Employing Multi-Modal Affective Computing Techniques to Design the Personalized Human-Computer Interface of an Intelligent Tutoring System - An Example on Digital Arts Learning

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Abstract: Some professional educators had indicated that emotion is one of the important factors which may affect learning results. But, to combined Affective Computing and e-learning is still at the initial phase. Recently, there are many projects establish a Intelligent Tutoring System to assist and enhance the learning effectiveness. Digital Arts, which are taken seriously by various teaching material designers, are regarded as an important method to help promote education because of it's great subjective and sensitive characters. So, base on this, this project will use Affective Recognition to coordinate with Digital Arts, apply to the Intelligent Tutoring System to observe learner's emotion to judge if the learning process is smoothly and give feedback promptly and timely, hope to increase interactive between users and our system, to increase our system's usability, learning motivation and learning effectiveness. This project used two different methods to recognize users' emotions: Facial expression recognition and semantic emotion recognition. Through this dual-mode mechanism, our system can enhance identified effectiveness and obtain more recognizable emotions. The best parts in this mechanism is that we can aware students' learning status any time. Training of image processing template is used for our Facial expression recognition and identify detected emotional keywords with syntactical logic is used for our semantic emotion recognition. Our system can analysis users' emotion and learning status to arrange proper teaching strategies and courses, then our virtual teaching assistant could be a good channel of communication between users and our system, so we can expect better learning effectiveness from our learners.

Keyword: Affective Computing, Digital Arts, Affective Tutoring System, Intelligent Tutoring System, Facial expression recognition, Personalized learning

Introduction

Baker et al.(2009）had indicated that emotional status and learning environments are interactive. But, in the past few years, it was incomplete when we are talking about combine Affective Computing with Tutoring System; so, this is really potential and really necessary to keep researching. In the parts of Emotion Recognition, Facial Expression is the most directly signal, so we can observe someone from he or she's face to obtain emotional information we need. When we are chatting, through vocabulary and cognition can access to other's emotions; After got emotion, we should adapt to learners' emotion and make the right judgment on how to contribute to learners. So, base on this situation, the learning effectiveness will rise.

The Digital Arts is constructed of the storage, transmission, existence, evolution, and the system, organization and network system is established in process. Not only interactive, virtual and wisdom, but also with uncertainty, variability and randomness, which can produce a self-evolution of reproductive features (Tseng, 2010). Collingwood(1938) considered that Arts activities is the performance of one's emotion experience, so courses in Digital Arts needs personal subjective, highly degree of emotion be the foundation in order to cause learning or even further ,creation. Therefore, it's need more attendant into emotional type of system to assist learning. Teaching Arts, most of the traditional teaching methods are just like one educator at front face to many learners. It's hard to handle every learners reaction and feelings.

So, if we can get response from every single learners and timely give the appropriate teaching then will be able to increase the learning effectiveness. Therefore, we take develop Digital Arts Courses' Tutoring System as the main point to discuss and explore, look forward to enhance user's motivation and learning effectiveness in Digital Arts. This project hope to combine Affective Computing with Intelligent Tutoring System, I.T.S., to recognize by learners image process, Affective Computing, Semantic Computing to improve the recognition accuracy. Sarrafzadeh et al.(2008）and Mao et al.(2009）both used a avatars to be the port of communication between their system and learners. Using great amount of virtual teaching assistant is good for learning motivation(Johnson et al., 2000）.; So, create a virtual teaching assistant which will accompany with students to learn is necessary. This project use many different modules, including : User Interface Module, Teaching Module, Affective Recognition Module and Courses Database to help increase learners' learning motivation and learning effectiveness.

