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Academic Reading Competence of the Engineering Students

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Abstract

The purpose of the study is to assess and analyse the academic reading competence of the ESL engineering students at the entry level of engineering education. It aims to identify emerging patterns of levels of academic reading competence among the Indian ESL students at undergraduate levels. The results of SRCI administered to 600 engineering students revealed four different patterns of reading competence. Those identified patterns are labelled as four bands according to the characteristic performance of the students. By analysing the band characteristics of the students, appropriate standardised courses for reading instruction can be designed. Thus, the study suggests that band-wise training may benefit students with different proficiency levels and backgrounds.

Keywords: Reading Skills; ESL; Assessment; Competence; Engineering students

INTRODUCTION

Reading is a complex cognitive process of decoding symbols in order to build or deduce meaning. Reading occupies a key role in almost every course of study. Down the centuries, the concept of reading has acquired tremendous change.

Reading is an essential skill that ensures success in academic learning [1]. Researchers on reading reports strong support for the positive relationship between the students' reading process and their ability to comprehend what they are reading. Further, reading process and reading ability will directly help the students to excel academically [8].

The objectives and practices for reading comprehension and studying are complimentary [18]. To study and store the information in memory, initially the reader should understand the meaning of the information [3]. Many studies have found that the good reader is capable of identifying key points in the text and so they predict reading skills as a vital skill for successful studying [6, 10, 18]. Students who are sensitive to main points in reading are able to answer efficiently for subjective questions.

Theories of reading have evolved especially during the past four decades. During 1960s, behavioural perspective was predominant in reading, which lasted until the seventies. Later, holistic or interactive approach begun and it continued to provoke thinking on reading comprehension. An interactive approach towards reading is a cognitive, developmental and socially constructed task, which deduces meaning beyond the text. Early practitioners of reading believed that reading is relatively a static process. They considered that the text constitutes the meaning and so it is the reader's responsibility to understand the meaning of the words that was transmitted through the text. Contemporary research observes reading as a dynamic activity in which the readers *construct* the meaning of the text based on the information collected from the text.

Reading is a complex process which involves 'word recognition, comprehension, fluency, and motivation' [14]. The college reading is different from school reading, where college reading demands deeper analysis and understanding of the textbooks [7]. For educational achievement, students must be able to read, interpret, and process printed material of varying levels of complexity [6]. The nature and scope of reading for college level student is much wider and scholarly. The path of the reader is moulded across disciplines depending upon the structure of the text, the amount of reading necessary, and the extent of class discussion based on the readings. The students of higher education are expected to build knowledge and meaning through interface with expository textbooks on science or mathematical subject matter [15]. As the students are exposed to a variety of literary genres, it is necessary to comprehend appropriate meaning from the text through reading. As comprehending these texts is crucial, it is necessary to focus on improving the reading skills of the college level students.

The objectives of the study are:

1. To identify the various subskills related to reading at undergraduate level with reference to ACTFL standards

3) To identify and analyse the emerging patterns of levels of academic reading competence among the first year engineering students.

American Council for Teaching of Foreign Languages

One of the first steps towards standardisation and accountability in language education has come out of the collaboration of educators, American Council for Teaching of Foreign Languages (ACTFL) and government agencies, including the Interagency Language Roundtable (ILR). ACTFL Guidelines has been developed with academic perspective and for academic purposes. In 1986, ACTFL

produced the first set of language proficiency guidelines. The ACTFL proficiency guidelines is a descriptive scale intended to guide proficiency in multiple languages, in listening, speaking, reading and writing performance at five levels from distinguished to novice through superior, advanced and intermediate. However, the proficiency level distinguished is available only for reading and listening skills. Depending upon the skills, these proficiency levels are further broken down into subcategories such low, mid, and high. Thus, the study has analysed the reading descriptors and listed out subskills related to reading in order to test the reading proficiency of the first year undergraduate students who had just exited from higher secondary education.

Research questions:

1. What is the level of reading proficiency of the ESL students at the entry level of higher education?
2. Is it possible to identify the emerging patterns of levels of academic reading competence among the first year engineering students?

