

Teaching style, ICT experience and teachers' attitudes toward teaching with Web 2.0

Ugur Kale · Debbie Goh

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Abstract Emphasis on 21st Century Skills development has increased expectations on teachers to take advantages of emerging technologies to support student learning. Yet it is not clear whether teachers are well equipped with the necessary skills, support, and positive attitudes toward integrating them in their practices. Even though student-centered teachers are considered receptive to collaborative technologies and likely to use technology meaningfully in teaching, to what extent teaching style influences their Web 2.0 adaption requires further investigation. This study attempts to identify K12 teachers' attitudes toward the use of Web 2.0 technologies in their teaching. 161 teachers from eight middle and high schools in both rural and urban locations of West Virginia participated in this cross sectional survey study. Overall, the findings indicate that while teachers are fairly proficient in their computer and internet skills and have fairly high computer self-efficacy, their workload and a structured and standardized curriculum were inhibitors of Web 2.0 adoption. Age, self-efficacy, workload, and views about Web 2.0 in teaching were observed to be significant factors predicting teachers' likelihood to find Web 2.0 appealing for teaching. Teaching style was not a significant predictor. The findings suggest infra-structural improvements, workload adjustments, and increased professional development opportunities allowing teachers to observe, discuss, and practice Web 2.0 technologies in their particular disciplines.

Keywords Information communication technologies · Web 2.0 · Internet · Teacher attitudes · Teacher professional development · Teaching style

U. Kale (✉)

Department of Technology, Learning, & Culture, West Virginia University, 506-D Allen Hall, PO Box 6122, Morgantown, WV 26505, USA
e-mail: ugur.kale@mail.wvu.edu

D. Goh

Wee Kim Wee School of Communication and Information, Nanyang Technological University, 31 Nanyang Link, Singapore 637718, Singapore
e-mail: debbiegoh@ntu.edu.sg

1 Background

1.1 Are teachers Web 2.0 ready?

Teachers today are expected to develop lessons that not only teach students academic content knowledge, but help them develop 21st Century Skills that enable them to be effective team players, inventive thinkers, active problem solvers, and digital literate citizens (Partnership for 21st Century Skills 2004; Solomon and Schrum 2007). Emphasis on 21st Century Skills arises from a firm belief that only with these skills can students succeed in a globally competitive world where interconnectivity, knowledge production and technological innovations are essential to productivity and success. Web 2.0 is a term referring to various emerging web-based technologies that allow users to (1) share knowledge through collaborative editing, communicating, publishing, and commenting and/or to (2) dynamically change the content of knowledge published on the web. With such affordances, Web 2.0 and virtual world technologies are rapidly gaining attention from educators globally. Meaningful incorporation of these applications alongside constructivist pedagogical approaches (e.g., project-based learning, inquiry based learning, cooperative learning, or etc.) are believed to help cultivate 21st Century Skills (Moylan 2008).

The educational potential and challenges of various engaging Web 2.0 tools in schools have been widely discussed. Regarding the potentials, blogs for instance have been considered as both a personal knowledge construction place and a participatory platform for student conversation, whereas wikis are believed to foster joined-knowledge construction, diversity of opinions, and decentralized information through collaborative authorships (Norton and Hathaway 2008; Rosen and Nelson 2008). By allowing for the generation and dissemination of digital information (e.g., audio, video, or picture), media sharing tools (e.g., Youtube) and podcasting are also viewed as effective for increasing student motivation, facilitating articulation of ideas, and promoting self-expressions (Albion 2008; Norton and Hathaway 2008; Rosen and Nelson 2008). Further, social networking and virtual world platforms are considered useful means to support students' informal interactions (Albion 2008), and immersive virtual world simulations have been explored for their effectiveness on increasing student inquiry skills and motivation (Barab and Dede 2007; Mayrath et al. 2010).

Despite such potential, the use of Web 2.0 in teaching raises some concerns (Albion 2008):

- Access to hardware, software, and network technologies supporting the use of Web 2.0 may still be challenging.
- Teachers may see little connections between technologies and their pedagogical use, and their practice may tend to reflect traditional way of teaching and learning, limiting the potential of Web 2.0.
- The rigid practice of school curriculum and assessment likely focuses on individual attainment, thus not being compatible with collaborative learning activities supported by Web 2.0.
- The fast development of technology may make it difficult for teachers to carefully select Web 2.0 tools suitable to their students' needs and their pedagogy.

- Even though students are considered digital natives, not all of them may be digitally enhanced, thus requiring both technical and pedagogical assistance with the use of technologies.

Additionally, the emerging technologies that students use regularly, from cell phone texting to Facebook, Twitter and computer games, are often considered “dysfunctional” or “disruptive” in today’s context of formal education (Jenkins 2006). If teachers possess negative attitudes toward using emerging technologies, lack understanding of how to use them meaningfully, or are constrained by limited student or teacher technology access, it is unlikely they will engage these tools in their lessons (Webb and Cox 2004). Yet, they are expected to take advantage of these tools to enhance student learning. Furthermore, it is not clear if teachers are well equipped with the necessary skills, support, and positive attitudes for incorporating these new tools for instructional purposes. There is thus a need for identifying K12 teachers’ experience and attitudes toward emerging technologies in relation to teaching so that a professional development program on the use of emerging internet technologies can be provided that will address their learning needs, concerns and attitudes, and help them meaningfully incorporate these technologies into their teaching practices.

