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Research on the curriculum development in English for Specific Purposes (ESP) to improve the communication skills of students in engineering and technology studies – a research scheme

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ABSTRACT: In this article, a call is being made, and a research scheme proposed, for comprehensive research concerning the impact of English for Specific Purposes (ESP) and communication skills on engineering and technology education and practice. For many years, strong emphasis in the training an engineer was placed on technical matters and subjects, as well as the closely related professional skills. Driven by the globalisation process and, hence the increased mobility of professionals, the English language has become the *lingua franca* and, really and truly, the second language for many countries in the world and, definitely, the main language of communication for engineers. Therefore, engineering education has to stand up to the challenge of preparing new professionals with outstanding communication skills. One way of achieving this goal is to develop a new curriculum where ESP teaching/learning and the enhancement of communication, as well as other so-called soft skills, will be as equally important as technical matters. The organisation of comprehensive research concerning the role of ESP in engineering education is presented and discussed in this article.

INTRODUCTION

The profile of a modern highly qualified engineer should include well-developed communication skills and high English language proficiency to provide efficient opportunities for competitiveness and success in the global work arena. Communication and language skills are interdependent in nature and can be developed simultaneously through each other. However, this synergetic effect is only achievable with the development and implementation of an innovative curriculum that will prepare engineering students for effective professional practice.

The area of the research enquiry is to find ways to rationally combine content, durability and implemented teaching, as well as learning strategies, so that the developed curriculum could be not only comprehensive and effective, but also flexible. The most desirable effect is to keep the curriculum responsive without losing its commitment to quality, should new topics emerge and the demands of the field evolve.

SIGNIFICANCE OF THE STUDY

Today, increasing emphasis is being put on enhancing the communication component of engineering education. It is widely accepted that scientists and engineers in all positions have to be able to communicate the purpose and relevance of their work, both orally and in writing.

According to the ABET Engineering Criteria 2005-2006, an engineering student, apart from other skills, should attain the following competences:

- *An ability to function on multi-disciplinary teams*;
- *An ability to identify, formulate, and solve engineering problems*;
- *An ability to communicate effectively* [1].

Recent reviews on engineering education carried out in the USA [2], Canada [3] and Australia [4] also stress the need to improve the communication abilities of both students and practitioners.

The need for developing more complex communication skills is increasing, together with the considerably increased quantity of documentation required for modern engineering practice. For example, in manufacturing, engineers are expected to develop both quality procedures and work instructions, and keep them up to date. Safety, maintenance and environmental management also depend on accurate and systematic documentation and reporting procedures. Moreover, the process of globalisation is also forcing the careful consideration of language and documentation in so far as international markets demand clear and unambiguous documents and culturally inclusive communication styles.

The idea is not new. Following Kearley, there is a substantial consensus on the non-technical criteria required for intercultural competence and professional success in another culture [5].

Recognising its pivotal role in engineering practice, communication should be implemented as the core element in those engineering and technology courses that are targeted at developing the professional competences of engineering graduates.

However, the current concerns are not only about the need to improve the curriculum of engineering courses, but also develop it, taking into account the impact of the information and technology revolution on all professions, including technical ones.

Regarding communication studies as important part of the curriculum, it is reasonable to adopt a multidisciplinary

approach to the development of communication skills and abilities, but this study focuses on designing the syllabus for English for Specific Purposes (ESP) because the underpinning principle of the teaching methodology here is communication [6].

According to the *Longman Dictionary of Contemporary English*, the word *language* is defined as *a system of communication by written or spoken words, which is used by the people of a particular country or area* [7]. At the same time, communication skills are nothing but the expression of versatile ideas to gain maximum understanding and acceptance.

Judging by these connotations, it can be suggested that the most appropriate subject to enhance communication skills is language because communication is the basic thing in teaching any language. Indeed, any language primarily serves as a tool for communication. ESP is taken into consideration because it can assist in attaining the goal of meeting those special needs of engineers, ie help learners gain insight into their preferred interpersonal styles, practice techniques to communicate with impact, and learn how to effectively influence subordinates, colleagues and superiors in their field of work by means of the spoken or written word. This is why ESP can be taken as a core communication subject to base the framework of the curriculum.