Reading Test Construct

The reading competences of the students are tested with the help of Student Reading Comprehension Inventory (SRCI) which is designed with reference to TOEFL reading test construct and scaling [12]. The study has listed 27 subskills related to reading as essential Academic Reading Skills required for the students entering higher education by referencing to ACTFL Proficiency guidelines (see Table 1). All these subskills are further classified based on the tasks that are associated. In general, multiple-choice questions for a reading comprehension tests are designed based on certain directives. There is a firm relationship between the questions and directives [12], which is established through three continuums such as type of information required, type of tasks and plausibility of distracters. Davey and Lasasso assert that explicitly stated textual information were significantly easier to comprehend than the implicitly stated textual information [9]. Therefore, the scores assigned for explicit questions are less than that of the questions that demand implied information in a 5-point scale. In the explicit questions, the readers can identify the answers concrete in the text itself, so the value assigned is one. Thus based on the difficulty level the points for testing the subskills are assigned. After the pilot study, the researcher ensured that the questions framed were comprehensive and bound under the desired purpose and scope of the study. The reliability of the instrument was tested with Cronbach's alpha values. The alpha value of the instrument is 0.94, which is an acceptable reliability.

Participants

The participants for this study consist of 600 Indian students from various parts of India studying first year engineering course at a Private University. The researcher has adapted stratified random sampling method for collecting data, so that around 100 students from every branch of the study has been randomly chosen for participation in the test with the permission of the concerned school head. There are six branches of engineering in the University. All the students are non-native speakers of English. The age of the participants is between 17 and 21. Around 70 % are male and 30% of the students are female.

Design and Analysis

Descriptive statistics (i.e., frequencies, percentages, means, and standard deviations) were adapted to identify the students' performance on SRCI. Average scores of the students for the individual skills were also calculated. This facilitated the assessment of student performance on a particular reading skill. The individual performance profile as well as the overall population performance profile was obtained. The population profile enabled the description of the characteristics of the University students in terms of academic reading competence broken into component sub-skills and the various levels to which they belong. This in turn enabled the formulation of a set of benchmarking bands that may be considered representative of similar population at a larger level both on campus and on other similar campuses in India. The population profile varies in terms of the background details like gender, medium of instruction at school, percentage of achievement in English and other subject at twelfth standard, locality, family status, motivation for higher education, reading habits. All these data collected were analysed using the Statistical Package for the Social Sciences (SPSS). An alpha level of .05 was set to ascertain the statistical significance of any differences discovered.

Overall Analysis of SRCI Results

When considered as one group, the first year engineering students are more capable of performing the task of locating and identifying explicit information from an academic text (Table 1). These students are less capable of performing the task of inferring and interpreting academic text. Identifying information or understanding the literal meaning of the text is the basic element of reading comprehension. Consistent to other researches on reading comprehension, students answered right for the reading items based on locating and identifying information [5].

Table 1: Overall Students Performance for the SRCI test and skills of reading comprehension

S.no	Skills (task)	Overall performance %
1	Specific Information (scan)	74.27
2	Specific Information (locate and interpret)	67.74
3	Main Idea (understand)	31.63
4	Main Idea (follow)	27.05
5	Main Idea (separate)	56.62
6	Main Idea (locate and interpret)	84
7	Details (understand)	62
8	Details (separate)	9.78
9	Fact (understand)	65.24
10	Fact (skim)	67.12
11	Fact (obtain,analyse)	64.95
12	Fact (distinguish)	57.94
13	Opinion (infer)	68.6
14	Opinion (interpret)	5.88
15	Opinion (distinguish)	51.44
16	Ideas and Opinion	23.91
17	Background knowledge (recognise)	15.73
18	Background knowledge (recollect)	92.8
19	Register 1	73.36
20	Register 2	11.97
21	Register 3	49.98
22	Ambiguity (infer)	59.51
23	Keyword (grasp)	57.51
24	Keyword (locate)	73.44
25	Specific details (infer)	32.76
26	Complex display (locate)	67.74
27	Complex display(search)	31.63
28	Complex display (locate, integrate)	27.05
29	Complex display(interpret)	56.62
30	Complex Information (integrate)	84
31	Complex Information (interpret)	62
32	Abstract information	9.78
33	Abstract information (interpret)	65.24
34	Purpose	67.12
35	Function of Text	64.95
36	Conclusion	57.94
37	Critically read	68.6
38	Content and form	5.88
39	Paraphrase (vocabulary)	51.44
40	Paraphrase (sentence)	23.91
41	Summarise	15.73
42	Structure1	92.8
43	Structure2	73.36
44	Cause and effect	11.97
45	Cohesion 1	49.98
46	Cohesion 2	59.51
47	Compare	57.51
48	Contrast	73.44
49	Compare and Contrast	49

