The Application of Affective Tutoring Systems (ATS) in Enhancing Learners' Motivation

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Abstract: The developments in information technology in recent years which allow the adjustment of teaching materials in accordance with the performance of learners and the new techniques to convert voice into text have meant that using information technology in academic language teaching has become more effective and successful. However, in his affective filter hypothesis, Krashen theorised that students with strong motivation and high self-confidence will approach learning with little or no anxiety and are therefore more likely to achieve good results in language learning. The Affective Tutoring System (ATS) monitors students' emotions and improves the affective interface of an Intelligent Tutoring System (ITS). This study aims to enhance the learning process by monitoring the emotional state of the students then providing appropriate feedback. By careful affective interaction design, the students' interest and motivation will be increased making their learning more effective.

Keywords: Affective learning, affective tutoring system, Japanese learning

Introduction

Under the influence of globalization, to understanding technology jargon, English/ Japanese as Specific Purposes (ESP/JSP) and English/Japanese as Academic Purposes (EAP/JAP), is a very important part of second language acquisition. However, for many people the process of learning a second language is not always smooth and successful. In recent years, there has been an increasing trend in the study of second language acquisition towards exploring learner's personality factors, in addition to the language acquisition process, and teaching methods. The application of technology in language learning has evolved from 'acquiring knowledge' to 'acquiring the ability to use the tools to gain knowledge'.

Chaudron [1] analyzed study papers published in The Modern Language Journal, between 1916 and 2000. He refers to the 1980s as a period of learner-centered learning, and mentions an increasing trend towards research into the relevance of learners' psychology. In the past, language acquisition research focused on the study of what characteristics are possessed by successful language learners.

Horwitz, Horwitz, and Cope [2] mentioned that many learners of foreign languages feel anxious. In Krashen [3] Affective Filter Hypothesis the affective filter is likened to an invisible wall which exists between learners and language. Factors such as negative attitudes, lack of motivation or enthusiasm in learning, form a filter which hinders the learner's message reception and comprehension, thereby affecting the outcome of second language learning. According to this hypothesis, the mood and attitude of learners is an

important factor affecting the quality of learning. Learning efficiency will be reduced when fear, anxiety and other negative emotions are present whereas enhanced positive emotions enhance learning outcomes.

Therefore, this study proposes an Affective Tutoring System (ATS) to be used in basic Japanese courses, and aims to allow beginners to study Japanese in less stressful situations, so as to enhance motivation and improve learning outcomes. This ATS system includes identification of learners' emotions; provision of courses appropriate to the learner's abilities; the addition of suitable teaching strategies (such as music) and affective feedback. All of these will reinforce learners' positive emotions thus improving negative moods, and achieving enhanced motivation which, in turn, will promote the effectiveness of learning, whilst helping students recognize their achievements.

1. Literature Review

1.1 An Intelligent Tutoring System (ITS) & Affective Tutoring System(ATS)

An Intelligent Tutoring System (ITS) is a computer teaching system based on learning and artificial intelligence technology, which is designed to provide individualized teaching[4] [5] [6]. Kort, Reilly, and Picard [7] proposed a new model to conceptualize how emotions affect learning, and then created a computer-based model, hoping to recognize the emotions of students and provide appropriate feedback to enable the student to learn in an optimum environment. The ITS approach combined with affective computing is called Affective Tutoring System (ATS). Easy with Eve[8] and the emotion agent tutor "Alice" studied by Mao and Li [9] made use of affective computing to detect the affective state of students whilst learning. These systems provided learning feedback and interactions of expression via emotion agent on behalf of a human tutor to improve the user's learning interest. However, common tutoring systems are used for teaching general subjects, such as mathematics, physics, language… etc.

Ammar et al. [10] once mentioned that the latest scientific findings indicate that emotions play an essential role in decision-making, perception, and learning; According to Picard[11], if we want to make computers to be more intelligent and to interact naturally with us, it is necessary to provide computers with the ability to recognize, understand, and even to have and express emotions. Many emotions are the focus of psychological studies, and Ekman [12] presumed that fear, anger, joy, sadness, disgust and surprise are the six ubiquitous basic emotions in everyday life. The studies of Graesser et al. [13] made numerous attempts to detect emotions in the learning environment, and they found that there is some relevance between students' behaviors and their learning in their learning courses.

1.2 Affective Factors & Affective Strategies

Chomsky's new theory in 1965 brought a revolution in linguistics, and Brown's [14] unique studies on second language learning in the 1970s paved the way for innovative teaching. The cognitive factor and affective factor in second language learning have gradually gained attention, and led to the introduction of Community Language Learning which emphasizes the psychological factors of successful learners.