LITERATURE REVIEW

The value of communication studies, as well as ESP in modern engineering education, cannot be overestimated. The rapid changes in industrial processes, connected with rapidly developing Information and Communication Technologies (ICT), have increased the need for improved communication between developed and developing countries of the world. Developing countries are hungry for obtaining … *the explosion of technical information … which has caused English to become the* lingua franca *of the international community* [8].

The top priorities are given to ESP because, in many developing countries and countries where English is the second language of instruction, it is widely required by learners to perform a social or working role. Furthermore, the lack of language and communication skills would restrict their development or adversely affect their future professional success and financial welfare in a certain manner [9].

Besides, ESP has been cited as:

> … *a natural link within multi-cultural, multi-lingual societies, as a vehicle for international communication, as a global career-wave for news, information, administration, and as the language in which has taken place the genesis of the second industrial and scientific revolution* [10].

The insights gained from the origin of ESP reveal three basic reasons: the demands of a *brave new world*, a revolution in linguistics and a focus on the learner [11].

Hutchinson and Waters note that two key historical periods have breathed life into ESP. First, the end of the Second World War brought with it an

> *... age of enormous and unprecedented expansion in scientific, technical and economic activity on an international scale for various reasons, most notably the economic power of the United States in the post-war world, the role* [of international language] *fell to English* [11].

Second, the Oil Crisis of the early 1970s resulted in Western money and knowledge flowing into the oil-rich countries. The language of this knowledge became English.

The second key reason cited as having a tremendous impact on the emergence of ESP was a revolution in linguistics. Whereas traditional linguists set out to describe the features of language, revolutionary pioneers in linguistics began to focus on the ways in which language is used in real communication. It was discovered that a variant of English will change within the particular context in which the language is used. Therefore, if language in different situations varies, then it is required to tailor language instruction in order to meet the needs of learners in specific contexts.

The final reason that Hutchinson and Waters cited was the gross impact of psychology on ESP. Rather than simply focus on the method of language delivery, more attention was given to the ways in which learners acquire language and the differences in the ways that language is acquired. Learners were seen to employ different learning strategies, use different skills, enter with different learning schemata, and be motivated by different needs and interests. Therefore, the focus on learners' needs became equally paramount as the methods employed to disseminate linguistic knowledge [11].

The natural extension of this thinking reflects in designing specific courses and developing curricula that would satisfy the specific needs of different professional specialties in engineering and technology.

It seems fairly obvious that, if teachers are to be the ones responsible for developing the curriculum, then they need the time, skills and support to do so. This support may include curriculum models and guidelines, as well as assistance from individuals acting in a curriculum advisory position. The provision of such support cannot be removed and must not be seen in isolation from the curriculum [12].

It can be concluded that, in designing and delivering the content-based and communication-focused language programme for engineering students, the following key issues should be taken into consideration:

- The abilities required for successful communication in occupational settings;
- Content language acquisition versus general language acquisition;
- Heterogeneous versus homogenous learner groups;
- Materials development;
- Effective strategies and practices for motivating students and enhancing their communication skills, language proficiency and encouraging their life-long learning paths.

Abilities for Successful Communication

There are many different educational approaches to developing communication skills [13][14]. Good communicators are made, not born. The communication strategies applied in ESP teaching should, in the long run, empower engineering students to communicate with confidence and authority in every

situation to every audience, implementing the fundamental principles of communicating, such as the following:

- How to grab the reader's or audience's attention from the start;
- How to maintain the connection while proceeding smoothly from topic to topic;
- How to provide substantiation for the points made;
- How to communicate with people from other groups, such as marketers, investors, users and others;
- How to overcome such obstacles as fear, boredom and aversion to the prepared materials [15].

