Study on the Influencing Factors on Network-based Autonomous Learning in Mechanical Engineering English

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Abstract—Exploring the influencing factors of network-based autonomous learning is very important for colleges and universities in the world who have adopted this teaching mode in their education system. Many studies have discussed the teaching mode of autonomous learning, but failed to pay enough attention to the factors influencing students learning results. The purpose of this study is to analyze the relationship between the influencing factors and students' learning results among different levels, and find better teaching method according to students' learning condition. Mechanical Engineering students in Luoyang Institute of Science and Technology are employed as the data source for this study. A number of data are collected and compared, and an analysis of various factors that influence the achievement of students' network-based autonomous learning is performed. Data calculation shows that: students from different grades and levels differ in their learning motivations and beliefs. In learning strategies, they have no difference in cognitive stratagem. But in Meta-cognitive strategy and resource management strategies they are different. There are significant positive correlations between students' intrinsic motivation and belief of resource management, students' responsibility strategy use; extrinsic motivation and strategy use are a negative correlation, but not significant.

Index Terms—Autonomous learning, influencing factors, mechanical engineering English, network-based

I. INTRODUCTION

With the rapid development of science and technology, Computer and Internet has become an indispensable tool in modern education and have brought great change in the teaching models of college education in the world. In the new era of this modern Information Technology, new teaching models based on the network make Mechanical Engineering English learning more personalized and autonomous. This model is more effective as it is without the limitations of time and place and the students' learning is less restricted by classroom instruction. Thus many colleges and universities have adopted autonomous learning in their Mechanical Engineering English class. However, for Mechanical Engineering students, since their interests and abilities in professional English are quite different, their achievements of autonomous learning are quite different too. Therefore, what are the main factors influencing autonomous learning and how do those affects each other, will be discussed in this paper with the objective to give suggestions to Mechanical Engineering English teaching.

II. LITERATUE REVIEW

Autonomous learning, also known as learner autonomy, has been advocated by education experts and psychologists in the early 1980s. Besides these two terms, there are many other synonymous, such as "self-regulated learning", "self-study", "active-learning", "self-education", "self-access learning", etc. The term "learner autonomy" was first put forward in 1981 by Henri Holec in his book, Autonomy and Foreign Language Learning [1]. He thought that autonomous learning is to take charge of one's own learning. It is an ability to make one's own decisions about what to do rather than being influenced by someone else or told what to do. That is to say, learners should have the capability to learn autonomously in completely unforeseen situation [2]. Little D. thought that, learner autonomy is a kind of ability to do independent and critical thinking, to make decisions and put into practice independently [3]. Benson P. defined autonomous learning as the ability to control the process of one's own learning, which refers to the ability in teaching management, cognitive process and one's control in choosing learning content [4]. According to the degree of autonomy, Sinclair [5] divided autonomous learning into completely autonomous learning and teacher-guided autonomous learning. Completely autonomous learning refers to learning objectives, tasks, processes and evaluations are all decided by the students; while teacher-guided autonomous learning means teachers supervise the whole process. In completely autonomous learning, students are overloaded and multi-tasking and often are not aware of how to organize their time online wisely [6]. If teachers join in the processes to give the students guidance, they can do much better. The study of autonomous learning in this paper belongs to the later.

However, there is not much research has been done about the influencing factors of learners' autonomous learning under the network environment. Only a few scholars of autonomous learning did the research about learning elements under the network environment. Combined with the current situation and characteristics of learners' autonomous learning, this paper proposes that under the network environment, the influencing factors of autonomous learning play an important role in the learning results. If we make it clear how the influencing factors affect students, we will find suitable methods and solutions for students to learn better by themselves.

In a traditional classroom, students are involved in listening to the instructor, reading the textbook, observing

the explanations or following the solution of problems. Such kind of passive involvement generally leads to a limited access to learning and retention of knowledge by students [7]. If teachers adopt network-based autonomous learning, students will have more initiative and be more active in their study [8]. The autonomous learning of Mechanical Engineering English is not to ask students to learn individually and independently, but rather it must be achieved by the interactions between teacher and student. It is influenced by many factors, such as students' learning attitude, their abilities, learning method, and their language level etc. In this paper, we will analyze three major factors that influence students' network-based autonomous learning, namely: Motivation, Beliefs and Strategies.

