Objective Achievement Analysis of Water Supply and Drainage Pipeline Engineering Title

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Abstract. Achievement degree of Water Supply and Drainage Pipeline Engineering is analysed for students whose major is Water Supply and Drainage Science and Engineering. This course aims to let student know basic definitions, theories, engineering design, and basic techniques in terms of water supply and drainage. In addition, it aims to cultivate students' ability to solve practical problems in works, which is quite important for engineers. Achievement analysis shows that the average total achievement degree is 0.85, achieving the expected value. The average achievement degree is 0.92 for object No.1, 0.9 for object No.2, and 0.77 for object No.3. Students have a relatively better grasp of object No.1 and No.2 than No.3 Hence, object 3 should be strengthened in later class teaching.

Keywords: Objective achievement analysis, Water supply and drainage pipeline engineering, Achievement degree.

1 Introduction

Sewerage Pipeline Engineering is a required core subject for students whose major is water supply and drainage science and engineering[1,2]. This course involves the following nine chapters: general introduction to water supply and drainage pipe network, engineering plan of sewerage network, fundamentals of mechanics, pipeline models, hydraulic analysis and computation, engineering design, design and computation of wastewater pipeline, design and computation of rainwater pipeline, maintenance and management. Through learning of this course, the students should grasp basic definitions in terms of water supply and drainage, engineering design, and basic techniques of pipeline plan and maintenance[3].

This course has three objectives. Firstly, the students should know theory and methods of pipeline hydraulic calculation, based on understanding of pipeline network functions and design principles[4]. Secondly, the students should master how to solve practical problems based on understanding of pipeline management and information technology, and how to prepare design documents based on pipeline plan. Finally, the students should be able to analyse and solve practical engineering problems in terms of water supply and drainage pipeline network[5].

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2 Course Objective Analysis and Evaluation Method

2.1 Objective Analysis and Requirements for Students

This course has the following requirements for graduates whose major is water supply and drainage engineering, as shown in Table 1. Through learning of this course, the students are required to understand theory and methods of pipeline hydraulic calculation, pipeline network functions and design principles. In addition, they should be able to analyse and solve practical engineering problems in terms of water supply and drainage pipeline network.

Table 1. Course objectives and requirements for students

	Requirements for students	Course objective
1.1	Know basic knowledge of pipeline network, involving pipeline functions, design theory and hydraulic basis.	No. 1
3.3	Be able to perform pipeline plan and design based on learning of basic knowledge.	No. 2
6.3	Be able to analyse and solve practical problems after learning preliminary design and relative knowledge.	No. 3

2.2 Evaluation Method

Score of this course involves regular grade and exam grade (Table 2). Regular grade depends on class performance, class test, class performance and homework, which has a proportion of 40% of the score. The final exam, closed book, has a ratio of 60%.

Table 2. Evaluation method of this course

Course objective	Requirements for graduates	Evaluation methods and ratios				
		Regular grade (40%)			Final exam 60%	Ratios
		Class performance	class performance and homework	class test		
No. 1	1.1 Know basic knowledge of pipeline network, involving pipeline functions, design theory and hydraulic basis.	6.67%	3.33%	3.33%	12%	25.33%
No. 2	3.3 Be able to perform pipeline plan and design based on learning of basic knowledge.	6.67%	3.33%	3.33%	18%	31.33%
No. 3	6.3 Be able to analyse and solve practical problems after learning preliminary design and relative knowledge.	6.67%	3.33%	3.33%	30%	43.33%

3 Achievement Degree Analysis for Different Objective

3.1 Evaluation Content of Course Objectives

Evaluation content for different objective is shown in Table 3. Regular performance in Table 3 involves class attendance, class test, homework and class performance. Regular score is 12, 18 and 12 respectively for the objective of No.1, No.2 and No.3. The final exam has three question types, fill-in-the-blanks, short-answer question items and computation items, and the ratio is between 24% and 42% depending on importance of the objective.

Table 3. Evaluation content of course objective

Course objective	Evaluation content		Target score	Ratio
No.1	Regular	Regular performance	12	24%
	Final exam	Fill-in-the-blanks	12	
No.2	Regular	Regular performance	16	34%
	Final exam	Short-answer question items	18	
No.3	Regular	Regular performance	12	42%
	Final exam	Computation items	30	
Final score				100%

3.2 Achievement Degree Analysis of Objective No.1

The following Table 1 gives a summary of all heading levels. Achievement degree analysis of object No.1 is shown in Fig. 1. The achievement degree is totally more than 0.7, close to the average value of 0.92 for most students. It indicates that most students have a relatively good grasp of basic knowledge of pipeline network, involving pipeline functions, design theory and hydraulic basis.

