DEVELOPMENT OF A WEB-BASED LEARNING ENVIRONMENT BASED ON THE CONCEPT OF GOAL SETTING THEORY

Jie Chi Yang[1], Chih Hung Lai[2], Tak Wai Chan[3] and Tzu Chien Liu[4]

Abstract ¾ This paper describes the development of a web-based learning environment based on the concept of goal setting theory. In this learning environment, some aids and tools are provided to help learners setting and achieving their learning goals on reading. In contrast with traditional learning environment, learners have more possibilities to make their decisions on a web-based learning environment. Therefore, how motivate learners to generate their motivation is an important issue on such a web-based learning environment. Some related researches pointed that goal setting is an important action during a learning process. Goal setting can motivate learners more easily toward their learning goals. Some design principles and system functional requirements are proposed for developing a web-based learning environment based on the concept of goal setting theory. A system has been developed under these considerations.

Index Terms ¾ goal setting theory, reading activities, system development, web-based learning environment

INTRODUCTION

In contrast with traditional learning environment, learners have more possibilities to make their decisions on a web-based learning environment. Therefore, how motivate learners to generate their motivation is an important issue on such a web-based learning environment. Some related researches pointed that goal setting is an important action during a learning process. Goal setting can motivate learners more easily toward their learning goals [5, 15, 16, 17].

The aim of this study is to develop a web-based learning environment based on the concept of goal setting theory. In this learning environment, some aids and tools are provided to help learners setting and achieving their learning goals on reading. The following sections describe design principles and system functional requirements for a goal setting learning environment and system implementation.

DESIGN PRINCIPLES FOR A GOAL SETTING LEARNING ENVIRONMENT

Design principles for a goal setting learning environment are considered based on the virtue of network learning environment and the steps of supporting goal setting and achieving. In this learning environment, some aids and tools are provided for helping learners setting and achieving their learning goals. The system supports for goal setting included tools of goal precision setting, goal difficulty setting, and schedule monitoring. The learning community management, participation mechanism for parents and teachers, feedback, learning histories recording, personalization, and evaluation functions are also taken into considerations in the system. The aim is to build a learner-centered learning environment for web-based learning.

This section describes design principles and system functional requirements in two aspects: helping learners setting and achieving their learning goals.

Helping Learners Setting Their Learning Goals

There are four design principles for helping learners setting their learning goals.

Setting a precise goal

A precise goal can guide learners more clearly toward their learning goal [16]. It also helps learners paying more attention on their learning activities. Contrast with an unclear or a general goal, a precise goal implies a clear direction, provides an exact schedule for achieving the learning goal. By knowing precisely what you want to achieve, you know what you have to concentrate on.

System functional requirements including:

- **Functions of goal setting**: The system provides tools and aids for goal setting, goal planning, and goal monitoring, such as, number of goals and detailed schedules for achieving these goals.
- **Functions of goal management**: The system provides tools and aids for goal managing, such as, operations of adding, modifying, canceling, and stopping a goal when it is achieved.

Adapting to learners' individual characteristics

The consideration of individual characteristics for goal setting is important since individual characteristics significantly affect learning performances [15, 16, 17]. Individual differences may exist on learners' learning competence. Therefore, an extremely difficult goal brings more stress on learning, whereas an extremely easy goal

---
[1] Jie Chi Yang, National Central University, Department of Computer Science and Information Engineering, Taiwan, yang@src.ncu.edu.tw
[2] Chih Hung Lai, National Central University, Department of Computer Science and Information Engineering, Taiwan, laich@src.ncu.edu.tw
[3] Tak Wai Chan, National Central University, Department of Computer Science and Information Engineering, Taiwan, chan@src.ncu.edu.tw
[4] Tzu Chien Liu, National Central University, Center for Teacher Education, Taiwan, ltc@cc.ncu.edu.tw

does not have any challenges. Consequently, a learning goal appropriate for individual competence is easier achieved.

In order to improve the acceptance of a goal, the difficulty of a goal should suitable for learners' competence, needs, interest, age, and schedule, and so forth. The more learners accept the goal, the more learners make efforts to achieve the goal.

System functional requirements including:

- **Goal attributes**: Goal attributes should be classified for adapting to learners' individual characteristics. The difficulty of a goal should suitable for learners' competence, needs, interest, age, and schedule.
- **Individual characteristics table**: A table holds individual characteristics should be established automatically according to learners' learning behavior on a web-based learning environment.

