

## Chapter 2

# FUDAOWANG: Implementing Advanced Education Concepts to Improve the Tutorial Intelligence of Intelligent Tutoring Systems

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### ABSTRACT

*The intelligence of an intelligent tutoring system is composed of reasoning intelligence and tutorial intelligence. The way to make an intelligent tutoring system with tutorial intelligence is to make sure the system has good tutoring functions. Determining how to provide good tutoring functions is an important research direction of intelligent tutoring systems. In this study, the authors develop an intelligent tutoring system with good tutoring functions, which they call “FUDAOWANG.” The research domain that FUDAOWANG treats is junior middle school mathematics, which belongs to the objective mature domain. Its characteristic is that the knowledge employed is the mature knowledge accepted by most people. FUDAOWANG uses automatic reasoning technology about objective mature problems to realize its reasoning intelligence. Based on the results of the automatic reasoning, FUDAOWANG synthetically applies the problem-based tutoring and the advanced education concepts to achieve tutoring functions of stepwise, prompt, detailed answers, rethinking after solution, consolidated exercise, etc. The evaluation of FUDAOWANG shows that it is helpful to the students in improving their learning achievements and cultivating good learning habits.*

### INTRODUCTION

With the increasing of science and technology, more and more technologies are applied in the field of education. A lot of education software that claimed to be able to help children study has appeared on the market. Does the education

software can help students? What functions of good education software that teachers and students need should have?

Students in general need the software to solve difficult problems in their study or work with them to explore problems, rather than the software only providing some fixed contents of problem

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sets. Students who learn better wish the software could provide the environment of training their innovation abilities, instead of simply imparting knowledge. Teachers hope the software could also be powerful teaching assistants to help them answer the general questions raised by students, so that they have time and energy to do more creative work.

So far, many scholars and research institutions have made a big effort, and have developed many actual intelligent tutoring systems. On the basis of the summary that Shute and Psotka (1996)

studied on the early intelligent teaching systems, this paper combines with the latest intelligent tutoring systems research, and summarizes the development process and the typical systems of intelligent tutoring systems, which is shown in Table 1.

The successful development of these systems provided the tutoring of various fields, and promoted the progress of education technology. Simultaneously, an intelligent tutoring system serving as an intelligent system is the result of the comprehensive application of artificial intel-

Table 1. The typical intelligent tutoring systems

ITS	Time	Developer	Main Technology	References	
SCHOLAR	1970	Carbonell	Production expert system	(Carbonell, 1970)	
WHY	1977	Stevens, Collins		(Stevens and Collins, 1977)	
SOPHE	1975	Burton, Brown		(Brown and Burton, 1975)	
WEST	1976	Burton, Brown		(Brown and Burton, 1976)	
BUGGY	1978	Burton, Brown		(Brown and Burton, 1978)	
GUIDON	1979	Clancey		(Clancey, 1979)	
LISP Tutor	1985	Anderson, Boyle, Reiser	Case-based reasoning, Natural language understanding	(Anderson, Boyle, and Reiser, 1985)	
Geometry Tutor	1985	Anderson, Boyle, Yost		(Anderson, Boyle, and Yost, 1985)	
PROUST	1986	Johnson		(Johnson, 1986)	
PIXIE	1987	Sleeman		(Sleeman, 1987)	
Smithtown	1990	Shute, Glaser	Intelligent agent, Natural language understanding, Neural network	(Shute and Glaser, 1990)	
Bridge	1991	Shute		(Shute, 1991)	
Stat Lady	1993	Shute, Gawlick-Grendell		(Shute and Gawlick-Grendell, 1993)	
Sherlock	1995	Nichols, Pokorny, Jones, Gott, Alley		(Nichols, Pokorny, Jones, Gott, and Alley, 1995)	
SQL-Tutor	1996	Mitrovic		(Mitrovic, 1996)	
Auto-Tutor	1997	Graesser		(Graesser, 1997)	
VC Prolog Tutor	2000	Peylo, Thelen, et al		Intelligent agent, Grid and distributed computing, Natural language understanding	(Peylo, Thelen, Rollinger and Gust, 2000)
SCoT-DC	2001	Herbert, Clark, et al			(Clark, Fry, Ginzton, Peters, Pon-Barry, and Thomsen-Gray, 2001)
Slide Tutor	2003	Crowley, Medvedev	(Crowley and Medvedeva, 2006)		
AHP-Tutor	2004	Ishizaka, Lust	(Ishizaka and Lust, 2004)		
MATHEMA	2009	Papadimitriou, Grigoriadou, Gyftodimos	(Papadimitriou, Grigoriadou, Gyftodimos, 2009)		
Mathtutor	2009	Aleven, McLaren, Sewall	(Aleven, McLaren, Sewall, 2009)		
IVRT	2009	Kim, Wang	(Kim and Wang, 2009)		
Oscar CITS	2012	Latham, Crockett, Mclean,	(Latham, Crockett, Mclean, 2012, 2014)		

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