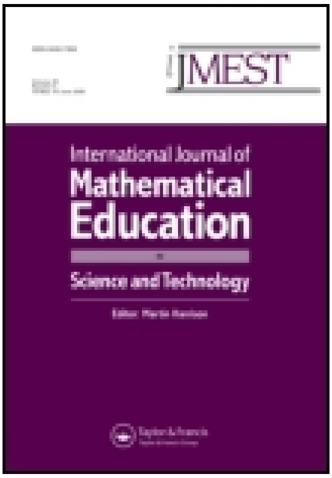

International Journal of Mathematical Education in Science and Technology
Publication details, including instructions for authors and subscription information:
http://www.tandfonline.com/loi/tmes20

An assessment of mathematics teachers' Internet self-efficacy: implications on teachers' delivery of mathematics instruction

Adedeji Tella [a]
[a] Faculty of Education, Department of Science, Technology, and Mathematics Education, Osun State University, Ipetu-Ijesa Campus, Nigeria
Published online: 18 Feb 2011.

International Journal of Mathematical Education in Science and Technology, Vol. 42, No. 2, 15 March 2011, 155–174

Taylor & Francis
Taylor & Francis Group

An assessment of mathematics teachers' Internet self-efficacy: implications on teachers' delivery of mathematics instruction

Adedeji Tella*

Faculty of Education, Department of Science, Technology, and Mathematics Education, Osun State University, Ipetu-Ijesa Campus, Nigeria

(*Received 20 April 2010*)

This study examined the mathematics teachers' Internet self-efficacy and its possible influence on the delivery of mathematics instruction. The participants were 90 mathematics teachers selected from various schools in five local government areas of Osun State, Nigeria. The results demonstrated that to a great extent mathematics teachers have high Internet self-efficacy and that correlation exists between mathematics teachers' age, Internet usage and Internet self-efficacy. Irrespective of gender, mathematics teachers have the same level of Internet self-efficacy. Moreover, Internet self-efficacy and usage were revealed to drastically improve the way teacher teach mathematics and conduct research. Upon these findings, it was recommended that mathematics teachers who do not know how to browse and search the Internet should consider doing so now without wasting much time. There is also the need to increase Internet usage, on the part of the mathematics teachers who just begin using the Internet. They need to do this considering the fact that increased usage leads to high Internet self-efficacy. Moreover, it is high time to close the technology gender gap which has been in existence since a long time. This can start from the mathematics teachers.

Keywords: mathematics teacher; instructional delivery; Internet; Internet self-efficacy; Nigeria

1. Introduction

Information and communication technologies are said to be reshaping the material basis of society [1]. Factually speaking, information and communication technology (ICT) has the capacity to support a wide range of learning activities. Those technologies have been integrated into teaching approaches of different training programmes. ICT can enhance the effectiveness of information presentation to teachers and stimulate their interest using various Internet and multimedia technologies [2]. Duke [3,4] points out that ICT capability should, in principle, represent a shift from content memorization to learning to search and learning to learn. In future, the role of teachers will still result in improved student learning, but will require the teacher to have broader capabilities than content knowledge and pedagogy skills. Those teachers will need to be technologically competent and

*Email: dejtell@yahoo.com

ISSN 0020–739X print/ISSN 1464–5211 online

DOI: 10.1080/0020739X.2010.519798
http://www.informaworld.com

information-literate [5]. Teachers must be equipped well to respond and guide students in centred learning environments.

Educators the world over have achieved great success at integrating computers with Internet connections into education. The use of the Internet as a medium for providing educational experiences is now a widespread phenomenon with a number of forces driving its proliferation [6]. Distance educators hail Internet-based instruction as a way to reach underserved populations [7]. Administrators, on the other hand, often favour the use of Internet-based learning as a means of conserving resources [8]. Since the inception of alternative modes for delivering educational content audio tape, video tape, satellite, video *via* telephone, computer, and most recently, the Internet, researchers have studied how these delivery methods affect the learning process [9]. While significant research has been done, questions still remain about whether technology, especially the Internet, affects the learning process.

Teachers' sense of efficacy is a judgement about capabilities to influence student engagement and learning, even among those students who may be difficult or unmotivated [10]. In this study, therefore, Mathematics Teachers' Internet Self-Efficacy refers to teachers' judgement about their capability to use the Internet in order to influence their student engagement in the subject and improvement in the teachers' delivery of mathematics instruction. Teachers with a strong sense of efficacy tend to exhibit greater levels of planning, organization and enthusiasm and spend more time teaching in areas where their sense of efficacy is higher, whereas teachers tend to avoid subjects and topics where their efficacy is lower. They tend to be more open to new ideas, more willing to experiment with new methods to meet the needs of their students better, and be more committed to teaching. They persist when things do not go smoothly and are more resilient in the face of setbacks. And they tend to be less critical of students who make errors and to work longer with a student who is struggling [11–14].

Ross [15] reviewed 88 teacher efficacy studies in pre-college settings and identified potential links between teachers' sense of efficacy and their behaviours. Ross suggested that teachers with higher levels of efficacy are more likely to (1) learn and use new approaches and strategies for teaching, (2) use management techniques that enhance student autonomy, (3) provide special assistance to low achieving students, (4) build students' self-perceptions of their academic skills, (5) set attainable goals and (6) persist in the face of student failure.

Observation shows that the deployment of Internet in some part of Osun State of Nigeria started some 15 years back. Since then, mathematics teachers have begin to make use of this opportunity to improve themselves and at the same time improve the teaching of mathematics and their methods of delivering the subject. Currently, mathematics teachers may have growing opportunities to improve their teaching by utilizing the Internet; therefore, their self-efficacy regarding the Internet (called Internet self-efficacy in this study), which may have considerable impacts on their views, usages and learning outcomes of their students in mathematics, should become an important research topic for educators as remarked by Hill and Hannafin [16], Joo et al. [17], Tsai and Tsai [18] and Yi and Hwang [19]. For example, Tsai and Tsai [18], Liang and Tsai [20], and Eachus et al. [21] have concluded that Internet self-efficacy can foster better information searching strategies and learning outcomes in Internet-based environments, together with instructional delivery. Hill and Hannafin [16] have shown a similar finding that self-efficacy influences the strategies utilized in web-based learning. It is observed that from the Nigeria context, studies on students' mathematics self-efficacy, students' self-efficacy in other subjects and generally the relationship between self-efficacy and other personality variables have been conducted [22–26], but no study has ever focused on mathematics teachers' Internet self-efficacy. In the light of this, therefore, it is noted that since the deployment of the Internet in Osun State of Nigeria in the last 15 years, there have been no researches or studies investigating mathematics teachers' Internet self-efficacy and its implication on their delivery of mathematics instruction. It is this development that prompts the researcher to conduct this study. It is expected that the outcomes of the study will assist the mathematics teachers, in the state and beyond, in improving their efficacy in the use of Internet.

