INTERNET AS A SOURCE OF MISCONCEPTION: "RADIATION AND RADIOACTIVITY"

Burcin ACAR SESEN
Istanbul University, Hasan Ali Yucel Education Faculty, Department of Science Education,
34452, Istanbul/Turkey. Tel: +90-212-4400000 ext. 26069
bsesen@istanbul.edu.tr

Elif INCE
Istanbul University Hasan Ali Yucel Education Faculty, Department of Science Education, Turkey

ABSTRACT
The purpose of this study is to examine students' usage styles of the Internet for seeking information and to investigate whether information obtained from the Internet is a source of misconceptions. For this reason, a two-stage study was conducted. At the first stage, a questionnaire was developed to get information about students' Internet usage styles. In the light of the questionnaire results, the first 200 websites were scanned and analysed by 3 experts to determine the probable incorrect information about "Radiation" and "Radioactivity" concepts at the second stage. It was found that a good number of websites contain incorrect and inadequate knowledge about radiation and radioactivity, which can cause various misconceptions.
Keywords: Misconception, Radiation, Radioactivity, Seeking Internet, Students' Internet usage

INTRODUCTION

The use of information technologies has shown a very rapid growth during the last decade in almost every country in the world. Increasing computer ownership and access to the Internet have changed the lives of people who get online on a daily basis at home, at school, and at work. With the ever increasing use of the internet in daily life , individuals have begun to use the internet for various reasons such as "seeking information", "using e-mail" and "downloading music and video", "chatting" and "playing games" (Kuhlemeier, 2007; Wishart, 2007). Internet has also been used in education. Several studies have been carried out about the connection between the Internet and education (Dybek, 2002; Fischer, Troendle, & Mandi, 2003; O'Hanlon, 2002; Shaver, 1999; Usun, 2002; Wilson & Hord, 2000).

Researches on the use of the Internet in education indicate that seeking information on the Internet has become the first choice option for many people, especially for students (Cole, Suman, Schramm, Lunn, & Aquino, 2003; Lawrence & Giles, 1999; Pew Lawrence & Giles, 1998). The results of these studies have shown that students use the internet activities (facilities) especially for seeking homework and their projects by using search engines. Major Web search engines, such as Google, Yahoo!, MSN Search and AltaVista are one of the most frequently used tools to get information from the Web (Nielsen/NetRatings, 2004), but Google alone claims to handle more than 250 million search queries a day (Sullivan, 2003).

However, researches indicate that students do not have enough ability and knowledge to search for information on the web (Wallace & Kupperman, 1997), which ends up obtaining a large amount of irrelevant information about their studies. They pay little attention to what the information *is* (e.g., the source, date, and reliability) focusing instead on what it *says*. This strategy is similar to the "copy-paste" strategy described by Bereiter and Scardamalia in novice writers (Bereiter & Scardamalia, 1989). In accord with this conception, most of these students accepted what they found on the Web as true, with no consideration of the source or purpose of the information. This brings about some important and interesting issues with it

1. Students don't explore much.
2. Students tend to seek answers rather than understanding the topic.
3. Students' use of academic resources is little.
4. Students find it difficult to pinpoint information and resources.

This proves that students do not know how to use the Internet especially when seeking information on the web. Students do their homework or assignments with the "copy-paste" method without worrying about the reliability of the internet sources. Students' misuse (mishandling) of the Internet can create incorrect learning and misconceptions in this way. The research on students' misconceptions has become a key issue in science education for the past two decades because they are presumed to be deeply rooted, instruction-resistant obstacles to the acquisition of scientific concepts (Lawson, 1988). Skelly and Hall (1993) defined a misconception as a mental representation of a concept, which does not correspond to currently hold scientific theory. They divided

misconceptions into two categories: experiential and instructional. The experiential misconceptions are also referred to as alternative, intuitive or native conceptions. Experiential misconceptions can be described a concept that has been understood, at least to some extent, through everyday experience and interaction with the phenomenon involved (Skelly & Hall, 1993). The internet usage can provokes to create misconceptions as experiential. Misconceptions adversely influence construction of knowledge and so learning process (Ben-Zvi, Eylon & Silbertein, 1986; Bodner, 1986; Brown, 1992; Jonassen, 1991). As mentioned by Şahin, Balta & Ercan (2010), research on internet usage have indicated that there is a strong relationship between internet use trends and educational performance, and wrong use of the Internet can cause a major decrease in students' academic performance. They investigated the diversity, accessibility and reliability of the internet resources used by the inexperienced university students during literature review and found that the more useful reliable information can be gathered using less accessible and more secure internet resources. The also indicated that using highly accessible internet sites may give fast results but the reliability of those results can not be ensured. Chen & Peng (2008), examined the basic relationship between the internet use of university students and their academic performance, interpersonal relationships, psychosocial adjustment and self-evaluations. The results show that non-heavy internet users have better relationship with administrative staff, academic grades and learning satisfaction than heavy users. They claimed that the heavy internet users were likely than non-heavy users to be depressed. This study provoked us to search the raising trends in use trap sites among university students.

