Teacher’s selection and use of Internet-based resources and tools to facilitate learning in primary classrooms

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This chapter discusses how primary school teachers make use of Internet resources and tools in an interdisciplinary subject. The research looks into 12 cases involving Grade 4 to Grade 6 teachers. The teaching designs developed are carefully analysed to identify teachers’ choices of Internet resources and tools. Semi-structured interviews with teachers are conducted to gain a greater understanding of the rationale behind their choices. Analyses of the teaching designs show that the use of videos is the most prevalent, followed by integrated websites and photographs, which are non-interactive resources. It also appears that the use of Internet tools in primary classrooms is an uncommon practice and the teachers are relying heavily on printed worksheets. Results from the interviews suggest that the teachers’ selection and use of Internet resources and tools is mostly governed by their availability, and hindered by students’ limited communication and information technology (ICT) skills. The findings raise concerns regarding both the availability and diversity of Internet materials as well as the ICT capability of primary level students.

Keywords Internet resources; primary education; interdisciplinary subject

1. Introduction

The emergence of the Internet has changed the world. It has also transformed education. Under the active advocacy of the use of information technology in education by the Hong Kong government, many teachers have made attempts to incorporate Internet resources and tools into classroom teaching. However, there is no evidence that these resources are used either widely or wisely [1]. Drawing on evidence from teaching design analysis and teacher interview, this study examines Hong Kong primary school teachers’ selection of resources and use of tools available on the Internet for an interdisciplinary subject. The experience of these teachers in selecting and using Internet resources and tools will have a wider significance, shedding light on issues associated with the integration of Internet into learning and teaching in the primary classrooms.

1.1 Roles of technology in education

When technology was first used in education, the focus was on skills acquisition and knowledge transfer advocated by the behavioural approach to learning [2][3]. For instance, drill-and-practice is an example of this approach to using technology in education. Currently, the role of technology has changed from a tutor to a learning partner or cognitive tool with the shifting role of the use of technology in education from ‘learning from technology’ to ‘learning with technology’ [4][5]. This change has resulted in having the use of technology in education that emphasises the active construction of knowledge and facilitate students to make associations as well as interactions with each other [5].

The role of technology in education, which began as an instructional tool used to provide richer and more exciting learning environments [6][7][8], has now changed to have a focus on the learners by providing support for constructing new understandings and capabilities as well as cognitive and metacognitive processes. Teachers are becoming facilitators in online environments, as guides or expert resources rather than the sole determiners of learners’ learning experience [9]. To date, the change of focus of technology efforts in primary and secondary classrooms has been on the introduction of technology into the curriculum instead of on the delivery of that curriculum through technology [10]. Hence, it is worth studying how teachers introduce technology into the curriculum and their classroom teaching. This study is focused on how this is being done in primary classrooms.

1.2 E-learning in school education

With the advancements of information and communication technology, and the proliferation of technology in education, web-based delivery of education, either called online learning or e-learning, has become a focus in education with ever-growing popularity. E-learning is suggested to include instruction delivered via all electronic media including the Internet, intranets, extranets, satellite broadcasts, audio/video tape, interactive TV and CD-ROM [11]. It is also referred
to as a web-based system that makes information or knowledge available to users or learners while disregarding time restrictions and geographic proximity [12]. Another definition is learning through and supported by the use of ICT [13].

Owing to its flexibility and its ability to virtually extend the classroom with the aid of technology, e-learning has become a trend in school education in different countries. The TIMSS report in 2007 showed that 13 out of the 36 participating countries and 3 out of the 7 benchmarking participants had policies about computer use as part of their science curriculum at the fourth grade [14]. A report discussing the results of national measures taken by 16 of the European Schoolnet’s member countries stated that ICT is used in the teaching of all Mathematics, Science and Technology subjects to varying extents in all of the countries surveyed [15].

In Hong Kong, the government has been actively advocating the use of IT in education in the past decade with one of the goals being to turn e-learning into an effective mode of learning [16]. It is suggested that e-learning can be more flexibly manipulated to raise pupils’ interest in learning, promote interactions between pupils and teachers, increase collaboration among pupils, help teachers address individual learning differences, support the whole person development of pupils, and ultimately realise educational goals [17].