2. Literature review

Efficacy is the ability to produce an effect, usually a specifically desired effect. Self-efficacy, then, is the perception of one's own ability to produce an effect. Measuring self-efficacy can allow us to better predict behaviour outcomes, including attributes such as influence on choices, thought patterns, effort, resilience, emotional reactions and perseverance [27,28] Self- efficacy is one of the building blocks of successful self-regulation, and self-efficacy can impact the success of online learning [29]. According to Compeau and Higgins [30], self-efficacy towards technology can be measured using three main categories: Magnitude (the belief that you can do a computer task), Strength (the belief that you can do a computer task well) and Generalizability (the belief that you can do a certain computer task well, even if the environment has changed).

Maddux and Gesselin [31, p. 219] have defined self-efficacy in these terms; *Self-efficacy beliefs are beliefs (accurate or not) about one's competencies and one's ability to exercise these competencies in certain domains and situations*. These writers suggest that self-efficacy is an evaluation of how well one can mobilize one's cognitive, physical and emotional resources to accomplish specific goals. The concept of self-efficacy therefore embraces all the beliefs that individuals have about their own capabilities to carry out particular tasks successfully and to execute specific courses of action necessary to produce desired outcomes [27,28].

An individual's self-efficacy beliefs tend to be domain-specific rather than general. For example, one may feel efficacious in relation to writing an essay but incompetent in solving mathematical problems. Or one may feel efficacious in relation to non-academic pursuits but much less capable in academic tasks. According to Klassen [32], personal estimates of self-efficacy are really a form of metacognition or self-awareness; and self-efficacy is closely bound up with an individual's capacity to identify the causes of his or her successes and failure (*attributional style*) [33].

Our perceived self-efficacy is a major factor in determining our willingness to take on challenges in life. Self-efficacy determines how much effort people will put in to a task, how long they will carry through a task if it is difficult, and ultimately the degree of success achieved [34,35]. Positive self-efficacy beliefs can have a beneficial impact on academic performance [36]. Bandura [37, p. 812] has remarked, 'the stronger the perceived self-efficacy, the higher the goal challenges people set for themselves and the firmer their commitment to them'. High perceived self-efficacy in a particular domain such as school learning is important because it enhances a student's motivation and is therefore a causal factor in future academic achievement [38–40]. In contrast, approaching a task with low self-efficacy feeds a self-perpetuating cycle of learned helplessness, usually resulting in poor outcomes [41].

Schunk and Pajares [42] have pointed out that, compared with students that doubt their learning capabilities, those who feel efficacious for learning participate more readily, work harder, persist longer when they encounter difficulties and achieve at a higher level. Academically underachieving students (such as those with special learning disabilities SpLD) have their self-efficacy beliefs constantly weakened because they see other students with less abilities being more successful. The situation explained here is also applicable to teachers.

3. Internet self-efficacy

Eastin and LaRose [43] remark that 'Internet self-efficacy, or the belief in one's capability to organize and execute courses of Internet actions required to produce given attainments, is a potentially important effort to close the digital divide that separates experienced Internet users from novices'. The authors explain that knowledge barriers to initial Internet adoption and comfort and satisfaction issues faced by users who are new may be construed as self-efficacy deficits. According to Bandura [27, p. 3], 'self-efficacy is the belief in one's capabilities to organize and execute the courses of action required to produce given attainment'. According to Pajares [44, pp. 725–734], 'self-efficacy is the individuals' perceived capabilities to obtain designated types of performances and to achieve specific results'. The construct of self-efficacy represents one core aspect of Bandura's social cognitive theory [27,45,46]. The theory posits that self-efficacy makes a difference in how people think, feel and act. Low self-efficacy is associated with depression, anxiety and helplessness. Persons with low self-efficacy also have low self-esteem, and harbour pessimistic thoughts about their accomplishments [47]. People with high self-efficacy choose to perform more challenging tasks and are creative [27].

Eastin and LaRose state that 'Internet self-efficacy focuses on what a person believes he or she can accomplish online now or in the future. It does not refer to a person's skill at performing specific Internet-related tasks, such as writing HTML, using a browser, or transferring files, for example. Instead, it assesses a person's judgment of his or her ability to apply Internet skills in a more encompassing mode, such as finding information or troubleshooting search problems. Internet self-efficacy differs from Computer self-efficacy as the belief that one can successfully perform a distinct set of behaviors required to established, maintain and utilize effectively the Internet over and above basic personal computer skills', adding that 'prior research on Internet self-efficacy has been limited to examining specific task performance and narrow behavioral domains rather than overall attainments in relation to general Internet use' [43]. They describe a study on 'Internet self-efficacy and the psychology of the digital divide', finding that, 'prior Internet experience, outcome expectancies and Internet use were significantly and positively correlated to Internet self-efficacy judgments'. They cite Ren [48] who 'reported a measure of self-efficacy specific to searching for government information sources. He found out that self-efficacy perception positively related to task performance and the amount of use' and Oliver and Shapiro [49] who 'reported that the stronger the person's self-efficacy beliefs, the more likely he or she was to try to achieve the desired outcome'.

This could also be applicable to the mathematics teachers: the stronger their self-efficacy, the more they are expected to carry out tasks using the Internet. It is also expected that their Internet self-efficacy should be positively related to the expectation of positive outcomes of Internet use.

It is within the specific context of information and communication technologies that this article examines mathematics teachers' Internet self-efficacy, with specific reference to how this influence their instructional delivery in mathematics. We are amidst a revolution involving virtual learning environments and identifying, measuring and manipulating any factor that might impede our access to, utilization of, or success with virtual learning, which should be a principal concern of educational research and pedagogical practice. There are many reasons or factors that make both access to and utilization of the Internet both desirable and necessary. Its ubiquitous nature has deemed access to and familiarity with the Internet an assumption of the modern age; not using the net may even be, as suggested by Wolfinbarger et al. [50] socially undesirable. However, although the human–computer interface is becoming increasingly intuitive, for inexperienced users there are still formidable problems. The Internet has the potential to impact on many facets of our daily lives, but for many people the ability to exert that power is limited by an inability to control that potential. This inability may be real in that the individual genuinely may not have the necessary skills or abilities or it may simply be a belief which results in incapacity and poor motivation, as in the case of self-efficacy expectations [51]. In their study examining Internet usage in older individuals, Wolfinbarger et al. [50] have already demonstrated the effect of self-efficacy beliefs in determining propensity and intensity of Internet use, with positive beliefs associated with earlier adoption of and increased use of the Internet.

The nature of self-efficacy as an ego-centric construct demands that it be measured directly, rather than indirectly and for this reason self-efficacy is usually measured using self-report scales [51]. Over the past decade, a number of scales have been developed to measure various aspects of Internet self-efficacy. The early measures tended to focus on a few specific types of Internet behaviour, for example creating bookmarks or entering the address of a web page correctly [52]. Similarly, Ren [48] reports on a self-efficacy scale designed to evaluate searches for government information. A more general measure of Internet self-efficacy was developed by Eastin and LaRose [43] and although the psychometric properties of this scale were adequate, the domain of behaviours examined was very limited and the scale itself only contained eight items.