Types of goal setting

Learning goals may be set by learners themselves or others, like parents, teachers or peers. Learners' interest usual deeply influences their learning motivation. Learners also wish to make a decision for selecting learning activities. In general, learners prefer to achieve their learning tasks by setting goals themselves [1, 17, 22]. It means that learners will make more efforts to achieve these goals which was set by them. In addition, learners take the responsibility of their selected learning activities too. Accordingly, goal setting by learners themselves not only encourage learners for active learning, but also help learners achieving their learning goal more easier.

However, learners, especially for children, may do not familiar with how to make a precise goal for the lack of experience. In this case, parents or teachers have to play an assistant role in providing or suggesting a precise or achievable goal to learners. Besides, if a learning goal is well established by peers, it could be shared and re-used. Learners could just make a few modifications and then easily made new goals that are suited to them.

System functional requirements including:

- **Goal setting by learners**: Learning goals are set by learners themselves.
- **Goal setting by others**: Learning goals are set by others (parents, teachers or peers). Parents or teachers could assist students to set their learning goals. A well-established learning goal also could be shared by peers.

Quantifying goals

Quantifying goals is a good way for evaluating learners' performance. It is also helpful for learners to manage their goals more easier. The quantitative data includes goal setting and goal achieving.

System functional requirements including:

- **Quantitative data of goal setting**: Quantitative data such as date of goal setting, date of goal starting, date of

goal planning, date of notification. Statistics on these data are also generated by the system.

- **Quantitative data of goal achieving**: Quantitative data such as date of goal achieved, un-achieved, in progress, achieved percentage of schedule progress, and canceled.

Helping Learners Achieving Their Learning Goals

There are four design principles for helping learners achieving their learning goals.

Learner-centered design

The web-based learning environment should be designed as learner-centered. The environment should provide different interfaces for different users according to different identifications. For example, parents and teachers play the assistant role. Besides, some interactively tools are also provided for parents and teachers in order to help learners with sending messages.

System functional requirements including:

- **Interface**: The system provides different interfaces for different users according to their identification.
- **Interactively tools**: The system provides some interactively tools for setting up a communication channel to help or encourage learners with sending suggestions to learners.

Personalization

The second principle for helping learners achieving their learning goals is personalization. It means that learning goals could be divided into categories by learners' age, interest or location. Learners could obtain further information by viewing and emulating someone who has a similar learning goal in the same category.

System functional requirements including:

- **Personal center**: The system provides personal interface, personal data modification, personal functions setting, personal tools, and so on.
- **Customization of learning goals**: Learning goals are divided into some categories by learners' age, interest or location (for example, at the same class or at the same school).

Reward mechanism

In order to encourage learners to use the system and participate reading activities on the web-based learning environment, a reward mechanism is considered in system design principle. The reward mechanism is designed under a scoring system. Scores are accumulated according to some criteria, such as how many times of learners login to the system, how long of learners login on each time, how many books are planned to read by learners, how many books are already read by learners, how many comments are reported after learners learn from their reading, how many times that learners commented on others' comments, how many messages that learners posted on discussion forums, how

many new books that learners recommended to the system, how many books that learners recommended to their friends, how many reading activities that learners participated, and so on.

System provides appropriate messages according to the total scores students gained. System also provides a honor board for listing some charts of well done students on different perspectives. The reward mechanism can be used as providing a clue for parents or teachers to understand their children's achievement.

System functional requirements including:
- **Scoring system**: The system provides appropriate messages according to the total scores that students gained. The scoring system is based on some criteria to accumulate scores.
- **Honor board**: The system provides a honor board for listing some charts of well done students on different perspectives.

Goals monitoring and management

After a learning goal is set, it will be traced automatically by the system according to the learning goals history which is set by learners. The status of learning goals is then monitored and displayed the results. The system provides notification functions to remind learners the schedule of goal setting. The system also provides tools for managing goals.

System functional requirements including:
- **Learning goals history**: The system records date of goal setting, date of goal starting, date of goal planning, date of goal achieved, date of notification, and so on.
- **Learning goals status and performance**: The status of a learning goal is displayed, such as achieved, un-achieved, in progress, achieved percentage of schedule progress, and canceled.
- **Notification**: The system notifies learners the schedule of goal setting by on the website or by E-mail. There are many types of notification, such as, notification when learners logged-in the system, messages notification, E-mail notification, and notification about schedule on calendar.
- **Goal management**: The system provides tools for managing a goal with functions of adding, modifying, canceling, and stopping.

IMPLEMENTATION

A system was developed under the considerations of design principles and system function requirements analysis for a web-based learning environment, as described in the above section.