1.2 Challenges in teaching with ICTs and Web 2.0

Although digital literacy, inventive thinking, effective communication, and high productivity are important skills necessary to successfully live in today’s interconnected complex world (Partnership for 21st Century Skills 2004; Solomon and Schrum 2007), there are very few examples where constructivist teaching approaches that incorporate information communication technologies (ICTs) are successfully implemented (Kozma and Anderson 2002; Kramer et al. 2007). Two areas of literature-ICT in education and Web 2.0 in schools may provide some explanations regarding these difficulties.

Regarding research on the use of ICT in education, Mumtaz (2000)’s review of the early studies identified the following three main factors influencing teachers’ use of ICT:

- Lack of time, professional development, and support provided by schools
- Lack of access to technology resources
- Teachers’ feelings and beliefs about of technology

More recent research efforts also indicated similar factors. Limited technology access in classrooms (Williams et al. 2000; Harvey-Buschel 2009; Latio 2010), lack of time to plan and teach with technology due to heavy workload (Lyons 2007; Dawson 2008), teacher-centered use of technology (Lyons 2007; Dawson 2008; Inan et al. 2010), and low self-efficacy and lack of digital skills (Cavas et al. 2009; Ertmer and Ottenbreit-Leftwich 2010) seemed to negatively influence teachers’ meaningful pedagogical use of ICTs in schools. Given the ICTs focused in these studies are rather traditional, understanding to what extent their results are applicable to Web 2.0 incorporated lessons requires further review of research on the use of Web 2.0 in schools.

The literature on Web 2.0 integration in K12 settings is scant and mostly provided anecdotal examples of projects or potentials of Web 2.0 tools (Albion 2008; Norton

and Hathaway 2008). However, a few current research studies and reports (Crook and Harrison 2008; Trinidad and Broadley 2008; Interactive Educational Systems Design 2009; Lee and Tsai 2010; Light 2011; Pan 2011) indicate that though teachers have generally positive attitudes toward emerging technologies, their adoption of Web 2.0 in teaching may be limited by low self efficacy, lack of experience with internet and Web 2.0 tools, lack of technical and pedagogical knowledge of using Web 2.0, lack of value placed on Web 2.0 in teaching, lack of professional development, standardized curriculum and assessment not fostering collaborating learning, and infrastructural issues including lack of adequate bandwidth, insufficient computer access, and lack technical support.

Although the results from these studies are useful, the selection of their research participants raises concerns regarding the applicability of the findings. For instance, the research studies conducted by Crook and Harrison (2008) and Light (2011) focused on teachers who already made progresses in adopting Web 2.0 technologies in their lessons, thus not necessarily indentifying issues that may influence those who have not started integrating such tools in teaching. Likewise, the survey research by Interactive Educational Systems Design (2009) examined attitudes and plans regarding Web 2.0 use in teaching, but responses were collected only from district technology directors, which may not necessarily reflect teachers' opinions. Also, the findings of Trinidad and Bradley's (2008) survey study may be difficult to generalize to a larger teacher population as this study involved a small group of primary school teachers. Lastly, the research programs that have started implementing virtual worlds are custom developed (Mayrath et al. 2010) and funded by big agencies or national initiatives, which are more unique than common in the current economic crunch. Thus, teachers' attitudes toward and experiences with Web 2.0 tools in relation to teaching still need further investigation in order to better inform professional development efforts focusing on K12 teachers' Web 2.0 integration.

1.3 Matching teaching style with ICTs

Teachers are likely to use technology meaningfully if it matches their pedagogy, indicating it as one of the strong determining factors (den Brok et al. 2004; Inan et al. 2010). Teaching style is orientation to teaching involving beliefs on learning, and the understanding and interpretation of pedagogy. It guides teaching behavior and instructional decisions, influencing classroom interaction and student learning (Allen 1998). There are two major orientations at the opposite ends of teaching style, namely student-centered and teacher-centered preferences. While teacher-centered style reflects objectivist teaching approach emphasizing teachers' centrality in students' learning, student-centered approach suggests students' high involvement in their learning process while underlining teachers' facilitative role.

One useful method to characterize teacher versus student-centered approach is to consider the degree of control teachers have in facilitating students' learning. Student-centered teacher tends to have "loose control" over the learning process; they encourage students to take the initiative on planning and completing the learning activities, whereas a teacher-centered teacher prefers to take over the performance of students by modeling the learning activities, and thus exemplifying a "strong control" teaching behavior (den Brok et al. 2004).

Teachers with “loose control” may be more receptive to using collaborative technologies. As Becker (1999) argues, student-centered teachers are likely to incorporate technology in their teaching more meaningfully; they tend to encourage students’ learning through inquiry or project-based activities, and thus may prefer technologies that foster collaboration, inquiry, and project management (Park and Ertmer 2008). Given its potential effects on teachers’ technology adaptation, to what extent teaching style influences the use of Web 2.0 technologies also requires further investigation.

2 Purpose

The objective in this study is to examine teachers’ attitudes toward and experiences with Web 2.0 in their teaching. Understanding teachers’ attitudes toward emerging technologies in relation to teaching is a key step in identifying factors that facilitate or impede adoption of these technologies in their practices. This will enable teacher educators and researchers to better design and develop professional development program for teachers. The research questions of this current study are:

- RQ1. What are teachers’ attitudes toward and experience with Internet and Web 2.0?
- RQ2. What teaching style control do teachers have?
- RQ3. What factors predict teachers’ likelihood of finding Web 2.0 appealing for teaching?