Engineers have to rethink not only the way that they communicate, but also the way that they construct their drawings to ensure that they are understood in a global workplace. The use of symbols in communicative environments is very significant. Pudlowski distinguishes the importance of visual communication via drawings and diagrams as *any individual* working in the engineering field has to *perceive, understand and process complex information through graphical means* [16].

A number of other authors have stressed the importance of visual thinking in engineering [17-20]. Arnheim and McKim, for example, have pointed out the importance of visual imagery in activities that involve creative thinking and communication [21][22].

Originally conceived by Aristotle, a meaning triangle is a three-way distinction between words, *experiences in the psyche* and things. It connects symbols, concepts and things. Each of the points on the triangle indicates a separate component that may be involved in thought or communication. The object is any entity from some real or imagined world about which an idea is held. The concept is the idea or thought of the object as held in the mind of a person. The symbol is an auditory, visual or other form of utterance that is taken to stand for the object when communicated as part of a language [23].

Indeed, any technical artefact created by engineers is a result of a collaborative construction of knowledge, creativity and its manifestation in text or speech. For many engineers, participating in the process of creating the concrete object, the object will only be *known* through its representation as documentation consisting of writing, drawing, graphics and mathematics [24].

The ability to perceive image-based information influences not only academic, but also practical performance in the engineering field. The skills to communicate through drawing and modelling can be enhanced through instruction based on Piagetian principles with respect to the trainability of spatial ability and symbolism in adulthood [25].

The Ratio of Specific to General English Acquisition

This principle, which is central for ESP teaching, involves content-based instruction. *ESP should not be taught in a vacuum, but rather should prepare students for the content and tasks to which they will be exposed in their professional life* [26].

Moreover, the content for an ESP course should be authentic and non-simplified as far as *the technical prose that students are going to read professionally will not be any easier than already written* [26].

According to Widdowson, ESP should be delivered with respect to a *process-oriented approach* that

> *… accepts from the outsets that the language data given to the learner will not be preserved in store intact but will be used as grist to the mental mill. Hence the language content of the course should be selected not because it is representative of what the learner will have to deal with after the course is over but because it is likely to activate strategies for learning while the course is in progress* [27].

Hutchinson and Waters have also given impetus to the emphases upon the practical activities that should be chosen to activate the *appropriate strategies for learning* and to help engineering students cope with the task demands of target situations [11].

One of the main questions that need to be answered is how much time should be devoted to vocabulary and content knowledge acquisition, as opposed to the time spent developing general and academic language skills.

Heterogeneous versus Homogenous

According to the current situation in engineering education, women are usually underrepresented in technological fields [28]. Nevertheless, there is a tendency of women to earn degrees in technological fields, making a notable gain in reversing the gender gap in higher education [29].

Moreover, there is still a strong stereotype that women have nothing to do in engineering. Recently, Harvard President Lawrence Summers suggested that women are innately less qualified than men to succeed in mathematics and science careers. This remark has fanned the flames about women's capabilities – whether they have the *right stuff* to succeed – not only in grey matter, but also in ambition, stamina and priorities. For centuries, this debate has challenged women's capacity for success. It has been proven, both by different research and life achievements, that women's capacities should not be in doubt [30].

The thing that must not be missed when developing the course for a heterogeneous group of engineering students is to find more effective ways to encourage and educate women on how to be leaders in their chosen field, as men and women have physiological differences that may influence their achievements.

Materials Development

The core question that Johns addresses is if ESP materials really exist. The scientist states the dilemma as follows:

> *ESP teachers find themselves in a situation where they are expected to produce a course that exactly matches the needs of a group of learners, but are expected to do so with no, or very limited, preparation time* [31].

The attempt to find ESP materials for engineering and technology courses proves the lack of textbooks that could respond to the needs of a specific student audience. Moreover, a minor search for ESP materials among the items offered by Cambridge University Press and Oxford University Press, Longman

and others showed that books do not cover all specialities, but rather the most common ones, such as English for Finance, English for Electronics, English for Computing, etc.

