ACTIVATING SCHEMA TO DEVELOP READING SKILLS

AMONG ENGINEERING STUDENTS

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ABSTRACT

English, being a global language, it is a universal fact that to succeed in one's career, engineers today need to be communicatively competent. As English is the dominant language in the field of science and technology too, acquiring proficiency in this language is mandatory for any engineering graduate. In such a scenario, where proficiency in English is compulsory, lack of communication skills in engineering graduates can not only hinder their career advancement, but also the development of our country. A professional engineer requires a high level of listening comprehension, effective reading and writing skills and above all, the ability to comprehend and speak fluently in English. For an engineering graduate to emerge as a professional engineer, it is important to develop all the four language skills holistically.

In such context, this paper highlights the importance of the reading skills, reading models, schema theory and types of schema. The paper also elucidates various strategies to activate schema theory and the teacher's role in it. It further presents few ideas, that can be converted into tasks to activate schema theory and ends with a sample lesson plan. In nut shell, the paper discusses how to improve students' reading comprehension through activating schema theory.

KEYWORDS: Reading Skills, Schemata, Reading Models, Strategies to Activate Schemata & Reading Comprehension

Original Article

INTRODUCTION

English being a global language, it is a universal fact that to succeed in one's career engineers today need to be communicatively competent. As English is the dominant language in the field of science and technology too, acquiring proficiency in this language is mandatory for any engineering graduate. In such a scenario, where proficiency in English is compulsory, lack of communication skills in engineering graduates can not only hinder their career advancement but also the development of our country. A professional engineer requires a high level of listening comprehension, effective reading and writing skills and above all the ability to comprehend and speak fluently in English. For an engineering graduate to emerge as a professional engineer, it is important to develop all the four language skills holistically.

Importance of Reading Skills

"Reading is the process of receiving and interpreting information encoded in language form, via the medium of print" (Urquhart & Weir, 1998:22)

The primary objective of developing reading skills in engineering students is to develop in them, the

cognitive ability to select the right strategy, and then distinguish between relevant and irrelevant information more quickly, process the information and act accordingly. This ability is crucial for engineering students, both in their academic and professional life to attain success. Engineers need reading skills to comprehend and assimilate written technical /official information efficiently in emails, letters, memos, instructions, project documents, technical papers etc.

An engineer spends a good deal of time reading technical material, analyzing and responding to it. As the job level increases, critical reading becomes a requisite for career advancement. Incorporating reading tasks into the course of technical communication for engineering students is one sure way to make engineering students enhance their reading skills, and a way to provide the much needed reading comprehension practice is through exposing them to different reading situations through tasks.

Different techniques such as mind mapping, skimming, scanning, predicting, using schema for comprehending reading material, reading for main idea, understanding key words and phrases etc., when applied appropriately while reading would yield effective reading comprehension. Though each technique has its unique advantages in developing reading skills, activating schema technique enables students to make connections to the text they are reading, and this would increase their comprehension of the text. In order to understand the relevance of schema or back ground knowledge better, it is vital to understand the different reading models that impact reading comprehension first.

Reading Models

Reading is a complex skill that involves orchestration of number of components. In an attempt to understand the complex nuances of reading process and the various factors that affect a readers mind during the process, several experts have been researching the link between the reading process and how to teach reading. The researches on the characteristics of reading have resulted in classifying the reading process into three key models.

Bottom-Up Model: Bottom-up model or in other words phonic approach to reading emphasizes that readers, taking reading materials as information input, start from letters and words recognition, and then combining information continuously to accomplish reading activity. In this model, the reading activity proceeds from part to whole – where according to Gough readers begin by translating the parts of written language (letters) into speech sounds & then piece the sounds together to form individual words & then piece the words together to arrive at an understanding of the author's written message. Simply put, bottom-up model presents reading activity more as a decoding process rather than comprehension. Teaching reading skill through a bottom-up model requires teachers to teach how to concentrate mostly on words, sentence patterns and grammatical knowledge related to the reading material, but pay little attention to relevant background knowledge. Some of the key proponents of this model are Flesch 1955, Gough 1985 and LaBerge and Samuels 1985.

