

# Intercultural communication methodology: teaching sciences and engineering students

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**Abstract.** The problem area of this research paper focuses on the priority functions of the language sphere of the being mentality necessarily reflecting the state documents on education, methodology of scientific and methodical support for the implementation of educational programs of language education for training students of non-linguistic departments of universities in line with the axiology within the current educational program research of the eco-system spaces of international language education in Russia. Current Scientific Scholarship in terms of the intercultural approach needs to be created for linguistic security via making the outmost of the language programs for SP. The goal of this article is threefold: a) to design Knowledge Content, Technology and Evaluation Concepts of the target Model, b) to substantiate the integration characteristics of intercultural communication at universities (Natural Sciences and Engineering), c) to clarify the integration characteristics of intercultural communication within the innovations of national education in the third millennium, based on topical issues of the polyphony of the eco-system spaces. The latter reflects the priority dominant values due to the cognitive, developmental and educational functions in line with positive trends requiring thorough attention of both the university pedagogical community and teachers of general education organizations.

## 1 Introduction

In this study the Implementation of Intercultural Communication is considered within the harmonious thinking/interaction/communication/transmission of knowledge from one generation to another as a dominant value while raising cultural awareness in the foreign language classroom, and as a factor of paramount importance for effects and challenges of the personal and professional development in terms of the Self as Cultural in the polyphony of verbalization and non-verbalization, other non-verbal signs and symbols of the current professional eco-system education, for teaching international languages (ESP) to Natural

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Sciences and Engineering students, and for the implementation of professional intercultural communication skills set.

Currently, both for improving the methodology of teaching international languages (ESP) and for achieving the effects as designed results via mastering educational programs by the Natural Sciences and Engineering students, of particular importance is the research area of optimal Knowledge Content, Technology, and Lingua Didactics Modus (KC.T.L&D) in terms of the authors' Concept Sphere of the information and linguistic security of the regional communication and education spaces, i.e. the eco-system environment [1-3]. As is the case, the humanitarian knowledge within the Natural sciences and Engineering spaces of universities cannot be value-neutral. The research program of cultivation of values and their reasonable application for security of national values to realize the strategic vision of goals and objectives, pedagogical science and practice are to fulfill a historically significant culture-creation mission in the communities of all educators, humanitarians and engineers. Thus, one of the prior trends of this search is recognized at all levels of comprehension of actual issues of this study, initiated for the creation of a unified eco-system of scientific and methodological support for foreign language educators, for authentic effects in the process of teaching and learning languages for SP.

At Regional Destination, the search becomes one of the most productive trends in the perspective of continuing humanitarian education of specialists as a value component – cooperation, creativity, the Self as intellectual, leadership, responsibility, as evidenced within the results of creative interaction of foreign language teachers for SP over the past ten years to neutralize the personnel scarcity and to increase motivation for teaching and learning foreign languages at Natural Sciences and Engineering University within the architectonics of regional communicative environment, as well as to prevent their professional burnout, and to disseminate advanced pedagogical novices. In the spaces of the ambiguous current landscape of training and learning foreign languages at national and regional Universities (Sciences, Humanities, Engineering), value horizons are to be considered in the aspect of cultivating the Self as intellectual based on dominant values of *Cooperation and Communication, Co-creation and Creativity of the language usage, Leadership and Emotional Intelligence including the intrinsic aspect of cognition*.

So, *the prior goal of this research* is to present some of the findings within the methodology and innovation pedagogy of culture-creation eco-system approach to the implementation of ESP at Humanities, Natural Sciences and Engineering Departments of State Universities as a result of the manifestation and intensification of constructive interaction within regional methodological associations and pedagogical communities of educational institutions to become as a priority for educators and universities.

The appeal to literary sources and advanced pedagogical activities within the framework of the design of methodological and scientific support allows one to reveal some problem zones of the most striking and positive phenomena occurring in the spaces of foreign language education and motivating to the mastery of languages, to the development of foreign language culture within a systematic comparison of languages and cultures. This includes preserving the traditions of national scientific schools within the study of foreign languages to maintain interest in polylinguall education, and the emergence of linguistic classes / schools/centers in the all-Russian and regional space, and the creation of schools with a national cultural component, including the idea of expanding the range of languages studied (Chinese, Kazakh, Tatar, Italian, etc.), and testing integrated courses based on the variability of curricula, novel teaching methods, devices, and information materials; early learning of foreign languages, and cultural exchange of teachers/school/university teams, as well as the enrichment of educational and methodological literature on foreign languages for SP [4-9].