The reminder of this paper is organized as follows: Section III is about the research design of this study. Section IV concludes and analyzes the data with SPSS software, and discusses the enlightenments of this study. Conclusions are summarized in section V.

III. METHODOLOGY

A. Research Questions

What are the differences between students from different grades and levels in the network-based autonomous learning? From what dimensions do motivation, autonomous learning belief and learning strategies influence the learner? How do these factors influence the learner?

B. Research Subject

The subjects of this study are the Grade One and Grade Two students from the School of Mechanical Engineering in Luoyang Institute of Science and Technology. They have been divided into High-level, Middle-level and Low-level according to the results of the English placement test after they have entered the college. Cluster sampling method was used in the study, We drawn 300 High-level students, 500 Middle-level students, and 200 Low-level students from the two grades of ME School as the research objects. A total of 1,000 questionnaires were handed out and collected 965 valid questionnaires. The response rate was 96.5%. The software of autonomous learning used in this study is Language Teaching System. It is used in the English classes of Mechanical Engineering students from Grade One and Grade Two; Figures 1 and 2 show the two interfaces of it.

Fig. 1 and Fig. 2 are the interface of autonomous learning system in the English class of Mechanical Engineering students in Luoyang Institute of Science and Technology. Using this learning software, students can learn by themselves both in class and after class from different aspects, such as reading, listening, speaking, translating and writing. This software contains the materials which students are learning in class, and can also be connected to the internet to get more related information.

C. Research Tool

This research used questionnaires and interviews to collect data. Three major questionnaires were used here: Questionnaire No. 1 is about motivation of network autonomous learning; questionnaire No. 2 is about the beliefs of network autonomous learning and questionnaire No. 3 is about strategies of network autonomous learning based on the existing questionnaires related to learning

Figure 1. Language Teaching System

Figure 2. Lange Teaching System

motivation, learning beliefs and learning strategies [9-10]. These three questionnaires are compiled following the characteristics of network-based autonomous learning. According to the requirement of psychological measurement, this paper analyzed the construction validity and reliability of the questionnaires.

The three questionnaires adopt principal component analysis to extract factor and orthogonal rotation to determine the maximum variance on the ownership of the project [11-13]. The questionnaire on motivation finally gained the two factors, namely the extrinsic motivation and intrinsic motivation. The questionnaire on network autonomous learning belief finally gained three factors, namely resources, students' responsibility and teachers' responsibility. It also finally gained three factors, namely, cognitive strategy, meta-cognitive strategy and resource management strategy [14]. By internal consistency test, the alpha co-efficient of each part about the three questionnaires is good in validity and reliability, as to meet the requirements.

IV. RESULT ANALYSIS AND DISCUSSION

Based on the analysis of the data collected through questionnaires, the author explains the meaning of numbers, and then proposes some suggestion in teaching about network-based autonomous learning. This part mainly focuses on the three aspects: A. students from different grades and levels vary in their motivations, beliefs and strategies; B. correlation analysis among the motivation, belief and strategy in network-based autonomous learning; C. the enlightenments of this study on foreign language teaching.

A. Differences between Students

It can be seen from table I that using the grades as the influencing factors and the two dimensions of learning motivation as the dependent variable. By carrying out "t" test, the results show that students from different grades are significantly different on extrinsic motivation and

intrinsic motivation. Grade one students score higher on extrinsic motivation and intrinsic motivation than grade two students (t=5.186, $p<0.01$; t=4.369, $p<0.001$). This illustrates that the extrinsic motivation and intrinsic motivation of grade one students are stronger than the grade two students in network-based learning. As shown from the data, the Grade One students are more interested in network learning than Grade Two students; at the same time, they value scores and rules much more than Grade Two students. They prefer to receive recognition from the schools, teachers and classmates. However, with the scaling up of grade, students' intrinsic motivation was weakening.