Top-Down Model: Top-down model, or in other words concept driven approach to reading takes concept theory as basis, and points out that readers predict reading materials according to previous syntax and semantic knowledge and make confirmation and modification during reading process. In this model, the reading activity proceeds from whole to part, where readers focus more on understanding the main ideas of a passage than understanding every word in the passage. Comprehending the passage is the key in this model, and teaching reading skill through a top-down model requires teachers to focus more on students' implicit knowledge and means to acquire it. Some of the key proponents of this model are Goodman. k 1985, Smith. F 1994 and McCormick T 1988 etc.

"Reading is a matter of bringing meaning to print, not extracting meaning from print"

(McCormick.T.1988)

An interactive reading model combines the best of the bottom-up and top-down models. It recognizes the interaction of bottom-up and top-down process simultaneously during the reading process for a better comprehension. In 1977, David. E. Rumelhart published "Towards an Interactive Model of Reading, which holds that in fact reading process is a complicated "interaction" process of many types of language knowledge, including letters, words, syntactic patterns and semantic meaning etc., that is, interaction of direct and implicit information; language processing interacts at different levels. Teaching reading skills through interactive model encourages students to share their knowledge with classmates or peers." This model allows the reader to bring his own background knowledge to reading and to interact with others to build meaning and memory from the text. Some of the key proponents of this model are David.E.Rumelhart 1985, Barr, Sadow, and Blachowicz 1990, Rudell and Speaker 1985

According to Hernandez (2003), "The ability of English language learners to succeed in the content learning has to do with how well they can infer meaning, draw conclusion, learn terminology, analyze problems, and synthesize information from various sources." The statement reflects the importance of reading skill acquisition for an engineering student not only to excel in his/her academics but to succeed later in their careers too. Reading skill is required by an engineering student at various levels beginning at understanding academic texts and moving on to interpret and synthesize information and on to a larger scale of accessing general knowledge available in the world. Hence, the main concern of educators and teachers today is to train students to become better readers and language users, so that, they can survive in the industry as well as in the society.

The existing practices of reading instruction has taken many turns where it started as a belief that identifying letters and words are enough to understand sentences and grasp meaning of the text. The belief was questioned by psycholinguists who considered reading as an active meaning- getting mental process and with the advent of interactive model, the combination of applying bottom-up and top-down theories for a holistic comprehension of a text was widely accepted. Since second language (L2) readers are susceptible to both language and content problems of a text, there is a need for classroom instruction to include both bottom-up and top-down processes of reading to assist students in the comprehension process. Unfortunately, the current teaching methodology for teaching language skills in many engineering colleges is still in traditional mode, which emphasizes increasing vocabulary and memorizing grammar rules only.

The instruction of reading skills is limited to few sessions of making students practice reading passages and answer them. Cultivation of a holistic reading ability among students is not given its due attention, which in turn, hampers the lifelong learning of the students. Hence, it is mandatory that, along with the strategies to develop linguistic ability and conceptual ability among the students, teachers should focus on new ways to develop reading skill among the students. Activating schema (plural: schemata) is one such way, which enables students to make connections to the text and further increases their comprehension of the text.

Schema Theory

"Comprehension occurs when the reader extracts and integrates various information from the text and combines it with what is already known"

(Koda, 2005:4)

Call it schema, relevant background knowledge, prior knowledge, or just plain experience, proponents of schema theory strongly believe that readers use prior knowledge to comprehend and learn from text. Schema etymological origin is from Greece and is a term of cognitive psychology. In 1781, this concept is first proposed by a German philosopher named Kant who pointed out that meaning exists only when concept is related to personal known information.