Gardner & Lambert [15] believed that learning attitudes and motivation are the most powerful predictive factors to successful second language learning. While research on language learning in the past often focused on what teaching approach would result in more effective grammar and vocabulary learning, there has been an increasing trend towards the study of learners' personal factors because given the same teaching approach

and learning environment, the learners do not always achieve the same level of learning [16]. Oxford [17] also believed that the influence of affective factors in language learning is very important. "Affective" includes emotions, attitudes, motivations and values. Language learners can use affective strategies to control these factors. The affective strategies proposed by Oxford to stabilize learners' emotions include lowering anxiety, self-encouragement, and taking one's emotional temperature. Good language learners are usually those who know how to control their learning emotions and attitudes [18]. However, Chamot et al. [19] pointed out that not many studies have examined the frequency of using affective strategies. Only about 1 in 20 learners employ affective strategies.

1.3 Affective & Music

Developed by Bulgarian psychiatrist and educator Georgi Lozanov in the 1970s, Suggestopedia (STP) suggests the intonation and rhythm of the instructions should match the slow version of four-four time signature Baroque music so as to diminish tensions and anxieties in the classroom and to enhance memory. Lozanov believes that the rhythm of the music affects the heart beat; when the heart rate is slower, mental awareness will increase.

Listening to soothing music helps learners relax and be more receptive to a positive learning attitude. Oxford [17] maintained that of the Four Language Skills, anxiety plays a very important role, as anxiety produces difficulties in learning. Speaking the target language usually results in the greatest anxiety. Some learners also feel extremely nervous when they use the target language for listening, reading or writing. Therefore, the use of music can effectively relieve the tension of language leaning. Jensen [20] suggested that, as a tool, music is used to inspire, to transmit language, and to stimulate the brain. Music for inspiration such as rock and roll lifts and refreshes the spirit, and soothing music smoothes the learners' state of mind.

Experiments by Giles [21] showed that the students' reading comprehension improves significantly when music is played to them. The widely known Mozart effect is the first study that provides empirical data, indicating that listening to music is a factor in improving spatial ability[22]. Gardner adds some important characteristics to the concept of intelligence, which may be essential to successfully learning a second language. For instance, musical intelligence can explain why some learners have better ability and are able to speak the language with proper intonation. McGinn, et al. [23] stated that music seems to provide a driving force to natural learning.

1.4 Affective filter hypothesis

One of the five hypotheses [24] concerning second language acquisition is the "affective filter", which acts like an invisible wall between learners and input, interfering with and limiting the delivery of language input. For example, those students who lack motivation are likely to pay less attention to the input; their filter level is high and so less input can reach them. On the other hand, highly-motivated learners will concentrate on the language input which penetrates their language acquisition device as a result. Thus, according to Krashen's hypothesis, passive attitudes, lack of motivation and enthusiasm in learning are regarded as a filter, and will impede learners' response to language input, thereby affecting the effectiveness of learning. When learners are bored, nervous, stressed or lacking motivation, their screen will be raised and they are not able to take in and process the contents of learning. It is clear that learners' feelings and attitudes are critical factors in the

quality of learning. When negative feelings such as fear and shyness are at a low level, learning efficiency increases, and vice versa.

The affective filter hypothesis maintains that affective factors influence second language learning. However, it is the speed of learning that they affect not the path and direction. Krashen thought that after puberty, the affective filter increases; adults have more self-consciousness and more varied emotions, thus creating differences in second language learning and first language acquisition. So the process of language acquisition is not related to age differences; adults have less success in language learning mostly because of the affective factors and not their age.

2.   Research Method

2.1   System Architecture

In this study, the affective tutoring system (ATS) is used to provide basic Japanese lessons. Using facial recognition and also input provided by learners with regard to their emotional state, the Affective Japanese tutoring system (ATS-JP) offers learners lessons with three different grades of difficulty in accordance with their mood: simple, normal and advanced. During the course, the system monitors the learner's emotional state, gives positive emotional feedback, and adjusts the curriculum accordingly.

This study attempted to investigate: (1) the ease of use of the affective Japanese tutoring system (ATS-JP), (2) the learners' ability to achieve their learning goals from using the ATS-JP (3) whether, whilst using the ATS-JP, the learner can maintain a positive mood or improve negative emotions, thereby strengthening motivation and improving the effectiveness of learning.

