

## **ASSESSMENT OF PEDAGOGICAL SKILLS IN TEACHING OF ELECTRICAL AND ELECTRONICS ENGINEERING IN THE UNIVERSITIES IN NORTHERN NIGERIA**

**\*Saba, T.M, \*Ma'aji, S.A. (Ph.D) & \*\*Tsado, J. (Ph.D)**

**\*Industrial & Technology Education Department**

**\*\*Electrical & Electronics Engineering Department**

**Federal University of Technology, Minna**

### **Abstract**

*The study was designed to investigate the pedagogical skills adopted in teaching of electrical and electronics engineering programmes and the pedagogical skills needed by electrical and electronics engineering lecturers in teaching in the Universities in Northern Nigeria. A 51-items questionnaire was used to collect data from 91 Lecturers, and 371 500Level students in the department of electrical and electronics engineering from the sample universities and 15 lecturers in industrial and technology education department, Federal University of Technology Minna. Mean, standard deviation and Z test were used in the analysis. The findings revealed that Lecture method is mostly used for instruction, Lecturers do not commence class activity from the previous lesson, students are not encouraged to do team work and there is no cordial relationship between lecturers and students. It is recommended among others that; Lecturers should establish a rapport with the class, Stimulate class participation and should be properly trained and retrained in the field of pedagogical skills.*

### **Introduction**

The concepts of teaching and learning are most central to education. Okon (2003) view it as a conscious and deliberate effort by a mature or experienced person to impact information, knowledge, skills and attitude, to an immature or less experienced person with the intention that the latter will learn or come to believe what he is taught on good ground. Nwosu (1995) sees teaching as an attempt to help someone

acquire, or change some skills, knowledge, ideal or appreciation. One of the cardinal objectives of teaching is to assist the learners develop physically, intellectually, emotionally, morally and socially in a manner that he or she will be able to exploit his potentials maximally. Learning on the other hand can be defined as a change in behaviour due to experience. It is a process by which behaviour is initiated, modified or changed. It is the process

by which we acquire and retain attitudes, knowledge, understanding, skills and capabilities that cannot be attributed to inherited behaviour patterns or physical growth. Our goal in teaching is to get information and skills encoded in our students' long-term memories. Moreover, once information is stored in long-term memory, cues are required for us to recall and use it. Linking the new material to familiar material provides a natural set of cues (Felder, Woods, Stice, and Rugarcia, 2000)

Pedagogical techniques are the practices and refinements of presentation, which teacher employs to make instructions more effective, more interesting and easier when using a specific method for a lesson unit. Ma'aji (2003) observed that for effective teaching of any skill activity, methods and materials play an important role in facilitating the learner's achievement objectives. Skill acquisition generally requires specialized instruction techniques in order to achieve maximum objectives. Assisting learners to learn is the ultimate goal of any instructional activity in both formal and informal education. In fostering learning in the classroom, teachers bring the learners in close contact with the curriculum contents using appropriate methods and materials. Methods play key role in ensuring effective, interesting and stimulating learning, in the same vein, teaching

methods may also hinder learning (Ukoha and Eneogwe 1996).

Atsumbe (1994) stressed that for effective teaching to take place; skilled teachers need to use different methods and skilled techniques of teaching at their command. Even though there is a great diversity in teaching methods and techniques, there is no one of them that can be regarded as the best. A carefully designed teaching method can work wonders in making learning effective. The various approaches to the teaching of technical trades have been found to be identical with the way science subjects are being taught in our schools. Demonstration method is commonly used to teach fundamental operations in technical education, this method helps the teacher to explain the steps involved in a lesson or an operation while teaching them (Oranu, 1994). Through this teaching/learning method, students usually use two or more of their senses. Hilda (1989) posited that demonstration and project method of teaching has been the most common teaching method in technical education. This is easy to understand with the emphasis that comes in an activity programme based on manipulation to fabricate and service products with the materials and tools of industry. Olaitan (1982) explained that instructional methods relevant to the teaching of technical courses are project, discussion, demonstration

excursion or field trip and homework. He further stated that lecture method might be used where necessary. These methods should be used effectively since electrical and electronic engineering programme is designed specifically to train personnel who will eventually be useful in industry or setup their own workshop.