1. **Literature Review**

1.1 Affective Computing

By using more Affective Recognition module to recognize users emotion can not only increase various emotional subject range, but also increase Affective Recognition's accuracy. Ren(2009）Setting words, voice and facial expression as the input signal, then ,by using our system, we can get accurate emotion and give back the appropriate feedback to users. And Gunes(2007）was used facial expression, gesture and pose to recognize users emotion. Facial Expression Recognition and Semantic Emotion Recognition don't take too much costs, they only need a web cam, a keyboard and a mouse to input the specific signal, low costs but very convenient , and it can be parallel imported to computer to detect the information we needs. So, we used Facial Expression Recognition and Semantic Emotion Recognition to identify users' emotion in this project.

1.1.1 Facial Expression Recognition

Ekman et al.(1971) had defined six facial expression base on Facial features. Includes of Joy, Sadness, Anger, Surprise, Disgust and Fear. T.F. Cootes et al.(1992) has mentioned an Active Shape Model(ASM); This method is used for training the same type of objects to create an Active Shape Model. Ko & Lee(2011) used ASM to combine with Dynamic Bayesian Network(DBN) to recognize emotion. Merti, Ghropade& Butalia(2012) used Facial Features rule, which was mentioned by Ekman, to establish a Facial Expression Recognition System(FERS). This system is focus on Recognize images and body postures. In Facial Recognize classifier area, Support Vector Machine(SVM) is quite popular for researchers because of it's mature framework, good classification, easy to apply to other

area and it's usability and optional are good at results. (Fig. 2-1) is this project's Facial Recognize Process.

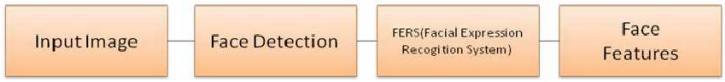

Fig.2-1 Facial Recognize Process(Merti et al., 2012)

1.1.2 Semantic Emotion Recognition

Semantic emotion recognize is used to find out sentence's correct messages. After receive correct messages, it can start emotion recognize and feedback. The recognize result will be different because of sentences or article. (Chen,& Knapp, 2010), first built a SVM training database by fairy tale, it can recognize which emotion from user's input is correct or important. Chen(2010) have proposes a automatic classify semantic emotion method; it can classify positive and negative by sinica corpus. Sun et al.(2010) proposed a Sentiment Classifier of Short Chinese Sentences. It used to statistic words usage, and built a dictionary for Chinese synonyms and an emotional phrases dictionary to convert short statements into vectors. The results of classification will be different base on the classification methods and experimental steps.

1.2 Affective Tutoring System, ATS

Affective Tutoring System is used to define learner's learning state and emotion state, then base on different status, we give learners different feedback and try to make learner's emotion goes to the positive way. Affective Tutoring System is developed from Intelligent Tutoring System, it is capable to adapt learner's emotion state(Sarrafzadeh et. al., 2003; Sarrafzadeh et. al., 2004; Vicente, 2003). Liu(2009) have used an agent to give feedback to user according to learner's emotion state. Mao and Li(2010) inquire into about satisfaction of Affective Tutoring System. In this study, we followed all point which was showed in this article to evaluate system design.

1.3 Teaching Strategy

John Keller created ARCS motivation module(Keller & Kopp,1987), this module include Attention, Relevance, confidence, satisfaction. Rober Gagne(1977) thought learning is not only "a course". his system divide learning process into nine stages and he also designed corresponding learning activities for these stages. In this study, we followed this teaching method. Many studies had confirmed that the teaching assistant agent will affect the learning situation, and some studies developed agent to alleviate learner's negative emotion, and it can also convert, imply, guide, and judge learner's learning state. A research had shown that a full-function agent can make learners confidence(Lester, 1997). Eyharabide et al.(2011) recorded student's learning situation, predict students' emotion by ontology and help students improve
emotion while negative emotion affect thinking and learning.

1.4 Digital Arts

How to make Digital Arts be understood and accepted is important for arts educators. Lin(2010) said that digital aesthetics is unable to attract students from her teaching

experience, it has interaction, feedback. In Taiwan, we mostly depend on board scholars to tide aesthetic discourse and literature review; That's why we are unable to create digital arts creative. What we do is just combine the theory and work with related works. In this study we deigned our courses according to Yen's paper(2005)- The History & Development of Digital Arts, and put hyperlinks and videos of courses into our courses to make our teaching material more generous. Our final goal is to help learners understand digital arts more deeper and clearer.