It can be suggested that the gap of ESP material can be bridged by means of Internet resources, as follows:

> *Just as the development of the printing press 500 years ago dramatically expanded the information available to individuals and society, the development of the Internet is doing so today. With a single computer and a phone line* … [anyone] *can access more information today than it was available by any means to the greatest scientists of the world a century ago* [32].

Effective Strategies for ESP Teaching and Learning

Courses that are developed in order to produce engineering graduates who are competent practitioners with technical and communication skills must be delivered with the implementation of effective teaching and learning strategies.

Recent technological advances have created the possibility for new ways of learning and teaching. The Internet, for example, can be utilised not only as an unlimited repository of up-to-date information in various specific areas, but also as a rewarding and motivating means to distribute the content and stimulate fruitful outcomes.

The Internet is the technology that has a revolutionary impact on every sphere of society, serving to reshape business, media, entertainment, communication, etc. The emergence of the World Wide Web (WWW) as a pipeline for learning has had a profound effect upon the manner in which students learn and lecturers teach.

Koonce states the following:

> … *from Web-based instruction and distance learning to virtual reality and online peer communities, training and technology are converging in rapid and radical ways. The convergence – speeded by the Internet and by the growth of company intranets and extranets – is having a revolutionary impact on both the nature of training and the skills that trainers* and those who are trained *will need to do their jobs in the next century* [33].

According to Gitsaki and Taylor, using the Internet as a classroom resource has the following advantages:

- The Internet provides students with opportunities for exposure to natural language and authentic language use, not only during, but also outside, the class, making the learning of English part of students' daily lives and an ongoing process;
- The Internet offers a variety of topics to satisfy a diverse audience;
- The information available on the Internet is current and frequently updated;
- Using the Internet is fun and highly motivating in that Web sites are full of animation, colours, interactive forms, etc;
- Using the Internet has become a part of life and learning, so knowing how to use it is essential for students because it develops basic Information Technology (IT) skills (eg word processing skills, Web-browsing skills, e-mail skills), while also facilitating English language skills at the same time;
- Using the Internet for English language teaching and learning enhances student autonomy and gives learners the opportunity to manage their own learning [34].

By implementing Web-based activities, ESP teachers may proverbially kill three birds with one stone, as follows:

- Develop knowledge and skills in English for Specific Purposes (ESP);
- Revise a major subject that students have learned in their native language;
- Inculcate in students the taste for life-long learning [26].

Research conducted by the Iranian scientist, Arani, on the utilisation of the Internet for ESP developed for medical students, has proved to be very efficient. His quasi-experimental study was carried out on 60 second-year students of medicine enrolled in ESP courses. One group was provided with materials derived from published medical articles on the Internet, while the other attended traditional text-based classes. The texts were selected carefully so that they corresponded to the same level of readability. The students' language proficiency was measured by the English Language Battery Test (ELBA Test). It was found that: *Using Information & Communication Technology (ICT) facilities the students managed to achieve much better results compared to the traditional text-based method.* Taking into account the research results, it was concluded … *that ICT specialized article-based instruction is a more effective method of teaching ESP to the students of medicine linguistically and methodologically* [35].

System principles should be embedded in order to design a curriculum model that has the potential to achieve the objectives and meet the criteria mentioned above. Systems principles acknowledge that the management of any system (including an educational one) requires the consideration of four factors: information, logic, innovation and time [36].

These four principles can be used as the fundamentals to design an innovative curriculum for English and communication studies in engineering and technology courses. The information dimension can refer to fundamental engineering knowledge; logic can imply generic communication skills required of all engineers to facilitate the relationships and networks needed to function; innovation can be seen as educational methods that must continually adapt to meet *customers'* needs; while the time dimension can be manifested as life-long learning [37].

