LEARNING A FOREIGN LANGUAGE: A DOOR OPENED FOR STEM EDUCATION

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Abstract

Science, Technology, Engineering and Mathematics (STEM) education has become the centre of attention in the education area since the beginning of this century. Given the accelerated development of the 21st century, developing a critical and creative thinking for improving the student competencies is mandatory. That is why, without the excellent development of language, it is impossible to implement the STEM education. Moreover, if the students can manage more than one language, they would be more competitive. This proposal demands the students to demonstrate they can express themselves using a foreign language in their field of action through an academic dissertation. It also facilitates the interdisciplinary and transdisciplinary development, integrating the language with the specialty. For the development of this research, empirical and theoretical methods were used to assess the trends of the teaching-learning process of languages, determine the primary scientific foundations that support the proposal and corroborate its reliability through workshops critical opinion and collective construction. Among the basics analyzed are the communicative competences, the theory of verbal activity, the Communicative Approach, the Teaching of English for Specific Purposes, the Historical-Cultural Approach, the Humanist Approach, the teaching development, the curricular design, and the STEM Education.

Keywords: STEM Education, Foreign Language Teaching, interdisciplinary, and transdisciplinary.

1 INTRODUCTION

Learning a foreign language constitutes a necessary tool within the university curricula. Foreign languages allow contacts with other cultures, expand the bibliographic horizon and allow access to knowledge. To be updated with scientific-technical advances, any researcher or professional needs to know other languages. With the increase in scientific-technical exchange, the possibilities to look for a job or superior studies opportunities abroad, participating in events and publishing through the use of another language both orally and in writing are very useful.

Foreign language teaching dates from antiquity, since the Second World War it has been considered a scientific specialty. Over many years, different methods and approaches have been used for the teaching-learning process of foreign languages. It has gone through different stages. In a first stage, grammatical-lexical contents were included; the Grammar-Translation method was used with a slight approach to the academic activity. Subsequently, the communicative approach that allowed the development of the four language skills was introduced. Currently, the link between the learning of the English language and the academic and professional activity of the student plays a fundamental role (Cutting, 1987) (Translated by the authors)

The foreign language teaching for general, academic and professional purposes has among its fundamental objectives: the training of professionals able to communicate themselves orally and written, developing reading skills in a way that allows them to read and get information from specialized sources, and interact in their field of action with certain communicative competence. To achieve this objective, it is necessary to create programs that respond to the new demands of the language teaching-learning process in higher education.

Foreign language, as a discipline, favours more and more the interdisciplinary development within the curriculum, with its function of being an instrument of work and culture. Language is not always linked so that students can use the knowledge, skills, and habits acquired in their sphere of action. Student in Higher Education must acquire and develop a system of knowledge, habits, and skills that allow them to apply it independently and in a creative way in the solution of problems in the construction of the new society (Corona, 1985) (Translated by the authors)
On the other hand, when the STEM education is a policy for the Zimbabwean education, and many ways to interpret it has been stated for different researchers, the pedagogy community has the huge challenge to implement it. Bindura University of Science Education (BUSE) has the responsibility to form the teachers that are going to carry out this task. That is why, dealing with the curriculum, there are many ways to give the right output to this policy. These researchers just want to give an example on how to favour the STEM education since a language course.

Taking into account that BUSE has opened its doors to the study of the Spanish language, introducing it as an optional course for some programs; the authors consider this course should be an example to demonstrate how to give a curricular output to the STEM education through a linguistic context.

The Spanish language is the second most studied language in the world. It is spoken for more than 570 million people and more than 40 Spanish speaking countries. It is one of the official languages in the European Union. Although, Equatorial Guinea is the only one Spanish speaking country in Africa, there are many speakers of this language in the continent.

The proposal of this course for Spanish as a foreign language provides the students with tools they need to make an oral presentation on the research design of the project of the final thesis and make a written summary of it. To achieve this, the student must integrate the knowledge of the specific terminological vocabulary, mainly related to Spanish as a Foreign Language, Communication Skills, the speciality courses and Research course.