*The first problem* concerns the issue of the systematic implementation of the scientific approach to language teaching that means in accord with current Scientific Scholarship, philosophical, psychological, linguistic, pedagogical and methodical discourse, and along with educational realia of recent decades to be developed into practical teaching programs and activities. The approximation of scientific and methodological knowledge aimed at the production, systematization and integration into the system of scientific and methodological knowledge on professional language education and teaching foreign languages for SP to objective truth is an endless and deeply contradictory process as well as educational practices where foreign languages must correlate with the dominant values of scientific and methodological research accepted within the professional community of educators, and on its philosophical and methodological concepts thanks to the Humanities, Knowledge Content that should be value-oriented on current language teaching, their crucial principles.

*The second issue* dwells upon linguistic aspects, and first and foremost, the prior aspect is a property of language described in the seventeenth century to be innovative and stimulus-free, and it is not a matter of habit and generalization. Secondly, a generative grammar of a language is a theory of the speaker's competence, and it serves as one component of a theory that can accommodate the creativity aspect of language usage. The limitations of generative grammar are a direct reflection of the limitations of correctness and explicitness in earlier linguistic work. Thirdly, it is correct that the underlying principles of general grammars cannot be acquired through experience and training, then they must be part of the intellectual organization which is a prerequisite for language acquisition. Fourthly, the significance of the intrinsic organization is great, and it is important for a pedagogue to get to carry out linguistic and psychological investigation of language, and try to determine and characterize the role of these fields of scientific approach to language teaching in the classroom. Furthermore, these aspects might become the essence of additional professional programs for ESP educators at non-linguistic departments of modern pedagogical and engineering universities and a research basis for educational policy.

*The third area* presents the professional programs of cultivation of values and their reasonable application for security of national values to realize the strategic vision of goals and objectives of a successful personality and a professional in the safe communicative spaces; pedagogical science and practice are to fulfill a historically significant culture-creation mission in the communities of scientists, educators and methodologists and to develop the Self as Cultural of students.

*The fourth aspect* sticks to the philosophical concept of the on-going transformations in the multicultural and multilingual educational environment of the country and regions: digitalization, trends of training and retraining students, co-working and coaching, as well as other innovations in education, suggests that all these phenomena will also work to improve its quality in the aspect of the Self as Cultural in terms of novel cultural value dominants within the space of diverse components of the information continuum - education as a value, native language as a value, multilingualism as a value, personality.

*The fifth problem area* shows more and more concepts on the realia that as technology becomes more complex, and one learns more and more about how students learn and which pedagogical methods work better in certain areas, institutions should be ready to use such technologies to improve student learning.

*The sixth actual issue*, according to the findings by the international research group (UK, Finland, Spain, Italy), reveals that "Teachers also highlighted how students were better equipped to engage with digital activities linked to their interests and hobbies and less so when it came to using digital technology for study purposes" [10]. Tuva Bjorkvold, and Erik Ryen give their idea on the professional teacher, who "implements the subject matter according to the level of the students and the methods they have acquired" [11].

*The seventh problem aspect* reflects the realia which both in Russia and at Region Destination is under deep discussion as a priority research area in terms of the methodology of cognition/comprehension of another culture via his/her own culture via organizational events to provide the safe/secure educational and informational spaces for effective continuous professional development of all participants. The following concept becomes the mainstream for upgrading professional language education in the aspect of designed meaningful technological effectiveness of the professional educational programs. The programs of recurrent professional education of a foreign language teacher are to be developed in accordance with the requirements for the structure of an additional professional educational program, as well as in accordance with the qualification characteristics of educational workers. The programs should be based on the communicative, activity and integrative approach to teaching language for professional purposes of educators, on a competence-based model of learning outcomes that could ensure the implementation of the Federal State Educational Standards in terms of educational achievements - personal, subject, meta-subject results of students. The program as a whole determines the content and technology/pedagogy/lingua didactics of the educational process, conforming to the basic principles of the state policy of the Russian Federation in the field of education, set out within the Law of the Russian Federation "On Education" and reflecting:

- humanistic paradigm of modern education, the priority of universal values, human life and health, free personal development;
- priority of the educational component, including the education of patriotism, national identity, social identity, citizenship, responsibility, diligence, respect for human rights and freedoms, love of the surrounding nature, family;
- innovative unified information and educational communicative space for the protection, security, and development of the regional cultural traditions and socio - cultural specifics of the target language of the education system to increase the level of linguistic and functional literacy of students.