Most research on e-learning has focused on post-secondary learners. Since e-learning is becoming more prevalent and accepted as a means of learning at the primary and secondary levels, a change in such a focus has been observed in recent studies [10]. Studies have shown that e-learning benefits student learning. In a study comparing the achievement of fifth grade pupils learning in an online virtual lab and under traditional class instruction [18], it was found that those learning in the virtual lab achieved better grades, and up to 75% of the pupils who participated in the study preferred the Web-based virtual lab over textbook reading only. In another large-scale study investigating the impact of digital technology [19], improvements in science for seven-year-old girls at all attainment levels and for seven-year-old boys at average and high attainment levels were found. However, although there have been benefits brought about by e-learning, Kirkwood has criticised the fact that the emphasis has more often been on ‘teaching’ rather than ‘learning’ with technologies [20].

A variety of e-learning models have emerged with on-going e-learning initiatives around the globe. Yet, there is no single ‘best practice’ or ‘right way’ to integrate technology into the classroom to enhance learning and teaching; Lamb proposed that the key is to provide the most effective learning environments for pupils [21].

1.3 E-Learning environments in the 21st century

Learning environments generally refers to the physical locations of places and spaces such as schools, classrooms, or libraries. Earlier research studies on learning environments have emphasised the development and use of instruments to assess classroom environments. Yet, there is new understanding of research and development in learning environments in the 2000s. Hill and Hannafin have suggested that resource-based learning environments should comprise resources, contexts, tools and scaffolds [22]. Blumenfeld, Kempler, and Krajcik have discussed the influence of various features of learning sciences-based learning environments including authenticity, inquiry, collaboration and technology, on learners’ values, competence, relatedness and autonomy, and subsequently motivation and cognitive engagement [23].

In the twenty-first century, learning environments can be virtual, online, and remote. The Partnership for 21st Century Skills suggests that the learning environments of the twenty-first century should include the structures, tools, and communities that inspire learners to attain the knowledge and skills that this era demands of us [24]. As discovered by Lee et al., Internet-based science learning environments have been implemented by teachers in many different forms or combinations of different forms including the use of online resources, stimulations/animation, virtual reality, discussion forums, video-conferencing, online game-based learning and Web 2.0 applications [25]. This understanding of learning environments appears to be focused mainly on two major components: the use of resources and tools on the Internet.

1.4 Use of resources and tools on the Internet

The Internet, as an information hub or ‘global library’, is the most promising medium for deploying educational content [26]. The Internet has revolutionised the way information is shared; up-to-the-minute or archived information covering all sorts of topics is just a few clicks away resulting in a wealth of online resources on the Internet. There are also numerous online tools to help people store, organise, analyze, edit and communicate information. The Internet, with its convenient and constant source of information and tools, is commonly and increasingly used by teachers in the classrooms.

Despite teachers’ attempts to incorporate online resources in their teaching, there is no evidence that these resources are being used either widely or wisely in Hong Kong [1]. Online resources seem to be picked and used haphazardly without much consideration of their appropriateness or how they can work in coordination with the other components of the entire learning environment to benefit pupil learning. In a similar vein, research in other countries shows that most teachers are not making use of the potential of the information and communication technologies to contribute to powerful learning environments [27]. Winn (2002) commented that educational technology research is often found to
be delinked from practice [28]. Therefore, there is an urgent need to examine how teachers create learning environments with Internet resources and tools which are conducive to pupil learning.

Resources contain the core information presented in the resource-based learning environments [22][29]. There are both static and dynamic resources. Static resources refer to data, text, videos clips, and graphics, while dynamic resources refer to data, video clips, calculation tools, Google Earth, Google Maps (ibid) and so on. These dynamic resources undergo frequent, sometimes continual, change.

Various tools could be used to facilitate location, access, manipulation, interpretation and evaluation of resources [22]. The appropriate selection of tools for students by teachers can provide them with engaging experience when performing tasks, increase their perceived competence in succeeding on specific tasks and foster positive peer interactions [23]. The use of tools, including those listed below aid information processing, searching and seeking, information and data collection, organising, collaborating and integrating, and communication [22][30]:

1. Information processing tools provide cognitive support for managing information;
2. Searching and seeking tools aid in locating and accessing information;
3. Information and data collecting tools enable retrieval of the data and information needed;
4. Organising tools help represent and confirm relationships between ideas;
5. Collaborating and integrating tools support the connection and representation of existing and newly gained understanding; and
6. Communicating tools enable the sharing and exchange of ideas.