From table II we can see that, using level as influencing factors, two dimensions of learning motivation as the dependent variable. By carrying on variance analysis, the results show significant differences in the two dimensions among students of the High, Middle and Low levels. Taking a further comparison, we found that, in the dimension of extrinsic motivation, there is a significant difference between Middle-level and High-level students ($p<0.05$), between Middle-level and Low-level students ($p<0.05$), between Low-level and High-level students ($p<0.05$). Under the intrinsic motivation dimension, there is significant difference ($p<0.05$) between High-level and Low-level students, and also between Middle-level and Low-level students. The results show that High-level students' intrinsic motivation is higher than extrinsic motivation in network-based learning; while for Middle-level and Low-level students, the extrinsic motivation are stronger. Meanwhile, High-level and Middle-level students' intrinsic motivation is stronger than Low-level students in network learning; which illustrate that the higher the level, the stronger the intrinsic motivation.

From table III, it can be seen that using grades as influencing factors, the three dimensions of learning belief as the dependent variable. By carrying out "t" test, the results show that there is significant difference between students from Grade One and Grade Two, in the two dimensions of student's responsibility and resource function. (t=2.482, $p<0.05$; t=5.765, $p<0.001$). It can be seen from the data, in "Belief of students' responsibility", Grade One and Grade Two students' mean values are 3.92 and 3.86 respectively. This indicates that students themselves think they are responsible for online learning, and the autonomous learning ability plays an important role in network-based autonomous learning. But compared to Grade One students, Grade Two students are slightly lower in the awareness. On the dimension of resources function, the mean value of Grade One students (3.95) is significantly higher than that of Grade Two students (3.78). It indicates that Grade One students think more actively in the importance of network resources than Grade Two students. We know from the interviews that Grade One students hold more positive understanding than Grade Two students, mainly because they are just beginning to use network in their autonomous learning and full of curiosity. While for Grade Two students, after a year of learning, their language using ability, especially listening and speaking skills didn't improve as they were expected. Sometimes they face problems that they are unable to solve and thus they questioned the effectiveness of online learning.

Table IV shows that, using levels as influencing factors, three dimensions of learning belief as the dependent variable. By carrying on variance analysis, the results show

TABLE I.
MOTIVATION DIFFERENCES BETWEEN STUDENTS OF DIFFERENT GRADES

	Extrinsic motivation	Intrinsic motivation
Grade One	3.58	3.50
Grade Two	3.28	3.36
t	5.186	4.369

TABLE II.
MOTIVATION DIFFERENCES BETWEEN STUDENTS OF DIFFERENT LEVELS

	Extrinsic motivation	Intrinsic motivation
High-level	3.07	3.56
Middle-level	3.64	3.52
Low-level	3.48	2.95
F	95.021	90.117
Multiple comparisons	L > H, M>H, M>L	H>L, M>L

TABLE III.
BELIEF DIFFERENCES BETWEEN STUDENTS OF DIFFERENT GRADES

	Belief of resource function	Belief of student responsibility	Belief of teachers' responsibility
Grade One	3.95	3.92	2.53
Grade Two	3.78	3.86	2.56
t	5.765	2.482	-1.011

TABLE IV.
BELIEF DIFFERENCES BETWEEN STUDENTS OF DIFFERENT LEVELS

	Belief of resource function	Belief of student responsibility	Belief of teachers' responsibility
High-level	3.87	4.01	2.69
Middle-level	3.82	3.94	2.67
Low-level	3.98	3.45	2.36
F	5.352	98.726	11.598
Multiple comparisons	L>H, L>M	H>M, H>L, M>L	H>L, M>L