The system consists of five main modules, namely, User Function Module, Goal Function Module, Learning History Module, Evaluation Function Module, and Interactive Function Module. Figure 1 shows the system diagram of the five modules.
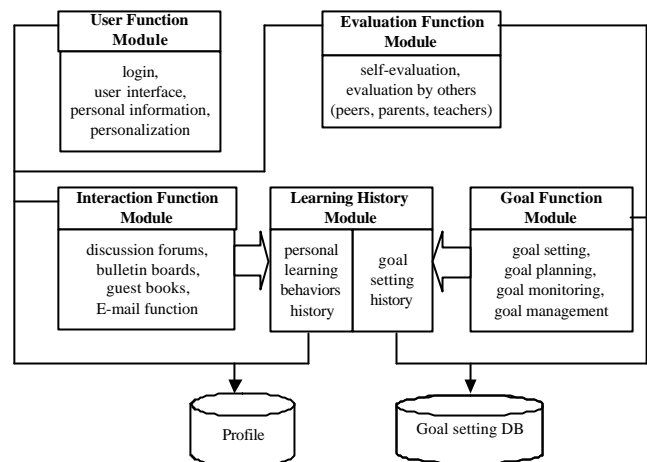

FIGURE. 1
SYSTEM DIAGRAM

User Function Module

The User Function Module includes login, user interface management, personal information management center, and personalization. Below is the explanation for each sub-module.
- **Login and user interface management**: This sub-module includes a user login and registration interface. Because the target users of the system is divided into students, parents, and teachers, users should select one identification to register to the system when they are using the system at the first time. After the registration, they can login to the system only using their accounts and passwords, the system identifies their identifications and provides adapted interface to the corresponding identifications.
- **Personal information management**: This sub-module is designed for individual information setting and management, includes personal information, favorite friends list, personal interest table, and personal learning profile. A personal information management center called "My Study Room" is developed as shown in Figure 2. When learners enter their study rooms, some information are displayed, such as how many books that learners planned to read, status of these books (planning to read, reading in progress, or finished the reading). Learners can click one of books to view the detailed information on that book. Learners also can report their comments on any books that they have already read to share their thoughts and feelings to others. Messages can also be left on discussion forums. Learners can recommend good book(s) to the system or their friends by the interface in their study rooms. From the above explanations, the role of "My Study Room" is trying to integrate functions provided by the system through the concept of personalization.
- **Personalization**: This sub-module deals with personal interface and personal setting. In system implementation

level, personal interest setting, personal message notification, and electronic news subscribing are involved. An agent is designed to collect personal data. When learners use the system at the first time, they are requested to answer some personal data. The other way to collect personal data is by analyzing learners' behavior of using the system. The agent analyzed learners' behavior and provided corresponding actions such as displaying appropriate web pages or sending an E-mail to learners. The right bottom of the Figure 2 shows that some books are recommended by the system according to the results of analyzing learners' behavior on the web-based learning environment.

FIGURE. 2
ONE SCREENSHOT OF "MY STUDY ROOM"

Goal Function Module

The Goal Function Module provides some tools for supporting goal setting, goal planning, goal monitoring, and goal management. This module is the core module of the system. Learners could choose books from a database of recommended books for children by some reliable organizations. The interface for the Goal Function Module is integrated on "My Study Room" as shown in Figure 2. Below is the explanation for each sub-module.

- **Goal setting**: The meaning of goal setting here is to choose a goal, namely, to choose a book to be planning to read. Learners can choose books by themselves or recommended by parents, teachers or peers.
- **Goal planning**: Once a goal is chosen, learners can then make a plan on that goal such as planning date of goal starting, date of goal achieved, date of notification, and so on. The schedule of goals can be planned through clicking the calendar or hyperlink of each book, as shown in Figure 3.
- **Goal monitoring**: Once a goal is planned, the system automatically traces and reminds learners according to learners planned schedules described above. This is designed for reminding learners to check the progress of

their learning goals. One of the way for reminding learners is synchronous notification when they logged-in the system. The other way is using E-mail or bulletin boards. Notification is also displayed on the calendar or as the status of each book on "My Study Room".

- **Goal management**: The goal management sub-module includes management of adding, modifying, canceling, stopping a goal when it is achieved. Learners could modify or cancel their learning goals before the date of goal achieved.
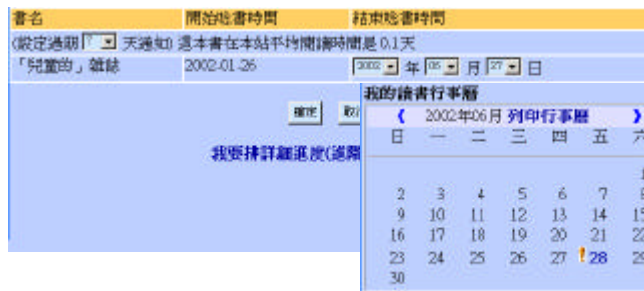

FIGURE. 3
ONE SCREENSHOT OF THE GOAL PLANNING FUNCTION

Learning History Module

Learning history can be treated as tools for assessing learning behavior in a web-based learning environment. Learning history can be recorded automatically during learners accessing some functions of the system for some learning behavior. The Learning History Module records personal learning behavior history and goal setting history of reading activities on the web-based learning environment.