Johnson, Johnson, and Smith (1999) said that cooperative learning is an instructional approach in which students work in a team on a learning task structured to have the following features. (1) Positive independence. (2) Individual accountability. (3) Face-to-face primitives' interaction. (4) Appropriate use of interpersonal and teamwork skills. (5) Regular self-assessment of team functioning. They further said that students taught cooperatively tend to have better and longer information retention, higher grades, more highly developed critical thinking and problem-solving skills, more positive attitudes toward the subject and greater motivation to learn it, better interpersonal and communication skills, higher self esteem, lower levels of anxiety about academics and, if groups are truly heterogeneous, improved race and gender relations. A survey, representatives of industry place communication and teamwork at the top of their lists of desirable skills for new engineering graduates. If teamwork is such a critical part of what engineers do, surely engineering

school should provide some guidance in how to do it (Felder and Brent, 1994).

The challenge that faces the education environment has always been to ensure that the teaching and learning process takes place effectively in a classroom environment. Excellence in engineering education comes from innovative teaching techniques and effective instructional materials. This would require one to change the traditional way of teaching electrical and electronic engineering. In the traditional teaching methods, lecturers offer course materials in a classroom where students listen, take notes, copy materials, execute homework and complete assignments. In many cases lecturers fail to transfer knowledge to students effectively despite personally having sound technical knowledge in the subject area. This occurs because it is often hard for students to take notes and listen with good comprehension simultaneously.

Standler, (2001) confirmed that the conventional use of lectures is due to the efficient use of faculty time, not because lectures are good way to teach problem-solving skills. Lectures can be an effective way to communicate facts, such as in a history class. But the most difficult task for science and engineering students is learning a variety of techniques for solving problems, not learning facts. If students can learn

from listening to a lecture, then they should be able to learn the same things from reading a book, which makes lectures unessential.

There are two aspects to professional competence. One is knowledge of the subject to be taught, the other is the ability to teach it in the way as to bring about learning on the part of the students. Poor instructional method may partly have contributed to the students' poor performance in electrical and electronic engineering. Consequently the instruction techniques adopted by most lecturers do not seem to adequately address the diverse learning, styles and preferences of the students (Saba, 2010). Most industries complaint that good number of graduates produces every year from universities and polytechnics lack necessary job-site skills required by the industry and thereby make them unemployable (Atsumbe, 2006). This may stem from inadequate pedagogical skills in teaching. Hence it has become necessary to assess the pedagogical skills in teaching of electrical and electronic engineering in the universities in Northern Nigeria.

### Research Questions

This study provided answers to the following research questions.

1. What are the pedagogical skills adopted in teaching of electrical and electronics engineering programmes in

the Universities in Northern Nigeria?

2. What are the pedagogical skills needed by electrical and electronics engineering lecturers in instructional delivery in the Universities in Northern Nigeria?

### Hypothesis

The following null hypothesis was formulated to guide the study and was tested at .05 level of significance.

**Ho<sub>1</sub>:** There is no significant difference between the mean responses of lecturers, and students with respect to their perceptions on the pedagogical skills adopted in teaching of electrical and electronics engineering programmes in the Universities in Northern Nigeria.

### Methodology

A survey research design was adopted for this study. The study covered all the universities in Northern Nigeria (North East, North West and North Central geo-political zones) where electrical and electronics engineering is being offered as a programme and has graduated students in the last five years. The target population for this study was made up of lecturers, 500 Level students of electrical and electronic engineering and institutions under study and lecturers in Industrial & Technology

Education (ITE) Department, Federal University of Technology Minna were used to respond to research question 2 only, because they possessed a skills needed to teaching technological courses. Purposeful random sampling was used to sample two universities from each of the three geo- political zones in Northern Nigeria, making a total of six universities. Stratified sampling technique was also used to select 91 lecturers, 371 students who responded to research question 1 and 15 lecturers in ITE Department which answered research question 2.

The data collected was analyzed using mean, S.D and Z test, to determine if the item is adopted or not adopted and needed or not needed the resulting mean scores was interpreted relative to the concept of the real lower and upper limits of numbers 1-4 as used on the rating scale adopted for the study. The decision point between the upper limit of 3 and lower limit of 2 being 2.49 and 2.50 respectively, this mean that items with mean values of 2.50 and above were considered as adopted or needed while items with values of 2.49 and below were considered as not adopted or not needed. For testing hypothesis 1, Z-critical value of 1.96 was chosen at .05 level of significant. Any value equal or less was considered not significant and above was considered significant.