2. **Research Methods**

2.1 System Structure

Our system base on two main topic: Affective Computing and Teaching , and we can divide into five modules, they are Facial Expression Module, Semantic Recognition Module, Teaching Assistant Agent Module, Digital Arts Courses Module and Teaching Strategies Module,Fig.3-1 is our system construction.

Facial Expression Recognition was established by EmguCV open sources, to develop Facial Expression Module. To recognize facial expression, it includes:(1) The place where we recognize the face.(2) Input the recognize facial data into classifier to compare with six basic emotions. (3) Define the emotion for learner. In this research, we use Haartsring, which was provided from OpenCV and great amount of sample(hundreds of photo) to find out Haar's features to train for our classifier, and we finally get one classifier which was named Boosted. This classifier collected 302 photo's into the Human Facial Expression Database, then we separate photos base on Ekman's six basic emotion: Happiness, Anger, Sadness, Surprise, Fear and disgust.

Semantic Emotion Recognition Module can let learners input their learning status and emotion at that moment, then we can get learners emotion and underway the appropriate teaching strategy immediately. The Module was established on three stages:(1) Established a keyword dictionary(2) Handle semantic structure(3)Define emotion for learner. The emotion dictionary includes two kinds of vocabulary, emotion and semantic structure. So, how does our system know a sentence's real meaning. First, we find out and match keywords, if it successfully match, then use our algorithm to cut one sentence into several semantic sentence, Finally, we can figure out users' emotion accurately from the judgment of semantic structure.

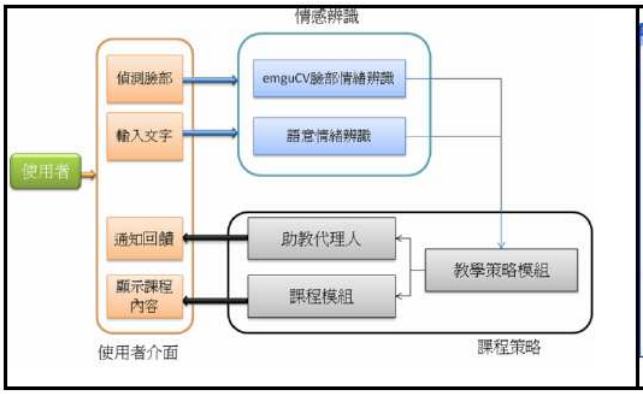

Fig.3-1System structure

Fig.3-2User usage

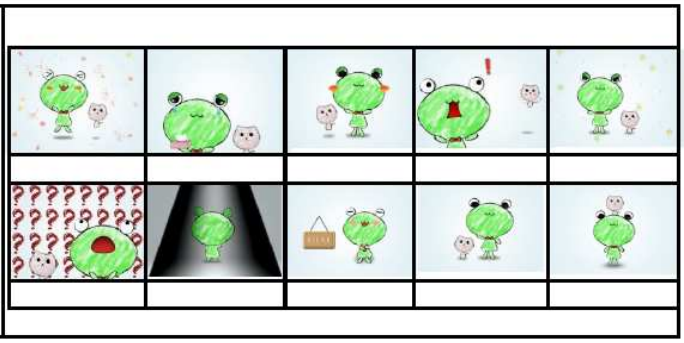

Fig.3-3 Semantic Emotion Recognition **Fig.3-4Figure of Agent's feedback**

Teaching Assistant Agent Module can use for capture user's emotion and give feedback timely, and it can also coordinate with teaching strategies, to concern user initiative to help improve user's learning motivation. In the learning process, while learner finish one stage, our system will give back specific feedback. Our system has set up Joy, Sadness, Anger, Surprise, Frustration, Uncertainty, Disgust and Fear these eight different emotional and functional feedback.