As mentioned above, students use Internet for their academic researches, and they acquire knowledge related to many school subjects. Radiation and radioactivity have strong links with the content of science, chemistry and physics and they have many areas of application in today's society. Therefore, students can find a lot of information about this subject on Internet. Most science education research linked to radioactivity and radiation has shown that students have difficulties in understanding these subjects and so they have lots of misconceptions (Eijkelhof, 1986; Henriksen & Jorde, 2001; Huestis, 2002; Millar et al, 1990; Millar, 1994; Mubeen et all., 2008; Nakiboglu & Tekin, 2006; Prather, 2005).

Purpose of the Study

Students generally use the Internet for their studies without formal help or training. This situation has important implications for the quality of work that students are able to produce based on their Internet use. Students need accurate knowledge, but if they are faced with inaccurate or misleading information, they lack the ability to distinguish this information from more reliable sources; they could not learn effectively (Metzger, Flanagin, & Zwarun, 2003). For this reason, in this study, the subject of radiation and radioactivity was selected and it was aimed to investigate whether information obtained from Internet is a source misconception about these subjects. To enhance the aim the following research questions were investigated,

1. How do students get information from the Internet?
2. Do Internet resources cause misconceptions about "Radiation and Radioactivity"?

METHODS AND FINDINGS

This study is composed of two stages as described below.

The First Stage

A questionnaire was developed to get more information about students' internet usage styles. This questionnaire includes three questions as follows;

1. "What do you use the internet for ?"
2. "Which search engines do you prefer while looking for information on the web? "
3. "If you want to get information about "Radiation and Radioactivity" on the Internet, which keywords do you use?"

The questionnaire was carried on 567 pre-service teachers from science, physics and chemistry education departments. In the data analysis, the content analysis method was applied and the percentages of the responses were determined.

The answers given by the students to the first question *"What do you use the internet for?"* can be seen in Table 1

Table 1: The percentage of the students responses to "*Why do you use the internet?* "

	Students affairs (%)	Seeking their homeworks or projects (%)	Using e-mail (%)	Downloading or listening music and video (%)	Playing Games and Entertainment (%)	Chatting (%)	Other (%)
Science Pre-service Teachers	**6.9**	**65.3**	**37.1**	**28.6**	**7.1**	**35.2**	**6.3**
Physics Pre-service Teachers	**12.7**	**62.7**	**25.7**	**32.0**	**8.7**	**47.0**	**3.2**
Chemistry Pre-service Teachers	**9.0**	**68.5**	**27.8**	**39.3**	**12.0**	**42.9**	**2.5**

According to the results, it was found that over 60% of the students use (the) Internet for their homework or projects. They also use the Internet especially for checking their e-mails, downloading music and video and chatting.

The answers given by the students to the second question *"Which search engines do you prefer while looking for information on the web? "* can be seen in Table 2

Table 2: The percentage of the students responses to "W*hich search engines do you prefer for seeking information?* "

	AltaVista-Search (%)	Yahoo (%)	Google (%)	ScholarGoogle (%)	MSN Search (%)	Other (%)
Science Pre-service Teachers	**5.1**	**11.3**	**72.8**	**3.1**	**1.1**	**1.8**
Physics Pre-service Teachers	**8.5**	**23.2**	**87.1**	**17.0**	**2.5**	**3.3**
Chemistry Pre-service Teachers	**4.1**	**17.8**	**81.5**	**11.2**	**1.0**	**4.3**

As shown in Table 2, all pre-service teachers from science, physics and chemistry education departments stated that "the mostly preferred search engine is **"*Google*"** with 72.8%, 87.1% and 81.5% respectively.

The answers given by the students surveyed to the third question "*If you want to get information about "Radiation and Radioactivity" on the Internet, which keywords do you use?"* can be seen in Table 3.