This chapter aims to analyse how teachers select and use Internet-based resources and tools for an interdisciplinary subject. The analysis is significant for knowledge building on issues related to the integration of Internet into teaching and learning in primary classrooms.

2. Methodology

This study examines how these primary school teachers selected and used Internet resources and tools in an interdisciplinary subject, General Studies, comprising three key learning areas – science education; personal, social and humanities education; and technology education. Based on the changing foci of educational technologies [28] from emphasis on content, format and interaction, to the creation of learning environments, the selection of resources and use of tools from the perspective of the various learning environment studies [22][23][31] are used as a reference for this study to answer the following research questions. First, what are the Internet resources and tools selected for use in primary classrooms? Second, what are the rationales behind these choices and the difficulties encountered?

2.1 Background of the participants

The 12 teachers participating in the study are teaching children of different grade levels. Agnes, Bernice, Carol and Dora are teaching Grade 4, Edward, Felice, Grace, Helena and Ivan are teaching Grade 5 while Jose, Kelvin and Lily are teaching Grade 6. In this study, they are involved in the teaching of science, earth science, health and environment topics in the General Studies curriculum (Table 1). Note that the teachers in this study are represented by pseudonyms.

Table 1 Topics and grades of lesson being studied.

<table>
<thead>
<tr>
<th>Grade</th>
<th>Topic</th>
<th>Content</th>
<th>Teacher</th>
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<tbody>
<tr>
<td>4</td>
<td>A</td>
<td>Connection and movements of bones</td>
<td>Agnes</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>Hong Kong climate</td>
<td>Bernice</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>Animal reproduction and growth</td>
<td>Carol</td>
</tr>
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<td></td>
<td>D</td>
<td>Digestive system</td>
<td>Dora</td>
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<tr>
<td>5</td>
<td>E</td>
<td>Climate in China</td>
<td>Edward</td>
</tr>
<tr>
<td></td>
<td>F</td>
<td>Inquiry of energy-saving light bulbs</td>
<td>Felice</td>
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<tr>
<td></td>
<td>G</td>
<td>Geography of China</td>
<td>Grace</td>
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<td></td>
<td>H</td>
<td>Resist smoking</td>
<td>Helena</td>
</tr>
<tr>
<td></td>
<td>I</td>
<td>Inquiry of sound</td>
<td>Ivan</td>
</tr>
<tr>
<td>6</td>
<td>J</td>
<td>Aerospace technology and our daily lives</td>
<td>Jose</td>
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<tr>
<td></td>
<td>K</td>
<td>Ecological balance</td>
<td>Kelvin</td>
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<tr>
<td></td>
<td>L</td>
<td>Animal classification</td>
<td>Lily</td>
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</tbody>
</table>

2.2 Analysis of teaching designs

The teachers chose the topics that they felt comfortable teaching with Internet resources and tools. The research looks into 12 cases involving Grade 4 to Grade 6 teachers. The teaching designs developed by the teachers were carefully analysed to identify the teachers’ choices and use of Internet resources and tools. The components identified from the
content analysis of the teaching designs were grouped under some main features with reference to the literature on learning environments.

2.3 Pre- and post-lesson teacher interviews

Effective learning requires both knowledge of learner styles and advance preparation on the part of the teacher. Since the teaching designs do not provide information on the process through which the teachers created them nor on how the designs were implemented or how the pupils reacted, semi-structured face-to-face interviews with individual teachers were conducted to gain a better understanding of the rationale behind their choices while searching for and using these resources and tools.

The 12 participating teachers were interviewed face-to-face for about 30 minutes on a one-to-one basis before and after lesson implementation. All interviews were audio-recorded, and transcribed. In the pre-lesson interviews, the teachers were encouraged to describe how they created the teaching designs, particularly how they selected the Internet resources and tools and how they planned to use them in the classroom. The post-lesson interviews, in contrast, focused on the teachers’ reflection on the selection and use of different Internet resources and tools. More ideas discovered from relevant studies and findings from the teacher interviews provided more detailed information to answer the research questions.