A reports of gender differences in computer user self-efficacy was given by Cassidy and Eachus [51], validity of the Web use self-efficacy WUSE was examined according to the known groups method. The WUSE (and its subscales) successfully distinguished between groups of males and females, with males scoring significantly higher on total scale scores and all subscales [53]. It is suggested that the gender difference reported here may be an artefact of experience and expertise as, males reported themselves as regular users for a significantly longer time than females. In addition, some evidence was reported for an age-dependent effect, with older participants having lower WUSE scores than younger participants, and for place of Internet access, with home-only access group scoring lower than work-only, and home-plus-work gaining the highest scores [53]. Both these effects were anticipated on the basis of the findings reported by Cassidy and Eachus [51] and Wolfinbarger et al. [50] and can be considered further evidence for the validity of the scale.

Several other studies have found that there is a gender gap with respect to use of Internet [54]. Gender is a major predictor of Internet use. Males seem to enjoy browsing the Internet for enjoyment while females tend to only use it for work-related purposes [55, pp. 87–202]. In a study of highly successful students, Ford, Miller and Moss found that 'female tended to experience more difficulty finding information on-line, felt less competent and comfortable using the Internet, use the Internet less frequently than males, and less varied set of Internet applications' [56]. Majid and Abazova [57] found a similar result in studying faculty members. While males tended to have better computing skills than females, age and year of obtaining highest educational qualifications were also important factors in establishing computer skills. Recent research studies have reported the existence of digital divide between genders in terms of access to, and use towards them, frequency of computer and Internet use, and self-assessment of computer and Internet competency [58–63]. Nevertheless, it is encouraging that some other research studies conducted provides indication of a change in traditional cultural and social bias which views occupation with ICT as a typically male activity [64]. Gender gap seems to be narrowing and even disappearing regarding access to and use of computers the Internet and attitudes towards them. However, it seems more persistent regarding frequency of computer and Internet use and self-assessment of computer and Internet competency [65–68]. The result by Mathews and Schrum [69] indicates that self-report of the amount of time spent using the Internet for academic work in Australia showed females spending significantly greater time online and engaged in academic work than males. A significant difference in the quantity of Internet use for students was attributed to differences in the perception that ones effort lead to one's good grades. The findings of Duggan et al. [70] show that there was no gender difference in terms of the attitude towards the Internet for either education use or of the grade point average. Tsai et al. [63] found differences in the type of resources accessed by male and female students. The males used interactive resources significantly more than the females, whereas, females used passive resources more than males.

In the light of the above review, this study is design to examine the mathematics teachers' Internet self-efficacy with its influence on mathematics instructional delivery. To achieve this, four research questions were developed. These are

(1) What is the extent of the mathematics teachers Internet self-efficacy?
(2) What are the correlation between mathematics teachers' age, Internet usage and Internet self-efficacy?
(3) What are the differences between mathematics teachers' Internet self-efficacy based on gender?
(4) How has mathematics teachers' Internet usage and self-efficacy influenced their teaching of mathematics?

4. Methodology

This type of my research employs a mixed method. In other words, it will involve the use of both quantitative and qualitative methods. Qualitative orientation will be used so that the research can gather in-depth information from the respondents on the ways Internet has influenced their way of delivering Mathematics instruction. Quantitative methods will be used to gather structure numerical data from the respondents. The essence of this is to be able to capture large sample to allow generalization of the findings to the larger population.

Manias [71] argued that using mixed methods refers mainly to the use of multiple methods of data collection with a view to increase the reliability of observation and not specifically to the combination of qualitative and quantitative approaches. Babbie and Mouton [72, p. 275] explain the advantages of mixed methods to include: 'overcoming the deficiencies that flow from one investigator and the potential for enhancement of the validity of the study findings'. Polit and Hungler [73, p. 259] buttress this by pointing out that a researcher can be much confident about the validity of the findings when they are supported by multiple and complementary types of data.

This study employed mixed methods, qualitative and quantitative. Therefore, the philosophy that underpin the study is positivist and interpretive. Positivists supposedly believe that reality is separate from the individual who observes it. They apparently consider subject (the researcher) and object (the phenomena in the world that as their focus) to be two separate independent things. In short, positivistic ontology is alleged to be dualistic in nature [74]. On the other hand, interpretivists believe that reality and the individual who observes it cannot be separated [75,76].

Often, these two paradigms root their arguments in Husserl's [77] notion of life-world in a nutshell that our perceptions about the world are inextricably bound to a stream of experiences we have had throughout our lives. The life-world has both subjective and objective characteristics. The subjective characteristics reflect our perceptions about the meaning of some world. The objective characteristics reflect that we constantly negotiate this meaning with others with whom we interact. In other words, it is objective in the sense that it reflects an inter-subjective reality. Both these philosophies will be used in this study, because a positivist associates with the use of quantitative method and an interpretive associates with the use of qualitative method [78,79].

5. Design

In an attempt to find solution to the problem in this study, a case study research design was used. Interviews and Questionnaires were involved to gather information from mathematics teachers selected across secondary schools in five local government areas of Osun State in Nigeria. These are Ejigbo, Ola Oluwa, Iwo, Awo and Ayedire local government areas. The term case study means different things to different people, and this is often a source of confusion and misunderstanding [80]. The case itself may take many forms, although the focus of enquiry is usually small in scale, as not only are case studies frequently characterized by micro level research but are also typically descriptive and qualitative in nature. As an approach to research, case study, however, has much to offer in terms of both theory and practice. The choice of case study in this research is based both on its own nature as well as the specific attributes of the research. Another important reason for employing case study in this research is that it provides a basis for the closer integration of theory and practice. Case study research is considered the most appropriate methodological tradition for use in this study, given that the purpose of the study which emphasizes the context of examining the mathematics Internet self-efficacy and how this influence the delivery of mathematics instruction. To gather accounts of different realities constructed by mathematics teachers from various local government areas in Osun State of Nigeria, both qualitative and quantitative methods were drawn upon. Questionnaire and face-to-face interviews were adopted to gather information from the sample of the study.

6. Population, sample determination and selection

To ensure adequate sample in this study, sample was determined using a purposive method. The sample was determined by taking census of mathematics teachers in all the participating schools. The target population of the study was the mathematics teachers in the public secondary schools throughout the state. The sample for the study was selected from these above-named secondary schools.

A purposive sampling technique was used to randomly select mathematics teachers from across secondary schools in the selected five local government areas of Osun State, Nigeria. With this purposive sample selection, census of mathematics teachers in each of the participating school was taken. This was to increase the number of participants in the study. Eventually, the result of the sample selection for each local government revealed the following: Ejigbo, 20; Ola Oluwa, 18; Iwo, 25; Awo, 15; and from Ayedire, 12. This indicates that 90 mathematics teacher participated in the study. Figures 1–4 contain the summary of the demographic information of the study participants. From among these 90 mathematics teachers, head of mathematics departments in each participating school were interviewed. They were 15 in number.