## **Results**

### **Research Question 1**

What are the pedagogical skills adopted in instructional delivery in electrical and electronics engineering programmes in the Universities in Northern Nigeria?

**Table 1**

Respondents Mean Scores on the pedagogical skills adopted in instructional delivery in electrical and electronics engineering programmes in the Universities in Northern Nigeria

N<sub>1</sub> = 91N<sub>2</sub> = 371

S/No	ITEM	$\bar{X}_1$	$\bar{X}_2$	$\bar{X}_t$	Remarks
1	Lecture method is mostly used as instructional methods.	3.24	3.70	3.47	Adopted
2	Demonstration method is used a teaching skills.	2.62	2.21	2.42	Not Adopted
3	Discussion method is used during the period of instruction	2.46	2.01	2.24	Not Adopted
4	Students are allowed to ask questions that will stimulate critical thinking.	3.41	2.63	3.02	Adopted
5	Lecturers use instructional methods that will lead to the development of psychomotor skills.	2.52	2.36	2.44	Not Adopted
6	Lecturers design instruction that enable students to study industrial process first hand.	3.41	3.32	3.37	Adopted
7	Lecturers use instructional methods that will lead to the development of cognitive skill.	2.64	2.74	2.69	Adopted
8	Lecturers use instructional methods that will lead to the development of affective skills.	2.69	2.01	2.35	Not Adopted
9	Lecturers formulate and publish clear instructional objectives.	2.46	2.08	2.27	Not Adopted
10	Lecturers promote active learning in the classroom.	2.46	2.06	2.26	Not Adopted
11	Lecturers use cooperative learning mode of instruction.	2.58	2.16	2.37	Not Adopted
12	Lecturers balance concrete and abstract information in every course.	2.86	2.41	2.64	Adopted
13	Lecturers utilize instructional methods that give safe working habits associated with practical.	2.66	2.60	2.57	Adopted
14	Lecturers provide workable practical	2.72	2.56	2.66	Adopted

	activity.				
15	Lecturers encourage student's personal initiative.	2.92	2.68	2.74	Adopted
16	Lecturers prepare laboratory/workshop before demonstration.	3.42	2.98	3.05	Adopted
17	Lecturers commence class activity from the previous.	2.46	2.04	2.22	Not Adopted
18	Students are encouraged to do a team work.	2.68	1.96	2.36	Not Adopted
19	Sequential operations of project or job are explained by lecturers	2.46	2.41	2.21	Not Adopted
20	Cordial relationship existed between teachers and students.	2.32	1.61	2.37	Not Adopted
21	Students are given practical project as an assignment.	2.46	2.08	2.04	Not Adopted
22	Lecturers motivate students during instruction.	3.36	1.87	2.22	Not Adopted
23	Assignments to students evolve from the lesson presented to them.	2.64	2.06	2.26	Not Adopted
24	Lecturers speak clearly, distinctly and not too fast.	2.62	2.11	2.33	Not Adopted
25	The method of teaching used by the lecturers makes the students concentrate in the lesson.	2.41	2.22	2.26	Not Adopted
26	The lecturers know the student by name.	2.56	1.87	2.22	Not Adopted
27	Individual differences are usually taken into account during instructions by lecturers.	2.41	2.12	2.27	Not Adopted
28	Students are judiciously rewarded for correct performance.	2.26	3.04	2.65	Adopted

$N_1$  and  $N_2$  = Number of Lecturers and students;  $\bar{X}_1$  = Mean responses of lecturers;  $\bar{X}_2$  = Mean responses of student  $\bar{X}_t$  = Mean responses of all respondents  

$$\bar{X}_t = \frac{\bar{X}_1 + \bar{X}_2}{2}$$

Table 1 show that the skills in teaching of Electrical and electronics engineering in the 28 items presented as pedagogical Universities in Northern Nigeria.

While the respondents not adopted 20 items indicating that they are not used while teaching electrical and electronics engineering.

What are the pedagogical skills needed by electrical and electronics engineering lecturers in instructional delivery in the Universities in Northern Nigeria?

**Research Question 2**

**Table 2**

Respondents Mean Scores on the pedagogical skills needed by electrical and electronics engineering lecturers in instructional delivery in the Universities in Northern Nigeria.

