Abstract

Reading ability is fundamental to teaching and learning (AFT 2004). This study assessed the reading ability of 25 in-service science educators at the University of Limpopo for three science texts: Grades 7, 8 and 9, using a cloze test and exploring materials that educators read. The scores were categorised as being independent, instructional and frustrating. The results of One-way ANOVA reveal no significant differences in scores for Grades 7 and 8 texts, but significant differences in scores between Grades 7 and 8 compared to Grade 9 texts. A Tukey (HSD) post hoc test indicates that Grade 9 texts accounted for the main differences, suggesting that educators read Grade 9 texts at a frustration level. The reading ability of most of the educators was at the instructional level. Data from semi-structured interviews suggest that educators do read when preparing for classes. The implications are discussed in the light of improving reading ability of educators at higher education level.

INTRODUCTION

Reading ability is fundamental to teaching and learning (AFT 2004) and essential to intellectual and study skills for the success of anyone in higher education (Fairbairn and Winch 1996). In fact, many problems and learning disabilities may have a deeper and underlying cause beyond teaching strategies and the degree of student motivation (Fairbairn and Winch 1996). Many learners with reading difficulties do not succeed in school. They end up as academic drop-outs and find difficulty obtaining well-paid jobs (Cramer and Ellis 1996). Several reasons contribute to reading difficulties, including the economic and social status of communities, the lack of research-based components and practices in the teaching classroom (Nicholson 1997). Thus, it would be useful for educators to incorporate reading when teaching science subjects (Adams 1998).

A study conducted by Dekkers and Mnisi (2003) suggests that science educators in Limpopo province do not possess the expected knowledge. The study discusses the lack of knowledge regarding the nature of science, which is central to understanding science. This concurs with a study from the Eastern Cape Province that although some schools have adequate laboratory equipment, science educators might not use them (Muwanga-Zake 1998). These two provinces (Limpopo and Eastern Cape)
perform the poorest in matric examinations in both mathematics and science learning areas. These two subjects have exhibited poor performance since 1995, according to TIMSS 2003 (Gonzales, Guzmán, Partelow, Pahlke, Jocelyn, Kastenburg and Williams 2004). The scenario regarding reading skills is not better either. The state of learners in South Africa is that Grade 3 learners are a full year behind where they should be, while Grade 6 learners are two years behind (Taylor, Muller and Vinjevold 2003). This trend of lagging behind the appropriate reading age increases exponentially for the higher academic levels and might have far reaching implications in higher education.

This situation has remained unabated since 2005, according to the Progress in International Reading Literacy Study (PIRLS), which tested the reading skills of children after 4 years of schooling. The study shows that the vast majority (80%) of South African learners did not even reach the lowest benchmark of 400 points (Rosenberg 2009). These benchmarks included an Advanced International Benchmark set at 625 points, a High International benchmark of 550 points, an Intermediate International Benchmark of 475 and a Low International Benchmark set at 400. These benchmarks are cumulative in that learners who could reach the higher benchmarks also display the knowledge and skills for the lower benchmarks (Howie, Venter, Van Staden, Zimmerman, Long, Scherman and Archer 2007).

Currently, studies have concentrated on learners’ reading ability and little on educators’ reading ability. Also, little research has been carried out on reading in South Africa (Pretorius and Machet 2004) and little has been published on reading patterns in the classroom (Fleisch 2007), suggesting that there is little information on the reading abilities of educators in general as well as for their learners, which may explain in part the reasons behind success or failure in higher education. As Guthrie (2007, 20) opines: ‘At some points in history – and this is one of them – the urgency of improving reading becomes too compelling to wait for researchers to catch up in every respect. So often, practice must lead research.’ This study focuses on the reading ability of science educators to shed light on why learners in rural schools in the Limpopo Province of South Africa possess poor reading skills. This study documents the reading ability of in-service science educators in order to design materials that would assist in raising the reading standards. Thus, improving educators’ reading ability, in the long run, will increase the reading ability of their learners in the science classrooms and consequently increase their success in higher education.

**THEORETICAL FRAMEWORK**

Reading ability involves comprehension and memory based on schema theory (Anderson 1984; 1994; Rurnelhart and Ortony 1977). Comprehension and memory are central to reading and serve as an equilibrant of the writer’s message. One aspect of the schema theory is the unified theory of reading (Sadoski 2004), which was used in this study. This theory was applied because it captures three aspects of
reading, namely: decoding and recording; comprehension; and response. Reading and comprehension abilities allow students to access knowledge, understand, and elaborate on concepts, always integrating information from lectures and reference books. Thus, the message and the interpretation of the writer are important and are determined by one’s reading ability.

