for each course hour. The application automates the function of generating dynamic content intended exclusively for the unique profile of the user. The return of the results to the user is done by installing a module "http request handler,"<sup>24</sup> which communicates the query information back to the application. The following code simulation exemplifies the intended principle of operation of the application. Thus, the content generated by the student is represented by "dataset\_1", and the content of the databases is represented by "dataset\_2". The filtering criterion is governed by the principle of the closest matches and is reflected by the Levenshtein score for each result. This example aims to illustrate a case of abbreviation specific to informal written interactions "lit. eminesciana," for which the closest correspondent is searched in a preset database. The minimum result selection threshold is at a Levenshtein score of 90. The search can operate according to a default setting and retrieve responses based on the publication date criterion which returns the most recent results, or it can be set for the notoriety criterion which reflects in a descending order the public number citations. Thus, the results displayed to the user may reflect the most recent as well as the popular articles for the selected keyword combination.

The code is exemplified through the Python3 program, within the Jupyter Notebook integrated development environment (i.e. IDE) facilitated by "Anaconda Navigator."<sup>25</sup> The procedure involves the previous installation of the "fuzzywuzzy," "python-levenshtein" libraries, and of the "process" mode in "fuzzywuzzy." The representation exemplifies the beta phase of the code section based on the "fuzzy-logic-levenshtein" model associated with the content-based recommendation application.

Depending on the course objectives, setting keywords or phrases can differ significantly. There may also be differences between the number of searches allowed and the number of results displayed to the user, as the number of searches is generally greater than or equal to the number of displayed results.

The immediate benefits are identifiable both in the area of optimizing cognitive load management and in the areas of partial substitution of adult supervision and interactions with colleagues. Recommendation systems can be a technological solution in the development of personalized education models.

***Chapter seven concludes the paper with a series of conclusions and final recommendations.*** This chapter briefly summarizes the answer to the research question. The answer is reinforced by the coefficients of polarity, magnitude and frequency whose verifiability

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<sup>24</sup> A. Caione, AL Guidp, R. Paiano, A. Pandurino, S. Pasanisi, *KPIs identification for evaluating E-learning courses through students' perception*, EAI Endorsed Transactions on e-Learning, Vol. 4, Iss. 13, E2, European Alliance for Innovation 2017, p. 5. <https://docs.python.org>, accesat în 25.06.21 la 09.27 am.

<sup>25</sup> <https://docs.anaconda.com>, accesat 26.06.21 la 13.21 pm.

is achieved through the kilobyte criterion. Because the presence of emoji symbols decreases as the cognitive value of content increases and as content relevance decreases, it is concluded that the exclusive integration of emojis in a system of quality and control of academic performance is not viable. The development of content evaluation architectures that include emotional emoji symbols not accompanied by text is therefore not recommended. This is based on the evidence from the cognitive content corpora where emotional symbols tend to indicate a low degree of engagement, but where, interestingly, the absence of emojis does not imply the presence of negative content polarity. The results of this study indicate that, although the individual polarity of emojis and that of text combined with emoji is positive, no causal relationship is identified between the presence of emojis and a significant increase in written contributions to forum discussions. However, a positive correlation is identified between the newly generated content and the presence of emotional symbols. Thus, the presence of neutral and positive emojis is not a determining factor in the process of stimulating the generation of in-depth content where learning occurs. The impact of the positive polarity of emotional symbols is not significant enough to engage, even indirectly, significant increases in relevant educational content. On the other hand, the positive polarity of emotional symbols is sufficiently significant and has a positive impact on the generation of microtext content. This dynamic is reflected by the presence of symbols in a majority proportion in the area of short synchronous interactions. One of the important questions that emerges from these reasonings is that of verifying the contexts in which short and informal content becomes a relevant resource for learning.

One of the important contributions of the study is the identification of a conflict between the poetic and the scientific language. The present research indicates that the presence of emojis encouraging the generation of informal content conflicts with the formal and impersonal way of managing written educational interactions. Also, considering that emojis are par excellence a personal and synchronous way of fast communication, their engagement in the asynchronous context of the classroom confirms the existence of a multilevel conflict between the social and educational register. It is confirmed that the introduction of emojis in asynchronous interactions risks being perceived as a counterintuitive language feature.

Another important contribution is related to the importance of correctly detecting both the positive and negative emotions. While negative emotions are explicit in the control group, their complete absence from the experimental group may indicate more commitment to safe behavior and less their non-existence. The results tend to confirm the literature findings which affirm that students participating in forum interactions rarely mention their negative feelings.