significant differences in the three dimensions among students of the High, Medium and Low levels. Take a further multiple comparison, we can see that Low-level students score higher than Middle-level and High-level students in resource belief dimension ($p<0.05$). Seen from the data, the mean values of three level students on the resource function belief are 3.87, 3.82 and 3.98 respectively. This suggests that they hold a positive attitude to the role of network resources in English learning. Students believe that much listening practice from network resources is helpful to improve English listening and speaking skills. They can improve their English writing skills too. On the belief of student responsibility, there is a significant difference between High-level and Middle-level students ($p<0.05$), between High-level and Low-level students ($p<0.05$), between Middle-level and Low-level students ($p<0.05$). But under the teachers' responsibility dimension, Low-level students score lower than the Middle-level and High-level students ($p<0.05$). The results show that with the students' rising of scores, their awareness of self-responsibility for learning increases. Independent learning ability in the network-based autonomous learning plays an important role. But at the same time, it also shows the result that High-level students are more

dependent on teachers in network autonomous learning than Low-level students.

It can be seen from table V, that using grade as the influencing factors and the three dimensions of learning strategies as the dependent variable, by carrying out "t" test, the results show that the mean value of Grade One students is higher than Grade Two students in cognitive strategy, meta-cognitive strategy and resource management strategy, and have significant difference (t=3.989, t=5.782, t=6.838, p<0.001). The results show that Grade One students are more adept at using various strategies for network learning than Grade Two students. This result is in line with the above survey on motives and beliefs, which show Grade Two students, are inferior to Grade One students in these aspects. This phenomenon happens because students after a year of study, Grade Two students want to learn more things and make much better achievements in their study. But their progresses don't meet their expectations. Meanwhile, they began to question authority according to their own learning experience, which confused them after a year of language learning using ability and gradually weakened their consciousness and desire for autonomous learning.

From table VI, we can see that using level as influencing factors, three dimensions of learning strategy as the dependent variable, by carrying on variance analysis, the results show significant differences in students' meta-cognitive strategy and resource management strategies among the High, Medium and Low levels(F=2.532, p<0.05; F=3.358, p<0.05). This indicates that High-level students have strong sense of meta-cognitive awareness, meta-cognitive ability and learning management ability. They have strong independent learning ability, can well plan learning objectives, monitoring the learning process and evaluating learning outcomes. On the dimension of resource management strategy, Low-level students have significant difference with High-level and Middle-level students (p<0.05). This indicates that Middle-Level and High-Level students can reasonably arrange their study and entertainment time. They can try to overcome various difficulties to adapt themselves to the autonomous learning method. Relative to the High-Level and Middle-Level students, the Low-Level students don't know how to make plans for their study, how to solve the problems they face when learning autonomously, and how to make use of the network properly. High-level and Middle-level students are better in using these strategies to help them adapt to the environment and adjust the environment to meet their own needs. During discussion with students, the Low-Level students said that their English level is generally low; they usually don't know what to learn and how to learn from the internet. While High-Level and Middle-Level students said that they have more plans and arrangements in using internet, as an interesting learning method to study. They expect more from this learning method and thus they will do better in learning results.

B. Correlation Analysis among the Motivation, Belief and Strategy

From table VII, we can see that there were significant positive correlation between the three dimensions of resource function belief, student responsibility belief and network-based learning strategies. But teachers' responsibility belief presented a negative correlation between the three dimensions of network learning strategies. This indicates that the more confidence students have in network autonomous learning, they will be more active in using learning strategies to make use of the resources on the internet to practice their English listening, speaking, and reading abilities actively. If they think teachers should be responsible for the monitoring and management of their learning, they will not take the initiative to use strategy to study. Conversely, if students' ability of learning strategy is raised, they will hold more positive attitude to network resources in their study. They also can be more aware that they themselves play the main role in network autonomous learning. They should make plans and choose learning materials by themselves and try to solve problems by themselves. Teachers are only leaders and promoters.