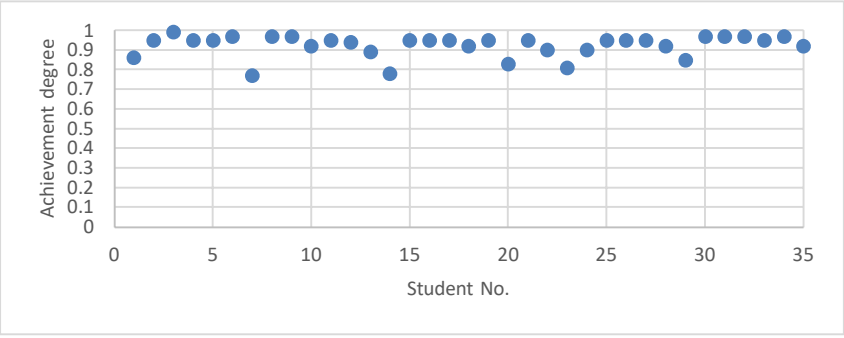

Fig. 1. Achievement degree analysis of objective No.1

3.3 Achievement Degree Analysis of Objective No.2

The average achievement degree of object No.2 is 0.9, close to that of No.1, as shown in Fig. 2. The achievement degree is near 0.9 for most students. It indicates that most students have a good understanding in terms of pipeline plan and design. Only one student has an achievement degree less than 0.6, and thus he should be given more help in later teaching of object No.1.

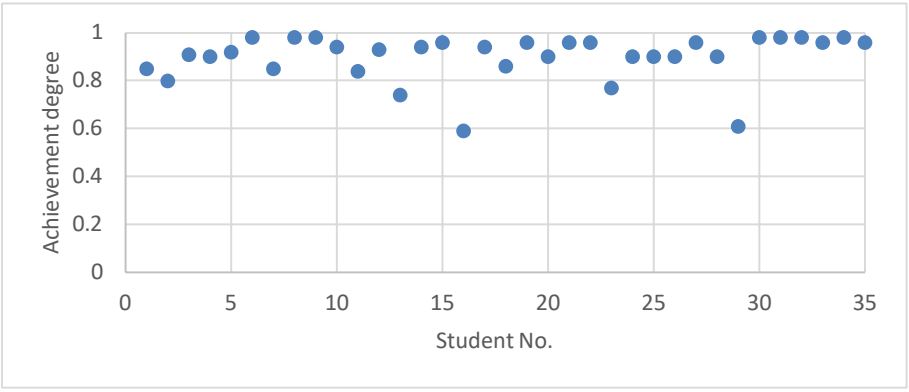

Fig. 2. Achievement degree analysis of objective No.2

3.4 Achievement Degree Analysis of Objective No.3

The achievement degree of object No.3 is 0.77 (Fig. 3), lower than that of object No.1 and No.2. It indicates that it is relatively more difficult for the students to solve practical problems in water supply and drainage, which should be strengthened in later teaching. Practical cases should be provided in teaching the object No.3, to let students establish ability in terms of solution of practical problems. Five students' achievement degree is lower than 0.6. and they should be given more help in the following learning.

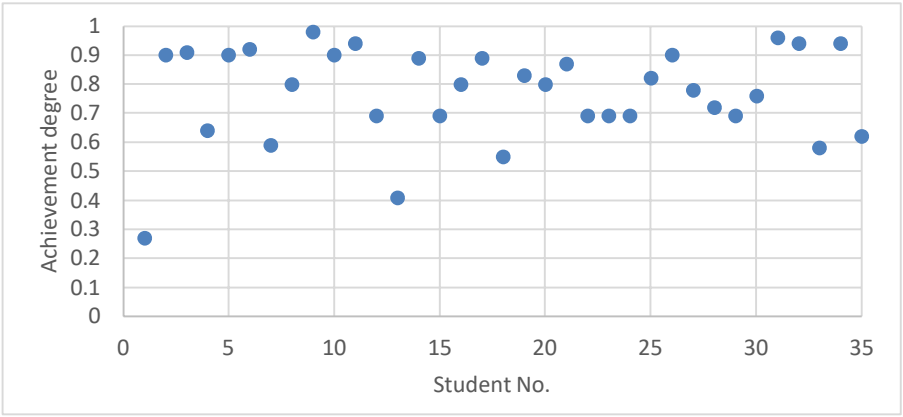

Fig. 3. Achievement degree analysis of objective No.3

3.5 Total Achievement Degree Analysis for Students

The average total achievement degree of 0.85 achieves the expected value, as shown in Fig. 4. It shows that most students are able to perform pipeline plan and design based on learning of basic knowledge. The average achievement degree of object No.1 and No.2 exceeds the total achievement degree, while that of No.3 is less than the total value. It indicates that the students have a better grasp of object No.1 and No.2 than object No.3. More practical exercises should be given in latter learning to strengthen learning of object No.3. Achievement degree for students is shown in Table 4.

