Available online at www.sciencedirect.com
ScienceDirect
Computers & Education 50 (2008) 1–22
COMPUTERS & EDUCATION
www.elsevier.com/locate/compedu

Using mobile communication technology in high school education: Motivation, pressure, and learning performance

Pei-Luen Patrick Rau [a,*], Qin Gao [a], Li-Mei Wu [b]

[a] *Department of Industrial Engineering, Tsinghua University, Beijing 100084, China*
[b] *St. Francis Xavier High School, Taoyuan, Taiwan*

Received 30 August 2005; received in revised form 15 February 2006; accepted 26 March 2006

Abstract

Motivation and pressure are considered two factors impacting vocational senior high school student learning. New communication technology, especially mobile communication technology, is supposed to be effective in encouraging interaction between the student and the instructor and improving learning efficiency. Social presence and information richness theory was applied to analyze the media and their impacts on the instruction process firstly. Then the author observed firstly the impact of using individual communication technologies – namely Short Message Service (SMS), email, and online forum – on student learning motivation, pressure, and performance, based on a comparative investigation of 176 students. Then the impacts of using combination of mobile and Internet communication technology – SMS + email, SMS + online forum – were examined with another experiment of 45 students. The result showed that instant messaging helps bonding the two roles – student and instructor – in the instruction process effectively. When combined with Internet communication media, it can significantly increase student extrinsic motivation without causing higher pressure. Additionally, communication media demanding public expression rather than private dialogue should be adopted with careful consideration, since they may raise student pressure.

Keywords: Mobile communication; Computer mediated communication; Education; Motivation; Pressure; Exam performance; Social presence; Media richness

1. Introduction

In Taiwan, senior vocational and technological education programs are designed for general junior high school leavers. Generally students enrolled in a vocational senior high school are those who do not perform very well in their past academic history. They are expected to master certain skills to an extent good enough to earn their own livings in a relatively short time range. Compared with students in regular high schools, students in vocational senior high schools have more pressure from future expectation. However, in spite of aspired by future expectation, vocational high school students in Taiwan were reported less motivated and

* Corresponding author. Tel.: +86 1062776664; fax: +86 1062794399.
E-mail address: rpl@mail.tsinghua.edu.cn (P.-L.P. Rau).

0360-1315/$ - see front matter © 2006 Elsevier Ltd. All rights reserved.
doi:10.1016/j.compedu.2006.03.008

not confident enough due to excessive academic frustrations and great social pressures (Xia, 1995). According to a campus wide survey done in Taoyuan vocational senior high school in 2001, the first major reason contributing to their academic frustration and failure perceived by students was lack of learning motivation.

To elevate student motivation and promote teaching efficiency, more and more computer technologies are integrated into classroom education, and recently mobile communication is emerging in the area. Communication between the instructor and the student will be influenced by the media-mediated communication environments, but how the differences between various media impact the instruction process and learning result is in query. Some educational experiments have been conducted to investigate the influence of using mobile communication in education, but most of them implemented mobile communication systems for managing learning activities, but not for leaning directly. The impact of using mobile communication technology to spread learning material and increase informal interaction has been rarely studied. Further, mobile learning was suggested to be better used as an extension to current learning tools, but how to combine mobile learning tools with Internet learning tools effectively still need to be explored empirically.

The objective of this study is to investigate the effects of mobile communication technology in education, concentrating on instant messaging usage. Two experiments were conducted in a Computer Literacy Course taught in Tao-Yuan vocational senior high school to study the following two questions, respectively: (1) what is the impact of different communication media, (namely Short Message Service (SMS), email, and electronic online forum) on learning motivation, student pressure and learning performance when each functions individually? and, (2) how can learning motivation, pressure and performance be influenced when mobile and Internet communication are used synergistically?

2. Literature review

2.1. Motivation in learning

Learning takes place through interplays between cognitive and motivational variables and these two aspects are found inseparable (Pintrich, 1999; Stefanou & Salisbury-Glennon, 2002; Valle et al., 2003). Therefore, motivational aspects were carefully studied in education theory. Previous studies have found that the motivational orientation (intrinsic or extrinsic orientated) of students have significant impact on their learning performance. Although both influence learning outcome positively, intrinsic motivation was found associated with a lower dropout rate, higher-quality learning, better learning strategies, and more enjoyment of school (Carlton & Winsler, 1998; Czubaj, 2004; Deci & Ryan, 1985; Kauffman, 2004; Moneta, 2004), and is generally considered more desired by western researchers (Pintrich & Schunk, 1996). Chinese students were found more often extrinsic motivated (Smith & Smith, 1999), which was considered negatively traditionally. However, researchers investigating learning behavior of Chinese students argued that extrinsic motivation, especially career related motivation, does not take place in a negative form for Chinese students (Kember, 2000; Xu, 2004). In spite of depressing intrinsic motivation as it happens to western students, for Chinese students, extrinsic motivation was found correlated with intrinsic motivation, and encourage students to adopt deep strategies in learning (Xu, 2004).

Classroom environment is critical for fostering motivation (Stefanou & Salisbury-Glennon, 2002). Deci and Ryan suggested that motivation are enhanced when educational programs are tailored to the unique individual needs of each learner (Deci & Ryan, 1985), and this was examined by a research in which a learner-centered environment yielded better performance and a more intrinsic motivational orientation (Alfassi, 2004). Some other researchers believed that how the learning environment emphases participation and responsibility influence the motivational orientation (Ames, 1992). Peer coaching and learning community are typical applications brought by such a belief. Stefanou and Salisbury-Glennon found significantly enhancement of both intrinsic and extrinsic motivation by the end of participation in the learning community in their experiment (Stefanou & Salisbury-Glennon, 2002).

2.2. Media richness and social presence

Media richness and social presence have been proved as two concepts related to communication performance and interpersonal relationships (Daft & Lengel, 1986; Daft, Lengel, & Trevino, 1987; Dennis & Kinney,

1998; Gatlin-Watts, Arn, & Kordsmeier, 1999; Irani, 1998; McQuillen, 2003; Nardi, Whittaker, & Bradner, 2000; Panteli, 2002; Schliemann, Asting, Folstad, & Heim, 2002). While the first refers to the ability of information to change understanding within a time interval or provide substantial new consensual understanding (Daft & Lengel, 1986; Irani, 1998), the latter refers to the degree to which a person is perceived as a 'real person' in mediated communication.

Daft and Lengel suggested that media richness is determined by four factors: the ability of the medium to transmit multiple cues, immediacy of feedback, language variety, and the personal focus of the medium. Based on this, they ranked various media according to richness. Later Connell et al. supplemented the list with CMC (Connell, Mendelsohn, Robins, & Canny, 2001). While face-to-face ranks the first, video follows to be the second, and then telephone, CMC, addressed written communication, unaddressed written communication, and formal numeric text the last. The exact richness level of each media is still in argument, however. For example, Panteli found that email, often considered as a lean medium, actually amplified rather than alleviated hierarchical differences in offices, due to the social cues contained in the way text message were constructed (Panteli, 2002). Another important conclusion held by richness theory is matching media richness with task equivocality will improve communication performance. It means that performance improves when rich media are used for equivocal tasks and lean media are used for nonequivocal tasks. However, empirical studies yield both positive and negative results for this conclusion (Dennis & Kinney, 1998; Schliemann et al., 2002).

Social presence is defined by Short et al. as a subjective quality of the medium itself, which determines the way the individuals interact with each other (Short, Williams, & Christie, 1976). Intimacy and immediacy were identified as two variables contributing to social presence. The former refers to physical representation of closeness, while the latter is the psychological distance between the communication subjects (Wiener & Mehrabian, 1968). Both verbal and nonverbal cues contribute to social presence (Connell et al., 2001), and the choice of communication medium was found impacting immediacy significantly (Heilbronn & Libby, 1973). Social presence was found consistently associated with learner satisfaction, which is assumed to influence learner motivation (Steffey, 2001).