Our Digital Arts Courses Module establish three different level base on teaching strategies to let every single user can use appropriate learning material and arrange different types of design base on different level of teaching contents. We apart five stage for Digital Arts Courses base on learning strategy, including: Before the lesson, The begin of the lesson, In the middle of the lesson ,Back of the lesson, The end of the lesson. Before the class starts, our system will use Semantic Emotion Recognition system to get user's emotion, then we can decide today's lesson and it's difficult base on learner's emotion. At the class, the Facial Expression Recognition System will be turn on and work with the Semantic Emotion Recognition System to detect learner's emotion and learning status; The teaching assistant agent will give advices and feedback to encourage students timely; Because of the continued learning, student might be tired or losing interest, so we let users lesson to music or watch some short movies in order to direct user's negative emotion.

After class, to find out user's learning situation, users can take some exercises by using our Lesson Practice function. After you finish your practice, you will get your score immediately and you can share score and your experience to get feedback.

3. Experiment Design

3.1 Object and environment of the study

To understand this system using for different groups in the Digital Arts area, we found four different collage students, and they all have computers and Arts background. We total found 146 students, and their average age are 22 years old.

First, to discuss if students have some Digital Arts concepts will feel different to another students. So, we separate these students into two different parts: Arts department (64 people) and Other department (83 people), base on their department. Then, in order to understand if different teaching methods will affect subjects; So we use three teaching methods: the Traditional Teaching, Course Website and Affective Tutoring System, to discuss these two different groups learning in these three different teaching methods which learning effectiveness is better. Table 1 is our subject in our different experiment.

Table 1 Experimental Sample

(Group)	Traditional Teaching	Course Website	Affective Tutoring System
Arts	63	33	30
Other	83	38	45
Total	146	71	75

3.2 Experiment Design and process

Before the experiment starts, we establish a multi-module Affective Tutoring System, a Digital Arts Course's website and develop a traditional teaching method; and make sure there's no error then we starts the experiment. At the beginning of the experiment, we will give two groups a pre-test of learning effectiveness and a experiment explanation, after the pre-test, we have our traditional teaching way, learners can ask questions any time, after the class, we give them a learning effectiveness questionnaire; to avoid subjects still have the traditional teaching contents in there head and decrease this experiment's reliability, so we leave our Affective Tutoring System and website these two experiment to one week later. The experiment explanation time takes 15 minutes, and the experiment take 50 minutes; While subjects are using our system, we observe them, give assistant and prepare to answer their questions. After the class, subject can fill the learning motivation and learning effectiveness questionnaire on the Internet, they only have 15 minutes to fill. The learners who used Affective Tutoring System should fill another scale, it's our System Usability Scale. Finally, we finished our experiment and get enough questionnaire, so we can analyze and get the final result, then we can finish our experiment.

3.3 Analysis Design

This research use Triangulation Design to observe, interview, do the questionnaire, to compare the data which we found and we have. Research experiments typically use more participants, more stringent control and more deeper data analyze, and statistical analysis is basic and essential. This research use a observation called participant observation to observe this whole experiment. After the experiment, we use a semi-structured focus group interview. Interviewees must be volunteer and it's takes almost 10 minutes, in the interview process must be recorded; after the interview, the transcription must be translate into the words on the paper and find the key note to en-code and input; The interview for this experiment is talking about system usage, learning motivation and learning effectiveness, according to interviewee's answer we can adjust the question. At last collected and analyzed these data and find out if this study is attach our research purpose.