"There can be no doubt that all our knowledge begins with experience"

(Immanuel Kant, 1781: 41)

The term "schema" was first used in psychology by Barlett, a British psychologist who held schema as "an active organization of past reactions or experiences" (1932). Later, schema was introduced in reading by Rumelhalt (1980), Carrell (1981) and Hudson (1982), when discussing the important role of background knowledge in reading comprehension. David Rumelhart, an American famous expert on artificial intelligence stated that, "schemata can represent knowledge at all levels-from ideologies and cultural truths to knowledge about the meaning of a particular word, to knowledge about what patterns of excitations are associated with what letters of the alphabet. We have schemata to represent all levels of our experience, at all levels of abstraction. Finally, our schemata are our knowledge. All of our generic knowledge is embedded in schemata." (1980)

The fundamental tenet of schema theory assumes that written text does not carry meaning by itself. Rather, a text only provides directions for readers, as to how they should retrieve or construct meaning from their own previously acquired knowledge. This previous knowledge is called the readers' background knowledge (prior knowledge), and the previously acquired knowledge structures are called schemata (Barrlett, 1932; Adamsand Collins, 1979; Rumelhart, 1980). In nut shell, proponents of schema theory opine that comprehension of a text is an interactive process between the reader's background knowledge and the text. According to them, readers back ground knowledge is stored in their mind in hierarchical form from general to specific.

Schema is a knowledge structure which has slots. The process of filling the slots is the process of schema concretion. When the slots of schema are filled, the schema is activated. Rumelhart held that understanding is the process in which the brain selects the corresponding schema and the variables that are under constraint. According to this view, a certain amount of information must be input to the reader in the process of reading comprehension. Then the reader begins to search for the schema that can explain the information. When the schema is found, it is activated and the article is understood effectively.

Types of Schema

There are three kinds of schemas: the linguistic schema, the format schema and the content schema.

Linguistic Schema: Linguistic schema is about the language, knowledge of vocabulary, grammar, syntax and usage. Linguistic knowledge is the prerequisite that the reader needs to understand the discourse. Without language schema, a reader cannot utilize content schema and format schema in brain by information and clue provided, not to mention comprehension of the reading material. Lack of language schema in terms of unknown vocabulary or failure to understand complex sentences would lead to incomprehension of the text. Hence, it is vital that English teachers while teaching, reading skill should develop rich language schema among the students.

Format Schema: Format schema refers to the knowledge of the ways, in which, different genres are presented and it deals with background knowledge of discourse forms (rhetorical forms such as myths, narratives, poetry, descriptive accounts, expository writing, research reports, etc.).Different kinds of texts and discourse (e.g. stories, description, letters, reports, poems) are distinguished by the ways in which the topic, propositions, and other information are linked together to form a unit. Hence, different text styles have different format schemas. Activating the relevant format schemas helps the readers to grasp the main idea and the logical relationship between the paragraphs and thus form a correct foresight further. This can improve the efficiency of reading. Therefore, in the teaching of reading, teacher should instruct the students to acquaint the format schemas in order to understand the contents and structures of articles.

Content Schema: Content schema refers to the background knowledge on the reading materials for the readers. It also includes the cultural background knowledge. It contains conceptual knowledge or information about what usually happens within a certain topic, and how these happenings relate to each other to form a coherent whole. Content schema works two ways, as it is both area-specific information (pertaining to specific area or country) as well as conventional universal knowledge (such as universal or global issues). Content schema can directly affect the comprehension of readers on the subject, and therefore, it plays an irreplaceable role in reading comprehension. Activating content schema during reading comprehension definitely yields better results in understanding a text.

Activating Schema and its Implications

Schema activation is generally recognized as the process in which, some textual stimuli signal the direction or area for the reader to look for, and evoke the relevant schema from memory into the present reading task. (Li and Cheng, 1997, p.295-296)

Reading is a complex process and for engineering students, it is a mandatory and a highly useful skill both for their academic success and future career. There are different strategies a teacher can apply to develop efficient reading skill among the students, and one such strategy that works on language building, identifying format and predicting context is activating schema to understand a text better. Application of schema theory not only promotes the understanding of content, but also improves the reading efficiency of the students. While activating schema teacher not only helps the students to decode the content, but also activates the schemata stored in the brains of the students and guides the students to comprehend the discourse and actively construct new schemata.