Reading theories state that there are levels of understanding in the text. If the text states information explicitly, understanding the meaning of the text becomes easier for the reader. In some cases, the information is not explicitly stated in the text, and so the readers identify the information that is implied in the text. Readers use various tasks associated with the skills to retrieve information from the text. As per the ACTFL benchmarks, the task such as locate, integrate, scan, skim, separate, obtain and analyse are the widely used for deploying information from the text. Gray refers to reading in three distinct stages such as 'reading the lines', 'reading between the lines' and 'reading beyond the lines'. 'Reading the lines' indicates literal understanding of the text, which is considered as lower levels of understanding. He states 'reading between the lines' requires the skills of 'inference' and 'reading beyond the lines' demands critical evaluation of text [11]. Since, inference, interpret and evaluating the text require higher levels of understanding of the text, that is, 'deeper' than literal meaning, the students feel it difficult to respond to the subskills associated with the mentioned tasks.

As per NCERT guidelines, students from elementary to high school level are taught with basic level of reading skills such as identifying main idea, specific information, understanding details, obtain facts, infer opinion, background information, compare, locate keywords and displays. Therefore, most of the students have performed well for these low level skills. Almost all the students have completed their schooling from English medium and entered higher education. However, advanced skills on information gathering are difficult for these students, which show that these students are capable of employing basic and intermediate skills but not the high intermediate or advanced level reading skills. Thus, the study identifies a gap that exists between exit level of standard XII and required level of reading at higher education.

Most of the academic texts they read deal with facts and details, which necessitates the reader to be capable of evaluating the text based on deductive and inductive inferences, hidden assumptions, and strength of arguments. These engineering texts have less scope for critical evaluation

such as understanding the author's motives, bias of the writer. Therefore, the engineering students answered right for subskills relating to evaluation such as summarising and paraphrasing information. As summarising and paraphrasing demand the reader to evaluate the text logically and obtain the facts through reasoning, the students can perform the task with less difficulty. Therefore, the repeated testing at schools on Summarising and paraphrasing skills has facilitated these students in accomplishing these skills. However, the students have felt it difficult to understand the 'function of text'. To understand the text function, initially the students have to judge the communicative value of the text and then evaluate it in association with the purpose of the text. As these students are fresh to engineering education, the students are not thorough with their subjects and so they have felt it difficult to judge the communicative value of the text. However, almost all the students are capable of understanding the purpose of the text. The NCERT school curriculum for reading has paid less attention to teaching text structures, and as a result, students are not confident in analysing the structure of the text while reading a passage [17]. Dijk and Kintsh investigated the discourse strategies based on syntactic and semantic cues of text and reported that these variables influence the reading performances [20]. Some research on first and second language reading studies emphasise on text structures analysis and concentrates on the assessment of syntactic and lexical knowledge. However, rhetorical and metalinguistic knowledge of the readers has to be studied in depth.

Students in general face problems in dealing with rhetorical elements of the text. They are not confident in comparing or contrasting the information stated in the text with the subsequent information. This indicates that these students fail to recognise the relationships that exist among the sentences. Therefore, these students' poor performance on separating or distinguishing the information from the existing information is a result of lack of knowledge on understanding relationship at the syntactic and pragmatic level. Moreover, schools students get fewer opportunities to read a text other than their subject materials. These subject books have plain language and explicitly stated information. Therefore, these students have less exposure to reading a complex text and that may be the reason for students' moderate performance for the items based on complex inferences. Nevertheless, the students entering engineering studies have to read academic material that may not be like school textbooks. Reading at higher education demands advanced levels of reading skills. The grade-level of the textbooks would be higher than that of the school grade-levels. Therefore, it is natural that these students face problem while inferring meaning from a complex text.