*The eighth actual issue* deals with the fact that it is important to consider the educational process (like any other living, productive process) as a corpus of events developed normally along the peaks of which are bright event moments – events of understanding, communicative events. An event is something that remains in memory (anchors – in psychology), it is something that changes our ideas, experience, thoughts/thinking as a valuable process of viewpoints on life, education, family values (the expansion of the horizon, points of growth). An event is a co-existence: interaction, polyphony where the core of the event is embedded in the deepest form of the word (in nouns, the prefix co-denotes compatibility: co-author, constellation).

Furthermore, in the logic of CSD theory and the school of comprehension/understanding where the signs/ symbols of a lesson as a communicative event are the presence of a contradiction (riddle) in the subject material, the unfolding of the situation based on the dialogue of student's versions, the emergence of educational intrigue, the presence of "horizontal connections" (student – student), dots/points of surprise, communicative space convergent type (implementation the teacher and students' communicative strategies of cooperation; productivity of role positions; active, lively sense formation: from meaning to meaning; functioning of an individual (students') language – a rhetorical dictionary – to express what is understood in the lesson (schemes, images, nominations, metaphors, associations); developed post/aftereffect of the educational situation.

Thus, critical analysis of current Scientific Scholarship reveals that in accord with certain tendencies and developments within linguistics and psychology that might have some impact on the teaching of language we think that they can be in need of summarized

under the following heading: creativity of language usage; the abstract aspect of linguistic transmission; the universal character of linguistic structure; the role of intrinsic frame in cognition (Naom Chomsky, 1966). One of the main theses which belong to “The Mozart of Psychology”, to Leo Vygotsky, was that an understanding of an individual's internal mental processes can be found in his relationship with the external environment. L. Vygotsky compared those who are looking for the source of higher mental processes inside the body to a monkey who is trying to find his reflection in a mirror behind glass. The main condition is the external environment: "a peculiar, age-specific, exceptional, unique and inimitable relationship between the child and the surrounding reality, primarily social." Leo Vygotsky (1989-1936) formulated several basic ideas of education that are relevant today: the theory of "zones of immediate development" says that it is necessary to set goals for the child that he has not mastered, but is able to master with the help of an adult. After all, it's not what he can do that matters, but what he can learn; the "learning by playing" approach is that the child's first acquaintance with skills and abilities should occur during the game; the system of individual education focuses not on the system as an end in itself, but on the support of the child's personality; the "five" is not the key to successful learning, because the marks in the diary speak only about the attention or inattention of the teacher to the child, and not about his abilities; education is the formation of a bright personality who is capable of self-education, self-development and creativity.

Certainly, the teacher of FL would do well to keep informed of progress and discussion in these fields, and the efforts of linguists, psychologists and scientific educators to approach the problems of language teaching from a principled point of view are extremely worthwhile, from an intellectual as well as a social and cultural point of view. It is significant to bear in mind the sentence that current methodology of language education principled on this design might enable it to support a “technology” of language teaching, in the scope and security of foundations. Furthermore, we should point out that scientific and methodological support for each educator within the development of regional human resources, in our case, the pedagogical community of teachers of languages needs critical analysis and system-based approaches to implement the updated Federal State Educational Standards, and to solve the urgent tasks of the Self as cultural, according to the results of the Federal Professional Expertise of all educational organizations at Region Destination. These are schools-leaders, regional resource centers, municipal methodological centers, Teacher Training and Engineering Universities and other educational institutions for upgrading professionals and specialists. A significant segment of these organizations is included into the process of developing the system of municipal methodological associations and pedagogical communities (hereinafter MMO) at Region Destination, with scientific and methodological support in accordance with the challenges of the State and Ministry of Education.

## **2 Methodology**

The authors' team continues to explore the topic of professional education in the field of sustainable development. This time they made a selection of programs that are available at universities according to selection criteria: online format, duration up to 3 months or up to 120 hours of training, free or with an available receipt in a study on the topic "Transformation of the function of learning and development of intercultural communication for ESP in new realities". The search covers the past four years of critical analysis of the regional situation within the professional educational spaces at universities and general education organizations because every living thing has a physical boundary that separates it from its external environment. And we stick to the viewpoint that in growing up people learn literally thousands of spatial cues, all of which have their own meaning in their

own context. Literally thousands of experiences teach us unconsciously that space communicates. Yet this phenomenon would possibly never have been brought to the fore of the level of consciousness if it had not been realized that space is structured and organized in different model within each culture.