- **Personal learning behavior history**: Learning behavior include all system logs, such as, how many time of learners logged-in to the system, how long of learners login, how long of learners login on each time, how many books are planned to read by learners, how many books are already read by learners, how many comments are reported after learners learn from their reading, how many times that learners commented on others' comments, how many messages that learners posted on discussion forums, how many new books that learners recommended to the system, how many books that learners recommended to their friends, how many reading activities that learners participated, and so on.
- **Goal setting history**: This sub-module records learning history of detailed information of goal setting on reading, such as, history of achieved, un-achieved, in progress, achieved percentage of schedule progress, and canceled. Other information on each goal such as date of goal setting, date of goal starting, date of goal planning, date of goal achieved, date of notification, comments from others are also recorded for further analysis.

Evaluation Function Module

In order to judge the degree of learners' efforts, to diagnose learners' difficult on learning, the Evaluation Function Module provides functions for evaluating learners' learning performance. Parents or teachers can immediately send messages to their children or students. This kind of formative evaluation can encourage learners and help them to modify their learning goals timely.

There are two kinds of evaluations to help learners evaluate their performances, namely, learners could evaluate themselves or be evaluated by others.

- **Self-evaluation**: Learners can evaluate their performance themselves after they have read one book. Learners are answered to some questions for self-evaluation.
- **Evaluation by others**: Learners could be evaluated by others, such as parents, teachers, or peers. Reviewers can choice one score and send some messages to learners according to learners' performance by using some tools in the Interactive Function Module which describes below.

Interactive Function Module

Learners interact with others in the Interactive Function Module. Parents and teachers can use this module to interact with children to know their learning situations. Learners can learn more and achieve better learning effects by interacting with others, especially their parents, teachers, and peers.

The Interaction Function Module provides discussion forums, bulletin boards, voting system, E-mail function, recommendation system, and notification function. Children can share their thoughts, feelings, or ideas by using these functions. Especially for discussion forums, the system provides one discussion forum for each one book. When a new book is registered to the system, a new discussion forum is created automatically by the system. Children can discuss any book with others who have the same interest in that book or who have already read the same book. Children also may recommend their friends about their favorite books by using these interactive functions. According to these interactions, parents and teachers may check to understand the learning situations, aptitudes, and interests of their children or students. There are two types of interaction, namely, between learners and between learners and the system.

- **Discussion forums**: Each book has a distinct discussion forum. Learners can share their thoughts and ideas on any book with others who have the same interest in that book or who have already read the same book. Learners can go to one of the discussion forums by clicking any book. Figure 4 shows one screenshot of messages posted on a discussion forum of one book.
- **Bulletin boards**: Bulletin boards provide learners, parents, and teachers for leaving a message. The system can also post a message for notification when necessary.

- **Voting system**: Learners can vote on books that they have interest to read by a voting system. The newest chart of the most favorite books is updated when every voting is completed.
- **E-mail function**: The system provides learners to send an E-mail to one person or one group by a mailing list. Learners can modify (add or delete) members in the list. The E-mail function can be used to deliver the newest messages to learners automatically or by system managers. Accordingly, learners do not need to check the website everyday, the system will send the newest information to learners by E-mail.
- **Recommendation system**: Learners may recommend their friends about their favorite books by using the recommendation system. Books are also recommended by the system according to the results of analyzing learners' behavior on the web-based learning environment.
- **Notification function**: Besides E-mail notification, the system prompts the newest information to learners when they logged-in to the system.

FIGURE. 4
MESSAGES POSTED ON A DISCUSSION FORUM OF ONE BOOK

CONCLUSION

This paper described the development of a web-based learning environment based on the concept of goal setting theory. The authors proposed some design principles and system functional requirements for developing a web-based learning environment. In this learning environment, some aids and tools are provided to help learners setting and achieving their learning goals on reading. A system has been developed under these considerations. In the near future, the authors plan to conduct an empirical study to evaluate the effectiveness of the system.

REFERENCES

[1] Bandura, A., *Social foundations of though and action: A social cognitive theory*, Engle-wood Cliffs, NJ: Prentice Hall, 1986.