The study subjects were 19 second-year catering students taking Japanese as an elective course at an Institute of Technology (beginners / experimental group) and, from the same school, 16 fourth-grade junior college students of Applied Foreign Languages (language majors /control group). To observe the effectiveness of the system, 15 questions on the content of the course were designed to be answered before and after the use of the system. The System Usability Scale (SUS) was used to determine the learner's opinion of system usability. After the experiment, a Motivated Strategies for Learning Questionnaire (MSLQ), was used in order to understand the motivation of learners.

2.2   Strategy Inventory for Language Learning(SILL)

Before the experiment, the experimental group was given a Strategy Inventory for Language Learning (SILL) questionnaire. This scale, which was proposed by Oxford [17], has two types of scale: English Learning Strategies Inventory for native English speakers and English Learning Strategies Inventory for those with other languages as their mother tongue. This study adapted the latter scale into a Japanese language Strategy Inventory for Language Learning. According to Oxford, the language learning strategies are: learners use a particular behavior to make learning easier, faster and more pleasant, more self-oriented, more efficient and easier to transfer to new learning situations. Oxford (1990), divided language learning strategies into two categories 1) direct strategies, directly related to behavior of language learning, which is further divided into three subsets: memory, cognitive, and compensatory strategies; 2) indirect strategies, related to the management of learning behavior, sub- divided into meta-cognitive, affective, and social strategies.

Three months after the Japanese course, the experimental group was evaluated using the Strategy Inventory for Japanese Learning (SIJL). As can be seen from Table 1, most learners had a low score in the application of language learning strategies; only 36.84% of the learners scored an average of over three points. Only the indirect - social strategy scored more than three points, indicating that the majority of learners were more passive, lacking motivation to learn and tending to rely on a cooperative approach to learning Japanese.

Table 1: Strategy Inventory for Japanese Learning scores of Experimental group

	Direct			Indirect			
	memory	cognitive	compensat	meta	emotional	social	Average
Average	2.71	2.64	2.79	2.78	2.68	3.20	2.80
Five-point scale percentage value>=3	26.32%	26.32%	47.37%	31.58%	36.84%	63.16%	36.84%
value<3	73.68%	73.68%	52.63%	68.42%	63.16%	36.84%	63.16%

2.3 System Usability Scale(SUS)

The system uses the System Usability Scale (SUS) which measures the user's subjective feelings [25]. This scale was developed in 1986 by Digital Equipment Corporation. SUS score reflects the overall satisfaction using a total of ten questions about the pros and cons of the problem with answers on a five-point scale (Likert Scale) from 1 "strongly disagree" to 5 "strongly agree". A formula is then used which transforms the data into a score out of 100 with the higher scores indicating a higher degree of satisfaction.

2.4 Motivated Strategies for Learning Questionnaire(MSLQ)

Motivated Strategies for Learning Questionnaire (MSLQ) scale is a common motivation measurement tool proposed by Pintrich, Smith, Garcia, & Mckeachie [26]. The MSLQ model divides the learning process into two major categories: motivation and learning strategies. The Motivation section is made up of three scales namely, value, expectancy and affective components. The value component is further subdivided into three components: intrinsic motivation, extrinsic motivation and task value. The value component measures the degree of importance of the learning to the learner, the relevance of the task to the learner and the reason to engage in learning. The expectancy component encompasses the learners' views on their success or failure and their self-efficacy refers to the learner's perception of their self-learning ability in specific learning activities; learners with higher self-efficacy will have greater perseverance and expectancy of success. The affective components refer to emotional reactions to learning tasks, learning results or learning ability, mainly test anxiety, i.e. worry or fear before or during examinations.

2.5 Instructional Strategies

The Affective Japanese tutoring system (ATS-JP) provides learners with three levels of courses according to their emotional state and inputted information: simple, normal and advanced. When the system recognizes negative emotions or information, it opens an easy page, and conversely, for positive emotions, a normal or advanced page will be opened. To exclude the possibility of measurement uncertainty factors caused by varying course content, the page content of the three courses is the same, there is no difference in text layout, there is just a difference in page color. The simple course material uses a warm

orange (Figure 1), the normal curriculum uses neutral green (Figure 2), and advanced pages use cool shades of blue (Figure 3).

According to Rauscher et al. [22] (who proposed the Mozart effect) and Jensen [20] and Dowling [27], music plays an important role in promoting a variety of academic and social skills. One of the features is that it activates the procedural memory, so enabling learning to be retained longer. Therefore, in the simple and normal versions of the course, gentle music was added as a background. In each of the three courses, hyperlinks to Japanese songs were added towards the end of the page to relieve emotions and to provide a short break. During the course, the learner can swap and adjust the learning context.