Inferring meaning from the text with explicitly stated information is much easier than the inference based on text with implicitly stated information [2]. In the text with implied information, the readers have to deal with two stages of inferences. First, the readers have to infer the information from the implied text and then have to interpret the inferred information to obtain the desired meaning. The process of inference becomes complex when the reader has to interpret the inferred information. Since the information in the text is not explicitly stated, it is less easy for the reader to infer the information correctly. In cases, the readers do not infer the right information from the complex text; they cannot proceed with the next stage of inference based on interpretation. Therefore, this is the reason for the students' poor performance for the skill based on 'complex information' that involves the task of 'locate and interpret' inferences.

BAND DIVISION AND RESULTS

Results of the Band analysis reveal that there are patterns that exist in reading competence of the students. The percentage of marks secured by the students for the SRCI is normally distributed. There are layers of achievement of reading comprehension skills among the students across the band levels. One of the objectives of the study is to benchmark the entry level reading comprehension skills of the students. Therefore, these students' performance for the SRCI test is benchmarked as four levels of reading competence and results of each of the bands are analysed.

For executing band-wise analysis, the students were divided into four bands based on their performance in the SRCI. The overall performance of the students indicates that these students are moderately prepared for academic reading and the students overall average scores fall into 52nd percentile.

Band one consists of students who performed above 75th percentile. Band one consists of 21 students (5% of sample) out of 600 first year science and technology students. These students are confident and extremely capable of comprehending meaning from the text. The students belonging to this band are capable of performing almost all the reading comprehension skills required at undergraduate level. Thus, the band one is benchmarked as Excellent Reading Proficiency Level. Band two consists of students who have scored above 52nd percentile and the students who have scored below 75th percentile. Band two consists of 360 students (60% of the sample) out of 600 students. These students belonging to band two are capable of comprehending meaning from the text, but they lack certain specific skills required for accurate comprehension of the academic materials. Thus, the band two is benchmarked as Operational Reading Proficiency Level.

Band three consists of students who have scored above 30th percentile and the students who have scored below 52nd percentile. Band three consists of 188 students (31% of the sample) out of 600 students. These students have basic comprehension skills, which is not sufficient for comprehending materials at under graduation level. Thus, band three is benchmarked as Basic Reading Proficiency Level. Band four consists of students who performed below 30th percentile. Band four consists of 31 students (5.4% of the

sample) out of 645 students. These students lack ability in comprehending meaning from academic material. Therefore, this band four is benchmarked as Poor Reading Proficiency Level.

BAND-WISE RESULTS AND DISCUSSION

Academic reading patterns are found to exist among the first year engineering students at a University. These patterns are benchmarked as the four different levels of academic reading competence of the students (See Figure.1 & 2.).

Band One

The students pertaining to Band one are capable of performing most of the subskills of reading. They are capable of comprehending complex text, if at all, the text provided is familiar. They have problems with few skills belonging to advanced levels of reading comprehension and high intermediate levels of reading comprehension. As these students are at the entry level of under graduation and lack specialised knowledge in their subjects, contrasting and distinguishing opinion from the text is difficult for them. Due to the same reason, the students find it difficult to understand the purpose of the text and the communicative value associated with it. Moreover, the profiles of these students reflect that these students have extensive reading habits and excellent academic records. Since these students are familiar with story reading, they are capable of identifying the progression of ideas in an academic text. Therefore, these students belonging to band one are benchmarked as Excellent Reading Proficiency Level.

Band Two

The students of Band two are capable of performing almost all the subskills of reading. The skills that these students find difficult are 'understand and follow' main idea, 'separate and interpret' opinion, identifying ideas and opinion and 'recognise' background details, 'infer' specific details, 'locate and interpret' complex information, evaluating content and form and function of text. However, most of the students in band two have problem if they are asked to interpret the text. Thus, overall the students pertaining to band two lack knowledge on advanced levels of skills and certain skills at intermediate levels also.

Students overall located at band two have problem if they have to comprehend meaning from a complex text even if the topic of the passage is familiar to them. Therefore, these students have difficulty in inferring specific details from the implicitly stated passages. Thus, it is identified that the students in band two have problems in comprehending information from the impliedly stated text. This states that these band two students have less experience with reading wider topics or topics other than their subject matter. They also have problems in evaluating the function of the text, and content and form.