Reading ability can be tested using a cloze test because a reader is forced to develop scanning and searching skills often neglected in second language reading (Raymond 1988). A cloze test is an excellent example of an integrative activity regarding vocabulary knowledge, grammar and reading proficiency (Cohen 1980). Geva (1992) found that ability to complete a cloze test needs reading discourse and reading proficiency. Educators prefer to use a cloze test because it provides the best match between texts and reading abilities at a given grade (Chall and Dale 1995).

Conversely, readability formulae reveal surface-structure information about the text and not the reader’s understanding of the text. These formulae cannot convey to the reader the complexity of ideas or whether the text is biased or not (Johnson 1998). Although formulae are good for testing English Second Language (ESL) (Greenfield 2003), they are not reliable when applied to texts of less than 100 words (Fry 1990). Furthermore they cannot identify the writing style, for example, active or passive voice, first or third person, etcetera. In addition, some researchers have found that these formulae are not accurate predictors of ESL difficulty either (Brown 1998). Clearly, another method is needed which measures the comprehension and reading ability of the reader. The ‘cloze’ method is proposed by Betts (1946) and Rye (1982) and used for learners of languages, but sparingly applied in other learning areas, such as mathematics and science education.

The cloze test has been criticised for being sentence-bound (Anderson 1983). Cohen (1994) concurs with Anderson (1983) that the readers are pre-occupied with the sentence (micro level), only moving on to considering the whole text (macro level) when a few gaps have been filled. To overcome this bottleneck, however, it is advisable to prepare cloze tests by deleting words that will force the reader to look beyond the immediate sentence (Cohen 1994). In Bachman’s view (1990, 166), ‘the primary interest in using language tests is to make inferences about one or more components of an individual’s communicative language ability’. Among the language tests, the cloze procedure – in which every n\textsuperscript{th} word of a passage is deleted – has been considered to measure overall language ability (Aitken 1977). The cloze test was designed to measure the readability of texts (Taylor 1953). It was initially used to assess first language (L1) reading comprehension. By the early 1970s, the cloze procedure was used in second language (L2), both as a reading activity and as a test. Brown (2001) argues that successful completion of cloze items taps into knowledge of vocabulary, grammar, and discourse structure, as well as reading skills and strategies.
THE PURPOSE AND RESEARCH QUESTIONS

The main purpose of this study was to assess in-service science educators’ reading ability at the University of Limpopo, by applying a cloze test on three texts from their senior phase science textbooks (Grades 7, 8, and 9). Also, the study explored the materials that science educators normally read. Specifically, this study aimed at answering the following questions: a) For which science textbook do in-service educators obtain the highest level of reading ability?; b) For which science textbook do in-service science educators obtain the lowest reading ability?; c) What materials do science educators read?; d) What hinders science educators from teaching reading in the science subjects?; and e) What are the implications of the results for in-service science educators and the learners that join higher education?

METHOD

Research design
The research employed both qualitative and quantitative approaches. The research design is exploratory in nature due to the fact that no study has been conducted regarding the reading ability of in-service science educators.

Instruments
The cloze test and semi-structured interviews were the instruments used in this study. The cloze test was chosen because it can be easily integrated into the lesson rather than being a formal test on its own. Also, the ability of readers to fill in the missing words correctly was viewed as a valid indicator of how well the text is understood (Doak, Doak and Root 1996). In the cloze test, specific words in a sentence are deleted at regular intervals, that is, every n\textsuperscript{th} word from the text (McNamara 2000; Chávez-Oller, Cithara, Weaver and Oller, 1985; Cohen 2001). The cloze test is sensitive to constraints below 5 words and beyond 11 words (Chávez-Oller et al. 1985; Cohen 2001). Therefore, deleting every 7\textsuperscript{th} word falls within the acceptance range (5–11) and this method was used in this study. In order to evaluate the validity and duration of the texts, two education experts were asked to examine the cloze procedure before administering it to in-service science educators. In addition to the cloze test, semi-structured interviews were used to decide on the materials that educators usually read, the frequency of reading among educators, and the methods that science educators use to teach reading in science subjects. An expert checked the semi-structured questions used in the interviews for face validity. Necessary changes were made before conducting the interviews. Interviews were used because they are friendly and serve as an invitation to the respondents to describe their experiences (Allen 2006).
Subjects
In-service science educators (n=25, 20 males and 5 females) studying a Bachelor of Education degree on a full-time basis at the University of Limpopo were the subject of this study. Educators were selected by the department of education from different districts in the province. These educators possessed teaching experience ranging from 2 to 15 years. All of them had at least a Matriculation certificate and a diploma in teaching. Twelve of them possessed a Senior Primary Educator Diploma (SPTD), 10 possessed a Secondary Educator Diploma (STD), while the last three held a Primary Teacher Diploma (PTD). More than 75 per cent of them had taught senior phase science classes for more than 3 years.