3 Method

This study surveys public school teachers in West Virginia. It examines West Virginian teachers’ attitudes and experience with Web 2.0, their teaching style and their likelihood of finding Web 2.0 appealing for teaching. West Virginia was selected because of the public schools’ emphasis on the implementation of 21st Century Skills initiatives and ICT literacy.

3.1 Teacher professional development in WV

Given the declining employment options in coal industry and the need for meeting No Child Left Behind requirements in public schools, West Virginia encounters great difficulties in preparing students to live successfully in the global world (West Virginia State Educational Technology Plan 2010). Its rather largely rural geography with limited broadband access (Miller 2011) as well as the ratio of economically disadvantage students higher than that of the national average (National Center for Children in Poverty 2010a, b) add further challenges to preparing West Virginian students for the 21st Century world, where information communication technology skills are highly demanded.

In 2005, to better align state’s economic development focus to such issues, and to help students gain the skills and knowledge for the workforce in the technology-driven world, West Virginia became the second state in the U.S. to apply a framework in public schools promoted by the Partnership for 21st Century Skills, emphasizing

ICT literacy, communication, and critical thinking skills (West Virginia Department of Education, n.d.a). As of 2007–2008 academic year in WV, there were 695 public schools with 281,715 students, 93 % of which were white. This rather small size and the homogeneous demographic of the state's educational system helped the implementation of comprehensive initiatives such as Partnership for 21 Century Skills (West Virginia Department of Education 2009–2010).

Part of these efforts has been a proliferation of professional development programs to help teachers provide effective technology-enhanced learning activities. The West Virginia Department of Education has been training teachers in a series of weeklong summer institutes over the past few years. However, these programs, some of which this paper's lead author is involved in, tend to emphasize pedagogical skills in isolation of emerging technologies, or focus on teaching technology skills aside from pedagogy and content. For instance, while in 2008, the summer institute focused on promoting project-based learning, reflecting a pedagogical stance, the more recent professional development opportunities (West Virginia Department of Education, n.d.b) emphasize a 21st century tools and digital learners, indicating a sole technology-focus. A recent project-Mobile Learning, sponsored by Verizon (Verizon 2011) in selected West Virginian counties is an example where teachers are trained to operate the devices and their *apps* without specific reference to content specific teaching strategies.

As observed in many other teacher professional development programs (Polly and Hannafin 2010), the initiatives in West Virginia seem to rarely provide teachers with opportunities to develop pedagogical understanding, skills and knowledge necessary to meaningfully incorporate technologies in particular content areas. Teachers may be left alone to connect their knowledge of technologies, pedagogy, and content, and to apply their *isolated* understanding of all of these to enhance students' learning. Without positive attitudes, enhanced technology skills, and a strong pedagogy reflecting student centered teaching style, they unlikely make such connections. This study thus examines what are teachers' attitudes toward and experience with the internet and Web 2.0, their teaching styles, and determines how these factors predict their likelihood of engaging Web 2.0 in their teaching.

3.2 Sample and survey instrument

Teachers from all the public middle and high schools ($N=13$) in two counties of West Virginia were invited to participate in the survey. The schools were located in both rural and urban locations. The school principal of each school was contacted and interviewed about their teachers' and schools' readiness for the project. The principals were asked to inform their teachers about the study and encourage them to participate in it. Once the principals confirmed their school teachers' participation, paper-based surveys with postage paid envelopes were mailed to the schools. Schools that preferred to take the survey online were provided a link to an online version of the same survey. The principals forwarded the survey link to their teachers via email. Teachers completed the survey on a volunteer basis. Each school had 3 weeks to complete the survey. Principals were asked to remind their teachers to complete the survey at the end of the second week. 161 teachers (out of a total of 548) completed the survey, resulting in approximately 30 % response rate.

The survey instrument comprised of mainly Likert scale items examining teachers' experiences and attitudes toward using Internet and Web 2.0 in teaching. Table 1 shows the main categories of survey items and the previous research they were adapted from.

4 Results

Responses on the survey were entered in a statistical program (SPSS) for analysis. Then, we identified the average tendencies of participants from their responses on a Likert scale items in terms of teaching style, attitudes toward and familiarity with Internet and Web 2.0 technologies. We also identified how these factors are related to and influenced teachers' likelihood of finding Web 2.0 appealing for their teaching. Correlations, test of means, and regression analysis were used.