TABLE V.
STRATEGY DIFFERENCES BETWEEN STUDENTS OF DIFFERENT GRADES

	Cognitive strategy	Meta-cognitive strategy	Resource management strategy
Grade One	3.35	3.32	3.25
Grade Two	3.25	3.15	3.03
t	3.989	5.782	6.838

TABLE VI.
STRATEGY DIFFERENCES BETWEEN STUDENTS OF DIFFERENT LEVELS

	Cognitive strategy	Meta-cognitive strategy	Resource management strategy
High-level	3.31	3.28	3.16
Middle-level	3.31	3.24	3.13
Low-level	3.23	3.18	3.05
F	1.720	2.532	3.358
Multiple comparisons	H>L	H>M, H>L	

TABLE VII.
RELEVANT INSPECTION BETWEEN BELIEF AND STRATEGY

	Cognitive strategy	Meta-cognitive strategy	Resource management strategy
Resource function belief	0.526	0.502	0.502
Student responsibility belief	0.426	0.422	0.381
Teacher responsibility belief	-0.431	-0.403	-0.405

TABLE VIII.
RELEVANT INSPECTION BETWEEN MOTIVATION, BELIEF AND STRATEGY

	Resource function belief	Self-responsible belief	Teacher-responsible belief	Cognitive strategy	Meta-cognitive strategy	Resource management strategy
EM	0.147	0.192	0.132	-0.17	-0.011	-0.013
IM	0.562	0.536	-0.399	0.694	0.637	0.610

From table VIII, we can see that there is no significant correlation among the extrinsic motivation and resource function belief, students' responsibility belief, cognitive strategies, meta-cognitive strategies and resource management strategies. Extrinsic motivation and teachers' responsibility has significantly positive correlation, whereas intrinsic motivation and teachers'-responsibility has significant negative correlation. This indicates for students, that the more extrinsic motivation they have, the more they depend on teachers in their learning; and in turn, the more students think teachers should be responsible for learning, the stronger extrinsic motivation they have. Their learning is mainly for achievements, facing those and other external factors. And intrinsic motivation has significantly positive correlation with resources function belief, students' responsibility belief, cognitive strategies, meta-cognitive strategies, and resource management strategies. The results show that the more intrinsic motivation students have, they will be more aware of the responsibility for their network autonomous learning, and use network resources more often. Meanwhile, the more positively they consider the network autonomous learning, the more intrinsic motivation can be stimulated. It also indicates that the stronger students' intrinsic motivation is, they are more active in using a variety of strategies to learn, and in turn, improving students' ability to use strategies are more effective in stimulating their intrinsic motivation.

Besides the three major questionnaires, the research also includes 3 other related surveys to get related information.

Since now a days internet is available in students' dormitories, they should have Computer which is very important in network-based autonomous learning. Therefore, this research handed out questionnaires to see whether students can do autonomous learning after class. Fig. 3 shows that most of the students have computers, so they can learn by themselves from the internet after class.

Another related questionnaire is about students' learning results by network-based autonomous learning. From Fig. 4 we know that most students think, they can improve listening ability. Speaking and reading ability are in the second and third place. Translation and vocabulary improvement was not significant. Writing improvement is at the least.

Fig. 5 shows that besides the three major influencing factors, students think that there are other factors influencing their network-based autonomous learning. For example, unstable internet connection, students' lack of persistence, students are involved to do other things on internet, teachers' lack of guidance, too much homework and some other factors. Among these influencing factors, students think that lack of persistence and involvement to do other things on internet, influence their study achievements to the highest degree.

C. The Enlightenments of This Study on Foreign Language Teaching

From the above analysis, we can conclude that network-based autonomous learning is generally approved by the students. Rich network resources provide a good environment and conditions for students' individualized and autonomous learning. By doing listening, speaking, reading and writing practice through Internet, they can improve their language skills. But due to different beliefs
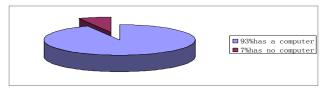

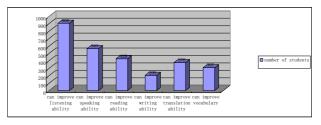Figure 3.   The percentage of students who have a computer

Figure 4.   The different abilities students can improve in network-based autonomous learning
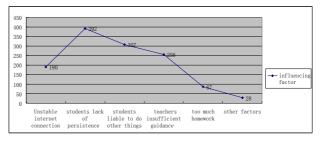