Data collection
At the beginning of the degree in 2005, all 25 in-service science educators were asked to read the selected texts from science textbooks for Grades 7, 8 and 9 (~250 words per text) during a class session. This exercise was intended to document the reading ability of the educators and to assist science educators in their study. The educators were given 30 minutes to read 3 texts and were subsequently required to fill in the missing words in the cloze test. In addition, data were collected using semi-structured interviews; each interviewee was audio taped for 30 minutes in order to gather information regarding the type of reading materials, the frequency of reading and the methods educators use to teach reading in the science subjects.

Data analysis
Data collected were analysed both quantitatively and qualitatively. For quantitative analysis, scores from the cloze test were analysed to determine the reading ability of in-service science educators for each science textbook, using the following equation from Betts (1946):

\[ \text{Cloze score} = \left( \frac{\text{exact matches}}{\text{blanks}} \right) \times 100 \text{ per cent.} \]

Counting the exact matches removed any bias in the scores of the cloze text. The scores were grouped into three categories according to Betts’s (1946) ranking which has been used by other researchers like Rye (1982), as well as Legenza and Elijah (2001): 1) scores less than 75, frustration; 2) scores between 75–90 per cent, instructional; and 3) scores greater than 90, independent category. Scores of the frustration level means that learners fail to progress satisfactorily and their comprehension is faulty, and the instructional level suggests that learners can read and comprehend if they receive guidance from educators, while the independent level refers to learners who can read fluently and comprehend easily without assistance. A one-way ANOVA was performed to detect any reading ability differences between the three science texts using the STATISTICA Statistical package version 6. Where significant differences were detected, a Tukey’s Honestly Significantly Different (HSD) test was applied to identify sources of variation. For qualitative analysis,
semi-structured interviews were analysed thematically so as to explore the type of materials that science educators read, the frequency of reading and the methods that educators use to teach reading skills in the science classroom.

RESULTS

The results indicate that generally the reading ability of science educators falls into the instructional category. There was a steady decrease in reading ability from Grade 7 texts (75%) to Grade 9 texts (50%), with Grade 8 texts indicating an intermediate position (71%). In contrast to the decreasing order of the instructional reading category, there was an increase in the frustration reading category from 17 per cent to 46 per cent for Grades 7 to 9 texts (Table 1). The independent reading category scores were the lowest of all the three texts surveyed with values ranging from 1 to 2 per cent (Table 1).

Table 1: Reading ability categories and scores of senior science in-service educators

<table>
<thead>
<tr>
<th>Reading Category</th>
<th>Grade 7 text</th>
<th>Grade 8 text</th>
<th>Grade 9 text</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent</td>
<td>2 (8%)</td>
<td>2 (8%)</td>
<td>1 (4%)</td>
</tr>
<tr>
<td>Instructional</td>
<td>18 (75%)</td>
<td>17 (71%)</td>
<td>12 (48%)</td>
</tr>
<tr>
<td>Frustration</td>
<td>4 (%)</td>
<td>5 (21%)</td>
<td>11 (46%)</td>
</tr>
</tbody>
</table>

The mean scores of the science educators for the three senior texts ranged from 37.48 ± 8.68 (Grade 9 text) to 56.74 ± 9.33 (Grade 7 text) (Figure 1). A one-way ANOVA indicated that there were significant differences (p < 0.05) between the mean scores obtained for Grades 7, 8, and 9 texts, respectively (Table 2).