4.1 RQ1: Attitudes toward and experience with internet and Web 2.0?

4.1.1 Teachers' demographics and internet use

A total of 161 teachers from 8 out of the 13 schools participated in the survey. Four of the schools were rural and four were urban. 55 % of teachers came from urban schools and 45 % came from rural schools. 48 % were middle school teachers teaching grades 5 through 8 and 52 % were high school teachers teaching grades 9 through 12. Subjects taught included Math, Science, English, Social studies and

Table 1 Survey sections and relevant existing survey research

Survey sections ^a	Adapted from
Demographics	Self
Experience with and attitudes toward Internet	(Pew Internet and American Life Project 2007; Calibrate 2008)
<ul style="list-style-type: none"> • Internet use • Proficiency and expertise with computers and Internet • Access to technology • Attitudes toward internet in teaching • Self-efficacy with internet • Perceived factors important to using internet in teaching • Perceived factors preventing from using internet in teaching 	
Experience with and attitudes toward Web 2.0	
<ul style="list-style-type: none"> • Experience and familiarity with Web 2.0 • Web 2.0 use possibility in various aspects of teaching • Climate supporting Web 2.0 in teaching 	
Teaching Style	(Grasha 1994; den Brok et al. 2004; Behar-Horenstein et al. 2006)
<ul style="list-style-type: none"> • Degree of control 	
Likelihood of finding Web 2.0 appealing for teaching	Self

^a Cronbach's alpha ranging from .74 to .97

humanities, art, health, second language, physical education, business, computer applications, construction, counseling, music, drama, career and life skills. Teaching experience ranged from less than 1 year to 44 years, with a mean of 13.5 years. The mean age of teachers is 44, and their ages ranged from 22 to 66. 74 % of the teachers were female and 26 % were male. In terms of internet use frequency, 90 % of teachers reported using the internet for more than 6 years. Only two teachers said they didn't know how long they had been internet users. The rest have been using the internet for at least a year. 85 % of teachers said they use the internet at least once a day, and only one teacher said he never use the internet. Almost half of the teachers (46 %) said they use the internet several times a day for lesson planning or implementation or both, and 22 % said they use it almost daily. A quarter of the teachers said they use it several times a month. Less than 3 % said they didn't use the internet for teaching.

4.1.2 Proficiency and expertise with computers and internet

To measure teachers' proficiency and expertise with computers and the internet, we asked teachers to indicate whether they were able to perform a series of computer and internet tasks on their own, whether they needed help, or they could not do them (Cronbach's $\alpha=0.965$). We tabulated the results into a scale ranging from 0 to 45 such that the higher the score, the more proficient the teachers are in using computers and the internet. The mean score ($M=34.96$, $SD=11.38$) indicated that teachers are fairly proficient in their computer and internet skills.

4.1.3 Access to technology

We also asked teachers whether they had access to a series of computer and digital equipment and services at home and at school to determine the degree of access they have to information and communication technologies. We gave one point for every item they had access to at home or at school, and tabulated the scores. The scores ranged from 3 to 27, with a mean of 11.58 ($SD=4.29$). This finding indicates that teachers do not have access to a wide variety of ICT equipment and services.

4.1.4 Teachers' attitudes toward internet in teaching

Next, we examined teachers' attitudes toward internet in teaching. Almost two-thirds of teachers (64 %) reported they were somewhat satisfied or very satisfied with using the internet in their work. A quarter were neutral and the rest (11 %) were not too satisfied or not at all satisfied. Almost 90 % of teachers said the internet should be used somewhat more frequently or much more frequently in their work, compared to the remaining 10 % who said the internet should be used less frequently or not at all. Teachers were split in terms of how they felt the internet influenced their workload. 8.5 % said using the internet decreased their workload a lot and 7.1 % said using it increased their workload a lot. Equal percentages of teachers (27.7 %) said using the internet decreased or increased their workload somewhat, while 22.7 % said using the internet didn't change their workload.

4.1.5 Teachers' self-efficacy with internet

We also measured teachers' computer self-efficacy to determine how comfortable and confident they were with using computers and the internet. A self-efficacy scale was developed from questions that asked teachers to rate their confidence and comfort using computers and the internet, and trying new applications and programs (Cronbach's $\alpha=0.913$). The scale ranged from 4 to 16 points, and the mean computer self-efficacy score was 13.4 ($SD=2.54$), indicating that teachers in general had fairly high computer self-efficacy. The findings consistently show that teachers in these schools have high levels of computer and internet proficiency and efficacy. This is very encouraging as self-efficacy is often one of the biggest inhibitors of ICT adoption.

4.1.6 Factors important to using of internet in teaching

We also asked teachers to rate the importance of a list of factors in influencing teachers' decision to use internet in their teaching (1=Not at all important to 4=Highly important). We compared the means (Cronbach's $\alpha=0.837$) and found teachers ranked students' ability to access the internet as most important ($M=3.49$, $SD=.70$). This was followed equally by making their work more effective ($M=3.43$, $SD=.67$) and students' learning needs ($M=3.43$, $SD=.68$), followed by making their work more creative ($M=3.38$, $SD=.72$), the need for education innovations ($M=3.18$, $SD=.71$), making their work easier ($M=3.11$, $SD=.89$), their personal interest in computers and internet ($M=3.01$, $SD=.90$), the possibility for professional contacts with fellow teachers ($M=2.77$, $SD=.85$), and expectations of the school administration ($M=2.75$, $SD=.85$).

This finding reveals that students' ability to access the internet is the most important factor teachers consider when planning internet-based lessons. While teachers like that the internet can make their work more efficient, they are influenced by the need for education innovation. Interestingly, they placed their personal interests, contact with other teachers, and expectations of the school as less important than their students' and teaching needs.