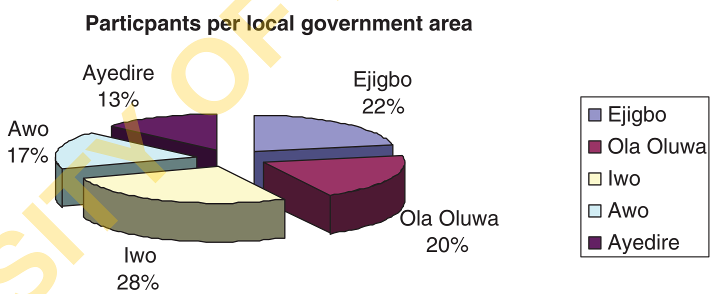

Figure 1. Participants per local government area.

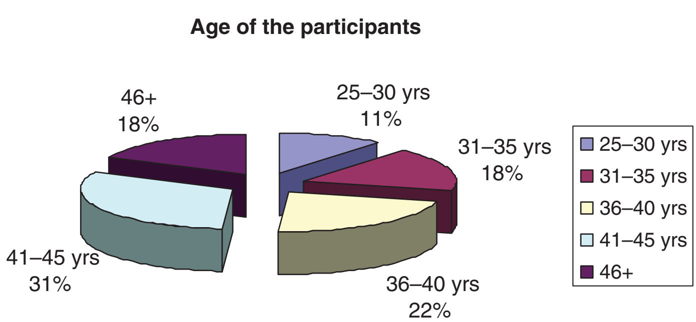

Figure 2. Age of the participants.

7. Instrument

7.1. *Questionnaire exploring Internet self-efficacy*

A total of 10 items were included to assess mathematics' teachers Internet self-efficacy, which were adapted from the items developed by Tsai and Tsai [18], Tsai and Lin [81], Wu and Tsai [82], and Peng et al. [83]. Internet self-efficacy indicated the self-perceived confidence and expectation of using Internet. As proposed by Tsai and Lin [81], Wu and Tsai [82] and Peng et al. [83], the 10 items were divided into two factors (scales), the first one addressed mathematics teachers' Internet self-efficacy in general (called General Internet Self-Efficacy scale, shortly GISE; 6 items,), while the second one probed their efficacy for Internet-based communication or interaction (called Communicative Internet Self-Efficacy scale, shortly CISE; 4 items). The following presents two sample items for the scales, respectively: 'I can search information on the Internet by using keywords', and 'I think I can talk to other mathematics teacher in online chatrooms'. Mathematics teachers' Internet self-efficacy was evaluated by a 5-point Likert scale from 'strongly agree' to 'strongly disagree', not as exactly the same as that employed by original study [i.e. 18]. The items in the questionnaire were validated by two researchers. Questionnaire responses representing their self-efficacy towards the Internet were scored as follows. A 'strongly agree' response was assigned a score of 5 and a 'strongly disagree' response was assigned a score of 1. The alpha reliability coefficients for these two

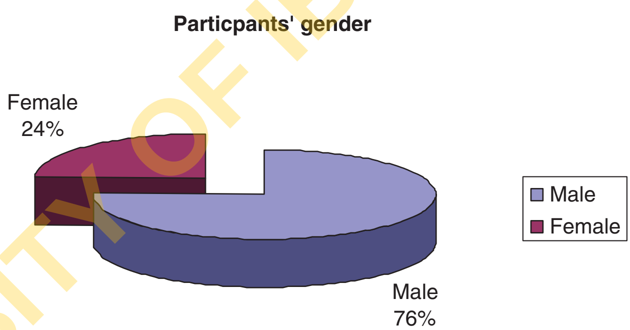

Figure 3. Participants' gender.

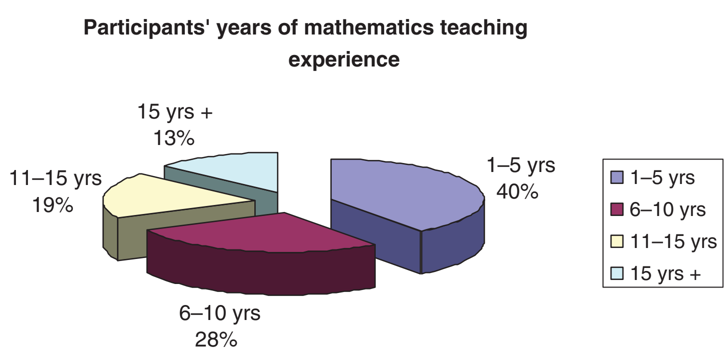

Figure 4. Participants' years of mathematics teaching experience.

scales were 0.91 and 0.89, and the overall alpha was 0.90. These values suggested high reliability for assessing teachers' Internet-efficacy by using the scales.

7.1.1. *Internet usage questionnaire (Items)*

To assess the Internet usage of the participants, they were asked to indicate the frequency of their Internet use. Daily use was rated as 4; 2–3 times a week was rated as 3; 2–3 times a month was rated as 2; and once a month was rated as 1. Moreover, number of hours of use of the Internet was also required from the participants. This was rated in Appendix.

8. Procedure for data collection

Data were gathered during mathematics teachers association's meeting. At the end of the meeting, it was announced that teachers who are users of the Internet should gather on one side. After their gathering, they were briefed of the purpose for that announcement. All those indicated were 90. Their distribution per local government has been described in the previous discussion. The questionnaire was later administered to them. After questionnaire administration, the heads of mathematics department in respective schools were identified and were interviewed.

9. Interview

Face-to-face interview was conducted for the head of mathematics department and assistants in each selected schools. A total of 15 heads of mathematics department, were censured from among the participants. They were interviewed to provide answers to the fourth research question.

10. Results

The results obtained on the analysis of the fourth research questions are presented as follows.

Research questions 1–3 on the study were answered through the data obtained from the Internet self-efficacy and the Internet usage questionnaire. On the other hand, research question four was answered through the face-to-face interviews with the 15 heads of mathematics departments.

Figure 1 reveals that the highest number of mathematics teachers were from Iwo local government areas of Osun State 28%. This is followed by mathematics teachers from Ejigbo local government 22%. While mathematics teachers from Ola Oluwa were 20%, Awo 17%, and Ayedire 13%, in that order.

Figure 2 reveals the age of the mathematics teachers who participated in the study. The figure shows that 31% were within the age of 41–45 years, 22% were within 36–40 years; 18% each were within 31–35 and 46 years and above, while 11% were from the age group of 25–30 years.

The gender of the participants in Figure 3 reveals that 76% of the mathematics teachers who participated in the study were male and 24% were female. This confirms the gender difference in the mathematics teaching and learning that has been existing over the years.

The number of years of experience of mathematics teaching by the participants as revealed in Figure 4 shows that 40% have 1–5 years of teaching mathematics, 28% 6–10 years, 19% 11–15 years and 13% 15 years and more.

10.1. *Research question 1*

The research question states, 'what is the extent of the mathematics teachers Internet self-efficacy'? To answer this question, teachers were asked to respond to the 10 items on Internet self-efficacy scale. The result is presented in Table 1.