2.3. Computer mediated communication (CMC) in education

Confronted with technology advances, instructors are pushed to incorporate computer technology into pedagogical practices. Computer-mediated communication is found facilitating constructivism learning and individualized learning (Abrami & Bures, 1996; Muir-Herzig, 2004). Students felt less threatened to express their opinions or to seek for help from teachers or peers due to reduced social cues within the mediated environment (Bures, Abrami, & Amundsen, 2000), and the school education is expected to become more student-centered and individualized after implementing computers into the system (Guzley, Avanzino, & Bor, 2001; Ragosta, 1983). Several studies indicated that using computers in education brings complexity to learning tasks and thus increase student motivation (Baker, Gearhart, & Herman, 1990; Dwyer, 1994). It helps student to become more self-reliant, and encourage peer coaching, facilitating collaboration in this way. Whereas most of these efforts adopt computers as assistants of classroom instructions, Smeaton and Keogh (1999) used virtual lectures in place of traditional delivery of lectures and presented an electronic version of a course delivery paradigm with which both teachers and students are familiar.

Some researchers investigated the factors influencing the effects of CMC adoption in education. Irani found that information richness and system design factors of a computer-mediated-environment have impacts on student attitude, preference, their satisfaction towards the course and learning outcome (Irani, 1998). Zagorsky pointed out that concerns about students' acceptance of the tools should not be neglected (Zagorsky, 1997). Bures et al. found that student motivation have impact on a student's acceptance of Computer Conferencing (CC) as an educational tool (Bures et al., 2000). Students who believed that CC would help them to learn the course materials (outcome-expectation) and students who believed that they could acquire the ability (self-efficacy) to use CC were more likely to be active online than students who were concerned about their relative performance compared to others (goal-orientation). Researchers also found that technology training is needed for the teachers to apply technology as a tool for their curriculum, and steps must be taken for technology to make difference (Muir-Herzig, 2004).

2.4. Mobile communication technologies in education

Following traditional Internet communication, mobile communication is recently emerging in the field of education. Compared with computer mediated communication, the high penetration rate of mobile devices and high popularity among the youth (International Telecommunication Union, 2002) lend mobile communication superior advantages when approaching young students. While CMC implementation in education mostly aims at enhancing learning in formal arenas (Mifsud, 2002), mobile communication, especially instant messaging service, is expected to be used as a bridge between the formal and informal learning approaches.

The impact of using mobile communication technologies in learning environments has been examined empirically by several studies, concluded as enhancing availability and accessibility of information networks, engaging students in learning-related activities in diverse physical locations, and enhancing communication and collaborative learning in the classroom (Liu, Wang, Liang, Chan, & Yang, 2002). It was found that students were excited to try the "new" thing, and spent more time in working with the subject taught with the new tool (Dvorak & Burchanan, 2002). However, Trifonova doubted if this excitement is just a temporal effect (Trifonova, 2003).

Among numerous choices mobile technology provides for education, instant messaging is one of the most widely spread applications. Some educational experiments have been carried out in this area. SMS were sent to students to inform of their schedule, changes in it, examination dates, places, marks, etc. (Stone & Briggs, 2002), or were used to guide, prompt and support the students in learning (Garner, Francis, & Wales, 2002). A survey in Norway also showed that students considered SMS as a proper tool for spreading information about lectures, schedule, etc. (Divitini, Hargalokken, & Norevid, 2002). The findings were generally positive. However, most of the implemented messaging systems were not directly for learning, but for managing learning activities.

Another important function of mobile communication is increasing interpersonal communication between people, mostly in an informal style. Nardi et al. (2000) suggested that informal communication is very effective in social bonding and social learning. Adoption of such informal interaction into education environment is expected to promote student motivation, reduce student pressure, and improve instructor–learner relationship. But empirical studies are needed to support such an affirmation.

Additionally, Kukulska-Hulme (2002) suggested, and some other agreed (Trifonova, 2003), that mobile devices are more appropriate to work as an extension of current learning tools, rather than replacing them, but how to combine mobile and Internet learning effectively has not been empirically explored yet.

3. Research issues

Instant messaging (SMS), email and online forum are mainly text-based, and considered relatively low in information richness. When the media are used to augment rather than substitute face-to-face communication, lean media can be more desired, since they reduce socio-emotional cues and thus reduce pressure upon people. People can express themselves with less inhibition, and act more like themselves. It is found that media low in richness with an asynchronous nature reduce pressure for people to response immediately and need to ingratiate (Connell et al., 2001). The result from an empirical study found that online electronic components in education process encouraged more help seeking behaviors, and students reported that they felt less threatened or embarrassed to seek help than in traditional classrooms (Kitsantas & Chow, 2005).

Research issue 1: What is the impact of using SMS, email or online forum separately in the instruction process on student pressure?

With respect of social presence, SMS is considered of high social presence due to its informal nature and pervasive usage. It is widely used due to its mobility and flexibility, and becomes one of most important bonding methods between the youth. The medium itself represents a certain level of immediacy. When the instructor communicates with the student with SMS, it is expected that the distance between the two parts will be shortened, resulting in better relationship and higher student motivation. Email and online forum bonding is expected to take place in a similar way, although with less immediacy are the

media. In addition, online forum is slightly different, since it provides not a one-to-one private dialogue, but a open environment for discussion. It is expected that such an environment would increase interaction among the students, and encourage peer coaching which can also increase learning motivation. Thus, all three media were expected to increase learning motivation. The improvement in motivation and pressure were expected to impact the ultimate exam performance positively. The differences between media were of interests.

Research issue 2: What is the impact of using SMS, email or online forum separately in the instruction process on students' learning motivation?

Research issue 3: What is the impact of using SMS, email or online forum separately in the instruction process on students' exam performance?

While SMS is strong in relationship bonding but relatively weak in richness – even weaker when compared with lean media such as email due to the limitation of message length, it was considered that using SMS to send brief information and using Internet tools (online forum/email) which are more capable for mass data transferring to spread learning material would yield even better instructional result, namely enhanced motivation, alleviated pressure and promoted performance.

Research issue 4: What is the impact of combining wireless communication and online communication (email or online forum) in the instruction process on student pressure?

Research issue 5: What is the impact of combining wireless communication and online communication (email or online forum) in the instruction process on students' learning motivation?

Research issue 6: What is the impact of combining wireless communication and online communication (email or online forum) in the instruction process on students' exam performance?

4. Methodology

4.1. Experiment 1

4.1.1. Independent and dependent variables

A one factor experiment design was used to investigate research issue 1–3. The independent variable was the use of individual media in instruction process. This was manipulated by spreading learning material and the instructor's encouragement via four different approaches: using SMS, email, online forum, or no digital media. The dependent variables were student pressure, motivation and performance of learning. Motivation and pressure were measured by a five point scale consisting of six items, which yielded a Chronbach alpha as 0.8637 and 0.8112 in pre- and post-experiment measurement. Learning performance was measured with the score of quiz at the end of each week.

4.1.2. Participants

One hundred and seventy six juniors majoring in accounting in Taoyuan vocational senior high school participated in the first experiment, including 142 females and 34 males (Table 1). According to their SMS, email,

Table 1
Participants in experiment 1

Group	Male	Female	Requirements	Total
SMS group	5	37	1. Have cell phone 2. Always carry on cell phones with them	42
Email group	7	39	1. Have computer at home 2. Be used to sending and receiving email daily at home	46
Online forum group	8	37	1. Have computers at home 2. Be used to surfing on the Internet	45
Control group	14	29		43
Total	34	142		176

and Internet usage, four groups were divided: SMS group, email group, online forum group, and control group. In addition, participants were assigned to different groups based on such a rule that no significant difference in previous learning performance – measured by performance in the past two tests of the lecture – existed across groups.