4.1.7 Factors preventing internet use in teaching

Another set of questions asked teachers how likely a list of factors would prevent them from using internet in their teaching (1=Not at all likely, 2=Not too likely, 3=Somewhat likely, 4=Very likely). We tabulated the means (Cronbach's $\alpha=0.741$) and found teachers ranked the most likely factor preventing them from using the internet as a lack of time to conduct online-based projects due to a packed school curriculum ($M=2.72$, $SD=.95$), followed by the lack of time due to preparation for standardized tests and exams ($M=2.68$, $SD=.95$), followed by a lack of time to prepare online projects due to their teaching workload ($M=2.49$, $SD=.92$). Teachers rank the difficulty of developing online projects and their lack of skills as the least important factor preventing their use of internet in their teaching ($M=1.90$, $SD=.97$).

The findings strongly indicate that one of the biggest inhibitors of internet adoption in teaching is teachers' workload and a structured and standardized curriculum. Nonetheless, it is encouraging that these factors do not appear to overwhelm teachers, given that the overall mean is 2.44 ($SD=.95$), indicating that their responses tended to fall between

not too likely and *somewhat likely* range. Teachers may not feel very discouraged by their lack of skills as many already possess fairly proficient internet skills.

4.1.8 Experience and familiarity with Web 2.0

To determine teachers' experience and familiarity with Web 2.0 tools, we identified seven popular Web 2.0 activities and asked teachers if they have used them (Cronbach's Alpha=0.803). We tabulated the total number of activities teachers have engaged in and found these ranged from 0 to 7 ($M=2.67$, $SD=2.17$). About 80 % have used Web 2.0. 21.7 % of teachers have never used Web 2.0, 55.8 % have used 1 to 4 tools, and the rest (22.5 %) have used 5 to 7 tools. The most commonly used tool was online social networking such as MySpace or Facebook, with 58.3 % of teachers reporting having participated in this activity. This was followed by posting comments on an online news group, website, blog or photosite (54.3 %). The third most popular activity was sharing something they have created online, such as artwork, photos, stories or videos (51.8 %). This was followed by taking materials online and remixing it (38.1 %). Working on their own webpage and blogging was the third and second least common activity, with 73.4 % and 72.4 % of teachers respectively reporting they had never done either. The least common activity was visiting a virtual world. 89.9 % of teachers said they had never done this before.

4.1.9 Web 2.0 use possibility in various aspects of teaching

We also surveyed teachers on how likely (1=Not at all likely, 2=not too likely, 3=unsure, 4=somewhat likely, 5=Very likely) they thought Web 2.0 could be use in various aspects of teaching (Cronbach's alpha=0.958). We tabulated the results into a scale ranging from 10 to 50. Overall, the mean score ($M=40.33$, $SD=9.15$) indicated that teachers are positive about Web 2.0's benefits to teaching.

Table 2 shows the means teachers reported with regards to how likely Web 2.0 can be used for each aspect of teaching. They think Web 2.0 can somewhat likely be used in all 10 aspects of teaching.

Table 2 Teaching aspects web 2.0 can be used for

Teaching Aspects	Means	SD
Communication about assignments among students	4.15	1.0
Increasing student motivation	4.15	0.96
Communication between teacher and students	4.11	1.09
Preparation of learning materials	4.11	1.0
Enhancing students' content learning	4.09	1.02
Increasing creative potentials of students	4.2	0.92
Increasing learning opportunities	4.2	0.99
Facilitating group work	3.99	1.02
Assessing students' content learning	3.91	1.09
Individualized instruction	3.9	1.02

4.1.10 Climate supporting Web 2.0 in teaching

We were also interested in the climate surrounding teachers' use of Web 2.0 in their schools and the resources available to them and surveyed them about technical support, availability of computers and internet access, and students' skills (Cronbach's $\alpha=0.735$). 65.5 % agreed or strongly agreed that computers in their schools supported Web 2.0, and 63.1 % agreed or strongly agreed internet access supported Web 2.0 use. However, almost three-quarter of teachers (72.6 %) agreed or strongly agreed that there were not enough computers in classrooms available for using Web 2.0, indicating that while schools may have computers and internet access to enable Web 2.0 use, they still faced challenges in making access sufficiently available to students in classrooms. 51.8 % of teachers felt there was no support outside the school setting for using Web 2.0, and 39.6 % felt there was no technical support in school for Web 2.0 use. Three quarters of teachers (75.2 %) said students lacked the skills or equipment at home for Web 2.0 projects.

4.2 RQ2: Teachers' teaching style control?

We measured teachers' teaching style control by 9 survey items we developed from the literature. These included 8 questions asking them to indicate how often they use various teaching strategies that encourage students to take the initiative on learning and 1 statement to indicate if they strongly agree, agree, disagree, and strongly disagree about how they teach by addressing students' needs and fostering their collaboration (see Table 3, Cronbach's $\alpha=0.814$). We tabulated results into a scale ranging from 9 to 44 such that the higher the score, the more control the teachers have over students' learning process. The mean score ($M=28.89$, $SD=4.30$), slightly higher than the middle point of the range-26.5, indicated that teachers claim to mainly prefer "shared control" with students over the teaching and learning process. That is,

Table 3 Teaching style control items

Questions	Let students take responsibility for teaching part of the class sessions.
	Solicit students' advice on how and what to teach in my courses.
	Give students choices on activities for completing course requirements.
	Let students decide the pace for working on an assignment.
	Develop activities that let students take initiative and responsibility for their learning
	Let students work on projects with little supervision from me.
	Stimulate students to evaluate their understanding of the subject matter by themselves.
	Let students plan by themselves how they will share their work in a group.
Statements	When I teach, developing the ability of students to think and work independently is an important goal.

teachers claim to encourage students to take active role in completing learning tasks but also tend to provide high level of guidance and facilitate their learning and collaboration.