2 METHODOLOGY

2.1 Theoretical framework

Currently, language teaching uses the information provided by psychology because of the application of scientific methods to analyse the mental activity that occurs in the process of acquiring a language.

Hence, that knowledge of the relationship between language and thought is necessary; it was an aspect profoundly addressed by Vygotsky and others, (1982) (Translated by the authors); which is possible through the interpretation of its origin, from social conditions relationships that men establish in work, together with biological conditions, that caused men to feel the need to communicate. From the didactic point of view, this relationship allows the language teacher to understand the communicative activity among the characters of the teaching-learning process.

Since the decade of the 1930s, the Didactics of Foreign Languages receives the influence of the different psychological trends mainly Behaviorism and Structuralism, coming from Psychology and Linguistic respectively. Behaviorism conceives linguistic interaction as a mechanical process of stimulus-reaction without appealing to the use and development of consciousness, so it reduces the understanding and teaching of communication to stereotyped repetitions of the language away from its contextual meaning and communicative purpose. Structuralism, for its part, considers the linguistic form. Then, communication focuses on the emission of grammatically correct structures relegating to a second place, the content or meaning of the expression.

Linguistics contributes to the teaching-learning process of a foreign language with the study of the language for its organization and transmission through syllabus and textbooks, as well as classes. Therefore, foreign language teaching uses the results of linguistic research when selecting and organizing the language material for teaching at phonics, morphosyntactic and lexical levels.

Since the Second World War, foreign language teaching was established as a scientific specialty; nevertheless, the influence of the teaching of Latin transcends the teaching of modern languages through the Grammar-Translation method. The procedures of this method were the basis of the teaching of the language from antiquity to the early stages of modern times. At the end of the 18th century and the beginning of the 19th century, the Reading method emerged from practical considerations of teaching, which in the 1930s was useful for the teaching of language for specific purposes; it allowed the development of the reading of scientific literature. (Cutting, 1987) (Translated by the authors)

Since the midnineteenth century, Psychology had played a role in explaining the development of linguistic processes. At the beginning of the last century, a movement emerged that aimed to transform the methods of teaching foreign languages from an oral approach.
With the influence of the Reformist movement in Europe and its interest in modernizing the teaching of foreign languages, there was a significant change, considering the primacy of the spoken language over the traditional predominance of written texts and the methodologies focused on oral communication. Natural methods were developed where the mother tongue was eliminated from the classroom: the Psychological method that allowed learning a broad and practical vocabulary in a short time, and the Phonetic method that was the first to emphasize in oral communication, with a study of the phonation organs and the way of producing sounds. (Cutting, 1987) (Translated by the authors)

In the decades of 1920s and 1930s, the Direct method was developed, its objective was the direct association of the language with objects and people, which is to say teaching meaning without translation.

In the 50s and 60s the Audio-oral or Audio-lingual method emerged in the United States. It emphasized in learning to speak before reading and writing and allowed the use of the first language.

As the Behavioural Psychology, learning was achieved through habit and accommodation. (Cutting, 1987) (Translated by the authors)

In the 50s, the Audio-visual method was used in the teaching of French, where the student practiced the language within a context through images. A technique of inflexible steps was followed: presentation, through film sequences accompanied by dialogue, explanation of meaning, selective listening, questions and answers, memorization, transposition, and practice of grammatical and phonological aspects. (Cutting, 1987) (Translated by the authors)

On the other hand, another theoretical reference is the Historical-Cultural Approach headed by Vygotsky, (1982) (Translated by the authors), which is fundamental in the program presented in this paper. There is an interrelationship, which gives great value to the context, and to the student-teacher relationship. The mediation of Vygotsky is particularly crucial in this proposal, because it is a syllable where the interaction plays an essential role in the process of foreign language learning. It is also important because of the value that the mediating elements attain in learning languages as part of the mediation process.