Table 3: The percentage of the students responses to "*If you want to get information about "Radiation and Radioactivity" on the Internet, which keywords do you use?* "

	Radiation and Radioactivity (%)	Electromagnetic Radiation (%)	Nuclear Reactions (%)	Fission and Fusion (%)	Radioactive Decay (%)	Other (%)
Science Pre-service Teachers	**82.8**	**33.9**	**27.3**	**13.2**	**8.0**	**5.9**
Physics Pre-service Teachers	**97.1**	**48.3**	**12.4**	**8.1**	**11.3**	**6.3**
Chemistry Pre-service Teachers	**63.4**	**41.2**	**18.9**	**4.4**	**3.2**	**8.2**

When the answers given to the third question "*If you want to get information about "Radiation and Radioactivity" on the Internet, which keywords do you use?* " were analysed, it was found that students use "Radiation" and "Radioactivity" keywords to seek these subjects at the highest percentage. Considering the results, it can be said that;

- Students take the advantage of the internet while doing their homework or projects at very high rates.
- A large majority of the students prefer to use "Google" as a search engine.
- Students use short titles of the subjects as keywords generally.

- Students used "radiation" and "radioactivity" as keywords to search for "Radiation and Radioactivity" issues.

The Second Stage

In the qualitative part of this study, scanning mode was used. To investigate the second research question of the study, the websites were analysed. In the light of the questionnaire results, it was found that students prefer "Radiation" and "Radioactivity" terms as a keyword and they use Google as a search engine with higher percentages. Therefore, "Radiation" and "Radioactivity" were selected as keywords in this study and used Google search engine. The contents of the first 200 websites were scanned by 3 experts to determine probable incorrect information. According to research results it was found that a lot of websites contain incorrect and inadequate knowledge about radiation and radioactivity, which can cause various misconceptions. The classification of incorrect and inadequate knowledge and their recurrence percentages in the Internet sources can be seen in Table 4.

Table 4: The percentage of *"Radiation and Radioactivity"* in the first 200 web sites' by using "Google" search engine.

Incorrect or Inadequate Knowledge	Percentage %
If the neutron numbers are higher than proton numbers in any nucleus, the nucleus has unstable structure, the neutrons in the nucleus emits alpha, beta and gamma-rays.	**26.3**
Radiation is a kind of energy which is emitted by energy package called as wave, particle and photon.	**17.9**
While Some kind of radiations, such as natural sources and medical applications are helpful, some kind of radiations, such as irradiation and nuclear wastes are harmful.	**30.1**
Temperature effects radioactivity. Decay rates of any radioactive substance decrease as temperature increases.	**11.3**
The most common radioactive isotopes are potassium-40 and carbon-14 isotopes in the human body. Other radioactive isotopes' half-lifes are enough long and they can not cause a damage to human. A cell can not be alive for long term as half-lives potassium-40. It means that radiation can not occur.	**19.7**
If an object is exposed to ionising radiation, it becomes radioactive.	**24.3**
Ionising radiation is not natural and it is always harmful. There are many sources of ionisation radiation producing. The mobile phone, radio, television, electronic devices, X-ray for medical applications are the most commonly encountered.	**38.1**
Others	**32.3**

Considering the results in the Table 4, it is seen that websites are full of many incorrect concepts about "Radiation and Radioactivity". They are commonly related to *radiation, unstable nuclei, half-life, ionising and non-ionising radiation* and *electromagnetic radiation.* The widely used incorrect knowledge is ***"Ionising radiation is not natural and it is always harmful. There are many sources which may cause radiation. The mobile phone, the radio, the television, electronic devices, X-ray for medical are the most commonly encountered "*** with 38.1 % . It is also found that some expressions like ***"While Some kind of radiations, such as natural sources and medical applications are helpful, some kind of radiations , such as irradiation and nuclear wastes are harmful "*** are with 30.1 %, ***" If the neutron numbers are higher than proton numbers in any nucleus, the nucleus has unstable structure, the neutrons in the nucleus emits alpha, beta and gamma-rays "*** is at 26.3 % ,***" If an object is exposed to ionising radiation, it becomes radioactive "*** is at 24.3 %.