N<sub>1</sub> = 15

S/NO	ITEMS	$\bar{X}_1$	REMARK
1.	Lecturers formulate and publish clear instructional objectives	3.46	Needed
2.	Commencement class activity from the previous lesson	3.33	Needed
3.	promotion active learning in the classroom	3.63	Needed
4.	explanation of Sequential operations of project or job	3.69	Needed
5.	Motivation of students during instructions	3.45	Needed
6.	Present selected learning materials at appropriate time	3.55	Needed
7.	Select and adopt relevant methods for content delivery	3.22	Needed
8.	Assess the learners performance	3.38	Needed
9.	Provide feedback on learners performance	2.79	Needed
10.	Encourage students personal initiatives	3.04	Needed
11.	Encourage team work among students	3.28	Needed
12.	Taking into account individual differences in students.	2.98	Needed
13.	Use appropriate questioning techniques to determine students.	2.69	Needed
14.	Promotion of good relationship between lecturer & students.	3.42	Needed
15.	Judiciously rewarded students for correct performance.	3.40	Needed
16.	Promotion of workable practical activities.	3.65	Needed
17.	Select and Use relevant instructional method to link the previous	3.37	Needed
18.	Balancing concrete and abstract information in every course.	3.53	Needed
19.	Using simple language in presenting information to students.	3.78	Needed



20. Present information from simple to complex.	3.39	Needed
21. Convey a sense of concern about students' learning.	3.56	Needed

$\bar{X}_1$  = Means of professional (Lecturers) ;

$N_1$  = Number of Professional (Lecturers)

The Table 2 revealed that the respondents agreed that the pedagogical skills presented are needed by electrical and electronics engineering lecturers in teaching in the Universities in Northern Nigeria.

**Table 3**  
**Hypothesis 1**

Z-test for the Mean Responses of Respondents on the pedagogical skills adopted in teaching of electrical and electronics engineering in the Universities in Northern Nigeria.

Respondents	N	Mean	S.D	df	P	z-cal	z-crit	Decision
Lecturers	91	2.75	0.16	358	.05	3.62	1.96	S*
Students	371	2.37	0.22					

\* Significant

The result of z-test presented in Table 3 shows that z-cal was 3.62. This implies that there is significant difference ( $P < .05$ ) in the mean responses of lecturers and students on techniques adopted in teaching of Electrical and Electronics Engineering in the Universities in Northern Nigeria.

**Findings**

Findings on pedagogical skills adopted in teaching of electrical and electronic engineering.

1. Lecturers balance concrete and abstract information in every course.
2. Lecture method is mostly used as instructional methods.
3. Lecturers use instructional methods that will lead to the development of cognitive skill
4. Lecturers encourage student's personal initiative.

Findings on pedagogical skills not adopted in teaching of electrical and electronic engineering.

1. Demonstration method is used a teaching skills.
2. Lecturers formulate and publish clear instructional objectives.
3. Students are encouraged to do a team work.
4. Lecturers use cooperative learning mode of instruction.
5. Cordial relationship existed between teachers and students.
6. Lecturers motivate students during instruction.

Findings from professionals on needed pedagogical skills in teaching of electrical and electronics engineering

1. Demonstration method when teaching skills.
2. Lecturers should formulate and publish clear instructional objectives.
3. Lecturers should encouraged students for a team work
4. Cordial relationship between teachers and students.
5. Lecturers should motivate students during instruction.

### **Discussion**

The findings in Table 1 revealed that lecture method is mostly used as instructional methods. This finding is in-line with the view of Lee and Yeap (1997) that methods

of teaching Engineering programmes are still the same today. A professor stands at the front of the room copying a derivation from his notes onto the board and repeating loud what he writes and the students sit passively taking note and listening to the lecturer. In the constant use of lecture method by the lecturers, they fail to transfer knowledge to students effectively despite personally having sound technical knowledge in the subject area. Standler (2001) was of the opinion that conventional use of lecture method is to efficiently managed time allocated for the lecture not because lecture method is a good way to teach problem-solving skills and this method is constantly employed by lecturers. He said if students can learn from listening to a lecture, then they should be able to learn the same things from reading a book, which makes lectures unessential. Students learn best by being actively engaged in doing something not by passively listening to lectures and taking notes.

It is also revealed that demonstration method is not employed when teaching skills. This finding is in consonance with the ideas of Nwoke (1989) which in the same view emphasized that demonstration is the most effective method in teaching skill performance oriented courses and demonstration tasks the learners' sense of sight and hearing. This is the method that is not commonly used by the lecturers.