3. Findings and Discussion

The analysis of the lesson designs and interview transcriptions resulted in categorization of the teachers’ work into selection of resources and use of tools. The selection of resources included static/dynamic resources and the sources of the resources. The use of tools comprised information processing, searching and seeking; collecting information and data; organising; integrating and communicating.

3.1 Selection of resources

3.1.1 Static and dynamic resources

All the 12 teaching designs involved the use of a range of static resources. Text, videos, pictures or photos, animations and data were selected by the teachers. Text and videos, which contain concrete information or messages, were most frequently selected by the teachers, with 9 out of the 12 teaching designs containing these two types of resources. Half of the 12 teaching designs involved the use of pictures or photos. Data and animations were least commonly chosen. Only the teachers designing ‘Hong Kong Climate’ (Bernice), ‘Climate in China’ (Edward) and ‘Resist smoking’ (Helena) chose data as a type of resources. Hence, it is worth understanding the reasons from the following teachers for choosing data as resources for students’ further work on comparison, identification and differentiation:

‘The data used are weather information such as temperature, humidity and UV level which are useful for the students to identify the difference between the four seasons in Hong Kong.’ (Bernice/PRE)

‘Students can find out the differences in temperature between several cities located in different parts of China by comparing their altitudes.’ (Edward/PRE)

‘The resources are mostly data to show students the number of deaths caused by smoking-related diseases which helps them to realise the fatal effects of smoking on human health.’ (Helena/PRE)

In contrast, dynamic resources were found in only one third of the teaching designs analysed. Since weather information is constantly changing, both the teaching designs of ‘Climate in China’ and ‘Hong Kong Climate’ involved the use of dynamic data. For ‘Inquiry of energy-saving light bulbs’, Felice selected an online calculation tool. The teacher’s views about the use of dynamic resources in generating new data will be of good reference for other teachers:

‘Students can use the online calculator to find out the energy consumed, electricity costs and carbon emission of using Tungsten light bulbs and energy-saving light bulbs, and then compare the results for identifying the effect of using energy-saving light bulbs.’ (Felice/PRE)

Besides, dynamic resources such as Google Earth and Google Maps were chosen by the teachers designing ‘Climate in China’ (Edward), ‘Geography of China’ (Grace) and ‘Aerospace technology and our daily lives’ (Jose). Edward and Jose, for example, talked about the rationale of their selection of these resources to gather data for further analysis tasks,

‘With the use of Google Earth and Google Maps, students will find out the latitudes of different cities and try to figure out why there are differences between the temperatures of these cities.’ (Edward/PRE)

‘I want students to get the weather information of different places around the world from Google Earth so that they can understand how the development of aerospace technology, such as the invention of artificial satellites, can benefit our daily lives.’ (Jose/PRE)

The teachers reflected on their selection of Internet resources after the lesson. They believed that most of the resources that they found were of an appropriate level for their students and that the resources could raise their students’
interest in learning. However, it was revealed from the interview data that the teachers’ guidance was crucial for students’ success in understanding the information provided by the resources. For example,

'I had to pause the music video and reminded students to pay attention to the lyrics.' (Edward/POST)
'I demonstrated how the calculation of carbon emission could be done before starting the activity; however, many students still raised their hands and asked me for help. Therefore, I asked them to stop working and watch me do the demonstration again.' (Felice/POST)

'Since none of the students had used Google Earth, I showed the class how to use it before the activity and then visited every group during the activity time to help the students use the application to find weather information.' (Jose/POST)

3.1.2 Sources of resources

In the analysis of teaching designs, it was found that the teachers had selected the Internet resources from a diverse source including government organisations (e.g. the Hong Kong Observatory for weather forecasts), non-governmental organisations (NGOs) (e.g. Greenpeace for facts about climate change and the energy crisis), academic organisations (e.g. the University of Hong Kong for information about smoking), education-related organisations (e.g. Science Education Net supported by the Ministry of Education of Taiwan for Information of digestive organs), secondary or primary school websites for information of specific topics, business firms (e.g. CLP Power Hong Kong Limited for information on electricity costs), TV stations (e.g. Television Broadcasts Limited in Hong Kong for past TV news reports), search engines (e.g. Yahoo! for electronic versions of newspaper articles), media sharing sites (e.g. YouTube for videos and Flickr for photos), and personal websites. The analysis shows that YouTube was the most popular site for searching for videos while news provided by the search engine, Yahoo!, was most frequently selected by the teachers.