Table 2: Results of a 1-way ANOVA of science in-service educators' reading ability scores on senior phase science texts

<table>
<thead>
<tr>
<th>Source of variation</th>
<th>df</th>
<th>MS</th>
<th>F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatments/texts</td>
<td>2</td>
<td>482.3</td>
<td>6.6</td>
<td>0.00*</td>
</tr>
<tr>
<td>Error</td>
<td>69</td>
<td>73.4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>71</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Significant at p < 0.05.

A post hoc Tukey’s Honestly Significantly Different (HSD) test revealed that there were no significant differences between the mean scores gained for Grade 7 and 8 texts, but there were significant differences (p < 0.05) between Grades 7 and 8 texts when compared to Grade 9 text (Figure 1, Table 3).
Table 3: Results of Tukey HSD post hoc test of in-service science educators' reading ability scores obtained for three senior phase science textbook texts

<table>
<thead>
<tr>
<th>Treatment /Text</th>
<th>Grade 7</th>
<th>Grade 8</th>
<th>Grade 9</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grade 7</td>
<td>1.00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Grade 8</td>
<td>0.48</td>
<td>1.00</td>
<td></td>
</tr>
<tr>
<td>Grade 9</td>
<td>0.00*</td>
<td>0.05*</td>
<td>1.00</td>
</tr>
</tbody>
</table>

*Significant at p < 0.05.

Qualitative data from the semi-structured interviews were grouped into four themes: background reading experiences; perceptions about reading and the usefulness of teaching reading; the type of reading materials as well as the frequency of reading; and the methods used to teach reading in science lessons. These themes are presented in the following sections.

BACKGROUND READING EXPERIENCES

The vast majority of educators 18 (72%) stated that they had more reading materials at college level than at high school level. Surprisingly, all educators stated that they enjoyed reading materials at high school level when compared to college level. Probing the reasons behind this answer, it was obvious that at college level they were exposed to many reading materials in a short time. One educator commented that:

I was glad that I completed college education so I could enjoy my normal life. I was not myself because I was trying to complete this and that in a short time.
Most educators contended that it is not possible to teach senior phase learners to be fluent readers during science lessons. In fact, 22 (88%) stated that learning to read fluently should be left to experts (the language educators) and not science educators, while 16 (64%) stated that language teaching, like grammar, punctuation and the like should be solely left to language educators. One educator stated that:

In a science class the emphasis should be on science content. After all, we cannot teach English because we did not train to teach reading to these kids. Also, reading need much time; there is always no time for such.

**PERCEPTIONS ABOUT READING AND THE USEFULNESS OF TEACHING READING**

On the question dealing with reading for more than 6 hours, educators indicated that it was not a problem at all. Their concern was lack of time after a normal working day. Nineteen (76%) contended that they work far from home. In the evening they have to relax, anyway. One educator lamented that:

One has to drive or take a public transport to school and by the time one arrives home in the evening, aah ... indeed one is very tired.

Another educator commented as follows:

Remember some of us were excess teachers in our former schools and during the re-deployment process we were separated from our families. I mean, we were traumatised to the extent that we cannot read for even one hour in a single day.

Some complained of having too many periods to teach, which exhausted their energies. For instance, one has to teach from Grades 7 to 9 and also supervise extramural activities. The usefulness of reading was to improve educators’ subject content knowledge where they gather new information. Thus, teaching reading was not feasible and thus all educators (100%) did not teach reading during science lessons. Reading skills are left to specialist language educators. One educator commented that:

After all, the reading skills from language classes should be enough for learners to effectively transfer to other contexts like in science lessons.

**THE TYPE OF READING MATERIALS AND THE FREQUENCY OF READING**

A total of 20 (80%) educators read newspapers either daily or weekly depending on where they are located during the week. Magazines and novels were not popular since only 5 (20%) read them on a three monthly basis. Science educators read no single journal from science education. The reasons given are that educators do not carry out research and so they leave journals to higher institutions of learning. On
the question as to how often should science educators read text books written for post matric level, 13 (52%) were against it and 12 (48%) supported the idea. Those that were against it included issues such as the belief that: text books written for post matric will not improve teaching skills in high schools. Instead, they need to master subject content of the Grades they teach. The group that supported reading text books written for post matric level justified their views by stating that an educator needs to know more that the learner. The group expressed the view that educators should have more subject content knowledge by reading such books. Regarding other reading materials, 10 (40%) revealed that science educators read religious materials like the Bible at church every week.