4.1.3. Procedure

Fig. 1 describes the procedure of the first experiment. The seventh chapter of the Computer Literacy Course was chosen for the three week experiment. In the first two weeks, two messages were sent to students in experimental groups. Students received a copy of learning material (exercise, lecture notes, etc.) via experimenting media (SMS, email and online forum) three days after the lecture. One day before the quiz of each week, a

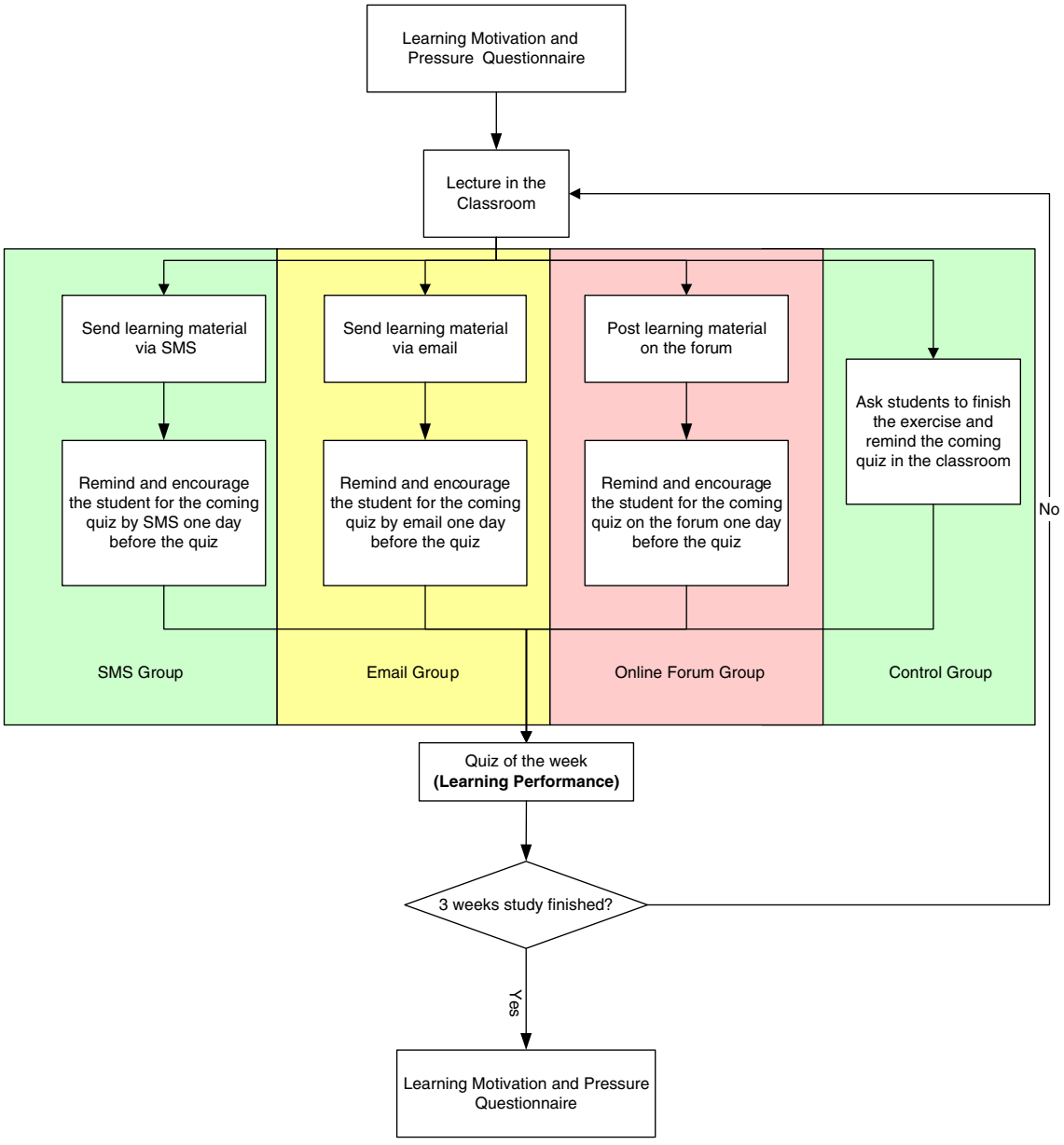

Fig. 1. Procedure of experiment 1.

reminder (containing also encouragement from the instructor) of the quiz were sent through different channels to students in experimental groups. In the third week, a reminder was sent before the quiz. The content of these messages were described with details in Appendix A. Students in the control group were given the exact same information, but received all in face-to-face interaction in the classroom. All students were asked to complete a questionnaire measuring learning motivation and pressure before and after the experiment, and were given a quiz at the end of each week.

4.2. Experiment 2

4.2.1. Independent variable and dependent variable

Research issues 4–6 were studied by the second experiment. The independent variable was different combinations of wireless and Internet communication tools in instruction process, namely: SMS + email, SMS + online forum, and no digital media used.

In experiment 2, pressure and performance were still dependent variables. However, it was found after the first experiment that the two aspects of the concept of motivation, intrinsic and extrinsic, should better be distinguished. Therefore, three motivational dependent variables were used in experiment 2: intrinsic motivation, extrinsic motivation, and overall motivation.

Because of this, the instrument used in the first experiment was not proper for the second one. The author adopted the Learning Trait Scale developed by Kang and Zhong (2004) after an examination of the literature. It was found to be a valid instrument in Chinese for measuring learning motivation and pressure. The Chronbach alpha of the instrument was 0.8001 for the pre-experiment measurement, and 0.8519 for the post hoc measurement. Learning performance was measured with two quizzes in each week.

4.2.2. Participants

Forty-five students were recruited for the second study, including 29 females and 16 males (Table 2). Similarly, participants were assigned to different groups in such a manner that no significant difference in previous learning performance existed across groups.

4.2.3. Procedure

The procedure of the second experiment was shown in Fig. 2. The ninth chapter of the Computer Literacy Course was chosen for the four week experiment. One obvious problem in the first experiment was that a single short message contains less than 69 Chinese characters, and therefore the instructor must divided those long messages – i.e., lecture note, exercises and answers – into several shorter messages and send them to students in a sequence. In experiment 2, this situation was improved by the synergistic use of SMS and email/online forum. Email and online forum were used to deliver lecture notes and exercises, and SMS was used to remind students to check the distributed material, remind them of the coming quiz,

Table 2
Participants in experiment 2

Group	Male	Female	Requirements	Total
SMS + email group	5	10	1. Have cell phone 2. Always carry on cell phones with them 3. Have computers at home 4. Be used to sending and receiving email daily at home	15
SMS + online forum group	6	9	1. Have cell phone 2. Always carry on cell phones with them 3. Have computers at home 4. Be used to surfing on the Internet	15
Control group	5	10		15
Total	16	29		45