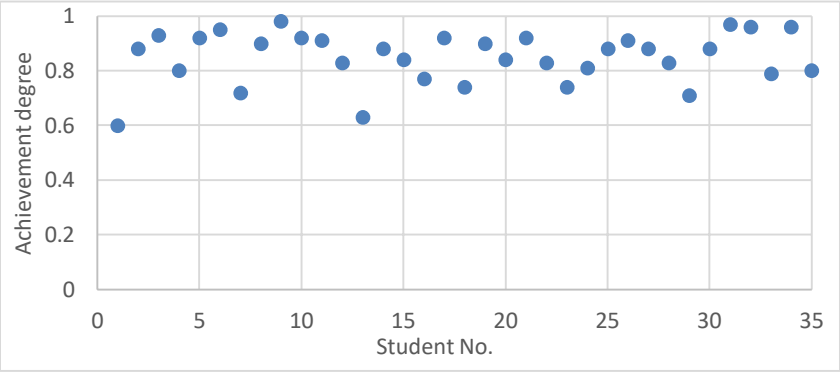

Fig. 4. Total achievement degree analysis for students

Table 4. Achievement degree analysis for students

Student No.	Aim 1		Aim 2		Aim 3		Total achievement degree
	score	achievement degree	score	achievement degree	score score	achievement degree	
1	21.7	0.9	26.5	0.8	11.5	0.3	0.6
2	24.0	0.9	25.2	0.8	39.0	0.9	0.88
3	25.1	1.0	28.7	0.9	39.5	0.9	0.93
4	24.0	0.9	28.2	0.9	27.6	0.6	0.8
5	24.0	0.9	28.8	0.9	39.0	0.9	0.92
6	24.7	1.0	30.7	1.0	39.7	0.9	0.95
7	19.5	0.8	26.7	0.9	25.5	0.6	0.72
8	24.7	1.0	30.7	1.0	34.9	0.8	0.9
9	24.7	1.0	30.7	1.0	42.7	1.0	0.98
10	23.4	0.9	29.4	0.9	39.0	0.9	0.92
11	24.0	0.9	26.4	0.8	40.8	0.9	0.91
12	23.7	0.9	29.1	0.9	29.7	0.7	0.83
13	22.5	0.9	23.1	0.7	17.7	0.4	0.63
14	19.8	0.8	29.4	0.9	38.4	0.9	0.88
15	24.0	0.9	30.0	1.0	30.0	0.7	0.84
16	24.0	0.9	18.6	0.6	34.8	0.8	0.77

17	24.0	0.9	29.4	0.9	38.4	0.9	0.92
18	23.4	0.9	27.0	0.9	24.0	0.6	0.74
19	24.0	0.9	30.0	1.0	36.0	0.8	0.9
20	21.0	0.8	28.2	0.9	34.8	0.8	0.84
21	24.0	0.9	30.0	1.0	37.8	0.9	0.92
22	22.8	0.9	30.0	1.0	30.0	0.7	0.83
23	20.4	0.8	24.0	0.8	30.0	0.7	0.74
24	22.8	0.9	28.2	0.9	30.0	0.7	0.81
25	24.0	0.9	28.2	0.8	35.4	0.3	0.88
26	24.0	0.9	28.2	0.8	39.0	0.9	0.91
27	24.0	0.9	30.0	0.9	33.6	0.9	0.88
28	23.4	0.9	28.2	0.9	31.2	0.8	0.83
29	21.6	0.9	19.2	0.9	30.0	0.9	0.71
30	24.7	1.0	30.7	1.0	33.1	0.8	0.88
31	24.7	1.0	30.7	0.9	41.5	0.7	0.97
32	24.7	1.0	30.7	0.6	40.9	0.7	0.96
33	24.0	0.9	30.0	1.0	25.2	0.8	0.79
34	24.7	1.0	30.7	1.0	40.9	1.0	0.96
35	23.4	0.9	30.0	1.0	27.0	0.9	0.8
Average	23.4	0.92	28.2	0.9	33.4	0.77	0.85

4 Conclusions

Through learning of this course, most students grasp basic knowledge of pipeline network, involving pipeline functions, design theory and hydraulic basis. They can perform pipeline plan and design based on learning of basic knowledge. They are able to analyze and solve practical problems after learning preliminary design and relative knowledge. It is more difficult for them to cultivate ability in solving practical problems. Hence, more practical exercises should be given in later class teaching to cultivate students' ability in solving practical problems.

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