The Humanist Approach, in the 70s, was another factor that had a significant impact on education and, specifically, on the Methodology of Teaching Foreign Languages: the role between student and teachers changed, and the students became the class role centre.

The Cognitive Theory emerged in the 70s, focused on the conscious control of the phonological, grammatical and lexical patterns of the second language, through the study and analysis of these patterns as a set of knowledge (Cutting, 1987) (Translated by the authors). That is, as a coherent and meaningful system in a real-life situation, the student understood and controlled the phonological, grammatical and lexical structures of the second language in such a way that they became automatic.

None of these methods allowed the development of communicative activity. Already in the 1960s, the foundations for generative and transformational linguistics were laid down based on the concept of linguistic competence provided by Chomsky, (1957). Moreover, the communicative competence of Hymes, (1972) has made possible the appearance of other methods or approaches such as Communicative Approach, Teaching by Tasks, Teaching English for Specific Purposes, Academic and Professional.

This paper focuses its attention on the specific and academic purposes; taking into consideration that the students are going to investigate within their field of action to transform their scope of action. They use broad terminological vocabulary related to their specialty, but at the same time they have to apply scientific methods to research and look for a solution to a scientific problem.

Richards, (1995) says that communicative competence is the ability to use language appropriately in communication depending on the spatial and temporal context, the roles of the participants and the nature of the transaction that occurs.

There are different theories of communicative competence; the most recognized are those contributed by Canale and Swain, (1980), who consider four areas within the communicative competence: linguistic or grammatical competence, discursive, sociolinguistic and strategic competence. Currently, a more advanced theory of communicative competence is sociocultural. Giovanini, (1996) (Translated by the authors) introduced the so-called learning competence.

To elaborate the proposal, the authors analyzed the sociocultural competence and learning competence. The first focuses on the knowledge of the sociocultural context where the target language is spoken and the ability to adopt appropriate sociocultural strategies to achieve the
communicative goals. Besides, the second is adjusted to the degree of autonomy that a student can enjoy organizing their self-learning, it depends on the ability to make decisions and take responsibility, to self-assess and monitor their self-learning, to actively participate in cooperative learning (Ramirez, 2005) (Translated by the authors)

In foreign language teaching, the Communicative Approach arouses in the 70s and 80s. Grammatical structures were added to express a conceptual aspect; the sentences were combined according to their meaning. Communication errors were more important than grammatical errors. That is why, needs, motivations, and characteristics of the students should be recognized. With this approach the teacher is no longer the centre; but the students guided by the teacher. The Communicative Approach allows students to talk most of the time about useful topics in their social and work life that interest them.

Linguists have said that teachers must adopt the best techniques of all known methods for teaching languages, and apply them in their procedures in the class for whatever purposes they deem convenient. That is why, this paper adopted what the authors considered the most appropriate principles from all methods and approaches mentioned.

A mediating element between the didactic science and the teaching-learning process is the curriculum. According to Horruitiner (2008) (Translated by the authors), the curriculum includes the conception of the graduate, the systematization of the content and the methodology to achieve it. The curricular design is responsible for developing the teaching-learning process at the discipline and course level.

In general, the curriculum constitutes a system of organized knowledge for the training of professionals. Through them, it directs, executes and controls the teaching-learning process, for the formation of a scientific potential with high competitive capacities, taking into account the necessity of the social context and interests and motivations of the leading actors of the process.

Ur, (1996) proposed different types of syllabi for foreign language teaching. In the case of this proposal, the most appropriate is the mixed or multipurpose syllable. Because these syllables combine different aspects so that they are as comprehensible and useful as possible for teachers and students; in them, it is possible to find specific elements of other types of syllables, such as: topics, tasks, functions, and notions, as well as grammar and vocabulary.