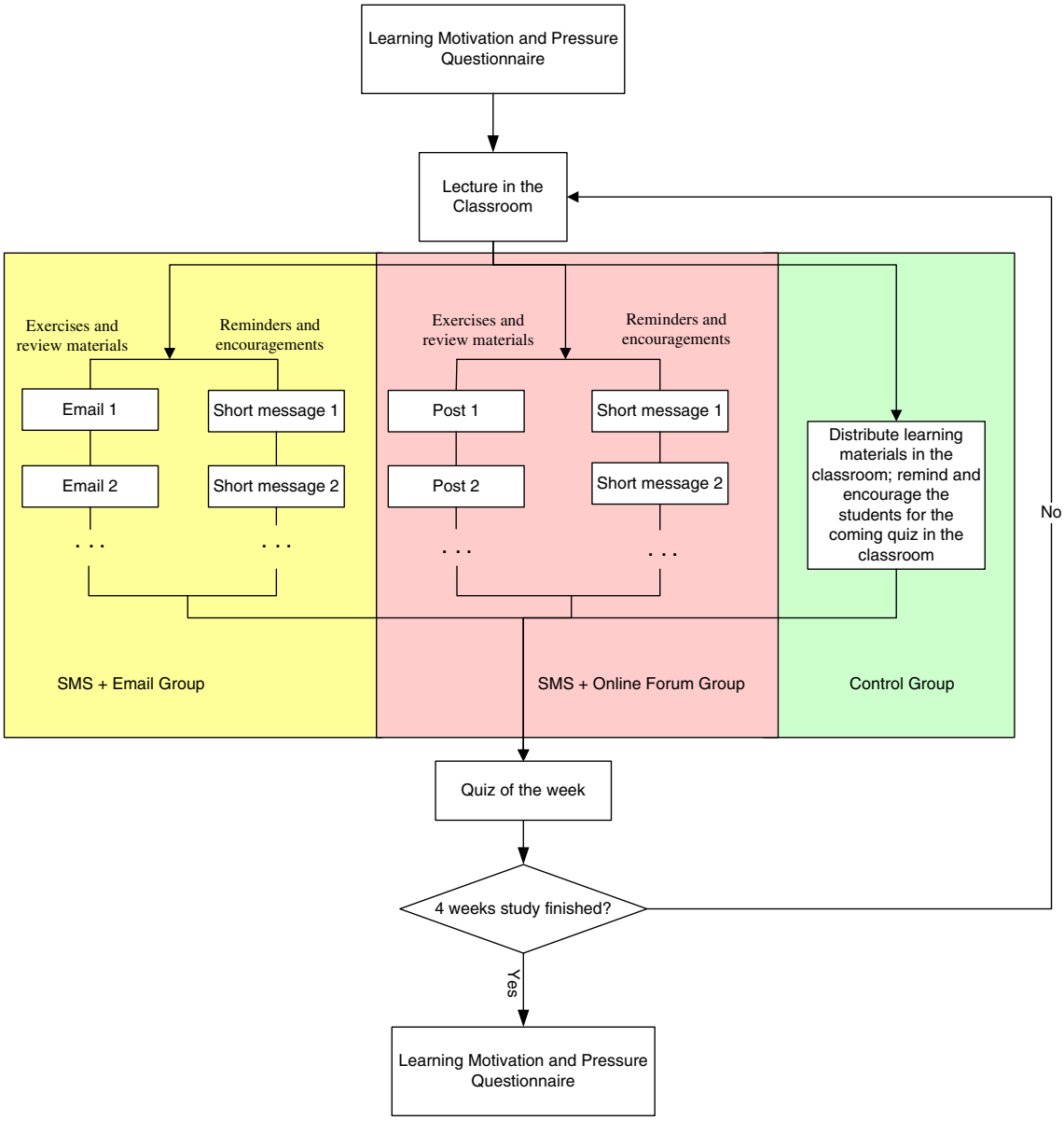

Fig. 2. Procedure of experiment 2.

and encourage them to hold on. Students in the control group were given the exact same information, but did not have any other communication with the instructor except for face-to-face interaction in the classroom. In each week the amount of messages/posts/emails varied depending on the lecture content of that week. In the first week, seven posts were posted for the SMS + forum group; students in SMS + email group received seven emails with the same content. Nearly the same four messages were sent to students in these two groups. In the second week, two posts/emails and three short messages; in the third week, two posts/emails and two short messages; and in the fourth week, two posts and three messages were distributed to students in the two experimental groups. The order and the content of these posts/emails/messages were detailed in Appendix B. Students took two quizzes once a week to examine their learning performance. All participants were required to complete a questionnaire for measuring learning motivation and perceived pressure before and after the experiment.

5. Result analysis

5.1. Experiment 1

One way ANOVA was used to examine the differences in learning motivation and pressure between groups before the lecture, and the results showed no significant differences across groups before the experiment.

The result of the three quizzes was shown in Table 3. No significant differences were found after one-way ANOVA analysis, but nearly all the mean of the experimental groups were larger than that of the control group, except for the score of SMS group in the second quiz. Comparisons were then carried out in pairs, and *t*-test was used to examine the differences. Motivation, pressure, and performance of each experimental group were compared with that of the control group after the lecture at first, then the differences of motivation and pressure between pre- and post-lecture measurement were examined. The result was shown below.

5.1.1. SMS group

When compared SMS group with the control group, significant differences were found with learning pressure. SMS group perceived less possibility ($M = 3.143$) that interaction with the instructor through SMS would increase pressure than the control group ($M = 3.857$, $t = -3.302$, $p < 0.05$). besides, some significant differences were found with certain items related to motivation and perceived performance facilitation when the SMS group is compared with the control group as shown in Table 4, including "lecture notes received through SMS can increase my motivation" ($M_{sms} = 5.024$, $M_c = 4.786$, $t = 2.399$, $p < 0.05$), "lecture notes received through SMS can promote my exam performance" ($M_{sms} = 5.143$, $M_c = 4.429$, $t = 3.016$, $p < 0.05$), and "reminders sent through SMS can promote my exam performance" ($M_{sms} = 5.119$, $M_c = 4.548$, $t = 2.680$, $p < 0.05$). However, no overall significant differences in learning motivation and performance were found between the groups. Moreover, no significant differences were found between the pre- and post-testing comparison of motivation and pressure.

5.1.2. Email group

Experiment result showed no significant differences between the control group and the experimental group regarding any dependent variables, i.e., motivation, pressure, and performance. There were no differences between the pre- and post-testing evaluation, neither.

Table 3
Student exam performance in the first study

	SMS ($N = 42$)		Email ($N = 46$)		Online forum ($N = 45$)		Control ($N = 43$)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Quiz 1	40.48	25.39	42.70	27.78	41.36	29.88	38.63	28.49
Quiz 2	64.64	14.95	65.17	16.19	71.11	15.63	64.65	18.03
Quiz 3	72.14	12.37	71.96	15.22	76.40	11.86	69.42	14.06

Table 4
Comparison of post-testing evaluation of learning motivation and perceived pressure between SMS group and control group in study 1

	SMS group		Control group		*t*-Value	*p*-Value
	Mean	SD	Mean	SD		
Using SMS to help review the lecture can promote my learning motivation	5.024	1.179	4.786	0.976	2.339*	0.024*
Using SMS to send encourage messages can promote my learning motivation	5.214	1.116	4.786	0.976	1.872	0.068
Using SMS to help review the lecture can improve my exam performance	5.143	1.095	4.429	1.151	3.016*	0.004*
Using SMS to help review the lecture can improve my exam performance	5.119	1.109	4.548	0.942	2.680*	0.011*
Using SMS to coach me strictly can improve my exam performance	4.381	1.143	4.143	0.977	0.824	0.414
Using SMS in instruction process increases my pressure	3.143	1.317	3.857	0.952	−3.302*	0.002*

* *p*-Value < 0.05, suggesting significant difference.

Table 5
Comparison of exam performance between online forum group and control group

		Number of students	Score mean	SD	*t*-Value	*p*-Value
Quiz 1	Online forum group	45	41.36	29.88	0.438	0.663
	Control group	43	38.63	28.49		
Quiz 2	Online forum group	45	71.11	15.63	1.798	0.076
	Control group	43	64.65	18.03		
Quiz 3	Online forum group	45	76.40	11.86	2.522	0.014*
	Control group	43	69.42	14.06		

* p-Value < 0.05, suggesting significant difference.

5.1.3. Online forum group

Significant difference was found in the score of the third quiz between the experimental group ($M = 76.4$) and the control group ($M = 69.42$, $t = 2.522$, $p < 0.05$), as shown in Table 5. However, no other significant difference was found in motivation, pressure, or other quiz scores.

5.2. Experiment 2

The result of one way ANOVA showed no significant differences in motivation and pressure across the groups before the experiment.

5.2.1. Learning performance

ANOVA analysis suggested that there were no significant differences between various groups in quiz scores. Either no significant difference was found in pair comparison between the control group and individual experimental groups. However, score means of both experimental groups were larger than the mean of the control group as shown in Table 6, implying electronic mediated communication may improve the learning performance in long term if using continuously.

5.2.2. Learning motivation and pressure

When comparing each experimental group with the control group with *t*-test, the author found that students in SMS + email group ($M = 3.70$) held higher extrinsic motivation than students in the control group without any electronic mediated communication with the instructor ($M = 3.11$, $t = 2.548$, $p < 0.05$). But no significant differences were found between the SMS + online forum group and the control group (see Table 7).

The comparison of motivation and pressure between the pre- and post-experiment showed that extrinsic motivation of students in SMS + email group was significantly promoted after the lecture ($M = 3.70$) when compared with before the lecture ($M = 3.46$, $t = -2.331$, $p < 0.05$). Students in the SMS + online forum group were also significantly more motivated extrinsically after the lecture ($M = 3.6$) than before the lecture ($M = 3.29$, $t = -2.930$, $p < 0.05$) as shown in Table 8, and the overall motivation after the lecture

Table 6
Student exam performance in the second study

	SMS + email ($N = 15$)		SMS + online forum		Control ($N = 15$)	
	Mean	SD	Mean	SD	Mean	SD
Quiz 1	79.3	17.3	75.0	14.4	71.4	10.3
Quiz 2	68.8	12.7	63.1	12.2	63.0	11.4
Quiz 3	61.2	14.4	58.7	12.5	58.4	12.5
Quiz 4	72.0	13.1	70.7	11.6	68.1	8.4
Quiz 5	54.7	16.4	54.7	12.6	53.7	12.7
Quiz 6	70.7	29.7	68.7	25.0	68.7	21.7
Quiz 7	54.1	19.7	49.7	20.8	46.5	23.2
Quiz 8	55.7	23.6	52.0	18.4	49.9	20.2

Table 7
Comparison of learning motivation and pressure after the experiment between SMS + email group and control group

		Number of students	Score mean	SD	*t*-Value	*p*-Value
Intrinsic motivation(enjoyment)	SMS + email	15	3.57	0.81	0.733	0.476
	Control	15	3.42	1.02		
Extrinsic motivation (endeavor)	SMS + email	15	3.70	0.81	2.548	0.023*
	Control	15	3.11	1.08		
Overall motivation	SMS + email	15	3.20	0.85	−0.848	0.411
	Control	15	3.38	0.91		
Perceived pressure	SMS + email	15	3.20	0.85	−0.848	0.411
	Control	15	3.38	0.91		

* *p*-Value < 0.05, suggesting significant difference.