The results in Table 1 above reveal that mathematics teachers have high Internet self-efficacy. This was confirmed by the responses to the Internet self-efficacy items. The results reveal high percentage for all the positive items in the table. Furthermore, on the negative items; for instance items 4 and 8, the report still remains with the fact that percentage of 'strongly agree' and 'agree to the items' were higher than the 'not sure', 'strongly disagree' and 'disagree'. These, in turn, indicate high Internet self-efficacy.

10.2. *Research question 2*

The research question states, 'what are the correlation between mathematics teachers' age, Internet usage and Internet self-efficacy'? To answer this research question, responses to Internet usage items of the questionnaire and Internet self-efficacy with age were correlated. Age was coded 25–30 years: 1; 31–35 years: 2; 36–40 years: 3; 41–45 years: 4; 46 years and above, 5. The result of the correlation is presented in Table 2.

The Pearson product moment correlation results reveal in Table 2 that correlation exit between age, Internet usage and Internet self-efficacy. The results show that Internet usage correlates with Internet self-efficacy with $r = 0.49$, and age $r = 0.46$.

10.3. *Research Question 3*

The research question states, 'what are the differences between mathematics teachers' Internet self-efficacy based on gender'?

The Table 3 shows the gender difference in mathematics teachers' self-efficacy. The result reveals that the teachers' calculated value = 1.27 greater than the teachers' table value 0.98 at $p = 0.05$ and 88 degree of freedom (df). This suggests that mathematics teachers have the same Internet self-efficacy irrespective of their gender.

10.4. *Research question 4*

The research question states, 'how have mathematics teachers' Internet usage and self-efficacy influenced their teaching of mathematics'? To answer this research question, teachers were asked to indicate whether they use the Internet. All the 15 interviewed respondents indicated that they use the Internet to get more facts when they want to teach their students. To buttress this question, they were asked to indicate whether or not their usage of Internet and Internet self-efficacy has really influenced their delivery of mathematics instruction. The majority of the head

Table 1. Extent of mathematics teachers' Internet self-efficacy.

S. No.	Internet self-efficacy	SA	*A*	NS	*D*	SD
1	I can search information on the Internet by using key words	45 (50%)	28 (31%)	7 (8%)	2 (2%)	8 (9%)
2	I think I can talk to other mathematics teachers in online chat room.	35 (39%)	35 (39%)	10 (11%)	5 (5.5%)	5 (5.5%)
3	I rarely have problems finding what I am looking for on the Internet.	41 (46%)	29 (31%)	5 (5.5%)	5 (5.5%)	10 (11%)
4	I sometimes find using search engines like Google and Yahoo can be difficult.	10 (11%)	8 (9%)	17 (19%)	25 (28%)	30 (33%)
5	I wouldn't have any problems downloading relevant information for the students for solving mathematics problems.	36 (40%)	32 (36%)	12 (13%)	3 (3%)	7 (8%)
6	I can usually sort out any access problems I may have on the Internet.	32 (36%)	48 (53%)	2 (2%)	5 (5.5%)	3 (3%)
7	I find using e-mail very easy.	50 (56%)	23 (26%)	2 (2%)	7 (8%)	8 (9%)
8	I much prefer using letters, GSM or telephone to communicate with people rather than the Internet.	5 (5.5%)	8 (9%)	2 (2%)	31 (34%)	44 (49%)
9	I use the Internet to communicate professionally with fellow mathematics teachers.	35 (39%)	27 (30%)	8 (9%)	10 (11%)	10 (11%)
10	I use the Internet to get news update on mathematics teaching.	40 (44%)	38 (42%)	2 (2%)	7 (8%)	3 (3%)

Table 2. Correlation between age, Internet usage and Internet self-efficacy.

Variables	Internet self-efficacy	Internet usage	Age
Internet self-efficacy	1.000		
Internet usage	0.486	1.000	
Age	0.455	0.442	1.000

Table 3. Mathematics teachers' Internet self-efficacy and gender.

Variables	No.	Mean	SD	df	Teachers' calculated value	Teachers' table	*p*
Male	90	38.55	15.87	88	1.27	0.98	0.05
Female	90	42.10	14.30				

of mathematics department interviewed indicated that since they started using the Internet as a medium to get more information in addition to information in textbooks and other sources, the way they deliver mathematics instruction has drastically changed. They added that even the change also reflects in the performance of the student. One of the respondents pointed out emphatically saying that 'the Internet has had a positive impact on my delivery of mathematics instruction. Most often my heart is filled with joy when I see the way students contribute to the lesson, raising comments and ask questions'.

To know how self-efficacious the mathematics teachers were in term of the level of the Internet skills they have, they were asked to rate themselves on five points levels: very high, high, average, low and do not know. Majority (13 out of the 15) of them interviewed, 87%, indicated very high and high rating while the rest 13% indicated average and low.

Aside from the above-mentioned rate, they were also asked to indicate how their efficacy in the use of Internet and their usage of Internet have influenced their students' academic mathematics academic efficiency. The response given includes the fact that their use of conventional documents has decreased and their dependency on the Internet has increased. In addition, it was pointed out that Internet is helping them to expedite action on their mathematics research process and moreover, it is improving their professional competence in the teaching and delivering of mathematics instruction.

Finally, they were asked whether or not their Internet self-efficacy affects or improves their research and teaching of mathematics as a subject. Almost all the interviewed respondents indicate the fact that their research in mathematics and teaching have improved following their use and their Internet self-efficacy. Ways in which respondents indicated include the fact that their mathematics research and teaching have, improved because they are now able to get up-to-date information on the recent development in mathematics research and teaching and this has contributed a lot to them. One respondent said that 'my use of the Internet and the self-efficacy I have in using the system has help me a lot. Apart from this I can tell you that I wrote my first textbook on mathematics some few months ago and am trying putting the second one together. This I think will be in circulation toward the end of 2009'. Other improvements indicated are quick update of mathematics research and communication, faster publication of communication quick access to mathematics databases on the Internet around the world and saving of time.

11. Discussion

This study has examined the mathematics teachers' Internet self-efficacy and its possible influence on the delivery of mathematics instruction. The results so far have demonstrated that to great extent mathematics teachers who participated in the study have high Internet self-efficacy and that correlation exists between mathematics teachers' age, usage and their Internet self-efficacy. Moreover, the results demonstrate conclusively that irrespective of gender mathematics teachers have the same Internet self-efficacy, their Internet self-efficacy and usage have drastically improved the way they teach the subject and do research.

The first research question which reveals that mathematics teachers have great extent of Internet self-efficacy is an interesting and welcome development. As pointed out in the literature, the repeated engagement in one activity leads to the tendency to increasing one's efficacy in that activity. This is true of the mathematics teachers in this study. Furthermore, the revelation of correlation between age, Internet usage and mathematics teachers' Internet self-efficacy is another interesting result revealed in this study. This corroborate the earlier finding by Eachus and Cassidy [53] who conducted a study that revealed some evidence for an age-dependent effect, with older participants having lower WUSE scores than younger participants. Similarly, the finding lends credence to the report by Eastin and LaRose [43] that Internet usage affects and influences Internet self-efficacy.