4.3 RQ3: Factors predicting teachers' likelihood to find Web 2.0 appealing?

First we measured teachers' likelihood to find Web 2.0 appealing for their teaching (1=Not at all appealing, 2=Not too appealing, 3=Somewhat appealing, 4=Very appealing). Over half of the teachers (57 %) said they found the use of Web 2.0 to be somewhat appealing in their teaching, and 16.5 % said they found it very appealing. 19 % said it was not too appealing and 7.4 % said it was not at all appealing. Only 9.2 % of teachers said they had used Web 2.0 in their teaching. The most popular tools used are blogs and wikis.

Then, to determine which factors will predict teachers' likelihood of using web 2.0, we identified variables examined in previous research questions that are strongly correlated ($R \geq .3$) with the dependent variable – how appealing is using Web 2.0 in teaching to you. The following variables are then entered into a regression model via the entry method: age, computer skills, access to equipment, how frequently internet should be used in their teaching, attitudes toward how likely Web 2.0 can be used in various teaching aspects, teaching style, Web 2.0 experience, self-efficacy, possibility of professional contacts with fellow teachers, influence of workload on time devoted to online projects, importance placed on students learning needs, the need for education innovation, making their work more creative and effective, how likely their computer skills make it difficult for them to develop online projects.

Together, these 15 variables account for 39.3 % of the variance in how appealing using Web 2.0 is ($F(15, 45)=3.593, p<0.001$). Age, workload, usefulness of Web 2.0 in teaching, computer self-efficacy, and students' learning needs significantly predicted how appealing they found Web 2.0. Teachers who were older and who viewed their workload as heavy were less likely to find using Web 2.0 appealing. Teachers who felt Web 2.0 could likely be used in various aspects of teaching were more likely to find Web 2.0 appealing. Teachers who have high self-efficacy and considered students' learning needs as an important factor influencing their internet use were more likely to find Web 2.0 appealing.

The standardized regression coefficients (Table 4) showed that computer self-efficacy is the strongest predictor, followed by workload, students' learning needs, age, and then views about Web 2.0's use in teaching. Experience with computers and Web 2.0 did not significantly predict how appealing teachers would find using Web 2.0. Despite being correlated with the likelihood of finding Web 2.0 appealing for teaching ($r(121)=0.310, p<0.001$), teaching style was not a significant predictor either.

5 Discussion and implications

Understanding teachers' attitudes toward the technology, one of the strongest predictor influencing how they adapt it in their classrooms, should be an integral part of planning for professional development that focuses on technology integration. There

Table 4 Regression analysis of predictors of how appealing using web 2.0 in teaching is to teachers

	B	SE	β	T	Tolerance
-Computer self-efficacy	0.126	0.059	0.401	2.147*	0.290
-My workload is too heavy and I have no time to devote to online projects.	-0.342	0.103	-0.391	-3.327**	0.733
-Students' learning needs	0.423	0.189	0.389	2.242*	0.336
-Age	-0.023	0.009	-0.360	-2.471*	0.475
-Web 2.0 use possibility in various aspects of teaching	0.023	0.010	0.259	2.249*	0.760
-My computer skills are limited and it is difficult for me to develop online projects.	0.255	0.172	0.317	1.481	0.220
-Teaching Style Control	0.030	0.018	0.181	1.650	0.840
-Strength of computer and Internet skills	0.010	0.014	0.144	0.739	0.266
-Web 2.0 knowledge & use	-0.081	0.046	-0.248	-1.762	0.512
-Access to equipment	0.012	0.023	0.068	0.504	0.562
-How frequently do you think the internet should be used in your work as a teacher?	0.045	0.180	0.038	0.249	0.442
-Making my work as a teacher more effective	0.009	0.220	0.008	0.041	0.267
-Making my work as a teacher more creative	-0.011	0.174	-0.011	-0.065	0.375
-Possibility for professional contacts with fellow teachers	0.036	0.105	0.042	0.342	0.666
-The need for education innovation	-0.372	0.186	-0.332	-1.999	0.366

$R^2 = 54.5$, Adjusted $R^2 = 39.3$, $p < 0.001$

* $p < 0.05$., ** $p < 0.01$

is a need for identifying teachers' attitudes toward emerging technologies in relation to their everyday pedagogical needs and objectives so that a professional development program on the use of emerging internet technologies can be provided that will address their concerns and attitudes, and help them effectively incorporate these technologies into their teaching practices. As the first step in pursuing this goal, this study examined teachers' attitudes toward using web 2.0 technologies in their teaching in relation to their attitudes and experience with internet and teaching style. The following sections discuss the results of this study and provide implications by presenting five major themes that emerged from the analysis.