3.4 Questionnaire

To find out users' learning and using conditions, we use System Usability Scale, S.U.S.to figure out the situation. This Scale was created by Equipment Co Ltd. at 1986, it's a save time, low-costs, but highly reliable. It's purpose is to help companies to analyze their products usability and it's easy to get data. This scale use Likert's five point scale to test, from one to five, one means very disagree and five means very agree. This scale was modified and confirmed by many experts, so this scale is very applicable for our system. Learning outcomes questionnaire, divided into the pre-test and post-test questionnaire. The pre-test questionnaire choosing two chapters in our Digital Arts courses for ten questions; The post-test questionnaire has 5 multiple-choice questions for both of these two chapters we pick up. The contents in the questionnaires have been verified by Digital Arts Expert. Motivation Strategies Scale was developed into an assessment tool by Pintich(2001); The full Scale

has 82 questions, it's purpose is to support students and educators to improve learning quality. This Motivation Strategies Scale includes Cognitive, Motivation, Behavior and Context these four levels, and it's connotation includes intrinsic goal orientation, extrinsic goal orientation, working value, learning of control beliefs, self- efficacy, expectancy for success, anxiety test, these seven oriented.

4. Experimental Results and Analysis

4.1 Emotion Recognition Results

In order to measure this system's accuracy of facial expression emotion recognition. We invited 15 subjects to take a small test. The emotion types include joy, anger, sadness, surprise, disgust and fear. In the experiment, we asked subjects to make a facial expression within 10 seconds, then compare with the system's judgment. If the experimental results is same to what subjects want to express, then we can conclude that the judgment is correct. Fig.4-1 is this experiment's Facial Emotion Recognition Accuracy. The facial expression recognition accuracy rate is almost 55%. Semantic Emotion Recognize module have measured users' joy, anger, sadness, surprise, frustration, doubt, disgust, fear. This experiment was used to find some sentences in the movie dialogue which is related to emotions, and we invited 15 subjects to test for our semantic emotion recognize module. Then compare with system's judgment and records. Fig 4-2 is the Semantic Emotion Recognize Accuracy. The semantic emotion recognition accuracy rate is 65%.

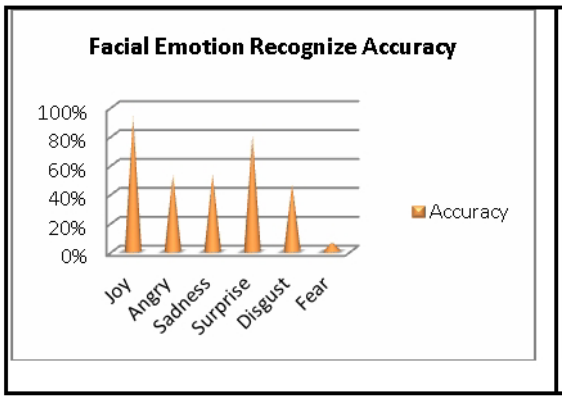

Fig. 4-1Facial Emotion Recognition Accuracy

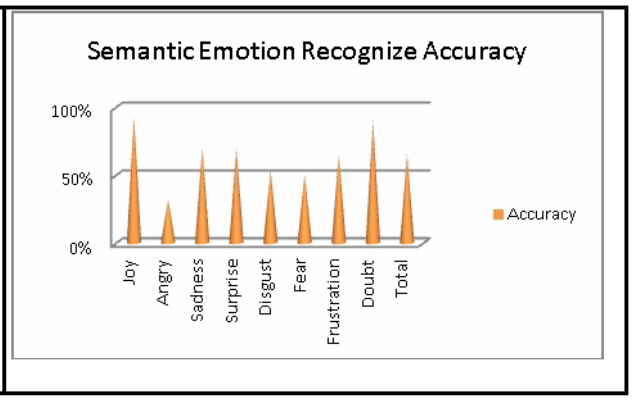

Fig. 4-2 Semantic Emotion Recognition Accuracy

4.2 System Usability Analysis

Table 2 is each questions statistics. To increase creditability, so we have to exclude the highest and second highest score. Higher score in questionnaire are Q2, Q7,and Q8. Q2 has 64% users feel that our system is not complicated to use. Q7 has 72.7% users thought that most people can learn how to use this system quickly. Q8 has 60% users thought it's not complicated for the system. We used paired t-test to analysis between Arts group and other group to find our differences. Table 3 is the analysis results. Usability of other group(M=63.5) is higher than arts group(M=61.5). It has no significant differences($p=0.524, p>.05$). This means that two groups are both accept using our system.