The report of the gender difference in mathematics teachers' Internet self-efficacy revealed in this study symbolizes and confirms the gender gap which has been revealed to be existing between male and female computer and Internet users in many previous studies [53,54,56,58–60,63,66–69], etc. Despite the global struggle to close the gender gap evidence of it is still persisting as this study revealed. The reasons for this result may be due to the fact put forward in earlier studies that males seem to enjoy browsing on the Internet for enjoyment while females tend to only use it for work-related purposes [55, pp. 87–202]. Moreover, Ford et al. found that 'female tended to experience more difficulty finding information on-line, felt less competent and comfortable using the Internet, use the Internet less frequently than males, and less varied set of Internet applications'. This might be another reason for the difference. However, this finding contradicts the report by Duggan et al. [70] who show that there was no gender difference in terms of the attitude towards the Internet for either education use or of the grade point average. Tsai et al. [63] found differences in the type of resources accessed by male and female students. The males used interactive resources significantly more than the females; whereas, females used passive resources more than males while Tsai et al. [63] focused on students as the population of their study; this study focused on mathematics teachers. This may be the reason for the reported gender difference. Similarly, this result counteracts the report that gender gap seems to be narrowing and even disappearing regarding access to and use of computers the Internet and attitudes towards them [65–68].

12. Conclusion and recommendation

This study has discussed a very important and interesting topic as far as the way the teaching and learning of mathematics can be improved through ICT (the Internet). The discussion on the Internet self-efficacy mentioned in this study is also a welcome development and interesting phenomenon, considering the fact that any activity in which a person demonstrates high self-efficacy always results in success.

Various reports and findings from around the world have confirmed that technology is contributing tremendously to the teaching and learning in nearly all subjects. The various results revealed in this study are no exception. In the light of the various results reported in this study, it is recommended that mathematics teachers who do not know how to browse and search the Internet should consider doing so now without wasting much time. The testimony of respondents in this study is enough to convince people, especially mathematics teachers in this category. There is also the need to increase Internet usage on the part of the mathematics teachers who just begin the use of the Internet. This they need to do considering the fact that increase usage leads to high Internet self-efficacy. There is need to close the technology gender gap which has been in existence long time ago. This can start from the mathematics teachers. In the light of this, the female mathematics teachers who up till now do not know how to browse the Internet or never visit cyber café or the net before should consider taking a step of doing so as this has been reported to contribute to one's teaching performance and delivery of instructions and even students' performance in mathematics.

There is no doubt about the fact that this study is a very important and interesting one. However, it has its own shortcomings. For instance, the sample for the study was too limited considering the myriad of mathematics teachers in the state that can be considered to participate in the study. In the light of this, future researchers are called upon to extend the scope of the study to cover wide geographical areas; possibly the entire mathematics teachers in the whole of Osun State, Southern region or Nigeria as a whole. Moreover, studies on self-efficacy of faculties, teachers, students and pupils are now common place. Worse still, there have never been studies particularly from the Nigeria context focusing on the self-efficacy of the politician, administrative. This should be given consideration by future researchers.

References

[1] S. Al-Jaghoub and C. Westrup, *Jordan and ICT-led development: Towards a competition state?* Inf. Technol. People 16(1) (2003), pp. 93–110.

[2] H. Moeini, *Identifying needs: A missing part in teacher training programs*, Int. J. Media Technol. Lifelong Learning 4(1) (2008). Available at http://seminar.net/index.php/volume-4-issue-1-2008-previousissuesmeny-122/93-identifying-needs-a-missing-part-in-teacher-training-programs

[3] C. Duke, *Teachers and New ICT in Teaching and Learning*. *Sectoral Activities Programme*, International Labour Office, Geneva, 2002. Available at http://www.ilo.org/public/english/dialogue/sector/papers/education/wp190.pdf

[4] C. Duke, *Teachers and New ICT in Teaching and Learning*. *Sectoral Activities Programme*, International Labour Office, Geneva, 2002. Available at http://www.ilo.org/public/english/dialogue/sector/papers/education/wp190.pdf

[5] S.E. Smaldino, D.L. Lowther, and J.D. Russell, *Instructional Technology and Media for Learning*, Pearson Merrill/Prentice Hall, Upper Saddle River, NJ, 2008.
[6] M. Lebec and J. Luft, *A mixed methods analysis of learning in online teacher professional development: A case report*, Contemp. Issues Technol. Teach. Educ. 7(1) (2007), pp. 554–574.
[7] W. Baer, *Will the Internet Transform Higher Education?* The Aspen Institute, Washington DC, 1998 (ERIC Document Reproduction Service No. ED434551).
[8] D.B. Eamon, *Distance education: Has technology become a threat to the academy?* Behav. Res. Methods Instrum. Comput. 31(2) (1999), pp. 197–207.
[9] F.M. Hess, A.J. Rotherham, and K.B. Walsh, *A Qualified Teacher in Every Classroom? Appraising Old Answers and New Ideas*, Harvard, Cambridge, MA, 2004.
[10] A. Wolfolk-Hoy, *Self-efficacy in college teaching*, Essays Teach. Excellence 15(7) (2004). Available at http://www.coe.ohio-state.edu/ahoy/
[11] P.T. Ashton and R.B. Webb, *Teachers' sense of efficacy, classroom behavior, and student achievement*, in *Teachers' Sense of Efficacy and Student Achievement*, P.T. Ashton and R.B. Webb, eds., Longman, New York and London, 1986, pp. 125–144.
[12] T. Coladarchi, *Teachers' sense of efficacy and commitment to teaching*, J. Exp. Educ. 60 (1992), pp. 323–337.
[13] S. Gibson and M.H. Dembo, *Teacher efficacy: A construct validation*, J. Educ. Psychology 76 (1984), pp. 569–582.
[14] M. Tschannen-Moran and A. Woolfolk Hoy, *Teacher efficacy: Capturing an elusive construct*, Teaching Teach. Educ. 17 (2001), pp. 783–805.
[15] J.A. Ross, *The impact of an inservice to promote cooperative learning on the stability of teacher efficacy*, Teaching Teach. Educ. 10 (1994), pp. 381–394.
[16] J.R. Hill and M.J. Hannafin, *Cognitive strategies and learning from the World Wide Web*, Educ. Technol. Res. Dev. 47 (1997), pp. 37–64.
[17] Y. Joo, M. Bong, and H. Choi, *Self-efficacy for self-regulated learning: Academic self-efficacy, and Internet self-efficacy in web-based instruction*, Educ. Technol. Res. Dev. 48(2) (2000), pp. 5–17.
[18] M.-J. Tsai and C.-C. Tsai, *Information searching strategies in web-based science learning: The role of Internet self-efficacy*, Innovations Educ. Teaching Int. 40 (2003), pp. 43–50.
[19] M.Y. Yi and Y. Hwang, *Predicting the use of web-based information systems: Self-efficacy, enjoyment, learning goal orientation, and the technology acceptance model*, Int. J. Hum. Comput. Stud. 59(4) (2003), pp. 431–449.
[20] J.-C. Liang and C.-C. Tsai, *Internet self-efficacy and preferences toward constructivist Internet-based learning environments: A study of pre-school teachers in Taiwan*, Educ. Technol. Soc. 11(1) (2008), pp. 226–237.
[21] P. Eachus, S. Cassidy, S. Norgate, L. Marrow, and L. Greene, *Internet self-efficacy and visual search strategies: The use of eye tracking technology in the development of web-based learning resources*, Proceedings of the Informing Science and IT Education Conference SITE, October, Australia, 2008.
[22] D.A. Adeyemo, *Parental involvement, interest in schooling, and school environment as predictors of academic self-efficacy among fresh secondary school student in Oyo State Nigeria*, Electron. J. Res. Educ. Psychology 5–3(1) (2005), pp. 163–180.
[23] A. Tella and C.O. Ayeni, *The impact of self-efficacy and prior computer experience on the creativity of new librarians in selected Universities Libraries in Southwest Nigeria*, Libr. Philos. Pract. 8(2) (2006), pp. 1–10.
[24] A. Tella, A. Tella, C.O. Ayeni, and R.O. Omoba, *Predictors of academic performance: Self-efficacy and use of electronic information*, Univ. Dar Es Salaam Libr. J. 9(1) (2007), pp. 69–83.
[25] A. Tella, A. Tella, and P.A. Adekunle, *An assessment of the Librarian social competence and ICT'S self-efficacy: Implications on the Library practices in the digital era*, Pacific Northwest Libr. Assoc. PNLA Q. 71(4) (2007), pp. 12–16.