RESEARCH HYPOTHESES

The framework of the research is outlined by the following hypotheses:

1. There is a strong impact of ESP on the professional formation of engineers and technologists, especially on those in developing countries, so that they are better prepared for their global professional activities;
2. Existing ESP courses do not make an adequate use of contemporary advances of information and communication technologies;
3. There is an inadequate application of modern methodologies and teaching/learning techniques in ESP courses;

4. The designed ESP curriculum provides a valid and efficient model for teaching/learning activities in engineering and technology courses;
5. The developed ESP curriculum for specialised engineering and technology studies is an efficient tool that should be used extensively in university courses, especially in developing countries.

RESEARCH METHODOLOGY

In an effort to dovetail the development of an innovative model ESP curriculum for particular target groups and to ensure that it is flexible and responsive to the changes in engineering education criteria and professional demands, the following methodology will be implemented:

- Review of relevant literature and publications concerning English and communication studies, and existing courses in ESP:
  - Review of books, journals and conference publications;
  - Review of relevant documents;
  - Internet searches, etc.

This will definitely provide further endorsements about the importance of communication skills for highly qualified 21st Century engineers and give the possibility to identify key activities required by engineering fields of practice. It will provide the ground to carry out comprehensive needs analyses in order to determine the appropriate content for ESP curriculum, which is designed to meet the specific needs of learners. The needs analysis data will make it possible to establish appropriate course goals and the instructional objectives that support them, so as to be able to design a course syllabus first and proceed to the design of appropriate, well-sequenced curriculum in engineering and technology courses.

- Research on the present status of ESP curricula in engineering and technology studies:
  - Search for, and the review of, journal and conference publications;
  - Study of available teaching programmes;
  - Review of ministerial documents;
  - Study of academic programmes available on the Internet, etc.

The thorough analyses and evaluation of the present status of ESP curricula will help to reflect on the range of possible models, adopt successful practice, learn about the challenges and conduct further research into a preposition of a *hybrid* curriculum that is appropriate for improving the communication skills of engineering students in developing countries.

One such model has been proposed by Z.J. Pudlowski, initially offered at the Technical University of Lodz, Lodz, Poland [38]. The model has been well-structured and based on an *English and Communication Skills* subject, and is comprised of such modules like:

> *… an intensive course in English, a technical drawing course, a problem solving course, and engineering writing and presentation course and a computer graphic for engineering drawing course* [38].

It was stated by members of the course development team that the effectiveness of the programme would be recognised by the Fédération Européenne d'Associations Natonales d'Ingénieurs (FEANI) [39]. This may indicate that it could serve as a prime example and be analysed in terms of its components and considered fundamental for designing a model appropriate for developing countries.

- Research on the impact of ESP on the professional formation of engineers and technologists:
  - Review of relevant literature concerning this matter;
  - Review of the available case studies concerning the research outcomes of specific engineering and technology programmes;
  - Individual communications with relevant experts in the field;
  - Internet searches, etc.

The purpose of this research is to look at the impact of ESP and use it as a core subject to rest the framework of the future curriculum, as well as to define the full spectrum of communication capabilities for engineering graduates addressing written, oral, interpersonal and graphical skills.

Hutchinson and Waters state that *ESP is an approach to language teaching in which all decisions as to content and method are based on the learner's reason for learning* [11]. It can be concluded that, for the ESP course to be effective, the multidisciplinary or integrative approach should be developed and implemented. In other words, it is a complex task, combining the professionalism and experience of engineering, language, communication and even literacy specialists.

Therefore, another goal is to relate the history and essential principles of ESP and describe how it relates to current content based engineering teaching and learning, authenticity and pedagogy appropriate to students in developing countries.

- The determination of existing ESP courses and subjects provided to engineering and technology students.
  - Internet searches for current, specific engineering and technology programmes that include ESP subjects;
  - Search for, and the review of, journal and conference publications concerning such ESP international programmes;
  - Individual communications, etc.