5.1 Age, self-efficacy, and skills

The findings show that teachers' age and computer self-efficacy predicted their likelihood to find Web 2.0 appealing for teaching. Teachers who were older or who were less confident and comfortable with using computers and internet were less likely to find Web 2.0 appealing for their teaching. These findings are congruent with existing research that found older teachers to be less positive toward technologies, and who were incorporating technology in teaching to a lesser degree as they lack digital skills (Athina and George 2005; Cavas et al. 2009; Kuskaya-Mumcu and Kocak-Usluel 2010). Literature indicates that adequate training, opportunities for daily practice, and ongoing support to use such tools may be necessary for older

adults (Hernandez-Encuentra et al. 2009). Simply providing professional development based on one-time, one-size-fits-all approach will not likely benefit them as it ignores their unique needs, which are probably different than those of younger teachers.

Nevertheless, this study also found that teachers overall have good computer literacy and computer self-efficacy, and that almost 80 % of them reported that they have participated in at least one Web 2.0 activity. Teachers do not feel discouraged by their lack of skills as many already possess fairly proficient internet skills. This is very encouraging as existing research indicates levels of computer and internet proficiency and efficacy are often the biggest inhibitors of ICT adoption.

The adoption of particular Web 2.0 tools, on the other hand, may require new skill sets that may not be needed in the integration of traditional ICTs. As observed in this study, visiting a virtual world was the least common Web 2.0 activity that teachers participated in. Around only 10 % of the participants reported that they had used virtual worlds in their personal lives. A recent study (Mayrath et al. 2010) examining the pedagogical use of Second Life- a virtual world revealed that prior gaming experiences are in fact correlated to positive attitudes toward and use of this virtual world. While the study suggested scaffolding *novice* learners to learn how to navigate in the system, manage resources, and communicate with other participants, it also emphasized the need for considering learners' prior gaming experiences for designing and implementing virtual world enhanced lessons. Likewise, identifying such skills particular to using various Web 2.0 tools and assisting *less* proficient teachers with in developing the skills may be crucial to their effective incorporation of Web 2.0.

5.2 Computers and more

The lack of available computers and internet access in classroom may prevent teachers from finding Web 2.0 appealing. The existing research reveals findings supporting this argument. There has been a strong correlation between classroom computer availability and the ICT adoption in teaching (Rosenfeld and Martinez-Pons 2005; Robinson et al. 2007; Harvey-Buschel 2009; Tondeur et al. 2009; Latio 2010). As our findings show, approximately three quarters of teachers agreed or strongly agreed that there were not enough computers in classrooms available for using Web 2.0. Teachers were also concerned with students' ability to access the internet when planning to incorporate web-based activities in their teaching. While schools may have computers and Internet access to enable Web 2.0 use, teacher still faced challenges in making access sufficiently available to students in classrooms. Digital divide, a great challenge to West Virginia, definitely contributes to teachers' concerns. West Virginia's rural and isolated geography, coupled with high poverty level, negatively influences its telecommunication infrastructure (Appalachian Regional Commission 2006; US Census Bureau 2010), which has one of lowest number of internet service providers and the level of broadband access in the country (Miller 2011). Without overcoming such structural barriers, West Virginian teachers are not likely to find Web 2.0 appealing even though they claimed to employ student-centered strategies in their practices.

The need for sufficient number of computers with necessary peripherals and internet access in classroom may be even more intensified for the adoption of Web

2.0 since it is more sophisticated requiring high speed internet for effective collaboration, and promoting the use of multimedia tools such as digital cameras, microphones, or web cameras. However, even the increased number of quality computers with such peripherals and internet access may not solely guarantee teachers' positive attitudes toward or successful implementation with Web 2.0 for teaching. Tondeur et al. (2009)'s study identified not only computer availability and internet access but also ICT planning and ICT support where teachers are involved in the decision making and monitoring process as the integral parts of structural changes leading to successful ICT integration. Likewise, we recommend teachers be provided with not only enough classroom technologies but also opportunities where they discuss and develop ICT policies and plans regarding Web 2.0. Such a strategy can even guard against the planning and implementation of e-safety and privacy related rigid school policies, a growing concern among teachers limiting their adoption of Web 2.0 in classrooms (Interactive Educational Systems Design 2009; Light and Polin 2010).

5.3 Curriculum and ICT for reduced workload

The analysis showed that workload and a structured and standardized curriculum seem to be one of the biggest inhibitors for Web 2.0 adoption. This is congruent with existing research that found heavy workload and the lack of time as obstacles to successful technology integration (Selwood and Pilkington 2005; Zakopoulos 2005; Banyard et al. 2006; Lyons 2007; Dawson 2008). These suggest the need for adjusting and restructuring standardized curriculum in order to reduce teachers' workload and providing them with time both in and outside their classrooms to prepare and execute Web 2.0 learning activities. While such arrangements requires school or statewide changes in policies and curriculum planning, promoting Web 2.0 as a means to reduce workload may be useful to help address teachers' concerns.

According to Selwood and Pilkington's study (2005), teachers tend to think that adopting ICT for teaching consumes excessive time, but their workload can still be reduced by ICT in the long run as it may help reduce the time spent on planning and administrative related tasks. For instance, given the nature of Web 2.0 tools, which enables users to share their work online without having to save on hard disks or any external drive, teachers and students may spend less time managing the learning content. While this prevents learning artifacts and students work from being easily lost, it also helps teachers and students keep track of their learning progress as they have access to the content of their work online anytime anywhere.