*The main methodological message* concerns the effects positioned as dominant values by focusing on the harmonious thinking/interaction/ communication/ transmission of knowledge from one generation to another, i.e. while raising cultural awareness in the foreign language classroom spaces within the Comprehensive Model of the Self as Cultural; which of the skills and qualities, professional competencies are necessary for successful work, what challenges the Russian education system, bureaucracy, as well as teachers, students intend to acquire in terms of the capability to carry out business communication in oral and written forms within the spaces of cultural traditions of the target language country, and speech etiquette patterns.

There is a Table 1 that reflects on the hierarchy of principles which define and regulate professionally oriented teaching of a foreign language to students. The principles are ranked by significance, taking into account the classification after N.D. Galskova and N.F. Koryakovtseva.

**Table 1.** Principles of professionally oriented foreign language teaching within the framework of the personal activity paradigm.

Psychological and Pedagogical Principles	Lingua Didactic Principles	Methodical Principles
orientation to the development of the student's personality and independence as his personal quality	orientation to the development of the student's linguistic and cultural personality	orientation to the development of the student's linguistic and cultural personality
value-semantic nature of learning based on the productive educational activity of the student	intercultural orientation of foreign language education	interrelated development of speech communication skills
problematic value-semantic nature of teaching	specifics of professional discourse	interrelated teaching of language means and communicative skills
continuity of education and its interdisciplinary nature	interrelated study of language and culture, and culture of professional communication	conscious learning of language and culture
reliance on students' productive academic activity	authenticity	reliance on students' experience in the native language

3 Results and their discussion

*Frame One* reflects on the design of the educational spaces organized on the principles of architectonics of the Self as Cultural in the polyphony of the target language education environment and aims at modeling elements of foreign language education, purposefully, languages for SP that presents in threefold frames of the Comprehensive Design based on the achievements and findings of national and international traditions of Methodology of ESP at training workshops of the company's employees within the trends of 2022-2023; at the demand for training topics; at set of skills that will be in demand in the years to come; at the set of professional competencies that employees currently lack; at popular employee training formats, and at the set of problems in talent development: what worries top management and others. See these parameters of the training sessions in Table 2.

**Table 2.** Formation of General Cultural and Professional Competencies at training courses "Foreign Language EFL" and "Special Foreign language ESP" (Bachelor's degree courses) "Chemistry", "General Biology", Teacher Training University.

major	Chemistry	General Biology
discipline	English as a Foreign Language	
competence	Capable to carry out business communication in oral and written forms (within the state language of the Russian Federation and foreign language(s))	
details	Foreign language communication; Cultural traditions of the target language country, Speech etiquette patterns	
means	Target language texts of general culture	
assessment	opening lines tasks; asking for information; discussions, etc.	
result	skills according to Bloom's taxonomy	
means	communicative tasks	
assessment	mind mapping; asking for information; discussions, etc.	
result	speaking & discussion skills	
means	polycultural studies	
assessment	functional literacy tasks	
result	presentation & public speaking skills	
final results	3% of students: oral presentations at students' conferences, 8% of students: poster presentations at students' conferences, 6% of students: virtual participants at students' conferences, 76% of students: complete the EFL general programme without participating in conferences. 7% of students: publish papers.	
major	Chemistry	General Biology
discipline	English for Special Purposes	
competence	Being able to use target language tools adequate to the goals and situations of communication to solve professional problem tasks in business communication both in Russian and foreign language(s)	Being able to implement into practice the techniques of compiling scientific and technical reports, reviews, analytical maps and explanatory notes, to present and critically analyze the information received and present the results of field and laboratory biological studies
details	Specific terminology and its implementation with the main spheres of speech activity in a foreign language (reading, writing, speaking, listening)	Specific terminology and basic phonetic, lexico-grammatical, stylistic features of the target language; techniques for compiling scientific and technical reports, reviews, analytical maps and explanatory notes
means	Foreign texts (concepts) of scientific papers	
assessment	opening lines tasks; asking for information; functional literacy tasks; discussions, etc.	
result	skills according to Bloom's taxonomy; presentation & public speaking skills	
final results	13% of students: oral presentations at students' conferences, 14% of students: poster presentations at students' conferences, 32% of students: virtual participants at students' conferences, 19% of students: complete the ESP programme without participating in conferences; 22% of students: publish papers.	