[26] A. Tella, A. Tella, C.O. Ayeni, and R.O. Omooba, *Self-efficacy and use of electronic information as predictors of academic performance*, Electron. J. Acad. Special Librarianship 8(2) (2007).
[27] A. Bandura, *Self efficacy: The Exercise of Control*, W.H. Freeman & Co., New York, NY, 1997.
[28] A. Bandura, *Self-efficacy: Toward a unifying theory of behavioral change*, in *The Self in Social Psychology*, R.F. Baumeister, ed., Psychology Press, Philadelphia, PA, 1999, pp. 285–298.
[29] M. DeTure, *Cognitive style and self-efficacy: Predicting student success in online distance education*, Am. J. Distance Educ. 18(1) (2004), pp. 21–38.
[30] D.R. Compeau and C.A. Higgins, *Computer self-efficacy: Development of a measure and initial test*, Managing Inf. Syst. Q. 19(2) (1995), pp. 189–211.
[31] J.E. Maddux and J.T. Gesselin, *Self-efficacy*, in *Handbook of Self and Identity*, M.R. Leary and J.P. Tangney, eds., Guilford Press, New York, 2003, pp. 218–238.
[32] R. Klassen, *Writing in early adolescence: A review of the role of self-efficacy*, Educ. Psychology Rev. 14(2) (2002), pp. 173–203.
[33] W. Tabassam and J. Grainger, *Self-concept, attributional style and self-efficacy beliefs of students with learning disabilities with and without attention deficit hyperactivity disorder*, Learn Disabil. Q. 25(2) (2002), pp. 141–151.
[34] R. Klassen, *A question of calibration: A review of the self-efficacy beliefs of students with learning disabilities*, Learn. Disabil. Q. 25(2) (2002), pp. 88–102.
[35] S.A. Rathus and J.S. Nevid, *Adjustment and Growth*, 3rd ed., Holt Rinehart and Winston, New York, 1986.
[36] L.H. Lee, *Goal orientation, goal setting, and academic performance in college students: An integrated model of achievement motivation in school settings*, Diss. Abstr Int: Humanit. Soc. Sci. 59(6-A) (1998), p. 1905.
[37] A. Bandura, *Self-efficacy*, in *Concise Encyclopedia of Psychology*, R.J. Corsini and A.J. Auerbach, eds., Wiley, New York, 1996, pp. 812–813.
[38] M. Csikszentmihalyi and K. Rathunde, *The development of the person: An experiential perspective on the ontogenesis of psychological complexity*, in *Handbook of Child Psychology*, W. Damon and R.M. Lernert, eds., 5th ed., Vol. 1, Wiley, New York, 1998, pp. 635–684.
[39] A.F. Grasha and D.S. Kirschenbaum, *Adjustment and Competence*, West Publishing, St Paul, MN, 1986.
[40] M. Pressley and C. McCormick, *Cognition, Teaching and Assessment*, Harper Collins College Publishers, New York, 1995.
[41] P.P. McCabe, *Enhancing self-efficacy for high-stakes reading tests*, Read. Teach. 57(1) (2003), pp. 12–19.
[42] D.H. Schunk and F. Pajares, *The development of academic self-efficacy*, in *Development of Achievement Motivation*, A. Wingfield and J.S. Eccles, eds., Academic Press, San Diego, 2002, pp. 15–31.
[43] M.S. Eastin and R. LaRose, *Internet self-efficacy and the psychology of the digital divide*, J. Comput. Mediat. Commun. 6(1) (2000). Available at http://jcmc.indiana.edu/vol6/issue1/eastin.html
[44] F. Pajares, *Self-efficacy beliefs in academic settings*, Rev. Educ. Res 66(4) (1996), pp. 725–734.
[45] A. Bandura, *Exercise of human agency through collective efficacy*, Curr. Dir. Psychol. Sci. 9 (2000), pp. 75–78.
[46] A. Bandura, *Social cognitive theory: An agentic perspective*, Annu. Rev. Psychology 52 (2001), pp. 1–26.
[47] R. Schwarzer and G.S. Schmitz, *Perceived self-efficacy and teacher burnout: A longitudinal study in ten schools*, Research Paper, Freie University Berlin, Germany, 2005.

