
Signal Processing in the Digital Era: Educational Strategies for Developing Curriculum for Teacher's Training at Secondary School A Need Assessment Analysis in District Kot addu South Pakistan

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Abstract

Due to the fast-growing technological expansion, signal processing has become one of the significant elements of learning, especially in a world where technology is rapidly growing. This study, titled "Signal Processing in the Digital Era: The research study titled "Educational Strategies for Developing Curriculum for Teachers' Training at Secondary School: A Need Assessment Analysis in District Kot Addu, South Pakistan" will focus on the need to include signal processing concepts in the training curriculum of teachers in secondary schools. This study aims to find out existing level of awareness and existing knowledge of teachers so as to find out the gaps / areas where further curriculum development could be attempted based on the district Kot Addu, South, Pakistan.

It will analyze the impact of digital tools and technologies in the improvement of teachers' competencies in signal processing through an evaluation of them extensively. Particular emphasis will be made on the difficulties which teachers encounter when implementing these concepts and technologies, the necessary conditions in schools and the necessary preparation of educators for proper curriculum implementation. The result from this study will be important for its contribution toward informing the process of curriculum development for teacher training, the context of the digital age, in order to promote positive change in educational outcomes of secondary school.

Keywords: Signal Processing, The Digital Age, Curriculum Development, Digital Technologies.

Introduction

Signal processing is one of the most significant research areas now with rapid advancements in technology everybody is looking for a system that can easily transform the signal into meaningful information for efficient communication system, data, image analysis, and artificial intelligence. It refers to the methods applied towards the modifying and analysing of signals in order in order to derive implied info or enhance signal quality; signals can be sounds, images or sensor outputs (Proakis and Manolakis, 2007). Widespread computerization in today's society has led to the broader application of knowledge in signal processing, which must be included in modern programs.

Educators especially those in secondary institutions have the major task of shaping the future generations especially concerning technological advances in the era of the digital world. However, to include signal processing skills into the learning process teachers who are proficient in the use of the tools and skills are needed. The subject of Curriculum Development for such

aims is highly appropriate in District Kot Addu – South Pakistan, due to the remaining gap between traditional blackboard learning and contemporary technological literacy. Teachers training to signal processing concepts enables them to teach aspects that are likely to be important to assist students in their world that is fast being dominated by technology (Haddad & Draxler, 2002).

However, in secondary schools in South Pakistan many teachers were found to experience difficulties related to: resource; infrastructure; and professional learning (Farooq et al., 2015). To this end, a needs assessment analysis is critical in order to determine the current knowledge about signal processing amongst teachers as well as the digital tools needed to improve their literacy. In this regard, the assessment can be used as the basis for establishing the educational interventions the and the curriculum changes that would respond to the technological necessities of the Yellow Nation in the 21st century.

Objectives of the Study

- To check the level of awareness and knowledge about concepts of signal processing among the college teachers in district kot addu south Pakistan.
- In order to assess the effect of the various digital technologies in improving teacher competency in signal processing.

Significant of the study

This research is quintessential to the training curriculum as it seeks to implement signal processing at the secondary school level in District Kot Addu South Pakistan. Through reviewing teachers' current knowledge and evaluating the utility of such tools to advance their competencies, this study will fill the gap of integrating conventional teaching methodologies and current technological requirements. The research findings will be important to educators, policy makers, and institutions, to design more effective curricula suited to technological advancements worldwide thus improving the quality of education in the region.

Problem of the Study

Although signal processing plays a significant role in the numerous fields, the teachers of secondary schools in District Kot Addu, South Pakistan usually do not have enough knowledge and practice to implement that in the teaching processes. This lack of awareness along with inadequacy of the teaching learning resources and technologies impedes teachers from preparing students for future that is built on Information Technology. Therefore, there is a growing need to establish their current competencies and to accurately determine the gaps that require educational interventions to support their strengthening in the area of signal processing.