*Frame Two* focuses on the fact that the educational process (like any other living, productive process) normally develops along the peaks of which are bright event moments – events of understanding, and communicative events/meetings. An event is something that remains in memory (anchors – in psychology), it is something that changed our ideas, experience and our boundaries of existence and coexistence (the expansion of the horizon, points of growth). An event is a co-existence: interaction, polyphony where the core of the

event is embedded in the innermost/the deepest form of the word (in nouns, the prefix co-denotes compatibility: co-author, constellation).

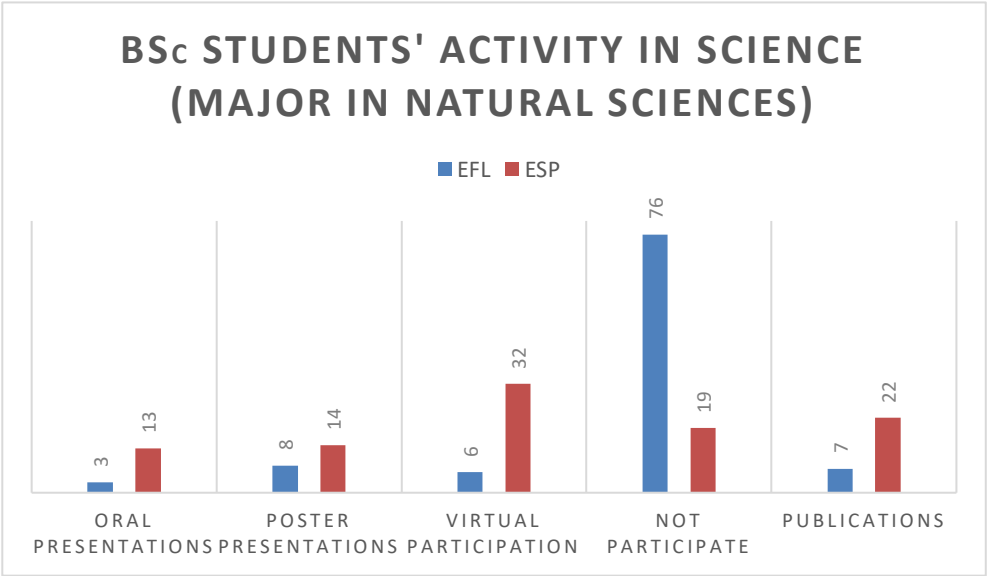
So, in the logic of the school of comprehension/understanding and CSD theory the signs of a lesson as a communicative event are the presence of a contradiction (riddle, enigma) in the subject material, the unfolding of the situation based on the dialogue of student's versions, the emergence of educational intrigue, the presence of "horizontal connections" (student – student), dots/points of surprise, communicative space convergent type (implementation the teachers' and students' communicative strategies of cooperation; productivity of role/constructive positions; active, lively sense formation: from meaning to meaning; functioning of an individual (students') language – a rhetorical dictionary – to express what is understood in the classroom (schemes, images, nominations, metaphors, associations); developed post/aftereffect of the educational situation. See these parameters of the training session in Table 3 that was developed by the authors' team of this study on the ideas of the opus SPACE SPEAKS by Edward T. Hall, and adapted for the English classroom for SP.

**Table 3.** Specifics of the educational process within the cultural environment in the English classroom for SP.

Specifics of the educational process	Criteria
Creation conditions for active meaning formation	Students create their own, fresh thinking and meanings for activities with them in the classroom (comparison, interpretation, transmission, development, classification, generalization, etc.)
Construction of the educational intrigue based on the difference of semantic (role-play) lines: to present the subject information within a dialogue modus	Points of surprise as an important element of communication and comprehension
Reflexivity of goal-setting in the lesson: the desire to reflect with children on the goal, stages, task plan of activity, results.	Reflexivity of a student: on goal, on activity, on a set of events in the classroom
Originality of the subject material (subject potential of the event corpus)	Riddles of language, text, components of productive contradictions
The nature of language material: its connection with authentic communication situations	Support on the meaningful sphere of speaking, reading a text based on authentic life situations ситуации, observation of one's own speech activity, reflection on one's own speech activity, situations and speech realia
Specifics of the communicative environment	Intense dialogue of versions, points of view, hypotheses, their verification, clarification and coordination, the presence of convergent points of divergence and convergence of meaning
Speech patterns of a classroom	Creation of one's own design, schemes, models, nominations as a moment of fixation of the understood meaning
Post – Effects of the participation/interaction/communication activity in the event corpus environment	As post effect of a class, Students share their impressions on the products of their activity within the spaces of discussions, writing essays and articles, speaking and asking questions