Table 2 SUS each questions statistics

Question	M.	SD	Sd.	kurtosis	5-point Likert scale				
Q1	3.09	.975	-.079	.075	5.3	17.3	49.3	18.7	9.3
Q2	3.67	.905	-.740	.775	2.7	6.7	26.7	49.3	14.7
Q3	3.57	1.080	-.525	-.350	4.0	13.3	24.0	38.7	20.0
Q4	3.45	.949	-.155	-.482	1.3	14.7	34.7	36.0	16.0
Q5	3.35	.937	-.046	-051.	2.7	12.0	45.3	28.0	12.0
Q6	3.32	.841	.171	.208	1.3	10.7	52.0	26.7	9.3
Q7	3.83	.906	-.206	-.856	0	6.7	30.0	36.0	26.7
Q8	3.73	.973	-.217	-1.02	0	9.3	30.7	30.7	29.3
Q9	3.31	1.013	-.350	-.369	2.7	5.3	37.3	25.3	29.0
Q10	3.39	1.185	-.223	-.715	8.0	16.0	32.0	25.3	18.7
Total	3.51	1.004	-.239	-.394	2.8	11.2	36.3	31.5	18.3

Table 3 paired t-test result

N	M	SD	SE	d.	
SUS Arts Group	30	61.5	12.13	2.215	.524
Non-arts Group	45	63.5	13.95	2.080	
Total	75	62.7	13.20	2.147	

4.3Learning Motivation Analysis Results

Table 4 is the learning motivation statistics result of Affective Tutoring System. To Observe various dimensions, Average of Intrinsic motivation is 3.63, it means subject have highly degree of learning motivation. Other group(M=3.81) have higher score than arts group(M=3.37). In extrinsic motivation, the total average is 3.52; it means that the subjects were willing to engage in learning for external values or standard. Other group(M=3.69) is higher than arts group(M=3.27), sig=0.000(p>0.001). In Value of works(M=3.66), it have the highest score in four dimensions. It means subjects think that it is importance, effectiveness, and interest in using our Affective Tutoring System. In this dimension, other group(M=3.76) is higher than arts group(M=3.51),sig.=0.02(p<0.05), so we can find out it doesn't has very significant difference between both of groups.

Table 4 The learning motivation statistics result of Affective Tutoring System

	Arts Group		Non-arts Group		Total		
	30		45		75		
	M	SD	M	SD	M	SD	d
Intrinsic motivation	3.37	0.75	3.81	0.82	3.63	0.82	0.000***
Extrinsic motivation	3.27	0.70	3.69	0.81	3.52	0.81	0.000***
Value of works	3.51	0.69	3.76	0.84	3.66	0.79	0.02*
Self-efficacy	3.34	0.65	3.74	0.83	3.58	.788	0.000***
Average	3.37	0.51	3.75	0.58	3.60	0.58	0.05*

Table 5 is the scale of compare with teaching mode between arts group and other group. Average of Arts groups use Affective Tutoring System(M=3.37) is higher than web class, sig.=0.497(p>0.05), so it is hard to improve arts group's motivation. This result is because of the arts group is more concerned about the arts curriculum contents, not learning mode. Other group get higher score in Teaching mode, ATS(M=3.75), is higher than web class(M=3.19), and have significant difference(sig.=0.000, p<0.001); It means that learners who don't have concepts about digital arts will learn more effectively by using Affective Tutoring System.