Table 8
Comparison of learning motivation and pressure between pre-testing and post-testing measurement in SMS + forum group

		Number of students	Score mean	SD	*t*-Value	*p*-Value
Intrinsic motivation (enjoyment)	Before	15	3.38	0.83	−1.708	0.110
	After	15	3.54	0.74		
Extrinsic motivation (endeavor)	Before	15	3.29	0.88	−2.930	0.011*
	After	15	3.60	0.85		
Overall motivation	Before	15	3.33	0.86	−3.756	0.002*
	After	15	3.57	0.80		
Perceived pressure	Before	15	3.12	0.82	−2.416	0.030*
	After	15	3.28	0.87		

* *p*-Value < 0.05, suggesting significant difference.

($M = 3.57$) was markedly promoted compared with before the lecture ($M = 3.33$, $t = -3.756$, $p < 0.05$). However, students were also found perceiving more pressure after the lecture ($M = 3.28$) than before the lecture ($M = 3.12$, $t = -2.416$, $p < 0.05$).

6. Discussion

Experiment 1 aimed to study the impacts of individual electronic communication media – mobile or Internet tools – on student motivation, pressure, and ultimate performance when these media are used to assist interaction between the instructor and the students besides classroom communication. It was expected the lean richness and increased immediacy will motivate the student without causing higher pressure, and finally result in better exam performance.

The experiment result proved that using mobile and Internet communication tools in the instruction process will not increase student pressure. For students communicating through SMS with the instructor, the perceived pressure was alleviated rather than increased ($p < 0.05$, as shown in Table 4). This finding is consistent with Kitsantas and Chow's study, which indicated that the reduced information lead to the absence of social cues, thus reduced the potential of feeling embarrassment while seeking help in learning (Kitsantas & Chow, 2005). No significant improvement in motivation was found, but SMS facilitated students reported several significant differences at certain motivational items. The reason for this may be that SMS is a popular informal communication tool among the youth, and it represents certain level of immediacy itself. When the student received SMS from the instructor, he/she may feel being cared for, and felt bonded strongly with the instructor and classroom activities. This induced positive attitudes toward the instructor and learning. Some students replied the instructor's message, saying, "I will work on, don't worry! ☺", which made the instructor feel

warmed, too. For email and online forum group, such phenomena were not found, suggesting that SMS might be more bonding than these Internet tools. The learning performance was not improved significantly by augmented mediated communication, using either mobile or Internet tools. Several plausible reasons may attribute to this: first, the time period is quite short. Only three week can not illustrate the impact that need a certain time period to exhibit. Second, SMS is inadequate to deliver rich content such as lecture notes or exercise. The divided messages might result in inconvenience for learning.

Experiment 2 aimed to examine the effects of various combinations of mobile and Internet communication tools on learning process. ANOVA analysis suggested significant difference in extrinsic motivation, but no significant difference in pressure, intrinsic and overall motivation. The finding is interesting. Firstly, communication via various media seems having accumulative communication effects. When the instructor "touch" students through various channels, the immediacy of each single media might be added or amplified by such a multi-channel communication style. While email and online forum deliver rich lecture-related information in a convenient way, SMS bonds the instructor and the student closer, and motivates students to pay more attention to information in their email box or on the online forum. Secondly, it implies that students are "pushed" rather than "pulled". While the intrinsic motivated students can be considered as pulled by perceived enjoyment and pleasure, extrinsic motivated students are more like pushed by desired outcome. The result implies that vocational high school students in Taiwan care more about their learning performances and exam outcomes, and might be more easily motivated extrinsically than intrinsically. This coincided with previous findings that Chinese students were more likely to be extrinsically motivated (Smith & Smith, 1999). For Chinese students, however, such a motivational orientation is not only natural, but also beneficial, since extrinsic motivation correlates with intrinsic motivation, and influences learning in a positive form (Xu, 2004).

The result also showed students in SMS + online forum group perceived more pressure after the experiment than before the experiment. While email and SMS provide a private dialogue between the instructor and each student, online forum demands students to engage in a more public communication environment. Since the discussion is demanded as in the study, students can hardly maintain an anonymous profile online. More social cues may be presented through the online discussion, and cause more pressure for students. Kitsantas and Chow's study indicated that feeling embarrassed, fear of being perceived as 'dumb' by others, and increased perceived threat to self esteem may prevent the student from seeking help from the instructor (Kitsantas & Chow, 2005). The result from current study implied that these feelings might increase student pressure, and can be alleviated with electronic communication tools if private dialogues are allowed, but might be aggravated with such tools if public discussions are demanded.

7. Conclusion

This study was limited in several aspects. Firstly the time period was too short. Three to four weeks of study was not sufficient to reveal changes in exam performance, which often takes place in a long time range. Secondly, intrinsic and extrinsic motivation were not distinguished in the first experiment investigating impacts of individual media. Further, it may be more helpful to measure the social presence besides motivation and pressure.

However, the result of the study did provide some valuable empirical data and findings, suggesting that mobile communication technology can help bond the instructor and students without increasing student pressure. Motivation derived from such a bonding may take place. The implication is very helpful for the instructors who are concerning how to shorten instructor–student distance and encourage more communication between the two sides.

When the mobile communication tool was combined with Internet tools, such as email or online forum, students can be significantly more motivated in an extrinsic manner. While the mobile channel can be used for concise information and interpersonal communication, the more capable Internet tools can be used for large amount data transferring. The result encouraged the instructor to combine mobile and Internet technology, and approach the student in a multiple-channel way.

Additionally, a communication medium allowing private dialogue should be preferred than a medium demanding more self-exposure regarding possible increase to student pressure. This might be culture

dependent, since Chinese students are considered very shy. But to get a solid conclusion, further study is needed.

Appendix A. Content of messages/posts/emails in Experiment 1 (The messages/posts/emails were ordered according to their distribution time.)

1st week: the first message/post/emails (for the SMS group, the complete content was delivered in three messages)

EXERCISE 1

```
for r = −3 to 3
s = s + r
next r
print s
```

EXERCISE 2:

```
s = 1
do while s mod 13<>0
a = a + 1
s = s + 2
loop
print a
```

EXERCISE 3:

```
for y = 1 to 10
t(y mod 6) = y * 2 − 1
next
? t(2) + t(3)
```

1st week: the second message/post/emails

In this section there is NO FINAL EXAM, and the score is computed based on your performance in the quizzes. Tomorrow is the FIRST QUIZ. Try your best!

Exercise answer:
Exercise 1: 0;
Exercise 2: 6;
Exercise 3: 32;

2nd week: the first message/post/email (for the SMS group, the complete content was delivered in three messages)

Chapter review:
Proxy server: firewall;
DNS: server name, resolve IP address;
SMTP, POP3;
Media;
Network architecture;
BPS;
OSI protocols;
Internet protocol: TIP/IP;
Server/client: server, client, WinNt;
Peer-to-peer: Win95, 98;
LAN, WAN;

2nd week: the second message/post/email

Tuesday will be the quiz of the whole chapter. If working hard enough now, you may not need a makeup or. Don't forget to study Computer Literacy! GO! Quite a lot of points in the chapter, and the exercises are also helpful!

3rd week: the first message/post/email

Though this evening is the Turkey–Brazil football game, don't forget the section test tomorrow! Pay attention to previous quizzes, the textbook, and the exercises, then you can enjoy a bright holiday! GO!

Appendix B. Content of messages/posts/emails in Experiment 2 (The messages/posts/emails were ordered according to their distribution time.)

1st week: the first short message

SMS + email group:

Do remember to receive the email of Computer Literacy's homework.

SMS + forum group:

Do remember to visit http://www.fxsh.tyc.edu.tw/teacher/lmwu/exam/login.asp to receive Computer Literacy's homework.