Communication and documentation are recognised as an integral part of modern engineering practice. It is desirable that ESP courses are assigned to a reality with the implementation of modern technologies. It would also be essential to ascertain the approach and strategies to help students improve their communication skills in English and effectively learn the context materials of professional and practical environments. It is interesting to analyse and pin down the advantages and drawbacks of existing ESP courses and how they are delivered.

- Review of present teaching/learning methodologies and systems used in existing ESP courses:
  - Search for available teaching/learning methodology used in ESP courses in engineering and technology studies;

- Study of relevant journal and conference publications;
- Review of relevant case studies;
- Individual communications with teachers and former students, etc.

The characterisation of teacher-learner roles and practices in ESP should be cognisant in curriculum revision or innovative development. In accordance with the classical genre, ESP teaching/learning methodology is based on *target performance needs*, *skill needs*, *and learning needs*.

The focus on the needs of the learner, as opposed to the inculcation of linguistic facts, lead to a shift from a teacher-centred to learner-centred approach. Nevertheless, this might be greatly influenced by the cultural peculiarities of learners who could still be teacher-dependant, like in some countries of the Third World. Therefore, it is required to use special teaching techniques, modern strategies and technologies that challenge the audience to communicate and motivates them for active learning.

The main purpose of an ESP course is students' acquisition of linguistic skills and communicative strategies related to the specific cultural areas of the future target situation within the field of experience; therefore, the course will be based on specific, authentic and non-simplified content.

According to Stryker and Leaver,

> … *content-based instruction implies the total integration of language learning and content learning. It represents a significant departure from traditional foreign language teaching methods in that language proficiency is achieved by shifting the focus of instruction from the learning of language per se to the learning of language through the study of the subject matter* [40].

Riemer and Jansen state that *a high percent of people involved in intercultural communication are engineers* and ESP teaching/learning methodologies should evolve *cultural context*, *non-verbal intercultural communication* and various soft skills [41].

Therefore, the methodologies, techniques and rewarding technologies must be widely used to encourage the extension of communication skills throughout the entire curriculum, not only for onward engineering practice but also life-long learning.

- Review the availability of teaching materials and aids used in existing ESP courses:

  - Search for available teaching/learning methodologies used in ESP courses in engineering and technology studies;
  - Study of relevant journal and conference publications;
  - Review of relevant case studies;
  - Individual communications with teachers and former students, etc.

Throughout the reviews, such resources will be pointed out that best respond to the educational needs for English and communication studies in engineering and technology courses.

The indicated lack of ESP teaching materials may require the development of new, or the adaptation of existing, ones to justify the particular course objectives and predefined outcomes.

Graves reflected in his work that, in order to select materials, the following issues should be taken into account:

- Effectiveness in achieving the course purposes;
- Appropriateness of the material so that students will feel comfortable; this means that the material will be relevant to their interests, course objectives and language level;
- Feasibility, so that the material will be in accordance with students' capabilities and the course will not prove too difficult for them [42].

Although all the difficulties concerning the content could be eliminated by means of implementing powerful Internet resources, which will allow the utilisation of such appropriate tools as online dictionaries, encyclopaedias, terminology reference books, Java tutorials and other helpful materials, it is necessary to find ways to adapt authentic materials that respond to specific learner needs within the context of well-sequenced ESP instructions.

- Review of existing ESP courses in professional development engineers and technologists will be carried out in terms of the following:

  - The efficiency of existing ESP courses in professional development engineers and technologists;
  - The impact of the achievements of existing ESP methodologies and the role of ESP in engineering and technology courses;
  - The impact of the achievements of modern educational psychology used in ESP;
  - The impact of modern technologies on ESP and its conduct in engineering and technology courses.

  This will comprise the following methodology:

  - Study of relevant journal and conference publications;
  - Acquisition of relevant information through a specially designed and administered questionnaire;
  - Individual e-mail and face-to-face communications with teachers and former students;
  - Interviews with relevant teachers and former students, etc.

- The design of an ESP curriculum for specialised engineering and technology studies.