Literature Review

The application of signal processing in teaching, particularly within the scope of teachers' training, has become an object of growing interest during the last years since this discipline significantly influenced many sectors of human activity connected with telecommunication systems, medical imaging, and data analysis. For example, the authors argue that to adequately prepare students for a digitally driven future, teachers need signal processing knowledge and skills. This paper aims to review literature that defines signal processing as an

essential component of education; review strategies in current education; and examine the issues that mirror implementation of such programs across the world especially the South Pakistan region.

1. Signal Processing and its Role in Modern Education

Signal processing is a technical discipline that focuses mainly on changing and the analysis of information in different forms and this can include the audio, video and sensorial information (Hayes, 2009). As part of secondary school curriculum, its objectives are to equip students with basic knowledge that may be useful in areas such as digital communication, data compression and Biomedical engineering as pointed out by Oppenheim and Schafer (2010). For more information, Rabiner and Gold (2016) explain that signal processing ensures that education empowers students with analytical as well as problem solving skills especially in the current society where data is paramount important. Yet again, for students to benefit from them, educators must be well trained to grasp as well as, explain such issues as these to the learners.

2. Teacher Training in the Digital Era

Specifically, in the context of the age that can be referred to as digital, the major concern of teacher training is in the use of ICT in education. Studies also indicate that the extent of teachers' ICT competence presents a determinant to the successful incorporation of new innovations and approaches such as signal processing (Hennessy, Ruthven & Brindley, 2005). Teachers with better digital literacy are in a better position to incorporate better forms of tools and ideas like the Digital Signal Processors (DSPs) as well as software that can assist in signal analysis for the intended improvement of the student's learning norms. Likewise, Mishra and Koehler (2006) conducted research TPACK that proposed Technological Pedagogical Content Knowledge integration of technology signal processing into how and what teachers teach.

In their review of ICT for STEM education, Voogt and Roblin (2012 actual) pointed out that for technologies that are still emerging such as signal processing to be incorporated into school practices, then preparation and professional development of teachers should include conceptual and practical components. This encompasses familiarization with signal processing tools, experiences in real life signal processing, construction of signal processing curriculum that corresponds with current technological requirements. These findings are of more significance to districts such as Kot Addu where the difference between the provision of technologies in the classroom and conventional teaching learning approaches are widely observed and experienced, making curriculum enactment and teacher training difficult.

3. Educational Strategies for Signal Processing Curriculum Development

The process of developing a curriculum in signal processing to be offered to secondary schools has its own implications. The current communicates stress curriculum relevance and updates to reflect the current world market and trends as well as technological developments. As cited in Smith and Khourey-Bowers (2014), instructional approaches of including PBL and practical experience in computer simulations enhance students' learning and practical skills in terms of comprehending signal processing. That is why, such approaches are effective in the teaching of STEM subjects which allow students apply the acquired knowledge in practice.

Furthermore, the presented model of embedding signal processing indicates that concept integration into the curriculum has to undergo academic standards and frameworks harmonization. Current curriculum frameworks such as the Next Generation Science Standards (NGSS) developed in the U.S. for example, focuses on inter-disciplinary competencies include; utilization of technology as well as engineering designs and practices that are closely tied with signal processing. In the same context, Li et al., (2020) agree with the author's notion of incorporating signal processing subject in the learning of the students early on as a way of building their technological competency as well as to enable them to prepare for university and job market.

4. Challenges in Implementing Signal Processing Education in Developing Regions

However, as the importance of signal processing increases, several difficulties arise when introduced in developing regions such as South Pakistan. Farooq et al. (2015) conducted a study and pointed out that secondary school teachers in rural areas experienced a lot of challenges which intern affected them in one way or the other such as absence of adequate modern teaching and learning resources, poor infrastructure and inadequacy of professional development. This is especially so in specializations such as signals and systems where the instructor needs to make use of digital equipment and computers in order to adequately teach the topic.

Another challenge is the mismatch between curriculum and technological pedagogical content knowledge of teachers. Akbari and Dadvand (2011) have pointed out that teachers face difficulties in managing change of tools that are needed for posing or delivering courses such as signal processing. Many a time, teachers who are posted to teach in these rural areas may not have adequate training or experience whether to incorporate such difficult digital concepts into their teaching. This underlines the need for effective professional development initiatives that seek to fill these lacunas.