Figure 1: Band one - students' performance percentage

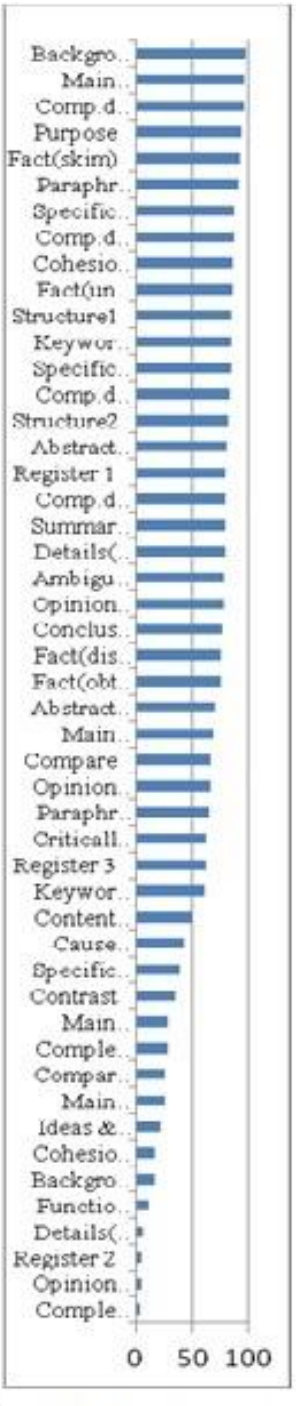

Figure 2: Band Two- students' performance percentage

Thus, the students at band two have to be trained in reading an extensively larger text, in order to get familiar with text reading at advanced levels. It may also improve the students' knowledge on reading various discourse texts. Thus, observing their accomplishment in reading skills, the students pertaining to band two are benchmarked as Operational Reading Proficiency Level. Thus, by examining the performance percentage of Band two students on the various subskills, the training can easily identify the necessary skills required for remediation and intervention.

Band Three

The students pertaining to band three have problems with most of the subskills of reading. The students have moderately performed the skills such as understanding main idea, identifying specific information, and facts from the text. They are capable of inferring opinion from a simple text. They are also confident in integrating and interpreting meaning from complex displays, locating keyword, evaluating purpose, and paraphrasing information. These students have moderately performed for the skill of summarising and drawing conclusion (See figure 3 & 4).

These students are better performer of the skill of inferring meaning from complex displays. It is understood from their profile details that most of the students belonging to this band have poor motivation in academics. They are not interested in going for higher education, but they want to settle soon with some kind of job after under graduation.

The reading skills performance of these students indicates that they generally read a passage, sentence by sentence and evaluate each word in a sentence to get the appropriate facts. Thus, they have acquired basic skills such as identifying facts and paraphrasing information, which are the basic skills involved in reading comprehension. Therefore, band three is benchmarked as Basic Reading Proficiency Levels.

As these students are at their basic level of comprehension, they face problems in comprehending academic materials, which may reflect on their academic achievement. Therefore, it is necessary that these students have to be trained in required reading comprehension skills initially at the entry level of under graduation. Most of these band three students paraphrase sentences and gather meaning for understanding the passage. Initially, these students have to be trained in reading a paragraph. Later the various aspects involved in reading comprehension have to be instructed. Since, most of these students are capable of integrating and interpreting complex displays, images or diagrams can be used as a supporting tool to instruct on reading comprehension skills during training. Before instruction, these students must realise the importance of their course, for which the teacher should motivate them. It is the instructors' responsibility to introduce these students to the facilities available for effective learning at higher education, which may influence the students' motivation level for reading.

A separate course on reading can be designed, which may be a two-credit course, which will enable the students to acquire the required skills and undergo reinforcement of skills that is learnt in school level.