Table 5 Arts group and Other group compare scale

Form	Teaching Module	N	M	SD	t.	d.
Arts Form	Affective Tutoring System	30	3.37	0.51	-.290	0.497
	Web class	33	3.29	0.97		
Non-arts Form	Affective Tutoring System	45	3.75	0.58	-0.68	0.000***
	Web class	38	3.19	0.47		

*p<0.05，**p<0.01，***p<0.001

4.4 Learning effectiveness Analysis Results

Table 6 is the scale of results of three different teaching mode for total subjects. We analyzed the learning effect on how progress on post-test and effected size. ATS is the highest one(M=10.13, d=0.60) and Web class is the lowest in teaching mode. So, there is no affective factors can help learning effect.

Table 6 The scale of results of three different teaching mode

Teaching Manner	N	Progress M	SD	Effect size	d
Traditional teaching	146	1.03	21.93	0.06	0.003**
Web class	71	-0.42	18.627	-0.03	
Affective Tutoring System	75	10.13	21.84	0.60**	

*p<0.05，**p<0.01，***p<0.001

Table 7 is the result of learning effect between two groups. Affective Tutoring System's got the best score in three different teaching mode between two groups, and these two groups both have significant effect(p=0.008,p=0.006) followed by traditional teaching. So Affective Tutoring System can enhance the effectiveness of learning and have a significant effect.

Table 7 The result of learning effectiveness between two groups

Form		N	Progress M	SD	Effect size	d
Arts Form	Traditional teaching	63	2.06	22.30	0.12	0.008**
	Web class	33	-2.12	17.99	-0.03	
	Affective Tutoring System	30	14.33	23.14	0.83	
Non-arts Form	Traditional teaching	83	0.24	21.75	0.02	0.006**
	Web class	45	-3.16	19.283	-0.22	
	Affective Tutoring System	38	10.89	20.72	0.72	

*p<0.05，**p<0.01，***p<0.001

4.5Analyze learning effectiveness with student's subjective comments

To understand is there any relationship between learning effectiveness and system usability, we use Pearson's related analysis method to confirm. The results indicated learning effectiveness and usability don't have much relationship. To further confirm the influence between the variables, we set the pre-test score as the control variables and we do the analysis again; the result shows that there is a relationship between learning effectiveness and usability; And to find out is there any relationship between learning effectiveness and learning motivation, we still use Person's related analysis method to confirm. No matter we set per-test score as the control variable or we don't do that. After the analysis, the results shows that: the relationship between learning effectiveness and learning motivation are only have low correlation. Base on these two analysis, we can conclude that the system usability or learning motivation they both can enhance learning effectiveness.

4.6 Interview Results

To start the experiment, researcher also played a observation role as a complete participant.the class, the arts-team students are not overwhelming response. In other group, a few students will focus on listening and interactive with teacher. We run the web class and ATS in the second week, Arts group and other group seems really interested on Affective Tutoring System, At the beginning, the arts group doesn't produce any negative emotion or exclude learning. subjects are concentrate and didn't discuss during the experiment, nut they praised our system and it's function and give many comments after experiment. But, in other group, they discuss with each other and seems pretty happy to use various function at the beginning. We found that pictures and videos are more attracted to learner's attention and it can improve users' learning motivation. We conducted the experiment of the web class on the same day. The observed results indicated that the interested course designing can improve learning motivation, but there is no affective factor involved in .So, users can not concentrate and keep their motivation. At the end of the experiment, we focus on interview some object, and record the whole interview process, then turn the record into the words on the paper, then we can find the keyword and recognize these keyword to valuable assets. We focused on usability, interface design, learning motivation.

Table 8 Spindle encoder

Code	Spindle encoder	Explain	Open coding
C1	Usability	Users feel for the use of affective tutoring system	System Design System is easy to use System interaction
C2	Interface Design	Users feel for the use of interface design	Interface Usability Agent design
C3	Learning	Users for the use of affective style tutor learning courses in digital arts of motivation	Curriculum design Motivation Teaching strategy design
C4	Intention to use	Caused by the continued use of the intent of the ATS system	System attractive Learning achievement

C1- Usability: Usability include user feelings, system design, system is easy to use and system interaction, subject S1 said :"It's very interesting and I have an amazing feeling". One of the subjects in other group said:"it's OK, we can accept." Although two groups hold different views, but they all assure the feeling when they are using the system is great,

C2- Interface Design: Interface Design include use feelings, interface usability, agent design. Both of the groups said:" The system is easy to understand, acceptable." S6 said: "It is easy to operate and it's very smoothly while i am using."