The education community to interpret the STEM education concepts should not translate it literally, taking just the Science, Technology, Engineering and Mathematics courses as such. STEM education is beyond a course, it is everything the lecturers do in class for the students learn to learn. Nowadays, the teacher has to motivate the learners to apply the most appropriate research methods, to choose the right technology, to innovate for transforming the object of the science they are searching in, and to transmit it by using a proper language.

The learners should be the centre of the lesson; they should be involved in hands-on activities, such as problem solving activities, inquiry, and project base learning activities. To communicate the results of each activity the learners should use the written and oral language. This proposal suggests that they do it not only in their national language, but also in foreign ones.

Launching it as a purpose of any syllable in the education system must be a challenge for this century. STEM education prepares the new generation to output more competent professionals who are going to be part of the human resources market. And to speak a foreign language is very important because in the first place there is a fast development of the information and communication techniques; also for getting a general integrated cultural level, promoting technique and scientific interchanges, and understanding the everyday circulation of large quantity of scientific information, discoveries and innovations. Sometimes all this development happens and changes in a pace, that it is not possible to translate it.

Besides, the Spanish is one of the official languages in the European Union, it is also important to know that these countries are close to Africa and there are many business possibilities between both areas. As well as the South American countries have a large economic and scientific interchange with this continent through the so call Sur-Sur Summit.

Spanish as a foreign language has been teaching at Bindura University of Science Education since 2016. It includes four courses, Foreign Language Spanish Course I, II, III, and IV. The first three courses are basically general Spanish and the fourth one is academic. This last course is based on the language for specific purposes, and it is the one taken for the proposal of this paper.
3 RESULTS

3.1 Proposal of an interdisciplinary program for the development of STEM education through language learning in the students of Higher Education

Corona, (1985) (Translated by the authors) recognized the necessity to learn the English language was not only as a subject in the basic cycle of the curriculum of Cuban universities. It was also that the students must use it in the activities of self-preparation and consultation. The literature review in a foreign language for coursework and diploma should be compulsory for all non-philological programs. Including the language for postgraduate training, all this would allow the foreign language to be used as an instrument of work and culture.

This program allows the linking of STEM education with foreign language teaching due to its base on the principle that the language must be mastered in its practical application and according to the needs of the students. This program is a guide to organize the teaching-learning process so that each academic year contributes to the performance in the foreign language of the future professional.

The authors take as reference the teaching of the language for specific purposes. Through this program they illustrate how language teaching is linked to the specialty. Aspect that make possible to relate the STEM education with the curriculum. At the same time, they show the different elements that should serve as a basis for the fair selection of the contents. The language teachers select the appropriate linguistic material and give curricular output to the development of science and technology through their classes. They also use an investigative approach, which will allow the student to investigate their sphere of action and transform it, expressing themselves about their field of action in the foreign language.

GENERAL INFORMATION

- **Title**: Foreign Language Spanish Course IV.
- **Length**: One academic semester.
- **Credits**: 10
- **Modality**: Conventional Course.
- **Places**: No more than 20 students per class.
- **Academic Field**: Social Sciences and Humanities.
- **Academic Centre**: Bindura University of Science Education.
- **Languages use**: Spanish and English.

Course aim and objectives:

This course aims to achieve the communicative competence in the Spanish language in the student’s activities, industrial attachment, and research, as well as, in the social activities with people from different countries and cultures where they need to use this language.

For that reason at the end of these courses, the students should be able to:

- Understand oral information in the foreign language both monologues as dialogues.
- Expressed orally in dialogues or monologues on topics that are presented in the course contents such as: the everyday life, and academic, investigative, socio-political and cultural activity, getting an intermediate level of communicative competence.
- Understand authentic texts and didactically prepared in the foreign language about scientific, technical, educational, socio-political and literary themes, to assimilate the information contained in the literature of the specialty providing the development of the academic, labour and investigative components.
- Express themselves in written form on various topics such as: the everyday life, and academic, investigative, socio-political and cultural activity, getting an intermediate level of communicative competence; through the use of an appropriate language in order to write different types of texts: notes, messages, instructions, letters, summaries, descriptions, stories, among others.
- Develop logical thinking through the observation, and the comparison of the linguistic content studied between the official language and the target one.
• Strengthen their knowledge on their mother tongue as a result of the development of communication skills.