METHODS EDUCATORS USE TO TEACH READING

Some of the educators taught reading in their science lessons, but none of them explained the methods they used to teach reading. One educator commented that:

Reading is not my job. This must be the role of language educators. Even, when I am marking science, I do not check the sentence construction. I look for points that match with what is on my memorandum.

DISCUSSION

In the present study, the main purpose was to assess science educators’ reading ability using the ‘cloze’ test on three texts from senior phase science textbooks (Grades 7, 8, and 9). In line with this purpose, the study reveals the vast majority of in-service science educators scored an instructional reading category for all three texts (Table 1, Figure 1). This suggests that science educators are not self-motivated to read science textbooks. In fact, almost half of the sample read Grade 9 text at a frustration category (Figure 1, Table 3). The problem is most likely that science educators do not have difficulties with comprehension only, but also experience problems with decoding and recording, as well responding to texts as contended in the Unified theory of reading (Sadoski 2004), and consequently, science educators exhibited a low memory of the words they read from the texts.

The low memory, in part, explains the findings of Dekkers and Mnisi (2003), which show that science educators do not possess the expected level of knowledge. Almost half of the science educators’ reading ability for Grade 9 texts fell into the frustration category, suggesting that their attitude towards reading is likely to be poor. It is likely that they do not enjoy reading and as such their motivation towards reading is low. Also, the low level scores in the cloze test (Table 1) may underpin the fact that many of these science educators exhibit low motivation to reading non-fiction books, such as science textbooks. This behaviour could be attributed to the frustrations experienced when reading science and non-fiction textbooks. Besides the lack of training, the high ratio of respondents falling in the frustration category presented in this study could explain why science educators were not interested in
teaching reading skills in the subject of science. After all, most of these science educators lack reading skills and therefore it is understandable when such skills are not taught.

Results from the semi-structured interviews indicate that the educators’ background exposure to various reading materials has an effect on their interest and their reading ability. This observation is in agreement with the results of the study conducted by Guthrie, Wigfield, Metsala and Cox (1999). Also, Grabe and Stroller (2002) contend that learners’ persistence to reading is related to their background experiences and the reading materials to which they were exposed. Perceptions towards reading materials and their usefulness were related to background exposure. Similarly, educators tend to teach in a similar manner to that which they were taught. Hence, if reading was never taught in a science subject, then it is understandable that they consider that reading is not the duty of a science educator. From the interviews, it was clear that 50 per cent of the educators in this study possessed poor perceptions of the usefulness of reading non-fiction books and books written for post matric levels. This corroborated with the responses, which reveal that all science educators did not read books written for post matric levels.

Again, all educators stated that they enjoyed learning more in high school than in college. This, at least to me, implies that there were large amounts of reading materials in colleges of education and that these reading materials were not welcome. In fact, one educator felt relieved of reading when college work had been completed and s/he graduated as an educator. This suggests that such an educator has a poor perception of the usefulness of reading and arguably cannot teach reading in the science classroom. Furthermore, none of the science educators indicated to have read for enjoyment or for discovering new information in science education. The lack of enjoyment may explain why the vast majority of these science educators exhibited poor reading abilities that ranged from the frustration to the instructional categories and that few were reading at the needed independent category, especially, from a Grade 9 text book (Table 1). The fact that the vast majority (80%) of educators read newspapers and did not read any non-fiction books suggests that these science educators lack an understanding of the usefulness of reading.

Science educators only read for the sake of preparation for the lessons, as needed by the Head of department (HOD) or the principal, suggesting that without such guidelines, reading of any science literature is minimal or non-existent. Their concern was a lack of time after a normal working day. These findings agree with Mathangwane and Arua (2006) in Botswana where parents, particularly in urban areas, did not have time to read. The lack of engagement in reading often results in low reading speed (Guthrie and Wigfield 2000). This agrees with the observation of the researcher (Unpublished data), that most of these educators have low reading speeds, ranging from 80 to 110 words per minute, which would translate to Grade 7 and 8 reading levels (Johnson 1998). More often, when educators were asked questions relating to material that required many pages of reading, they could hardly accomplish the work in time because they either did not have enough time or the
work was too difficult to comprehend (per. obs.). The implications of low reading speeds and poor reading abilities of science educators are far reaching. The ultimate result of non-reading science educators could be the breeding ground for the very low reading speeds of the learners they teach. Also, the poor reading ability of science educators will be revealed in the poor matric results of the learners. Such learners, when admitted to higher institutions of learning, are more likely to be affected by their poor reading abilities in higher education.