3.2 Use of tools

The analysis of the 12 teaching designs shows that the teachers had selected different types of tools to help students learn with the Internet resources through information processing, searching and seeking, information and data collection, organising, collaborating and integrating, and communication. The reasons for their use and the difficulties encountered were captured from the interviews. The following discussion shows how their design supported student learning and their justification of the use of tools for specific activities.

3.2.1 Information processing

The teachers mostly chose printed worksheets as tools for information processing with the intention of providing cognitive support for students to manage the information collected. The printed worksheets created by the teachers consisted of tables and forms, fill-in-the-blanks, question and answer, matching, multiple choice questions, fill-in-the-diagram and drawing tasks to help the students record, manage and interpret the information or data they obtained from different Internet resources.

Two of the teachers explained their selection of printed worksheets as follows,

'I hope the worksheets can help students construct understanding step by step. And because their [students’] ability in typing Chinese is still pretty low, simply asking them to write down their ideas and answer is more time efficient.' (Agnes/PRE)

'The worksheets can serve as the student’s learning portfolio as well as for recording and for assessment. There are questions for students to answer. There are also tables for students to record information.' (Jose/PRE)

Though the lesson was conducted with primary school students, there was one teacher who attempted to use Google Documents to facilitate student groups to manage the information retrieved from the website. Grace said,

'Different groups of students were reading different information and then they had to fill in the information in the table in Google Documents. After all the groups had filled in the information, a comparison between different landforms in China could be seen clearly.' (Grace/POST)

3.2.2 Searching and seeking

Tools for searching and seeking were not prevalent among the 12 teaching designs involved in this study. Only Grace and Jose selected Google Earth to aid their students in locating and accessing information about the geography of China and the weather forecasts for different cities around the world respectively. Edward chose Google Maps to assist his students in locating and accessing information about the altitudes of different cities in China. Jose found that although the students encountered difficulty in using Google Earth, they were fascinated by it. He said,
The students found using Google Earth a bit difficult because it was new to them. However, they were really engaged. Probably we [teachers] would need to provide more support to students when using Google Earth.’ (Jose/POST)

3.2.3 Information and data collecting

Tools for collecting information and data were found in two teaching designs to enable students to get the data and information needed. In ‘Connection and movements of bones’, Agnes provided each group of students with a mini-notebook with a built-in camera to record a short video clip to demonstrate the results of their inquiry task. Hence, the students could exhibit their understanding of the connection and movements of the elbow through a recorded video of their work. These videos could be viewed afterwards by the whole class for comparison and discussion.

For ‘Inquiry of energy-saving light bulbs’, Felice arranged the students to use the ‘Energy Calculator’ from CLP Power Hong Kong Limited1 to calculate the energy consumed, electricity cost and the ‘Carbon Calculator’ from The Climateers2 to find out the carbon emission of Tungsten light bulbs versus energy-saving ones. The basis of the use of these tools was to work out the exact amount of energy consumed, electricity cost and carbon emission for using two kinds of light bulbs so that comparisons could be made easily and decision on the selection of light bulbs could be made based on the comparison results.

3.2.4 Organising

Concept mapping was selected by three teachers (Bernice, Edward and Jose) as a tool to help the students organise their ideas or information. These organising tools helped the students represent and confirm the relationships between ideas. Although there are numerous free online concept mapping applications, none of the teachers had used any of them. The only reason is that they believed that pen-and-paper concept maps served the same purpose and are easier for students to manage.