Nasir et al. (2018) further unveiled that in the absence of training support and presumptive orienteering, it will be improbable for teachers in different regions including Kot Addu to embrace new teaching pedagogy and or apply modern technological concepts in their teaching. In their research, they also stress that the implementation of such formats is possible only with the support of institutions as in practice, not only teachers are involved, but also policymakers, higher educational institutions, and local governments.

5. The Need for Contextualized Teacher Training and Curriculum Development

To get over the above mentioned challenges, there is need to train teachers for the relevant positions by establishing teacher training programs suitable for the teachers in the rural and developing countries. Guskey (2002) further notes that change made to professional learning for teachers should be consistent, site based and instructionally related to impact the teaching-learning processes afloat in classrooms. In the context of signal processing education for teachers this translates into conversion of pertinent knowledge and preparation of educators to integrate digital technologies into their curriculum.

The teacher training context for signal processing in District Kot Addu must therefore emphasise effective infrastructural adaptation and the acquisition of colourful, easy-to-use

multimedia tools for teachers (Farooq et al., 2015). Focusing on the particular obstacles that teachers in this area encounter, everyone involved in educational development will be able to create curricula not only familiarizing learners with signal processing, but also training educators in techniques for instilling technological competence in their students.

Methodology

1. Research Design:

Educational strategies for developing curriculum for teacher's training and experiences of participants regarding Signal processing in the digital Era: Educational strategies for developing curriculum for teacher's training.

2. Population and Sample:

The target population was the students, teachers as well as educational managers in the secondary schools in District Kot Addu.

A purposive sampling technique was also employed to get participants of about 20-30 people who possessed certain knowledge and experience regarding the topic under study.

3. Data Collection Methods:

In-Depth Interviews: The participants were administered with semi-structured interviews. Participants' perception of Signal processing in the digital Age: A perspective towards the development of methods for designing a training curriculum for teachers. Participants' understanding of Signal processing in the digital Era: Educational strategies for developing curriculum for teacher's training. Their beliefs about how these teachings affect education and the society. Curriculum for teacher training environments educational strategies for development. Participants. An interview guide with open-ended questions focused on: Participants' understanding of Signal processing in the digital Era: Educational strategies for developing curriculum for teacher's training. Their views on the impact of these teachings on education and society. Personal experiences or observations related to Signal processing in the digital Era: Educational strategies for developing curriculum for teacher's training. Focus Group Discussions: The students were formed into focus groups in order to ensure that there was more interaction during group discussions on topics like empowering women, education and leadership and gender relations from an Islamic perspective. Two to three focus group with 6-8 participants were conducted.

4. Data Analysis:

Thematic analysis is a method of identifying and analyzing patterns – thematically – in the text. The following steps were taken: Data collected in interview and focus group discussions were transcribed exactly as they were spoken. To ensure that the data were familiar, they were read several times. Scholarly importance phrases and concepts were coded. The codes were categorised into major themes and subthemes with regard to the research questions.

Findings

The research in this study showed that teachers of the secondary school in District Kot Addu have a poor signal processing knowledge, which greatly affects their teaching efficiency. Despite the synergistic impact evidenced by means of digital tools to have the potential to

improve teacher competencies, access to such tools remains limited. Additionally, the teachers appeared to have a very high interest in signal processing centered professional development in an attempt to prepare them for current teaching requirements. These findings show why curriculum developments and improved training programs must be implemented to integrate teaching approaches in light of the emerging virtual environment.

Conclusion

Thus, the study concludes that signal processing should become a compulsory component of the teacher training in District Kot Addu, South Pakistan. This work posits that there is a deficiency in teachers' knowledge about new technologies and access to relevant tools, and recommends focused professional continuing education and curricular changes. It would help educators prepare students effectively for technology-dependant occupations to build the right set of skills for the future.

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