DISCUSSION AND CONCLUSION

The purpose of this research is to investigate whether information obtained from the Internet is a source of misconceptions. For this reason, a two-stage study was conducted. To enhance the purpose, it was aimed to determine the reason of the students' Internet usage and the way of their seeking information about "Radiation" and "Radioactivity" in the first stage. In the light of these results, "Radiation" and "Radioactivity" were identified as keywords and 3 experts analysed the contents of 200 websites on Google search engine in the second stage. According to the findings, a good deal of incorrect information about "Radiation" and "Radioactivity" subjects was identified in several websites. In coherent with literature, the incorrect information can cause misconceptions. For instance, it was found that the sentence of ***"Ionising radiation is not natural and it is always harmful. There are many sources of ionising radiation sources. The mobile phone, radio, television, electronic devices, X-ray for medical applications devices are the most commonly encountered"*** was repeated in the 80 out of 200 websites. These sentences are scientifically incorrect, because ionising radiation can be natural such as ultraviolet, cosmic rays, gamma-rays and X-rays. These radiations can be

harmful according to their energies and wavelengths. It means they are not "**always"** harmful. "*The mobile phone, radio, television, electronic devices, X-ray for medical applications"* is not ionising radiation sources. Electronic devices produce non-ionising radiation and they cannot account with X-rays. X-rays are electromagnetic radiation and their effects depend on the amount of radiation dose. It is clear that when students read and use this information, they cannot distinguish between *ionising radiation, non-ionising radiation* and *electromagnetic radiation.* It can be a resource of misconception which has been mentioned in the literature (Lijnse et al., 1990; Millar, Eijkelhof, & Eijkelhof, 1990). The other incorrect information found on the websites as ***"While some kind of radiations, such as natural sources and medical applications are helpful, some kind of radiations, such as irradiation and nuclear wastes are harmful"*** is also another misconception determined by Mubeen, Abbas, & Nisar (2008) and Klaassen (1995). As explained above, effects of radiation depend on the amount of radiation. If the amount of radiation dose is excessive, it is harmful, it has got nothing to do with. Another source of misconceptions determined by Prather (2005) as **"If the neutron numbers are higher than proton numbers in any nucleus, the nucleus has unstable structure, the neutrons in the nucleus emits alpha, beta and gamma-rays"** was found in the websites. Scientifically, if a nucleus has unstable structure, the nucleus emits particles such as alpha, beta and gamma-rays instead of neutrons. The neutron is a nucleon like proton. The nucleus can also emit neutrons. **"The most common radioactive isotopes such as potassium-40 and carbon-14 isotopes are in the human body. Other radioactive isotopes' half-lifes are quite-long and they cannot cause any damage to the human body. A cell cannot be alive for a long period of time like half-lifes of potassium-40. It means that radiation cannot occurs"** is another incorrect information. When students read this, they can think that potassium-40 and carbon-14 isotopes are dangerous and they should not drink milk, water and eat banana as mentioned by researches (Eijkelhof & Eijkelhof, 1990). Another incorrect conception is related to "half-life" in this paragraph. It was written that ***"radiation cannot occurs before half life"*** *but* half life is a time for decay of nucleus. In this process, the mass of the nucleus is reduced to half and radiation can occur (Nakiboglu & Tekin, 2006). Another misconception found in the websites is **"Temperature effects radioactivity. Decay rates of Radioactivity decrease as the temperature increases"** (Nakiboglu & Tekin, 2006). Radioactivity has nothing to do with the temperature. Radioactivity does not depend on the temperature but on the type of the matter. The state of **"If an object is exposed to ionising radiation, it becomes radioactive"** is also the other incorrect information. If an object is exposed to ionising radiation, it becomes irradiated not radioactive. For a while, it can be at excited level then it backs to stable level. It is clear that this information can cause some misconceptions on *irradiation-contamination* (Henriksen & Jorde, 2000; Millar & Gill, 1996) and *ionising-non ionising radiation* (Millar, Eijkelhof, & Eijkelhof, 1990; Mubeen et all., 2008).

In conclusion the results of this study indicate that there is a good deal of deficient and incorrect knowledge about the subjects of "Radiation and Radioactivity" on the websites. Considering Internet to be a the first choice of students looking for information for their studies, it can be said that this incorrect information can cause misconceptions not only for these subjects but also for the other science concepts. The Internet has become a waste of knowledge throughout the time, because most of the information available on the web is not prepared by experts and the incorrect information is copied some other websites. Anybody can create websites without checking up the accuracy of the knowledge. While there have been a lot of studies that identify the positive aspects of internet usage in education, negative aspects have not underlined in the literature. Therefore it is clear that this study will make important contribution to the literature. In view of the results of this study, it is suggested that websites should be examined, students should be informed about internet use and be directed to appropriate websites by teachers.

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