[2] Bonk, C.J., & Cummings, J.A., "A dozen recommendations for placing the student at the center of web-based learning", *Educational Media International*, 35, 2, 1998, 82-89.

[3] Chan, T.W., Hue, C.W., Chou, C.Y., & Tzeng, O.J.L., "Four spaces of network learning models", *International Journal of Computers & Education*, 37, 2, 2001, 141-161.

[4] Corno, L., "The metacognitive control components of self-regulated learning", *Contemporary Educational Psychology*, 11, 4, 1986, 333-346.

[5] Corno, L., "Student volition and education: Outcomes, influences, and practices", In D.H. Schunk & B.J. Zimmerman, *Self-regulation of learning and performance: Issue and educational applications*, Hillsdale, NJ: Erlbaum, 1994, 229-251.

[6] Harterr, S., & Connell, J.P., "A model of children's achievement and related self-perceptions of competence, control, and motivational orientation", In J. Nicholis, *The development of achievement motivation*, Greenwich, CT: JAI Press, 1984, 219-250.

[7] Keller, J.M., "Development and use of the ARCS model of instructional design". *Journal of Instructional Development*, 10, 3, 1987, 2-10.

[8] Keller, J.M., & Suzuki, K., "Use of the ARCS Motivation Model in Courseware design", In: D.H. Jonassen, *Instructional Design for Microcomputer Courseware*, Hillsdale, New Jersey: Lawrence Erlbaum Associates, 1988, 401-434.

[9] Kuhl, J., "Volitional aspects of achievement motivation and learned helplessness: Toward a comprehensive theory of action control", In B.A. Mather, *Progress in Experimental Personality research*, 13, NY: Academic Press, 1984, 99-171.

[10] Kuhl, J., "Volitional mediators of cognitive-behavior consistence: Self-regulatory process and action versus state orientation", In J. Kuhl, & J. Beckman, *Action control: From cognition to behavior*, NY: Spring-Verlag, 1985, 101-128.

[11] Kuhl, J., "Action control: The maintenance of motivational states", In F. Halish & J. Kuhl, *Motivation, intention, and volition*, NY: Spring-Verlag, 1987, 279-291.

[12] Kuhl. J., "A theory of self-regulation: Action versus state orientation, self-discrimination, and some application", *Applied Psychology: An International Review*, 41(2), 1992, 97-129.

[13] Kuhl, J., "Action versus state orientation: Psychometric properties of the Action Control Scale (ACS-90)", In J. Kuhl & J. Beckmann, *Volition and personality: Action versus state orientation*, Seattle: Hogrefe & Huber, 1994, 47-60.

[14] Kuhl, J., "Who control whom when 'I control myself'?", *Psychological Inquiry*, 7(1), 1996, 61-68.

[15] Latham, G.P., & Locke, E.A., "Self-regulation through goal setting", *Organizational Behavior and Human Decision Process*, 50, 1991, 212-247.

[16] Locke, E.A., & Latham, G.P., *A theory of goal setting and task performance*, Englewood Cliffes, NJ: Prentice-Hall, 1990.

[17] Locke, E.A., "Toward a theory of task performance and incentives", *Organizational Behavior and Human Performance*, 3, 1968, 157-189.

[18] Madden, L.E., "Motivation students to learn better through own goal setting". *Education*, 117, 1997, 411-416.

[19] Malone, T.W., "Toward a theory of intrinsically motivating instruction", *Cognitive Science*, 4, 1981, 333–369.

[20] Ministry of Education, *Action plan for children reading campaign*, Taiwan, 2000.

[21] Nicholls, J.G., "Achievement motivation: Conceptions of ability, subjective experience, task choice, and performance", *Psychological Review*, 91, 3, 1984, 328-346.

[22] Punnett, B., "Goal setting and performance among elementary school students", *Journal of Educational Research*, 80, 1986, 40-42.

[23] Ryan, R.M., & Stiller, J., "The social contexts of internalization: Parent and teacher influences on autonomy, motivation, and learning", In M.L. Machr & P.R. Pintrich, *Advances in motivation and achievement. Greenwich*, CT JAI Press, 1991.

[24] Wang, S.H., Yang, J.C., Ho, C.W., & Chan, T.W., "Development of a web-based learning environment using goal setting theory - an example of reading website", In *Proceedings of the 5th Global Chinese Conference on Computers in Education* (GCCCE 2001), Chung-Li, Taiwan, 2001, 748-755.

[25] Yang, J.C., Chen, C.H., Chen, Y.B., Lai, C.H., Chan,T.W., and Liu, T.Z., "Reading contract system based on mission-based learning", In *Proceedings of the International Conference on Computers in Education* (ICCE 2002), 2002. (accepted)