They also agreed that the two most important sense organs that come into play in communication are those of sight and hearing, when a teacher demonstrate before a class or a single learner, these two senses are made full use of most frequently. The questioning method adopted by lecturers to stimulate learning agrees with the opinion of Ogwo and Oranu (2006) that questioning as a technique of teaching has two vital advantages; it enables the teacher to stimulate thinking and elicit responses that will lead to the proper solution of a problem. Through questioning the teacher will determine the amount, direction and quality of the students thinking.

Findings show that co-operative learning is not used as mode of instruction and students are not encouraged to work as a team. These findings are not in agreement with the work of Ogwo and Oranu (2006) in which they agreed that the teacher should use simple language in giving explanations. Felder and Brent (1994) were of the view that most engineering is done cooperatively not individually and technical skill is often less important than interpersonal skill in getting the job done. They agreed that industry places communication and team work at the top of their lists of desirable skills for new engineering graduate and engineering schools should encourage the students on co-operative learning and team work.

They further said that co-operatively taught students tend to have better and longer information retention, higher grades, more highly developed critical thinking and problem solving skills, more positive attitudes toward and greater motivation to learn it.

Findings revealed that students are not well motivated during instruction and there is no good relationship between lecturers and students. These findings are not in agreement with the work of Ogwo and Oranu (2006) which asserted that motivation is a prime mover in human behaviour. And learning is usually more efficient and rapid when the learner is motivated. They said for students to be well motivated there must be cordial relationship between teachers and students. It was also agreed that lecturers are not using visual illustration when teaching students. The finding does not agree with the views of Lamancusa and Jorgensen (1995) which observed that visual materials such as charts, picture and diagrams aid the students' understanding and make learning to be real and concrete.

### **Conclusion**

The production of Electrical and Electronic Engineering graduates' well-trained and equipped to work in private and public sector of economy is the desire of the government and

the society. This cannot be achieved in the hands of lecturers that lack pedagogical skills of teaching. The study confirmed that lecturers do not applied appropriate skills in teaching electrical and electronics engineering while the professional in the field of technology education adjudged those skills as needed skills, if there should be proper transfer of learning. There is need for training and re-training of lecturers in pedagogical skills to enable them impact knowledge to the learner which will in turn help them acquire relevant skills to cope with challenges of employment.

### Recommendations

The followings recommendations were made from the findings:

1. Lecturers in the department of Electrical and Electronics Engineering programmes should be properly trained and retrained in the field of pedagogical skills to enable them have proper understanding of instructional methods and other techniques of course delivery.
2. Lecturers should positively reinforce students' behaviours that lead to positive outcomes.
3. Effort should be made by the lecturers to establish a good rapport with the students, since most students face intellectual challenges and learn better when they are not feeling threatened.
4. Students should be stimulated to actively participate in the class since undergraduate students appreciate the opportunity to engage in well-planned class discussion and other interactive activities.
5. Lecturers should be encouraged to write out instructional objectives for a course (or a section of a course) that encompass both knowledge of content and mastery of the skills you wish the students to develop.

### References

- Atsumbe B.N. (1994). Strategies for improving the preparation of introductory technology teachers in Kogi State. *Unpublished M.ED Thesis* Department of Vocational Teacher Education. University of Nigeria Nsukka.
- Atsumbe, B.N., (2006), School-Industry Partnerships: A Veritable Tool for Quality Technology Education. *Journal of Research in Curriculum and Teaching* 1 (1) 39 – 47.
- Felder, R.M., & Brent, R. (1994). *Cooperative learning in technical courses*. Retrieved, on march, 10,2009 from