3.2.5 Collaborating and integrating

There is a need for teachers to integrate tools to support students’ connection and representation of existing and newly gained understanding. However, among the 12 cases, only Agnes asked the student groups to create an artefact, a short video clip, to demonstrate the results of their inquiry experiment, which required the students to integrate what they had learned in the lesson about the connection and movements of bones. Agnes shared the purpose of designing this activity in the interview. She said,

‘The writing ability of Primary 4 students is still relatively low. I think it’s easier for them to use sound and images to represent their learning.’ (Agnes/PRE)

3.2.6 Communicating

Communicating the outcomes is an important part of student learning for the sharing and exchange of ideas. The teachers in this study used different ways to help the students communicate their learning outcomes with each other. Oral presentation in class by groups or by individual students was found in all of the teaching designs analysed. It is not only the most common and direct way to tell others what one has learned, it is also the easiest and fastest way to get feedback from others. Agnes discussed why she preferred presentation in class over electronic communication methods:

‘Although students might be familiar with the use of instant messenger or blogs, they’re not very good at providing feedback to others. So I’d rather stress in-class face-to-face sharing between groups.’

(Agnes/PRE)

Nowadays, the Internet has become a read-write Web, i.e. Web 2.0. Although Web 2.0 tools are abundant on the Internet, their use by the teachers involving in this study was uncommon. Only three (Agnes, Jose and Lily) out of the 12 teachers endeavoured to use Web 2.0 tools. Agnes selected the osTube for her students to share the short video clips they had created; Jose used Google groups as a platform to let students from different groups share their opinions on the contribution of artificial satellites to our daily lives; Lily designed an online form with Google Spreadsheets to let students express their ideas on how dolphins and penguins should be classified. Both Jose and Lily displayed and discussed the results with the class immediately after the students groups had input their information into the online platforms.

1 The largest vertically-integrated electricity generation, transmission and distribution company in Hong Kong serving 80 percent of the territory's population.

2 It acts as the nucleus of individual and organizational actions to tackle climate change in Hong Kong.
4. Conclusion

The rapid march of information and communication technology has almost changed every aspect of our daily lives. It has also transformed teaching and learning. Over the years, research studies had provided evidence for the benefit of using the Internet in teaching and learning. The Internet allows access to both up-to-the-minute and archived information from government organizations, global corporations, education as well as non-education institutions, offering a practical solution for the data collection process of inquiry-based learning in classrooms [32][33].

However, McCormack and Jones raised the concern that learners who have received mainly traditional didactic teaching might have problems adapting to learning with Web-based learning activities [34]. Yet, the concern about using the Web nowadays is centred on the teachers who have had a very different growing up and learning experience from their students. The gap of understanding between students and the teachers is rapidly growing [35]. It is reasonable to believe that teachers who grew up in an even more traditional learning environment would have problems adapting to teaching with the Internet. Indeed, research has found that most teachers fail to utilise the potential of ICT to contribute to powerful learning environments [27]. The findings of the present study with analysis of teachers’ designs reflects that the use of text and videos is the most prevalent, followed by pictures or photos and animations, all are non-interactive resources. It also appears that the use of online tools in primary classrooms is an uncommon practice and the teachers are relying heavily on printed worksheets instead. The analysis of teaching plans and teacher interviews also suggests that certain resources and tools are under-used and ways to support students to make better use of the resources and tools, e.g. concept mapping tools, Google Earth, are recommended. This provides useful hints for teachers to select appropriate resources and perhaps diversify their selection. The sharing from teachers on how they used tools from the Internet to help the students process information, searching and seeking, collecting information and data, organising, collaborating and integrating, and communicating, are of value to teachers who wish to broaden the use of Internet tools with primary students.

What’s more, the results from the interviews reveal that teachers’ selection and use of Internet resources and tools is mostly governed by the availability of different resources and tools, and hindered by students’ limited ICT skills. The findings have raised concerns regarding both the availability and diversity of online materials as well as the ICT capability of primary students. Yet, the suggestions from the teachers to provide more support to students to use certain tools implies support that addresses students’ needs is crucial in expanding the use of Internet-based resources and tools for learning.

Our future studies will focus more on reporting the benefits to student learning with the growing discussion on the use of Internet in classrooms. These discussions include the use of Internet personalises student-teacher relations, increases enjoyment of learning, and motivates students to learn [36]; as well as improving outcomes in the affective domain (e.g. attitudes and motivation), learners’ conceptual outcomes (e.g. conceptual change) and non-conceptual outcomes (e.g. problem-solving skills), and allowing for more learner control [25].

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References