A study of the undergraduate law students at the North-West University reveal that indeed high matric achievers (Grades A, B and C) in the English language as a medium of instruction succeed better in their courses compared to those who achieved lower symbols, despite prior exposure to reading instruction at university level (Zulu 2005). Furthermore, Zulu (2005) states that critical reading was the most difficult skill for undergraduate learners, suggesting that educators of all subjects should change their focus to include reading skills in order to improve the learners’ achievements in their fields of specialisation. On the other hand, educators need to possess the necessary skills in order to foster good reading behaviour. Hoover and Gouch (1990) show that oral reading and an understanding of print material are important skills, especially if one is to become a proficient reader with regards to comprehension as well as mastering the decoding processes. Decoding is a major problem because learners have to struggle to decipher the unfamiliar words in the text and in the process comprehension may be lost entirely (Hoover and Gouch 1990). Such struggling readers, if asked to explain what the reading is all about, often repeat a few unrelated words without much attention to the thinking in which one engages (Allington and Cunningham 1996; Mueller 2001). Also, it has been reported that decoding words at times reduces speed, and memory is greatly compromised and may result in poor comprehension (Doak et al. 1996).

Despite the lack of scientific research to support the role of comprehension strategies that work best, it appears that struggling readers improve rapidly on how to ‘think as they read’ after undergoing instruction in comprehension (Pressley 2000; Pressley and Wharton-McDonald 1997). It has been demonstrated that struggling readers who engage in dialogue as well as collaborative learning improve their reading abilities substantially (Fall, Webb and Schakowsky 2000; Zevenburgen and Whitehurst 2003). This, therefore, means that, as a ‘rule of thumb’ in order to improve reading ability of science educators it is necessary to engage them in conversation about the texts they read. Engagement in reading has been defined as not only the number of words being read, but also focusing on the meaning of the texts (Guthrie and Wigfield 2000). Thus, engagement demands cognitive coordination, social discourse and motivation to read (Boakye and Southey 2008).

**LIMITATIONS OF THE STUDY**

The limitations of this study is the small sample (n = 25), which therefore cannot be used for generalisation. Also, there was a gender imbalance: 20 males against
5 females. Nevertheless, issues identified could be of significance to all science educators and curriculum planners to improve the reading skills of science educators and to improve the reading abilities of learners, even in higher education. A replication of this study with a large sample is highly recommended. Also, Kobayashi (2002, 582) advises us ‘to interpret the results of different cloze tests with caution, especially given the variability of cloze item statistics seems to depend on the types of words deleted’. The reliability of cloze tests should be consistently high or low even if the tasks are different and at the same time, ‘it is important to realise that it is not possible to eliminate inconsistencies entirely’ (Bachman and Palmer 1996). Despite this, the author is confident that the valuable information from the cloze test along with the personal interviews renders credence to authentic reading abilities of science educators, at least in this study. The information will be very useful for curriculum advisors as well as institutions of higher learning that train science educators to consider developing modules that deal with reading skills. This was a preliminary study and there are many factors that may play active roles in teaching and learning that are unknown. To obtain the extent of the poor reading ability of science educators, more research is needed with a large sample and from different parts of the country. The study should also explore educators’ intrinsic and extrinsic factors, specifically reading efficacy, reading challenges, and reading for enjoyment (Metsala, McCann and Dacey 1996/1997).

**IMPLICATIONS OF THE STUDY**

While the culture of non-reading dominates high school in-service science educators in this study, there is a need to change this pattern. The changes can be implemented not only for the in-service courses, but also for the colleges and universities that prepare science educators. These changes could include, among others, the following:

1. A professional development programme at the institutions of higher learning should foster a core curriculum geared towards promoting reading skills, with a focus on methods of how to teach reading in science lessons.
2. Although educators claim that there is no time for reading, proper time management could make this possible if science educators are trained how to create time for personal reading;
3. Increase the reading materials in each subject area of specialisation at higher education; and
4. Textbook developers should address the lack of materials to teach reading skills in the science subjects.

**REFERENCES**


AFT, see American Federation of Teachers.