The results also revealed that direct instruction and social presence are strongly influenced by the linguistic complexity of the initial formulations. Thus, it becomes noticeable that the social presence signaled by symbols decreases with increasing complexity of learning content, but it returns to the nominal thresholds in case of recalibration of content for the student's range of cognitive comfort. Therefore, the general satisfaction of the student tends to fluctuate depending on the cognitive coefficients of the content, those of the direct instruction, the format of the content to be learned and on that of the course design. The level of perception for the acquisition of new knowledge is also strongly correlated with the learning content and the course format.

At the same time, the results confirm the fact that content relevance conditions the engagement of social symbols. The notable difference is that only the most relevant content attracts the constant engagement of emotional symbols. While kinesic symbols are present in



posts with relevant content, the simultaneous presence of emojis and likes in the newly created content in turn establishes a positive correlation of the social symbols with the new quantity of created text. As the level of relevance decreases and with it the amount of newly created kilobytes, the emoji symbols disappear from the written interactions. On the other hand, the decreasing percentages of kilobytes drive the same trend of like symbols engagement.

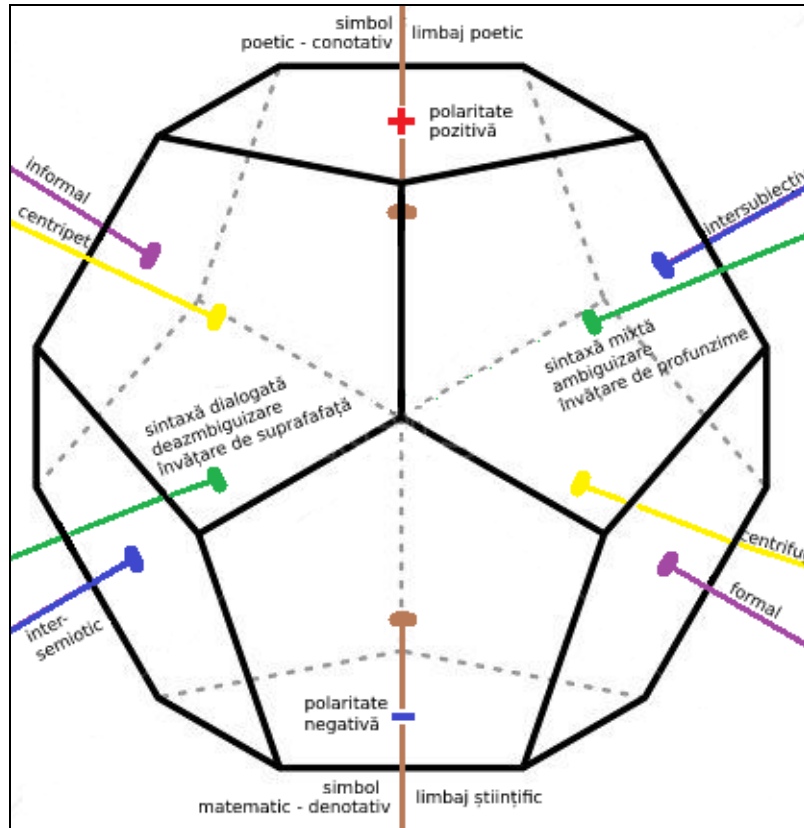
An important aspect signaled by the present investigation points at the understanding of the elearning content as "the new gold." The granular exploitation of digital educational data and its aggregation at ecosystem level can significantly contribute to the establishment of registry variables specific to the Romanian educational environment. In order to support performance education, it becomes imperative to develop a Romanian digital educational corpus. This development would facilitate the emergence of new investigative scenarios and would encourage the formulation of advanced educational intelligence technological paradigms.

The conceptual analysis framework manages to intuitively capture the textual dynamics generated by Generation Z exponents, within the learning process delivered through the Edmodo educational platform. Both the analysis of the key performance indicators and the analysis of the digital pedagogical discourse from the perspective of the pedagogical situation are found in the relations between semiotic functions and semantic metafunctions.

Therefore, the inductivist analysis of empirical data regarding the contribution of digital psycholinguistics to the calibration of elearning programs through emotional symbols highlights the formulation of a final hybrid conclusion. More specifically, the research results indicate that the integration of sentiment analysis based exclusively on emotional symbols is best suited for experimental analysis, while the integration of sentiment analysis based on text-emoji can have practical applications in the calibration area of the digital educational process..

The contextual-dynamic implications of the present study accommodate the broadest understanding of the linguistic context, which includes the extralinguistic-gestural, situational, and social-historical levels. The relationships between the mental state of the interlocutors and the message, between the sequential particularities of messages and mental processes, between social groups and the modification of messages, between language and culture or between the evolution of a subject and its language are strongly reflected by the selective and relational character of interactional linguistics.

A graphic synthesis of the linguistic implications of affective signs-symbols within the digital pedagogical discourse can be viewed alongside.



The variationist distribution of the affective sign-symbol based on the pentagonal dodecahedron geometry.