5.4 Teaching style

The analysis showed that teacher style had significant positive correlation to the likelihood of finding Web 2.0 appealing for teaching. That is, the less top-down control teachers claim to practice over students' learning process, the more appealing they would find using Web2.0 in teaching. This is consistent with existing research that indicates teachers employing student-centered pedagogies tend to have both increased (den Brok et al. 2004; Inan et al. 2010) and more meaningful (Becker 1999) use of technologies in their classrooms.

Despite this correlation, teaching style was not found a significant predictor in our study, however. That is, just because teachers indicate to be student-centered and to highly involve their student in the constructivist learning process does not mean they will find Web 2.0 technologies appealing for their teaching. Given their potential to foster student collaboration and inquiry, these tools may be considered a better match for student-centered pedagogies. Yet, other conditions such as reasonable workload and available time may need to be in place first even for student-centered teachers to develop positive attitudes toward and be more receptive to Web 2.0. Although implementing student-centered approaches is associated with increased technology use in classroom (den Brok et al. 2004; Inan et al. 2010), it may not be a contributing factor unless teachers have available time, and access to enough number of computers with necessary configurations in classroom that support the use of Web 2.0 activities.

Further, as findings showed, teachers claimed to mainly prefer “shared control” with students. They preferred to encourage students to take active role in their learning but also tend to provide necessary guidance for students. Although this may imply that teachers are not aversive to collaborative and user-generated content aspects of Web 2.0, their tendency to control the planning aspect of the lesson may still influence their perception about Web 2.0. As the use of Web 2.0 generally involves spontaneous learning tasks (taking pictures, posting on Facebook, commenting on blog post, and etc), teachers may be concerned about being able to timely meet lesson objectives and learning goals that they set for web-based lessons. With such lesson planning concerns in mind, what teachers may need is a clear understanding of how to use Web 2.0 pedagogically, which likely helps develop more positive attitudes toward such technologies.

5.5 Professional development with content oriented Web 2.0

The findings suggest that as teachers might be less concerned with their Web 2.0 experiences, what is more important for them to develop positive attitudes toward Web 2.0 incorporated lessons may be to have clear ideas about how these tools are effectively used in classrooms to enhance students’ learning in particular content areas. Trucano’s (2005) review of effective use of ICTs in education shows that the perceived lack of suitable and relevant content for ICT-enabled pedagogies was a great barrier for teachers to adopt ICT in school settings. As found in our study, teachers who felt Web 2.0 could likely be used in various aspects of teaching and considered students’ learning needs as an important factors for internet use were more likely to find using Web 2.0 appealing in their practices. In other words, if teachers do not conceptualize the ways in which Web 2.0 can be used in teaching, or are not sure how it might help meet students’ content learning needs, they are not likely to find it appealing even though they may have fairly good experiences and familiarity with Web 2.0 technologies.

One way to overcome this is to expose teachers to existing practices where Web 2.0 is incorporated in particular content areas of teaching. However, given that Web 2.0 in education has emerged only recently, examples of effective practices with Web 2.0 available to teachers are scarce. Developing video-based classroom cases (Chaney-Cullen and Duffy 1998; Brush and Saye 2007) or video clubs opportunities (Sherin and Han 2004; Sherin and van Es 2009) that enable teachers to review and

discuss videos from their classrooms can be an effective method to provide observable pedagogies. Even though teachers may be new to using Web 2.0 in their lessons, seeing each others' practices and getting feedback for their own teaching as they develop and implement their lessons can help them learn new ways to foster students' learning with Web 2.0. Such school level initiatives, unlike “on-time” and “one-size fits” workshops that are usually planned for larger group of teachers (Lyons et al. 2006; Wilson and Ringstaff 2010; Goos et al. 2011), may provide better professional development opportunities for West Virginian teachers by allowing them to critically examine each other's teaching, and to discuss any concerns unique to their schools' rural settings such as infrastructural barriers or workload.

6 Conclusion

This research examined K12 teachers' attitudes toward and experiences with adopting Internet and emerging Web 2.0 technologies in their teaching. Teachers from both rural and urban schools in two counties of West Virginia participated in this cross sectional survey study. The analysis revealed factors such as age, self-efficacy, workload, and views about Web 2.0 in teaching that significantly predicted how likely teachers found these emerging tools appealing for their teaching. Although being a student-centered teacher was helpful, reasonable workload, computer availability, students' ability to access internet, and clear ideas about how to teach with such tools in content areas seemed to be more essential factors for teachers to develop positive attitudes toward Web 2.0 adoption in teaching. To help this process, this study suggests the need for not only increasing the number of available computers in classrooms and the level of student internet access but also involving teachers in discussion and development of schools' ICT policies. Further, the study emphasizes the importance of adjusting teacher workload and providing teachers with opportunities to observe existing Web 2.0 enhanced practices in their particular discipline.

There are areas of further research related to examining teachers' adoption of Web 2.0. Empirical investigations of how teachers' attitudes and experiences with these tools change overtime could expand the suggestions made in this paper. The newly developed ICT policies, recent infrastructural changes, and current professional development efforts in schools for different groups of teachers (e.g., age, experience, or content area) will be worth examining regarding how they may affect their evolving attitudes and experiences with Web 2.0. Lastly, while the survey items used and developed in this study could be adopted for other research in focusing teachers' integration of emerging technologies, more qualitative data driven explorations such as interviews with both teachers and students, and observations of their classrooms will enhance the understanding of issues particular to individual cases of teachers' technology adoption.

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