• Demonstrate understanding and knowledge of different aspects of national and international culture, particularly of Spanish-speaking countries.

• Develop different kinds of projects and independent work, where cooperation and mutual help are put into practice. Presuppose a responsible attitude on self-learning through:
  o Using different ways of research work for the independent study and the development of projects of practical work.
  o Self-reflect on their strengths and weaknesses in the development of the communicative competence process, which favours the processes of self-regulation.

• Use evaluation, self-evaluation, and co-evaluation of communicative competence developed according to their level.

• Use different learning strategies cognitive and metacognitive, socio-affective and learning support to help them understand and speak better the Spanish language in different contexts.

Table 1. Outline course: (Academic).

<table>
<thead>
<tr>
<th>Topic</th>
<th>Functions</th>
<th>Notions</th>
<th>Grammar</th>
<th>Vocabulary</th>
<th>Task</th>
<th>Methods</th>
<th>Values</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Scientific problem.</td>
<td>Introducing the topic. Describe a place. State a scientific problem. Approach to an academic text</td>
<td>This project is carried out..., all these ideas bring the necessity to start a scientific research..., as a result of this analysis this problem is identified..., How to improve...</td>
<td>Passive voice. The use of se Perfect tenses</td>
<td>Scientific problem The speed of the information. Current situation</td>
<td>To state the bases of the scientific problem.</td>
<td>Collaborative Cooperative.</td>
<td>Solidarity. Modesty. Sensibility Honesty. Responsibility.</td>
</tr>
<tr>
<td>2 Research object and field of study. The research objective.</td>
<td>Delimited a research object and field of study. State the research objective. Ways of processing information</td>
<td>The research object is..., The research scope is delimited..., Elaborating...,</td>
<td>The use of subjects. Impersonal statements</td>
<td>Objective. Field of study.</td>
<td>To determine the object and the field of study of the research.</td>
<td>Collaborative Cooperative.</td>
<td>Solidarity. Modesty. Sensibility Honesty. Responsibility.</td>
</tr>
<tr>
<td>3 Hypothesis. Scientific Questions. Scientific Tasks.</td>
<td>Establish a possible solution to a scientific problem. Set up a program. Negotiating and debating</td>
<td>To support the research, the following hypothesis is established. To analyze..., to favour..., to develop..., to elaborate..., to value...</td>
<td>Conditional sentences. Future tense. Comparatives Infinitives. Question patterns.</td>
<td>Hypothesis. Scientific tasks. Scientific questions.</td>
<td>To state the hypothesis or the scientific questions and the tasks to fulfill them.</td>
<td>Collaborative Cooperative.</td>
<td>Solidarity Modesty. Sensibility Honesty. Responsibility.</td>
</tr>
</tbody>
</table>
Methods.
Technology


Table 2. Assessment.

<table>
<thead>
<tr>
<th>Coursework</th>
<th>30 %</th>
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<tbody>
<tr>
<td></td>
<td></td>
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<tr>
<td>Final exam</td>
<td>70 % (written exam)</td>
</tr>
<tr>
<td>Total</td>
<td>100%</td>
</tr>
</tbody>
</table>

4 CONCLUSIONS

The linguistic, psychological, and didactic characterization of the formation process on a foreign language provides the identification of the theoretical framework for the elaboration of the proposal. The proposal aim was to transform the teaching and learning process and to favour the development of oral and written communicative competence of students in foreign language with specific purposes.

The social relevance of the research is that the curricular output of the development of Science, Technology, Engineering and Mathematics through foreign languages teaching can help to promote the development of students’ education on aspects related to their professional profile. STEM education also allows them to satisfy their expectancy as future professionals, which is turned into to a better professional and social performance.

REFERENCES