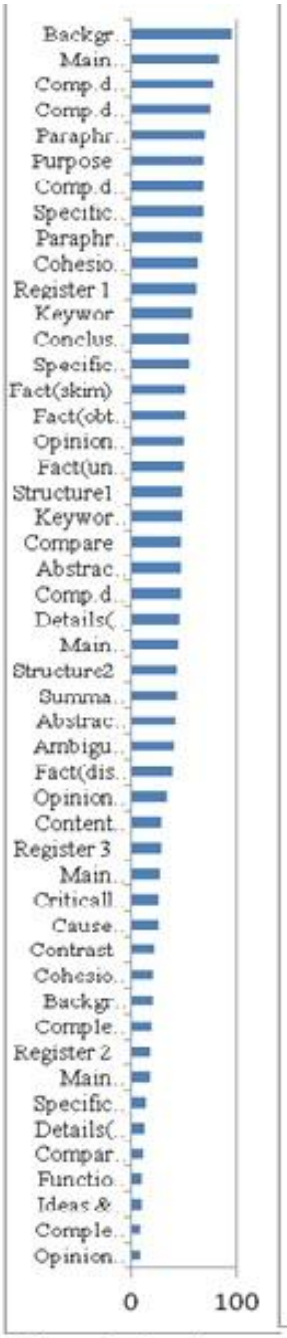

Figure 3: Band Three- students' performance percentage

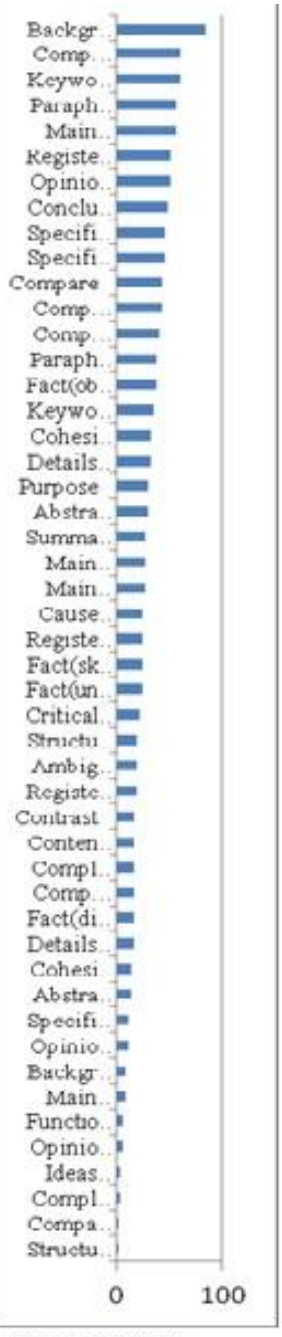

Figure 4: Band Four- students' performance percentage

Band Four

Students belonging to band four have performed poorly for all the sections of reading comprehension. These students are capable of performing lower level skills such as identifying meaning of a word, identifying main idea from a simple text, infer opinion from explicitly stated familiar text. They are capable of locating keywords and complex displays. They are also capable of evaluating a sentence to paraphrase. It is identified that these students are capable of comprehending meaning of both familiar and unfamiliar vocabulary depending on the context in which it is used. Based on the performance of these band four students, it is obvious that these students have problems with major skills required for academic reading. Therefore, this band four is benchmarked as Poor Reading Proficiency Level. However, students belong to this band have to trained in reading comprehension skills which is required for undergraduate education.

A separate course on reading can be designed in order to enhance the reading proficiency levels of these students. In addition, these students need to be motivated before instruction. Lack of motivation and appropriate guidance seems to be influencing the reading proficiency of these students.

The reading course to be designed for these students can be a three-credit course, with three hours of instruction in reading per week. The 49 competences of reading spread into 90 hours of instruction on reading skills would improve the academic reading comprehension of these students within a semester. If the course designed for reading were implemented in the first semester of under graduation, the students will be benefited. Therefore, this training may positively prepare the students for academic reading at under graduation.

Overall, it would be beneficial, if the students were motivated at undergraduate level to inculcate regular reading habits. Students with poor reading comprehension must practice regular reading. It is the instructors' responsibility to train these poor reading students with appropriate reading materials.

Theoretical and Pedagogical Implication of the Study

This study has implications for both assessment and instruction. First, it helps to define the level of reading competence of the students in an academic context. It has categorised the reading competence of the students into four different bands with specific characteristics. By observing the performance of the students, the study has identified the gap that exists between the exit level and entry level of the students in higher education.