[48] W. Ren, *Self-efficacy and the search for government information*, Ref. User Serv. Q. 38 (1999), pp. 283–291.
[49] T.A. Oliver and F. Shapiro, *Self-efficacy and computers*, J. Comput. Based Interact. 20 (1993), pp. 81–85.
[50] M. Wolfinbarger, M.C. Gilly, and H.J. Schau, *Keeping up with the times: Innovation and usage of the Internet among later adopters*, CRITO Consortium Project, 2005. Available at www.crito.uci.edu/consortium
[51] S. Cassidy and P. Eachus, *Developing the computer user self-efficacy (CUSE) scale: Investigating the relationship between computer self-efficacy, gender and experience with computers*, J. Educ. Comput. Res. 26(2) (2002), pp. 169–189.
[52] D. Nahl, *Affective monitoring of Internet learners: Perceived self-efficacy and success*, J. Am. Soc. Inf. Sci. 33 (1996), pp. 200–209.
[53] P. Eachus and S. Cassidy, *Development of the Web Users Self-Efficacy Scale (WUSE)*, Issues in Informing Sci. Inf. Technol. 3 (2006), pp. 199–209. Available at http://informingscience.org/proceedings/InSITE2006/IISITEach219.pdf
[54] D. Waldman, *Freshmen's use of library electronic resources and self-efficacy*, Inf. Res. 8(2) (2003), paper no. 150. Available at http://informationr.net/ir/8-2/paper150.html
[55] N. Ford and D. Miller, *Gender differences in internet perception and use*, in *Electronic Library and Visual Information Research. ELVIRA 3: Papers from the Third ELVIRA Conference*, M. Collier and K. Arnold, eds., ASLIB, London, 30 April–2 May 1996, pp. 87–202.
[56] N. Ford, D. Miller, and N. Moss, *The role of individual differences in Internet searching: an empirical study*, J. Am. Soc. Inf. Sci. Technol. 52(12) (2001), pp. 1049–1066.
[57] S. Majid and A.F. Abazova, *Computer literacy and use of electronic information sources by academics: A case study of International Islamic University Malaysia*, Asian Libr. 8(4) (1999), pp. 100–111.
[58] A. Enochsson, *A gender perspective on Internet use: Consequences for information seeking*, Inf. Res. 10(4) (2005), p. 5.
[59] D.J. Haisken, R. Pischner, and G. Wagner, *Use of computers and Internet depends heavily on income and level of education*, Econ. Bull. 37(11) (2001), pp. 369–374.
[60] K. Hakkarainen, L. Ilomäki, L. Lipponen, H. Muukkonen, M. Rahikainen, T. Touminen, M. Lakkala, and E. Latinen, *Students' skills and practices using ICT: Results of a national assessment in Finland*, Comput. Educ. 34 (2000), pp. 103–117.
[61] E. Millard, *New technology, old inequalities; Variations found in the use of computers by pupils at home with implications for the school curriculum*, 1997. Available at http://www.leeds.ac.uk/educol/documents/000000362.htm
[62] R. Nachmias, D. Mioduser, and A. Shemla, *Information and communicationtechnologies usage by students in an Israeli high school: Equity, gender, and inside/outside school learning issues*, Educ. Inf. Technol. 6(1) (2001), pp. 43–53.
[63] C. Tsai, S.S.J. Lin, and M. Tsai, *Developing an Internet attitude scale for high school students*, Comput. Educ. 37(1) (2001), pp. 41–51.
[64] M. Papastrergiou and C. Solomonidou, *Gender issues in Internet access and favourite activities among Greek high school pupils inside and outside school*, Comput. Educ. 44(4) (2005), pp. 377–393.
[65] T. Brickson and C. Panis, *Computers and connectivity: Current trends*, in *Culture of the Internet*, S. Kiesler, ed., Lawrence Erlbaum Associates, Mahwah, NJ, 1997, pp. 407–430.
[66] J. Fountain, *Constructing the information society: Women, information technology, and design*, Technol. Soc. 22 (2000), pp. 45–62.
[67] L. Miller, H. Schweingruber, and C.L. Brandenburg, *Middle school students' technology practices and preferences: Re-examining gender differences*, J. Educ. Multimedia Hypermedia 10(2) (2001), pp. 125–140.

[68] P. Schumacher and J. Morahan-Martin, *Gender, Internet and computer attitudes and experiences*, Comput. Hum. Behav. 17 (2001), pp. 95–110.
[69] D. Mathews and L. Schrum, *High speed Internet use and academic gratification in the college residence*, Internet Higher Educ. 6(2) (2003), pp. 125–144.
[70] A. Duggan, B. Hess, D. Morgan, S. Kim, and K. Wilson, *Measuring students' attitude toward educational use of the Internet*, J. Educ. Comput. Res. 25(3) (2001), pp. 267–281.
[71] E. Manias, *Rethinking ethnography: Reconstructing nursing relationships*, J. Adv. Nursing 33(2) (1990), pp. 234–242.
[72] E. Babbie and J. Mouton, *The Practice of Social Research*, Oxford University Press, Cape Town, South Africa, 2001.
[73] D.F. Polit and B.P. Hungler, *Nursing Research: Principle and Methods*, 6th ed., Lippincott, New York, 1999.
[74] R. Weber, *The rhetoric of positivism versus interpretivism: A personal view1*, MIS Q. 28(1) (2004), pp. 1–7.
[75] M. Alvesson and K. Sköldberg, *Reflexive Methodology: New Vistas for Qualitative Research*, Sage, London, 2000.
[76] A.S. Lee, *A scientific methodology for MIS case studies*, MIS Q. 13(1) (1989), pp. 33–52.
[77] E. Husserl, *The Crisis of European Sciences and Transcendental Phenomenology* (translated by D. Carr), Northwestern University Press, Evanston, IL, 1970.
[78] L. Dubé and G. Paré, *Rigor in information systems positivist case research*, MIS Q. 27(4) (2003), pp. 597–635.
[79] H.K. Klein and M.D. Meyers, *A set of principles for conducting and evaluating interpretive field studies in information systems*, MIS Q. 23(1) (1999), pp. 67–93.
[80] J. Collis and R. Hussey, *Business Research: A Practical Guide for Undergraduate and Postgraduate Students*, 2nd ed., Palgrave Macmillan, Basingstoke, 2003.
[81] C. Tsai and C. Lin, *Taiwanese adolescents' perceptions and attitudes regarding the Internet: Exploring gender differences*, Adolescence 39(156) (2004), pp. 725–734.
[82] Y.-T. Wu and C.-C. Tsai, *University students' Internet attitudes and Internet self-efficacy: A study at three universities in Taiwan*, CyberPsychology Behav. 9 (2006), pp. 441–450.
[83] H. Peng, C.-C. Tsai, and Y.-T. Wu, *University students' self-efficacy and their attitudes toward the Internet: The role of students' perceptions of the Internet*, Educ. Stud. 32 (2006), pp. 73–86.

Appendix

Internet self-efficacy items

I can search information on the Internet by using key words.
I think I can talk to other mathematics teachers in online chat room.
I rarely have problems finding what I am looking for on the Internet.
I sometimes find using search engines like Google and Yahoo can be difficult.
I wouldn't have any problems downloading relevant information for the students for solving mathematics problems.
I can usually sort out any access problems I may have on the Internet.
I find using e-mail very easy.
I much prefer using letters, GSM or telephone to communicate with people rather than the Internet.
I use the Internet to communicate professionally with fellow mathematics teachers.
I use the Internet to get news update on mathematics teaching.

Internet usage items

What is the number of hours of your using the Internet per week?
Less than 1 h a week – 1
2–4 h a week – 2
5–6 h a week – 3
7–9 h a week – 4
10–20 h a week – 5
More than 20 h a week – 6

Interview items

(1) Do you use the Internet and how has the usage of Internet improved the efficacy of using the Internet mathematics instructional delivery?
(2) What is the teachers' level of Internet skills?
(3) How has Internet usage of Internet and Internet Self-efficacy influence students' mathematics performance and learning outcomes?
(4) How has Internet self-efficacy and usage of Internet influenced research activities in mathematics?