*Frame Three* presents as an example at the Pedagogical University, Bachelor's degree courses "Chemistry", "General Biology General Biology", at the Interfaculty Department of Foreign Languages, in cooperation with the graduation departments, the disciplines "Foreign Language. EFL" and "Foreign Language ESP" are in the Curriculum. The specifics of training the students (majoring in non-linguistic areas) is within the Model of preservation of continuity in teaching, and the implementation of interdisciplinary integration. First of all, the applicants of these educational areas mainly have knowledge of fundamental disciplines (Chemistry, Biology) corresponding to the level necessary for their enrollment. Therefore, we cannot predict and say the same on the proficiency of the applicants in a foreign language. That is why the first semester is partially / or completely devoted to adjusting the level of their foreign language training, and only afterwards the situation starts to be changed for the formation of communicative competence taking into account the environmental and individual approach. Thus, the possible solution of this problem is seen in two aspects: increasing the multicultural level of students and their academic and publication activity reflecting "the pedagogical design focused on the ideal track of personal development in the aspect of changing the format of communication-oriented learning, functions as the leading methodological message" [12]. The usage of different English language resources of the University Digital Library of NSPU; Russian Index of Scientific Citations, Google Scholar, Mendeley, ResearchGate, ORCID, Taylor&Francis online, etc.), and training programs as Padlet, Kahoot, etc. platforms, Padlet, Kahoot, etc., unique text-oriented materials as History of Organic Chemistry at Russian Universities in the course of training in General English & ESP helps both to their easy access to the Content to be in need of , and to neutralize the anxiety of modern students in the classrooms, presented within the results of the micro-examination are presented below (Figure 1) that show the change of the students' achievements in publishing activity as well as in scientific conference participating activity.



**Fig. 1.** BSc Students' activity in Science (Major in Natural Sciences).

## 4 Conclusion

In sum, one can state that the effects of the implementation of the target regional project can be attributed to the active involvement of educators of foreign languages in improving methodological approach to overcoming professional deficits in terms of FLT for SP – pedagogical diagnostics, self-examination and self-analytical work, subsequent self-education, planning for further development online technologies. Educators are interested in offering new forms of interaction during the survey. The number of appeals to the specialists of the Department has increased (in 2022, almost daily the appeals were recorded) on participation in advanced training on the creation of conditions for security of the educational environment in the aspect of the formation of both communicative and information competences of students. It is planned to organize the system activities of educators in full for the implementation of novices in Methodology of FLT for SP.

The research results are under consideration at a unique moment of a broad consensus of the professional advanced training & retraining of foreign language educator community (FLT) which is currently reconstructed, and isn't delivering on its promise of educational improvement and excellence for all teachers, students of additional professional programs. As is the case, today there is also a fruitful support for doing things differently and widespread recognition that new approaches, in this very study, regional approach and new structures are in line with the fixation of the current situation, to bring about an improved result, and to make this kind of improvement a reality of the national university education as a whole. There is a lot of promising energy behind innovations in public education; that concerns the issues of the professional development areas related to technology and techniques of renovation/ transformation/translation of current professional education of both educators and science students.

As such, this research presents a definition of innovation that is informed by strategic and projective sessions within the fruitful Integration Courses “English for SP (Natural Sciences, “Biology”, Chemistry delivered at regional Universities translated in terms of the value dominants (patriotism, pride for the history of the country and the place where we live in) that constitute the culture-creation purpose and goals of the national University education as a whole and account for innovation's many faces. The critical analysis of all factors that keep innovation from taking hold in professional education, and use that as an entry point for describing the current opportunity for innovation in recurrent language education of a pedagogue in terms of the integration approach.

By the same token, we have to admit the fact that along with ultimate individualization, continuity, age diversity, culture self-education via language self-realization, priority of the educators' needs and interests, one has to pay much more attention to the problems associated with the spread of humanitarian activities of practitioners on value dominants of an individual in the recurrent education of adults, i.e. particularly, in the area of professional advanced training.

Currently, the priority of these aspects of the research is firstly to be clarified: our system of public education in the knowledge economy of the 21<sup>st</sup> century translates the concept that reads as the overarching goal to prepare the youth for citizenship, community, and work that earns a livable family wage, into a need to ensure all students have the academic foundation for college and university success although there is little credible disagreement about this goal, there is huge disagreement about the correct devices to reach it and to encourage the national university education sectors to work productively toward a better system for education innovation.

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