In India, English syllabus designed for the students at higher education is just an extension or reinforcement of the skills that are acquired at school level [13, 17, 19]. Students studying at different universities might have different skills accomplishment. To understand their level of reading accomplishment, SRCI test can be used. By conducting SRCI test to the engineering students, the reading competence of students belonging to various universities can be identified and the reading proficiency of the students can be patterned as band levels. By correlating the results of SRCI with the background variables of the students, the reading characteristic of the students can be identified and so can place the students in appropriate future learning.

Some universities really focus on teaching advanced skills for the students at the higher education level. Even then, the courses designed have fewer credits that demand the teachers to teach all the LSRW skills within less classes or periods. The science and technology institution really lack a specific course for teaching reading skills. Further, these courses are designed with less attention to teaching subject specific language skills. Mostly, students belonging to arts, law, pure science, science and technology will learn same course designed for English. However, to enhance the standards of teaching and learning on par with global standards, a separate course for all the LSRW skills are required. Thus, to measure the science and technology students' reading competence, the SRCI test can be used as a common yardstick of measurement.

By referring to global standards, this study has produced a list of academic reading skills that may be the essential skills required for science and technology students at undergraduate level. By referring to these standard sets of reading skills, a separate course for reading, particularly for engineering students can be designed

The study proves that there are huge variations among the individual students reading performances and the overall reading accomplishment. Hence the material preparation for enhancing reading for this heterogeneous group becomes difficult. The study has suggested band-wise training as a possible solution to handle a heterogeneous group of students. These individual differences among the students have been reduced by grouping them into bands and by categorising them based on their reading test performances. Therefore by reading the Band descriptions, the instructor can benchmark the students' academic reading competence and design suitable course materials [16].

The students from band four needs an extensive training in reading which may not be needed for Band one students. For the students belonging to excellent proficiency levels appropriate training sessions on advanced reading skills will be sufficient. Students pertaining to poor band and basic proficiency require explicit teaching of reading skills with 90 hours of reading instruction. Therefore, a complete course on reading can be framed. Students pertaining to operational proficiency band may not require training in all the skills. These students are not aware of using certain reading strategies and advanced level skills. Therefore, a course can be designed for these students specifically on higher

intermediate level skills and advanced level skills, which may require only 40 hours of reading instructions. Hence, each band needs different course design and duration to enhance their reading competence.

Suggestions for Future Research

1. The current study can be reduplicated with students from various universities. This would particularly strengthen the design of the SRCI test for the assessment of reading competence of the students in the ESL context

2. The extension of the current study can be also performed. The students pertaining to different band levels can be trained with appropriate reading instructions and the findings can be elaborated.

3. A separate reading test construct can be designed for students of arts and science, pure science, law and other disciplines, by keeping SRCI test construct for science and technology students as a model.

Contribution to Existing Research

Anderson says that scales for testing proficiency are required to increase the reliability of subjectively judged rating and to provide a common standard for validating such judgements [4]. The SRCI is designed by referring to the ACTFL proficiency standards and TOEFL performance assessment. Thus SRCI test has focused on the educational domain and has particularised the reading test construction and assessment as specific for the students who belong to engineering disciplines.

- The study has listed out 27 reading subskills (with reference to ACTFL) as essential reading skills for students studying science and technology at undergraduate levelThe study has tested the reading competence of the students and identified the existences of various patterns in students' reading achievements. These identified patterns are benchmarked into four band levels.
- The study has identified the gaps and illustrated that the reading skills achieved by most of the students at the exit level of school education are not sufficient for managing their academic reading during their engineering education.

CONCLUSION

The study has identified essential reading skills that are required for successful academic reading at undergraduate level with specific reference to engineering students. Further, it is found that there is a gap between required reading skills at under graduation and the students' reading achievement at school. It has also identified that various patterns exist in the academic reading competence of the first year science and technology students in India. These identified patterns are benchmarked into four band levels. The profiles of the students within the band levels are analysed in order to understand the characteristics of the bands. The study suggests that by analysing the band characteristics of the students, appropriate standardised courses for reading instruction can be designed at higher education level. It also suggests that students have to be trained band-wise and a standardised course on reading may be designed according to band characteristics, in order to meet the desired levels of proficiency at higher education.

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