1st week: the first post/email

Chapter 1 review: introduction to computer

Characteristics of computers:

- Fast processing
- High correctness
- Large memory
- Long working time
- Easy information transfer

The evolution of computer components

Vacuum tube → Transistor → IC → VLSI

PS: characteristics of VLSI:

Types of computers

Classified according to the scale:

- Supercomputer
- Mainframe
- Minicomputer
- Microcomputer
- Embedded computer

Classified according to the usage:

- General computers
- Specialized computers

Classified according to the information processing method:

- Analogue computers
- Digital computers

1st week: the second post/email
Homework of Chapter 1

(1) CAI is the abbreviation of (A) computer aided design (B) computer aided instruction (C) office automation (D) multimedia computer.
(2) The component that integrates all electronic components such as transistors, diode, and resistance, on a single chip is called (A) Integrated Circuit (B) Transistor (C) VLSI (D) Vacuum Tube.
(3) Some domestic e-commerce websites provide visitors on-line order services. After confirming the order, the company sends the products and collect corresponding payment. This type of transaction is called (A) B2B (B) B2C (C) C2B.
(4) Some software exist permanently in the computer ROM. We call them (A) software (B) auxiliary memory (C) firmware.
(5) The abbreviation of (人工智慧) (Artificial Intelligence) in English is (A) AI (B) CI (C) IA (D) OA.
(6) Which of the following is not an OA tool? (A) electronic whiteboard (B) electronic meeting (C) email (D) robot.

1st week: the third post/email
Homework of Chapter 2

(1) There are 24 data lines in a Microcomputer, and the address bus has 16 address lines. Then how big is the addressing capacity? (A) 65536 Byte (B) 1024 Byte (C) 16 Byte (D) 24 Byte.
(2) What method is used by a LPT port to transfer information? (A) parallel commutation (B) serial commutation (C) both parallel and serial commutation (D) not mentioned above.
(3) The amount of data exchanged between a modem and a computer at one time is (A) 1 Bit (B) 1 Byte (C) 8 Bits (D) 8 Bytes.
(4) When we say that the memory of a computer is 256MB, we refer to (A) RAM (B) ROM (C) CD-ROM (D) BIOS.
(5) Which of the following equipment is proper for connecting numerous various equipments ? (A) VGA (B) USB (C) AGP (D) IDE.
(6) If a DC has a 64MB memory card, and the size of a colored photo is 400KB, then how many photos can be stored on the DC? (A) 80 (B) 100 (C) 120 (D) 160.
(7) Which of the following auxiliary can be repeatedly written and read? (A) CD-R (B) CD-ROM (C) DVD-RW (D) all mentioned above.
(8) Which register is used for saving the address of the next instruction to be executed? (A) accumulator (B) instruction register (C) program counter (D) flags register.

1st week: the fourth post/email
Homework of Chapter 2 (2)

(9) Which of the following is not appropriate for long-time backup? (A) RAM (B) MO (C) CD (D) CD-RW.
(10) Which unit of a computer is responsible for coordinating and directing the operation of other units? (A) memory unit (B) input unit (C) arithmetic and logic unit (D) control unit.
(11) What does 550 in "Pentium – III550" stand for? (A) BPS (B) MHz (C) MIPS (D) TPI.
(12) The index hole of a floppy disk can (A) detect the last track (B) detect if it's writable (C) detect the first sector (D) detect track 0.
(13) Which of the following is not a peripheral of a computer? (A) MO (B) RAM (C) printer (D) mouse.
(14) 1 毫秒 is (A) a thousandth of a day (B) a thousandth of a hour (C) a thousandth of a second (D) a thousandth of a minute.

1st week: the second short message
Hey you guys, tomorrow is the quiz for chapter 1 and 2. At least you should finish your homework before that. You know you third grade students must pay more attention to your study!

1st week: the fifth post/email
Homework of Chapter 3

(1) Only when both inputs equal to 1, the output can be 1; otherwise, the output is 0. What is this operation? (A) AND (B) XOR (C) EQV (D) OR.
(2) How are data coded in the computer? (A) decimal coded (B) binary coded (C) octal coded (D) hexadecimal coded.
(3) 1GB is about (A) 1024KB (B) 1024TB (C) 1024MB (D) 1024 Byte.
(4) The ASCII value of the letter "A" is 65, then how big is the ASCII value of the letter "F"? (A) 70 (B) 66 (C) 46 (D) 80.
(5) The size of a non-signed integer is 8 bit, then the biggest value of the integer is (A) 127 (B) 128 (C) 255 (D) 256.
(6) The most popular code used in communication equipments is (A) BCD code (B) CCCII code (C) EBCDIC code (D) ASCII code.
(7) IBM PCs use 2′s complement to denote negative integers, and the range of integers is from −32768 to +32768. In this case, how many bits is used by an integer? (A) 8 (B) 10 (C) 14 (D) 16.
(8) Which of the following symbols is not a legal symbol in hexadecimal code? (A) G (B) 0 (C) 1 (D) A.
(9) A Chinese journal article is typed into the computer with Zhuyin input, and saved into the disk. Which coding method is used for saving the article? (A) Zhuyin code (B) Chinese internal code (C) ASCII code (D) EBCDIC code.
(10) Which of the following will incur an error during odd parity check? (A) 01001100 (B) 11111011 (C) 10100011 (D) 10001001.
(11) The result of a logic operation 101001 Δ 110101 is 111101, then Δ is (A) OR (B) XOR (C) AND (D) EMP.
(12) Binary coded number 11101001 equals to (A) F916 (B) 3257 (C) 11010 (D) 351.

1st week: the sixth post/email
Homework of Chapter 4

(1) Which application software is appropriate for managing students' scores? (A) presentation software (B) graphic software (C) spreadsheet software (D) word processing software.
(2) Which is the main language used in webpage developing? (A) VB (B) HTML (C) JAVA (D) COBOL.
(3) Which of the following software is used for data compressing? (A) OutLook Express (B) RealPlay (C) Winamp (D) Winzip.
(4) Code written in high-level language is converted to object code by a translator. The translator is called (A) compiler (B) interpreter (C) connector (D) editor.
(5) Which software takes charge of system resource allocation and task management in a computer system? (A) OS (B) DS (C) SQL (D) PS.
(6) Which statement about machine language is false? (A) do not need translation (B) high portability (C) control the hardware directly (D) the fastest executing speed.
(7) Which software is most appropriate for the occasion that a teacher gives a lecture or a student gives a speech report? (A) presentation software (B) graphic software (C) spreadsheet software (D) word processing software.

Homework of Chapter 5

(1) Which of the following is not a main function of an operation system? (A) protect the computer from virus (B) execute application software (C) administrate system resource (D) provide user interface.
(2) With windows98, which of the following technology can help the computer more easily detect new hardware? (A) IDE (B) SCSI (C) Plug and play (D) PCMCIA.

(3) Which of the following Windows function is to collect data dispersed in numerous discrepant disk sectors and store in a continuous sector in order to fasten reading/writing speed of the disk? (A) defrag (B) disk scan (C) format disk (D) erase diskette.
(4) With which of the following can the color, resolution, and screen saver be set? (A) network (B) printer (C) add/remove programs (D) monitor.
(5) Which of the following can show the equipments installed on a computer, e.g., floppy drive, CD ROM, printer, etc.? (A) network neighborhood (B) recycle bin (C) my computer (D) my documents.
(6) Which of the following file is used for saving DOS internal commands? (A) COMMAND.COM (B) IO.SYS (C) AUTOEXEC.BAT (D) MSDOS.SYS.
(7) Which system is not able to support multi-user and multi-tasking operation? (A) time sharing operation system (B) batch operation system (C) real time operation system (D) multi-tasking operation system.
(8) The scores of the national university entrance exam is processed by (A) time sharing operation system (B) batch operation system (C) real time operation system (D) multi-tasking operation system.
(9) Which of the following does not belong to multi-tasking systems? (A) MS DOS (B) Windows95 (C) UNIX (D) Linux.
(10) Which of the following is not an OS function? (A) system resource allocation (B) monitoring tasking (C) resource scheduling (D) data base management.

1st week: the third short message

Hey, tomorrow is the quiz of chapter 3, 4 and 5. How is your preparation for that? Come on, time is of essential!