Different Ways to Activate Schema

Activating schema should occur at the beginning of the lesson. The teacher should plan the schema activity before the teaching a portion of the lesson. Whether this is the first segment of the lesson plan, or after the review segment, is up to the teacher. There are certain strategies, the teacher can use to help students build and activate their schema

Prediction: Prediction ability is an important skill for reading. No matter right or wrong the prediction is, it can help students get closer to the content of an article which is good for their understanding. Students' prior knowledge gets activated with lead in question such as "What do you think this is about?" This triggers the guesses about what will happen or what will be said in a text. When students predict, they are using what they do know and forming expectations about what will follow.

Pre-Reading: Pre-reading is another useful strategy that can activate schema. In pre-reading, teachers can help students to do some reading-related preparation, such as listing and explaining words, phrases and sentence patterns in the

reading material. Pre reading as a strategy helps in building and activating linguistic schema. Linguistic schema is a pre requisite for reading comprehension. Looking over the text, reading the first and last lines of a paragraph to form an idea about what the students will be reading can activate their schema.

Visualization: By creating mental pictures or images based upon the words students are reading, their back ground knowledge can be activated. When students create pictures in their minds, they become more involved with the text. Visualization stimulates the imagination, enhances involvement with the text, and improves mental imagery. By using prior knowledge and background experiences, readers connect the author's writing with a personal picture.

Mind Mapping or Brain Storming: Mind mapping is an effective strategy that can bring up to the surface of the students' mind, associated key terms/ information related to the topic. Human mind is complex and strategies like mind mapping and brain storming triggers the submerged details in the memory of the students.

Previewing: A method of assessing students' needs before starting to read by deciding what the material is about, what needs to be done, and how to go about doing it. It is formulating a reading strategy and then reading to meet those goals. To preview, encourage the students to look over the material, think and ask themselves direct questions like: What is my purpose for reading? How is the material organized? What will be my plan of attack?

Recall: Recall as a strategy is used to preview what students have read, to highlight important points they have read, to connect what they have read to other experiences in order to increase their comprehension of the topic.

Teachers' Role in Activating Schema

Teachers play an important role as they can create opportunities which help students to activate schema and can guide them through the process. The success of improving reading efficiency through activation of schema lies in the ability of the teacher to design activities that inspire students to trigger the existing schema stored in their brains, use it to decode the content, finish the activity, and further to actively construct new schemas. The following are some measures teachers can follow:

- Teachers should introduce an element of speculation to the students taking the advantage of the fact that every student has some prior knowledge, knowledge that is common place and universal, even though if it is not directly experienced. Therefore, when a certain schema is determined in the reading process, the readers assume the slots of schema which conform to their experience. In order to erase the obstacles in reading comprehension, the teacher should purposely organize the students to prepare for reading and activates their schema stored in brains and instruct the students to speculate the content of article via the bottom-up and top-down modes. The teacher can employ innovative techniques such as projecting pictures, playing short videos, using key word prompts etc. to activate the existing schema of the students and help them to construct new schemas and ultimately improve the reading efficiency.

- Content schema plays a vital role in comprehending a passage. Despite having good vocabulary, a student can fail to understand the meaning of a passage if the student is alien to the background of the passage. For example, culture specific passages need some background information to effectively understand the passage. Encouraging the students to improve the general reading habit helps to expand their knowledge in various areas. New information acquired through reading modifies and strengthens the existing schema and aids better

comprehension of any passage.

- In improving the linguistic schema of the students, teachers can play a dominant role. With the help of vocabulary games and innovative activities to expand terminology teachers should generate interest among the students to expand their vocabulary and increase their store of words. The more the existing vocabularies range in a student's brain, the more the chances of understanding a passage.