- <http://www2ncsu.edu/unity/lockers/users/f/felder/public/papers/html>.
- Felder, Woods, Stice, and Rugarcia (2000) The future of engineering education: Teaching methods that work. *Journal of Chem. Engr. Education*, 34(1), 26–39.
- Hilda, R.B. (1989). Instructional techniques in industrial technical education. Boston: Oxford University Press.
- Johnson, D.W., Johnson, R.T., & Smith K.A. (1999). Active Learning and cooperation in the classroom. Edina: M.N Interactional Book Co.
- Lamancusa J.S., & Jorgensen, J.E. (1995). The learning factory a new approach to integrating design and manufacturing into engineering curricular. A paper presentation at ASEE Conference Anaheim, California. June 25-28.
- Lee, F.T., & Yeap, B.H. (1997). Application of effective teaching and learning methods in engineering education. *Journal institute of Engineering Malaysia* 28(4) 51-59
- Ma'aji, A.S. (2003), Evaluation of vocational technical training programmes in northern Nigerian prisons. *Unpublished Ph.D Dissertation*. Department of Vocational Teachers Education. University of Nigeria Nsukka.
- Nwosu, C. (1995). Essentials of curriculum and instruction. Lagos: Joralf Book Publishing limited.
- Nwoke, G.I. (1989). Strategies for effective preparation of graduate technology teachers in college of education. In E.T Ehiamentalor, M.A Izuagiw and S.O Olaitan (eds) Implementation of national policy on education, theoretical and emperical analysis. Benin City, NERA p 352-360.
- Ogwo, B.N and Oranu, R.N (2006). Methodology in formal and non formal technical and vocational education. Uwani, Enugu: Ijejas Printer and Publishers Company.
- Okoh, J.D. (2003). Philosophy of education; the basics. Owerri: Corporate Impressions Publishers.
- Olaitan,S.O. (1982). The theory and practice of vocational education in Nigeria. *Unpublished Memo graph*.
- Oranu R.N. (1994) Problems of vocational and technical education in Nigeria. A lead paper presented at the National Conference on

Vocational Technical Education  
at Umunze April 20-23.

Saba, T.M.,(2010) Assessment of the Implementation Level of Electrical and Electronics Engineering Programmes in the Universities in Northern Nigeria. *Unpublished. M. Tech Thesis* Industrial and Technology Education Department, Federal University of Technology Minna

Standler, R.B. (2001). Standler's teaching style. Retrieved on 24<sup>th</sup> November 2009 from <http://www.rbsc.com/teaching.htm>

Ukoha, U.A., & Eneogwu, U.N. (1996). The instructional process. In B.A Ogwo (ed) Curriculum development and educational technology. Markurdi: Onawi Printing and Publishing Limited p 66-88.



Teaching skills that employers look for in candidates for employment, examples of each type of skill, and how to show employers you have them. Teachers must be able to perform the core responsibilities involved in the role, from comfortably using Microsoft Office to create materials to being comfortable providing disciplinary action as necessary. See additional keywords related to the technical skills required from teachers: Childcare. The development of the above-mentioned skills is carried out in the course of teaching methods and scientific and methodological activities in the preparation and implementation of the professional work of the teacher (Law «On education» of RK, art. 29 -1). Therefore, the requirements for the formation of the necessary competencies of teachers of FL include the components of the research competence. T.Taubaeva proved the concept of research culture as an innovative and didactic activity of the teacher in complete pedagogical process of a comprehensive school. In our view, the research competence may be defined as integral characteristics of research features and skills, readiness to apply research type of thinking and acting in the different fields of activity. The paper describes teaching and assessment amendments that have been made in order to provide better support for students with different learning style preferences. The study utilises Honey and Mumford's Learning Style to examine the learning styles of students, assess existing teaching and assessment methods within the module and suggest module enhancements that should facilitate a broad range of learning styles. View full-text. Article. The paper describes a pedagogical method used in the Electronics Department of the Pierre et Marie Curie University to introduce microprocessors. The main idea is to present microprocessor as a component and introduce informatic development system only when there is a necessity for students. Pedagogical innovation in changes in the content and technology of education and upbringing, aimed at increasing their effectiveness. Thus, the innovation process consists in the formation and development of the new content and organization. In general, the innovation process is understood as a complex activity for the creation, development, use and dissemination. The didactic teaching system provides for extensive use in the teaching process of heuristic and research methods that must meet the creative needs of students. Control and self-control ensure the effectiveness of mastering the necessary knowledge. " design engineering; " artistic design; " Technology evaluation of proposed projects. " Electrical Communications Engineering " Electronic Information Science and Technology " Etc. that had the same core reqts. as EE majors in the US, e.g.: " programming " circuits " analogue electronics " signal processing and digital systems. Our comparison majors comparison table. 2. Selected content and sub-content areas (with experts). We developed content maps in each subject that contain " content areas taught in high school and in college in each country " the relative weight of the content areas in each country's national curriculum. We conducted extensive interviews with 12 content experts in each country.