1st week: the seventh post/email

Homework of Chapter 6 and 7

(1) Which of the following lines of code is false? (A) READ "ABC" (B) LET A = B + C% (C) Y = AB (D) Y = Y * (B − 3).
(2) The result of the code *PRINT USING "& "; "GOOD"; "BYE"* is (A) GOODBYE (B) G (C) GB (D) GOOD.
(3) Scr in BASIC stands for (A) integer variable (B) real variable (C) string variable (D) single precision variable.
(4) Which of the following variables occupy 2 byte space? (A) PK% (B) PL! (C) PM# (D) F$ = "apple".
(5) After *PRINT TAB(3);60;SPC(5);78* being executed, 6 should be displayed at (A) the second line (B) the third line (C) the fourth line (D) the fifth line.
(6) Which of the following is the double precision variable? (A) DOUBLE (B) STRING (C) SINGLE (D) INTEGER.
(7) Which of the following is not a constant? (A) −78.54 (B) "PRINT" (C) STU (D) &O125.
(8) Which of the following extension is related to the most used document type for a writer? (A) PPT (B) DBF (C) DOC (D) TXT.
(9) The function *=SUM(B5:E5)* in Excel equals to the code (A) =B5 + E5 (B) =B5 + C5 + D5 + E5 (C) =B5 * C5 * D5 * E5 (D) = B5 * E5.
(10) When you are going to edit a part of the spreadsheet, which shortcut should be used? (A) F4 (B) F3 (C) F2 (D) F1.

1st week: the fourth short message

Tired after coming back from the Late Reading Room? But tomorrow is the quiz of chapter 6 and 7, so keep alert!

2nd week: the first short message

Tomorrow is the review test. Each review test is an accumulation for the final exam, hold on!

2nd week: the first post/email
Homework of Chapter 8

(1) How many * will be printed after the following code being executed? (A) 100 (B) 90 (C) 10 (D) 101
IF I\10<>I/10 THEN PRINT ""*
NEXT I
(2) What is the result of the following code? (A) 30 (B) 25 (C) 20 (D) not mentioned above
X = 0:S = 0
WHILE X <> 10
X = X + 2:S = S + X
*WEND
*
PRINT S
(3) Which of the following statement is repetitive? (A) IF-THEN (B) SELECT CASE (C) FOR-NEXT (D) GOTO.
(4) Which of the following symbols is used for the selective structure in a program flowchart? (A) circle (B) square (C) arrow (D) diamond.
(5) Which statement about FOR-NEXT is false?
(A) suitable for the case when the number of iteration is known
(B) impossible to jump from the outer back to the loop
(C) it tests condition after each iteration
(D) the increment can be neglected when it is 1
(6) To improve the readability of the code, which of the following is helpful? (A) REM (B) GOTO (C) FOR-NEXT (D) IF-THEN.
(7) IF-THEN-ELSE is generally used for (1) iteration (2) comparison (3) modulization (4) structurization.
(8) In the following code, how many times will line 30 be executed? (A) 27 (B) 28 (C) 29 (D) 30 (E) not mentioned above
10 S = 0
20 FOR L = −100 TO 100 STEP 7
30 S = S + 1
40 NEXT L
50 PRINT S
(9) What will be result of the following code? (A) 65 (B) 44 (C) 80 (D) 27 (E) not mentioned above
K = 1
WHILE K < 20
K = K + 4:S = S + K
WEND : PRINT S
(10) Continue from the last question: after the code being executed, what is the value of K? (A) 20 (B) 21 (C) 17 (D) 13 (E) not mentioned above.

2nd week: the second short message
Programming is not easy, but don't give up! These will be included in the exam, hold on!

2nd week: the second post/email
Homework of Chapter 7 (2)

(1) Which of the following serials is sorted in a descending order in terms of the memory space the variables occupy? (A) A%, "BYE", C!, D# (B) "BYE", A%, C!, D# (C) D#, C!, "BYE", A% (D) C!, A%, "BYE", D#
(2) Which operator has the highest priority? (A) AND (B) MOD (C) > (D) *
(3) Which expression is correct? (A) T% = "1" + "4" (B) F$ = F4 + F2 (C) R# = T$ (D) F# = A + B!
(4) The value of *PRINT 5 = 10/2 AND 27 = 3^3* is (A) −1 (B) 0 (C) 1 (D) 2

(5) What is the value of B after the following code executed? (A) 5 (B) 6 (C) 4 (D) 7

```
10 DATA 3,4,5,6
20 DATA 7,8
30 READ A,B
40 READ B,C,D
50 PRINT B
```

2nd week: the third short message

Hi you guys, remember the homework of chapter 7! Finish the homework first after going back home! Try hard!

3rd week: the first short message

Tomorrow is the section test of Computer Literacy! Though it's late now, you still need to work on! Otherwise the makeup is painful ...

3rd week: the first post/email

Homework of Chapter 8 (2)

(1) Which of the following statements about GOTO is false? (A) detrimental to the structure of a structurized program (B) should be used as rarely as possible in structurized programs (C) should not be used in structurized programs
(2) Which of the following is an illegal variable name? (A) PP$ (C) 2 + B (C) SCR# (D) Y!
(3) What is the output of the following code? (A) 100 10 (B) 150 100 (C) 90 10 (D) 50 100

```
10 T = 60:C = 0
20 FOR Y = 10 TO 100 STEP 10
30 T = T + 3
40 C = C + 1
50 NEXT Y
60 PRINT T;
```

(4) What is the output of the following code? (A) 2 (B) 3 (C) 4 (D) 5

```
10 R = −5
20 WHILE R < 5
30 S = S + R
40 R = R + 2
50 C = C + 1
60 WEND
70 PRINT C
```

3rd week: the second short message

There are a lot of important points with iteration, and iteration is an important part of program development. More practices are helpful! Ask me and your peers for help when you find the question irresolvable.

3rd week: the second post/email

What is an array?

(1) An array is a programming construct that stores data and allow us to access them by numeric index or subscript.
(2) All the elements in an array are of the same type.

Declaration of an array

(1) After an array being declared, the computer will allocate memory resources to the variable based on the type of the array and the upper bound of the array.

(2) If the upper bound is less than 11, the array does not need to be declared.
(3) DIM A(5), 5 is the upper bound of the array, indicating that the index of array A ranges from 0 to 5, altogether 6 elements.

4th week: the first post/email
Homework of Chapter 8 (3)

(1) What is the output of the following code? (A) 3 3 4 4 (B) 3 1 2 4 (C) 1 2 3 4 (D) 3 4 5 1
```
10 DIM G(3)
20 DATA 3
30 READ G(0)
40 DATA 4,5
50 READ G(3)
60 RESTORE
70 READ G(1),G(2)
80 DATA 1,2
90 PRINT G(0);G(1);G(2);G(3)
```
(2) Continue the last question: how many elements can be stored in array G? (A) 10 (B) 11 (C) 4 (D) 3
(3) Continue the last question: how many bytes does each element of array G occupy? (A) 4 (B) 2 (C) 8 (D) 6
(4) Continue the last question: how many bytes does array G occupy? (A) 12 (B) 44 (C) 20 (D) 16
(5) What is the output of the following code? (A) 1 2 3 4 (B) 1 2 0 1 (C) 1 2 0 4 (D) 1 2 1 2
```
10 FOR L = 1 TO 4
20 A%(L) = L MOD 3
30 NEXT L
40 PRINT A(1);A(2);A(3);A(4)
```
(6) Continue the last question: how many elements can be stored in A%? (A) 10 (B) 11 (C) 4 (D) 3

4th week: the first short message
Tomorrow will be a quiz of array, pay attention! Array questions frequently appear in the final exam!

4th week: the second post/email
Homework of built-in functions
W$ = "TAIPEI": X$ = "IP": L = 55.18: M = −5.18: Y$ = "1": Z$ = "20"

1. PRINT CHR$(L + M) —
2. PRINT LEN(W$) —
3. PRINT LEFT$(W$,2) —
4. PRINT MID$(W$ + X$,4) —
5. PRINT INSTR(W$,X$) —
6. PRINT MID$(X$,2,2) —
7. PRINT VAL(Y$ + Z$) —
8. PRINT RIGHT$(X$,3) —
9. PRINT LEN(STR$(L)) —
10. PRINT ASC(W$) —
11. PRINT CHR$(INT(L)) —
12. PRINT VAL(Y$) + VAL(Z$) —
13. PRINT SGN(ABS(L)) = SGN(ABS(M)) —
14. PRINT INT(SQR(VAL(Z$))) —
15. PRINT ASC(Y$) —

4th week: the second short message

Hi, all you diligent students, there are a lot of built-in functions, and you may need to review for several times. Don't forget to finish the homework first!