- Creating awareness of cross-culture is another key measure to improve reading comprehension skills among the students. Especially for technical students like engineering students who face exams such as GRE, IELTS, TOEFL etc. lack of awareness of western culture would create a void in understanding passages that reflects western views and culture. Hence, providing relevant background knowledge to students in such areas during practice sessions would help them to expand their schemata.

"Subjects from the United States and India read letters about an Indian and an American wedding and recalled them following interpolated tasks. Subjects read the native passage more rapidly, recalled a larger amount of information from the native passage, produced more culturally appropriate elaborations of the native passage, and produced more culturally based distortions of the foreign passage."

(Margaret S. Steffensen, Chitra Jogdeo, and Richard C. Anderson, 1978)

- Introducing different writing formats and writing habits across the cultures would help students expand their format schemata. Only after the students achieve the related schemas do they further understand the expression habits and structures of English articles. For instance, in a scientific article, the author first gives his opinion and then demonstrates the opinion by series of proofs. The teacher should distinguish the structure difference between the articles and establishes the corresponding schemata for the students. Then, the schema is activated in the training of reading and this can enhance the comprehension ability of students.

- Finally, in a holistic process of developing linguistic, content and format schemata, the teacher should classify the articles according to the themes and formats and then guide the students to participate in special training. The teacher should first instruct the students in the knowledge of reading and further help them to build the schema, and then strengthen the schema via reading comprehension. While reading, the teacher should encourage the students to summarize the writing format and grammar knowledge, and guide the students to speculate the purpose of author via the schema knowledge. This can eventually make the students to read actively. In the aspect of cultural background, the teacher should introduce the familiar background knowledge to students and encourage the students to compare it with other cultures, and eventually expand the knowledge scope of students. Moreover, the teacher should demonstrate to the students how to speculate the purpose of author via the keywords in article. With the help of these trainings, the students can read the articles effectively and fast.

Building Schema through Activities/Tasks

As discussed above, teachers play a vital role in helping the students build their schema. Along with providing guidance as to the various kinds of schema and their importance teachers should design activities that provide opportunities for the students to work on building the schema. Activities that make the students read, brainstorm, use vocabulary, trigger background knowledge and have scope for prediction enables the students to develop their reading skills and eventually

become effective readers. Echevarria, Vogt and Short (2008) emphasize that reading comprehension can be a particular challenge for students from different cultural backgrounds, not because of difficulties with words or sentence structure, but because their schemata do not match those of the culture for which the text was written. It is the teacher's responsibility to determine the best way to activate students' varied background knowledge on a topic and provide appropriate activities.

There are many interesting and creative ideas that can be turned into activities to activate and build schema. Below are few ideas that can be converted into useful activities with the objective of building schema:

- **KWL Charts:** One of the frequently used ideas to activate students' background knowledge is making the students fill KWL charts. Students prior to reading a passage are asked to divide a chart into three columns "Things I know" , " Things I want to know" and "Things I learned". In a pre-reading activity, students are asked to fill up the first two columns. This helps the students to activate their back ground knowledge of the topic and fill the two columns. The third column is filled up post reading by the students. Sharing and discussing the columns with the rest of class adds new schema to the existing schema.

- **Student Journals and Quick-Writes:** After introducing the topic of the reading to students, they are asked to respond in their journals to a writing prompt that asks them to relate the topic to their personal experience or prior learning.

- **Concept Check:** Before reading an article or passage students are encouraged to self-assess their knowledge of the topic by listing key vocabulary, concepts, or ideas on a sheet of paper. Each student is given a copy and is asked to mark it according to his/her knowledge. Have the students reassess their knowledge after the reading or lesson.

- **Anticipation Guide:** Students are given a list of statements that are related to the concepts in the reading or lesson. Then they are asked to put a check mark next to the statements that they agree with or think are true. After reading, students revisit the statements. If they have changed their mind, they should remark the statements accordingly. They should note paragraphs or lines from the reading that caused them to change their mind.