C3- Learning Motivation: Include curriculum design and teaching strategy design. On Curriculum design, arts group can learn more deeply from our courses. S6 said :" I am not familiar to the digital arts, but it feels newly about lessons."; But for other group, their response is:" If lessons can be multiple, it would be fitted for different learners."

C4- Intention to use: The intention to use include: system attractive, satisfaction and learning achievement factors. Both of the groups said :"It's funny and interest. " and Other groups N3 said :"I feel excited and curiosity while I am using this system."; They all said they are willing to try and continue to use Our Affective Tutoring System.

4.7 Summary

According to the result of interviewing and analysis results, Affective Tutoring System also

has good interactive and interface design. These two superiorities make users feel interactive with Affective Tutoring System; and our affinity proxy design reduced users' exclusion at the first time. On the other hand, interviewer thinks deeply about development of system than using it. When we are have interview, they offer more suggestions, and willing to learn difference contents by our Affective Tutoring System. Base on this, there is enough proof for us to find this system is attracted to users to use it. On the learning intention, we use MSLQ scale to compare Affective Tutoring System and web class; and the results shows that Affective Tutoring System can let users feel easy to user, and get higher learning effectiveness. When we are talking about the learning effectiveness, Affective Tutoring System compared with Traditional teaching and web courses, A.T.S. get better learning effectiveness, second place is traditional teaching. These three different teaching methods have significant difference; the results shows that Affective Tutoring System can help learners keep learning and bring much better learning effectiveness.

5. Conclusion and Future plans

In this project we built an Intelligent Tutoring System with Multi-Module Affective Computing technique, that means students' emotional status will affect learning results when they are using our Tutoring System. Although a common Intelligent Tutoring System can adapt students' learning conditions, but the different between Tutors and Tutoring Systems is that human can identify students' emotion (Mao & Li,2010). In this study, we have confirmed that by adding emotional factors can make our system more humane and closer to our users. Our Affective Tutoring System used Facial Expression Recognition and Semantic Emotion Recognition to obtain learners' emotion so we can arrange appropriate contents for that moment. (Eyharabide et al., 2011) said the positive emotion can help users to learn, on the other side, the negative emotion will disrupt learning effectiveness. So, in order to guide students' negative emotion, our system give hem appropriate teaching strategies, activities and some feedbacks. The results shows that our system can enhance usability, motivation and learning effectiveness, they all have positive and great effectiveness, so we believe that this project is worth for continued develop and applied to the researches.

We have a few advices for our future works, The first one is that we hope to increase more emotion recognition modules, like: voice recognition system and identify biology information. While users are using our system to learn , they will be more concentrate . To increase the recognize accuracy, we need to use more identified methods. User Interface and the Avatars must be different because of users' age or computer's familiarity, one way is to set different using complexity and changing agent's role, we can use this way to teach students learning contents which is unfamiliar or not easy to learn. The second one is the Digital Arts, we can design many kinds of fresh and multi learning contents, it's doesn't has to be only introduce or watch some Digital Arts works, learners can learn Digital Arts from games or implement Digital Arts Contents, to make teaching material more active, more close to normal life, and to make Digital Arts be accepted by more people and more ubiquitous in Arts. The last parts is about the future research, in this project, we have confirmed our system is worth to continue to use and the usability about combine Affective Computing with Intelligent Tutoring System is quite potential, so, in the future, we can develop more modules to keep expend and utilize this system; and we hope to improve experimental environment to make our learners feel free while they are learning by our system and develop this system into a Web-based version or a smarts phone application to promote Affective learning's development.

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