Figure 1. Simple class　　**Figure 2. Normal class**　　**Figure 3. Advanced class**

3. Experimental Results

3.1 The effectiveness of learning

This study attempted to discover whether the use of the affective Japanese tutoring system (ATS-JP) can help to improve the effectiveness of Japanese language learning by using cognitive tests before and after the experiment for analysis. Before the experiment, the two groups of students were given a test in order to determine whether there was a difference in their basic knowledge of Japanese. The test results in Table 2 show that there was no significant difference between the experimental group and control group (p =. 2189> .05) in the students' prior knowledge. Table 3 shows pre- and post-experimental results for the two groups. For both groups, progress was significant, with the experimental group correctly answering more questions than the control group.

Table 2：Pre-test t-test analysis summary table for the two groups

	Number	Average	Std Deviation	F
Experimental group	19	6.84	1.74	1.49
Control Group	16	6.81	1.42	

Table 3：The two groups before and after the test

	Pre-Test				Post-Test			
	Mean	Min	Max	Std. Deviation	Mean	Min	Max	Std. Deviation
Experimental group	6.84	4	10	1.74	10.63	7	15	2.33
Control group	6.81	4	10	1.42	9.56	7	12	1.78

3.2 System Usability for ATS-JP

In order to understand the learners' usage of the affective Japanese tutoring system (ATS-JP), after the experiment the two groups of students were scored using the System Usability Scale test. The SUS score reflects the overall satisfaction and results are shown

in Table 4. The subjective evaluations of the two groups of students in the system are both more than 60 points with the scores of the control group slightly higher than the experimental group. However, there are no significant differences ($p = .484 > .05$). Table 5 shows the percentage of the two groups in the five subscales; positive scores for both groups were 86.31% and 89.38% respectively, indicating that both groups of students had a positive assessment of the ATS-JP system.

Table 4：Summary of the SUS results for the two groups

	Number in group	Mean score	Standard deviation	F
Experimental group	19	61.84	12.043	.610
Control group	16	64.53	10.092	

Table 5：System Usability Scale (SUS) on the ATS-JP

	Mean	Standard deviation	Five-point scale percentage of each question				
			1	2	3	4	5
Experimental	3.47	1.096	8.42	5.26	33.68	35.79	16.84
Control group	3.58	0.967	2.50	8.13	36.88	33.75	18.75

3.3 Motivated Strategies for Learning Questionnaire

After the two groups of students finished using the ATS-JP, it was found that most of the students of the experimental group used simple or normal courses to complete the experiment, whilst the control group used normal or advanced courses (see Figures 4 and 5). Therefore the two groups of students did not demonstrate the same emotional state during the process: the experimental group tended towards negative emotions, whilst the control group tended towards positive emotions. Table 6 shows the Motivated Strategies for Learning Questionnaire (MSLQ) results for two groups. The mean results are greater than 3.5 showing that ATS-JP has a positive effect on learning motivation. The average scores in self-efficacy of the experimental group are a little higher than those of the control group. This result echoes the previous study results where the experimental group average post-test score was higher.

Figure 4：The experimental group of the experiment, mostly using simple courses (orange) or normal courses

Figure 5：The control group in the experiment, using more normal (green) or advanced courses (blue)

Table 6：Average scores for the two groups in
Motivated Strategies for Learning Questionnaire (MSLQ)

	Mean	Standard deviation	Intrinsic motivation	Task value	Self efficacy	Extrinsic motivation
Experimental group	3.78	0.73	3.89	3.87	3.76	3.60
Control Group	3.76	0.75	3.93	3.88	3.63	3.70

4. Conclusions and Future Prospects

In this quasi-experiment, beginners (non-language department students) were prone to demonstrate negative emotions because in their previous learning experience, they used learning strategies less often. ATS-JP may help beginners reduce negative emotions such as anxiety, unease and loneliness, assist them to focus more on learning content and allow them to monitor their own emotional state. The system had a positive effect on learning motivation and outcomes but there is a need for more teaching programs and further research and observation.

In this study, the language department students may have already been familiar with language learning strategies, have had fewer tendencies towards negative emotions, and had high SUS and MSLQ motivation scale responses, but they are were easily distracted, which ultimately affected the effectiveness of learning.

The ATS-JP system is still in an experimental phase; in future more emotional identification methods will be added to improve the recognition accuracy. In addition, better algorithms are needed to improve the computer's ability to recognize learner's emotional state from text input. Another goal is to add voice functions to provide voice practice and recognition, to help students who are shy of talking or introverts to have more opportunities to practice. The aim is to achieve easy and stress-free language learning.

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