- **Picture Quick Write:** A picture from the book or related to the topic of the story is displayed and students are given 30 seconds to a minute to write down anything and everything that comes to their mind while they look at the picture. Then, they are given an opportunity to share with the class and write everything around the picture for everyone to see.

Sample lesson plan with the objective of activating schema and description of the activity that promotes building of schema among the students is as follows:

Table: 1

Reading Task : Activating Schema for Reading Comprehension	
Objective: To develop in the students the ability to activate existing prior knowledge of the topic for a better comprehension of a passage/article.	
Outcome: Students would be able to apply the strategy of using schema to improve reading skills.	
Description of the Class: A class of 30 students with intermediate proficiency level in English.	
Material: Task sheets & Hand out. **Duration**: 1 lab session: 2 hours	
Introduction	• The teacher explains the importance of the strategy of using schema for better comprehension of a reading material. • The task and its objective are explained and any doubts or questions

	regarding the task are clarified.
Pre task	• Students are given three questions based on the passage from the main task. They are asked to work in pairs and answer using their prior knowledge (schema). Answers are submitted.
Task cycle Planning & Report	• Students are given a passage in jumbled sentences and are asked to re arrange in order. • Students finish the task and submit the re arranged passage.
Post task Analysis & Practice	• The answers submitted in the pre task and task are analysed to check the usage of schema by the students and suggestions are given by the teacher for improvisation. • Students are asked to fill in the word families sheet given using the words used in the article
Language Focus	Vocabulary: Word families (parts of speech)
Evaluation	Evaluation can be done through scaling the students' performance using a rubric for assessment and through correcting the submitted sheets.

Task Sheet on Reading Task

Activating schema for reading comprehension

Pre Task: Work in pairs and before reading, answer the following questions:

- Do bears live in the wild in your country? What kind of bears?

- How would you feel if you met a bear while hiking?

- What do you think we should do if we encounter a bear in the wild?

Task: Re arrange the sentences into a meaningful paragraph:

> The bear reacted defensively, injuring the woman's leg and hands.
> The woman was carrying bear spray but it was not deployed.
> The Swift current Pass trail was closed over the weekend but reopened today.
> The nearby trail leading to Iceberg Lake and Ptarmigan Tunnel remains closed due to bear activity.
> An off-duty Glacier National Park employee sustained non-life threatening injuries after surprising a bear in the Swift current Valley Saturday evening.
> The woman was able to walk most of the trail back to Many Glacier before she was met by park rangers.
> The woman was picking huckleberries a quarter mile off the Swift current Pass trail near Red Rock Falls when she startled what park officials believe was a sow grizzly bear.
> Park wildlife managers consider this a non-predatory, defensive attack and will not pursue the animal.

Post Task: Exercise: Vocabulary – fill in the word families using the words used in the article

Verb	Noun	Adjective	Adverb

(Reference Link: Task adapted from: "Helping ESL Students Become Better Readers: Schema Theory Applications and Limitations." Stott - Helping ESL Students Become Better Readers (Schema Theory) (TESL/TEFL), www.iteslj.org/Articles/Stott-Schema.html. Accessed 20 Jan. 2017.

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CONCLUSIONS

Hence, it can be ascertained that reading is a complex process which needs an active involvement on the reader's part. The reading models discussed in the paper emphasize the fact that of the entire three models interactive model promotes development of reading skill among the students. Activating schema theory as a strategy has more scope for teaching reading skill. It creates a platform for interaction by guiding readers as they make sense of new experiences and also enable them to make predictions about what they might expect to experience in a given context. With proper planning and care, various classroom reading activities can be designed by the teachers that provide opportunities for students to assess and evaluate meaning from a text, confirm with others predictions and assumptions, and share background knowledge with each other. The paper ends on a hopeful note that the positive role of application of schema theory in comprehending reading passages is given its due importance and more reading activities for building schema are made part of the curriculum for engineering students.

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