4th week: the third short message

Tomorrow will be a quiz of built-in functions, and there will be a lot of blank fillings. Get familiar with the functions, otherwise you won't have a good result as you expect.

References

Abrami, P., & Bures, E. (1996). Computer-supported collaborative learning and distance education. *The American Journal of Distance Education, 10*(2), 37–41.

Alfassi, M. (2004). Effects of a learner-centered environment on the academic competence and motivation of students at risk. *Learning Environments Research, 7*(1), 1–22.

Ames, C. (1992). Classrooms: goals, structures, and student motivation. *Journal of Educational Psychology, 84*, 261–271.

Baker, E., Gearhart, M., & Herman, J. (1990). The Apple Classrooms of Tomorrow: 1990 UCLA Evaluation Study, UCLA Center for the Study of Evaluation, Los Angeles.

Bures, E., Abrami, P., & Amundsen, C. (2000). Student motivation to learn via computer conferencing. *Research in Higher Education, 41*(5), 593–621.

Carlton, M., & Winsler, A. (1998). Fostering intrinsic motivation in early childhood classrooms. *Early Childhood Educational Journal, 25*(3), 159–166.

Connell, J., Mendelsohn, G., Robins, R., & Canny, J. (2001). Effects of communication medium on interpersonal perceptions. In *2001 International ACM SIGGROUP conference on supporting group work, Boulder, Colorado, USA*.

Czubaj, C. A. (2004). Literature review: reported educator concerns regarding cyberspace curricula. *Education, 124*(4), 676–683.

Daft, R., & Lengel, R. (1986). Organizational information requirements, media richness and structural design. *Management Science, 32*(5), 554–571.

Daft, R., Lengel, R., & Trevino, L. (1987). Message equivality, media selection, and manager performance. *MIS Quarterly, 11*(3), 355–366.

Deci, E., & Ryan, R. (1985). *Intrinsic motivation and self-determination in human behavior*. New York: Plenum Press.

Dennis, A., & Kinney, S. (1998). Testing media richness theory in the new media: the effects of cues, feedback, and task equivocality. *Information Systems Research, 9*(3), 256–274.

Divitini, M., Hargalokken, O. K., & Norevid, P. (2002). Improving communication through mobile technologies: which possibilities? In *The IEEE international workshop on wireless and mobile technologies in education (WMTE'02)*.

Dvorak, J., & Burchanan, K. (2002). Using technology to create and enhance collaborative learning. In *The 14th world conference on educational multimedia, hypermedia and telecommunications (ED-MEDIA 2002), Denver, CO, USA*.

Dwyer, D. (1994). Apple classrooms of tomorrow: what we've learned. Retrieved 2002-3-12, 2005, from http://www.ascd.org/readingroom/edlead/9404/dwyer.html.

Garner, I., Francis, J., & Wales, K. (2002). An evaluation of the implementation of a short messaging system (SMS) to support undergraduate students. In *The European workshop on mobile and contexual leaning, Birmingham, UK*.

Gatlin-Watts, R., Arn, J., & Kordsmeier, W. (1999). Multimedia as an instructional tool: perceptions of college department chairs. *Education, 120*(1), 190–197.

Guzley, R., Avanzino, S., & Bor, A. (2001). Simulated computer-mediated/video-interactive distance learning: a test of motivation, interaction satisfaction, delivery, learning and perceived effectiveness. *Journal of Computer-Mediated Communication, 6*(3).

Heilbronn, M., & Libby, W. (1973). Comparative effects of technological and social immediacy upon performance and perceptions during a two-person game. In *The annual convention of the American psychological association, Montreal*.

International Telecommunication Union. (2002). ITU Internet Report 2002: Internet for a Mobile Generation, available from: <http://www.itu.int/ors/spu/publications/mobileinternet>.

Irani, T. (1998). Communication potential, information richness and attitude. *ALN Magazine, 2*(1).

Kang, F.-W., & Zhong, R.-G. (2004). Integration plan of technical drawing and CAD instruction and related education experiment, Result report of research in National Science Committee of Central Government of Taiwan.

Kauffman, D. (2004). Effects of time perspective on student motivation: introduction to a special issue. *Educational Psychology Review, 16*(1), 1–7.

Kember, D. (2000). Misconceptions about the learning approaches, motivation and study practices of asian students. *Higher Education, 40*, 99–121.

Kitsantas, A., & Chow, A. (2005). College students' perceived threat and preference for seeking help in traditional, distributed, and distance learning environments. *Computers and Education*.

Kukulska-Hulme, A. (2002). Cognitive, ergonomic and affective aspects of PDA use for learning. In *The European workshop on mobile and contexual learning, Birmingham, UK*.

Liu, T., Wang, H., Liang, J., Chan, T., & Yang, J. (2002). Applying wireless technologies to build a highly interactive learning environment. *IEEE International Workshop on Wireles and Mobile Technologies in Education (WMTE'02)*(63), 70.

McQuillen, J. (2003). The influence of technology on the initiation of interpersonal relationships. *Education, 123*(3), 616–623.
Mifsud, L. (2002). Alternative learning arenas – pedagogical challenges to mobile learning technology in education. In *IEEE international workshop on wireles and mobile technologies in education (WMTE'02), Vaexjoe, Sweden*.
Moneta, G. (2004). The flow model of intrinsic motivation in chinese: cultural and personal moderators. *Journal of Happiness Studies, 5*(2), 181–217.
Muir-Herzig, R. (2004). Technology and its impact in the classroom. *Computers and Education, 42*, 111–131.
Nardi, B., Whittaker, S., & Bradner, E., (2000). Interaction and outeraction: instant messaging in action. In *2000 ACM conference on computer supported cooperative work, Philadelphia, Pennsylvania, United States*.
Panteli, N. (2002). Richness, power cues and email text. *Information and Management, 40*, 75–86.
Pintrich, P., & Schunk, D. (1996). *Motivation in education: Theory, research, and applications*. New Jersey: Prentice-Hall.
Pintrich, P. (1999). The role of motivation in promoting and sustaining self-regulated learning. *International Journal of Educational Research*(31), 459–470.
Ragosta, M. (1983). Computer-assisted instruction and compensatory education: a longitudinal analysis. *Machine Mediated Learning, 1*, 97–127.
Schliemann, T., Asting, T., Folstad, A., & Heim, J. (2002). Medium preference and medium effects in person-person communication. In *CHI '02 extended abstracts on human factors in computing systems, Minneapolis, Minnesota, USA*.
Short, J., Williams, E., & Christie, B. (1976). *The social psychology of telecommunications*. London: Wiley.
Smeaton, A., & Keogh, G. (1999). An analysis of the use of virtual delivery of undergraduate lectures. *Computers and Education, 32*, 83–94.
Smith, P., & Smith, S. (1999). Differences between Chinese and Australian students: some implications for distance educators. *Distance Education, 20*, 64–80.
Stefanou, C., & Salisbury-Glennon, J. (2002). Developing motivation and cognitive learning strategies through an undergraduate learning community. *Learning Environments Research, 5*, 77–97.
Steffey, C. (2001). The effects of visual and verbal cues in multimedia instruction. Dissertation, Virginia Polytechnic Institute.
Stone, A., & Briggs, J. (2002). ITZ GD 2 TXT – How to use SMS effectively in M-learning. In *The European workshop on mobile and contexual learning, Birmingham, UK*.
Trifonova, A. (2003) Mobile learning – review of the literature. Technical report DIT-03-009, Informatica e Telecomunicazioni, University of Trento.
Valle, A., Cabanach, R., Nunez, J., Gonzalez-Pienda, J., Rodriguez, S., & Pineiro, I. (2003). Cognitive, motivational, and volitional dimensions of learning. *Research in Higher Education, 44*(5), 557–580.
Wiener, M., & Mehrabian, A. (1968). *Language within language: Immediacy, a channel in verbal communication*. New York: Appleton-Century-Crofts.
Xia, H.-W. (1995). An exploratory study on specialized high school education and instruction. *Technology and Vocational Education, 28*, 32–34.
Xu, R. (2004). Chinese Mainland Students' experiences of teaching and learning at a Chinese University: some emerging findings. In *BERA 2004 conference, Manchester*.
Zagorsky, J. (1997). E-mail, computer usage and college students: a case study. *Education, 118*(1), 47–56.