  - Qualitative analyses of the existing curricula for ESP;
  - Determination of the objectives and outcomes in terms of the knowledge, skills and attitudes that need to be achieved through a comprehensive ESP curriculum;
  - Determination of the concepts, topics and ideas to be included in such an ESP curriculum;
  - Design of a model of an ESP curriculum;
  - Determination and design of subject syllabi in the ESP curriculum;
  - Selection of appropriate teaching/learning methodologies and styles;

- Selection and inclusion of desirable teaching/learning exercises, aids, recent facilities of information and communication technology (hardware, software, multimedia, the Internet, etc).

The process of designing an ESP curriculum for specialised engineering and technology studies will be based on the modelling method. Following Pudlowski,

> … *the method is extremely efficient in planning a modern curriculum. Its chain structure provides an opportunity for further system development* … [allowing] *restructuring and modernization of existing study systems without undesirable disturbances and heavy expenditures* [43].

The curriculum will be developed on the bases of a functional recognition of the scope of those communication and documentation activities that are considered fundamental for modern engineering practice. Recognised and carefully planned teaching of engineering international discourse can contribute positively to activity within the tertiary sector concerned with engineering education quality initiatives.

- Verification of the validity of the devised and designed ESP curriculum will consist of the following:

  - A pilot experiment concerning the designed curriculum;
  - Survey of the views by current teachers by means of a questionnaire;
  - Interviews with expert specialists involved in ESP;
  - Qualitative and quantitative analysis of the obtained results.

The assessment of the developed ESP curriculum will be carried out in accordance with an action approach. Action research methodology offers a systematic approach to introducing innovations in teaching and learning.

Zuber-Skerritt states the following:

> … *through systematic, controlled action research, higher education teachers can become more professional, more interested in pedagogical aspects of higher education and more motivated to integrate their research and teaching interests in a holistic way. This, in turn, can lead to greater job satisfaction, better academic programmes, improvement of student learning and practitioner's insights and contributions to the advancement of knowledge in higher education* [44].

Moreover, the action approach has certain distinctive features that could be very useful in describing the teacher requirements and training needed for English and communication studies in engineering and technology courses. According to Zuber-Skerritt, action research entails the following:

- *Critical* collaborative enquiry by
- *Reflective* practitioners who are
- *Accountable* in making the results of their enquiry public,
- *Self-evaluative* in their practice, and engaged in
- *Participative* problem-solving and continuing professional development [44].

Discussion on the devised and designed ESP curriculum will cover the following issues:

- Efficiency of the designed curriculum;
- International acceptance of the curriculum;
- Potential impact and implications on the international engineering and technology curricula and educational systems;
- Potential ways and methods of implementation.

The other important stages of this research include the following:

1. Comments and Recommendations.
2. Potential Future Research in this Area.
3. Relevant Bibliography and References.

CONCLUSIONS

Communication and relevant documentations, which relate to it, are recognised as an integral part of modern engineering practice. ESP has, then, an important impact on the quality of such means.

Engineering education has the responsibility for preparing future engineers to be able to practice their profession efficiently. So the crucial objective is to enhance communication and soft skills required by key activities in engineering fields of practice. In other words, it should be estimated as important as any other subject matter in engineering and technology courses.

ESP should be based on a multidisciplinary or integrative approach. Therefore, it is a complex task to combine the professionalism and experience of engineering, language, communication and even literacy specialists.

The application of ESP in engineering education, especially its functions and features, requires comprehensive research to be carried out that involves the analyses of engineering and technology courses. This should help to determine the appropriate content for an ESP curriculum that is especially tailored for engineering and technology courses. Moreover, such analyses should be helpful in defining the most effective teaching and learning techniques, including the implementation of information and communication technologies.

The best response to the educational needs for English and communication studies in engineering and technology courses would be the design of an appropriate, well-sequenced curriculum, as opposed to the range of existing ESP teaching models appropriate for improving the communication skills of engineering students.

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