Figure 5.   Other influencing factors in network-based autonomous learning

among students of different grades and levels, there still exists differences in learning motivation and learning strategy. In order to eliminate the difference and improve students' network autonomous learning ability, teachers should do well in the following aspects in their teaching: (1) strengthen the students' intrinsic motivation; keep the students' drive in network-based autonomous learning. Learning motivation as a drive to promote students interest to learn, affects the students' degree of efforts and how much they take part in language learning activities [15]. The more intrinsic motivation the students have, the more active they will be in using various strategies to learn. . Strengthening the inside learning motivation and keeping the students' learning drive play an active role in developing students' autonomous learning ability. Teachers should motivate and keep students' enthusiasm for English online learning according to the motivation of different student groups; teachers should also know that students value scores. They can take advantage of this extrinsic motivation, to motivate students for online learning. Besides, they can also take advantage through funny network learning activities to promote its intrinsic motivation, to make the students enjoy the benefits of online learning. Teachers should assign interesting homework online. When they will realize that network assignment task is interesting, students will be more active in autonomous online learning. This could help them get higher scores and improve their language skills. (2) Improve students' understanding of network autonomous learning. The belief of learning has the character of meta-cognitive feature, is a self-awareness of learners to the dimensions and levels in learning [16]. As part of the meta-cognitive knowledge beliefs affect students' planning, monitoring and evaluation in the process of learning and play an im-

portant role in the development of students' autonomous learning ability. The more positive belief students have towards network autonomous learning, the more voluntary they are at using various strategies to learn, and more intrinsic motivation can be stimulated. Teachers must cultivate among the students a positive and correct belief of learning and to explore a feasible way to help students set up correct belief of learning [17]. On the one hand, as leader and promoter, teachers have positive impact on students' learning belief. On the other hand, teachers want to further strengthen the students' responsibility towards themselves. If students can learn actively and voluntarily, they will achieve their goals and adjust their own learning behaviors. (3) Improving students' ability of using strategies for network-based autonomous learning. Learning strategy refers to the measures taken for effective learning. Only when certain learning strategy is formed, can learners achieve the ability of autonomous learning and the study effect will be better. Therefore, to strengthen the strategy training, improving the ability of students to use learning strategies effectively, is very important to cultivate and develop the students' ability of autonomous learning. Teachers must help students to experience a positive feeling of using strategy. They can set appropriate learning task, let the students recognize and experience the meaning and value of strategy use in the process of completing the task, try to turn strategy knowledge into action and the external strategy into students' inner demand. Teachers should try to cultivate the students' meta-cognitive monitoring ability. So that they can adjust the strategy in the process of its usage, find the problem in time to choose more effective strategy in order to achieve better learning effect.

V. CONCLUSIONS

The purpose of this study is not only to clearly grasp the influencing factors of Mechanical Engineering students' autonomous learning ability in professional English, but also to find out the cause of the weak ability of autonomic learning In addition, for teachers to suit the remedy to the case, to better meet the needs of students' autonomous learning and improve their ability. By analyzing research questionnaires, this study found that: Mechanical Engineering students from different groups showed differences in their autonomous learning motivation, beliefs, strategies, and in the eight dimensions of these influencing factors. These influencing factors affect each other in students' learning process. Through the questionnaire survey conducted among ME students' from different grades and levels, this study makes it clear that: (1)There are motivation differences and learning belief differences students in different grades and levels on network-based autonomous learning; (2) After using cognitive strategy, there is no significant difference between grades and levels, but in using meta-cognitive strategy and resource management strategy, there are differences exist; (3) there is a significant positive correlation in strategy use with factors of intrinsic motivation, resource function belief, and students' self-responsibility; and a negative correlation between extrinsic motivation and strategy use, but not significant. Therefore, Mechanical Engineering English teaching must face these differences existing among the students, and take counter measures to eliminate the differences. This will help the students to be benefitted from the network-based autonomous learning and teachers will

be able to find suitable solutions to help students make achievements during their learning process.

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