The Values on Academic Frontier-based Approach' Implementation

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Abstract: Academic Frontier-based Approach (AFA) is a student-centred instructional approach used to promote active and deep learning by involving students in investigating academic frontier issues in a collaborative environment. In this paper, we discuss the student surveys conducted at the end of the study period to solicit feedback from students on their learning experience. It is suggested that AFA takes the students as the center, consolidates the academic knowledge of the students. Through the teamwork and autonomous learning, students know more about the frontiers of science and technology and open their horizon. In addition, the ability of language organization, speech, compressive resistance, communication and cooperation are all increased. Furthermore, students' interest in studying is increased because of the autonomous learning. It is expected the popularization of the consecutive courses will certainly improve these important abilities further more. And it is hopeful that students will take advantage from the sustainable ability of autonomous learning in their future career life.

1 INTRODUCTION

As one of the Student-centered teaching methods, collaborative learning activities can provide students with the opportunity to study for them, conduct small research projects and foster their higher level cognitive thinking skills. Johnson and Johnson's model of cooperative learning highlighted five essential elements: positive interdependence, promotive interaction, individual accountability, group processing, and social skills (Johnson, 1984). The social-constructivist methodology for collaboration was first proposed by Kiraly (Kiraly, 1995). From Kiraly's view point (Kiraly, 2000), collaborative learning (CL) emphasize its joint completion so that the team members can construct meanings together and can develop cultural and professional knowledge. Obviously, CL, which characteriser student-centered teaching method, represents a significant shift away from the typical lecture-centered milieu in higher education. According to Kiraly, there is an evolution from teaching oriented towards the teacher as the main source of knowledge to teaching based not on the students themselves, but on teaching itself. In the learning activities, students generate social interaction among the team members and mutual dependence to achieve specific aims (Johnson, 1994). In collaborative classrooms, teachers who use collaborative learning approaches tend to think of themselves less as transmitters of knowledge. On the contrary, they act as instructors in the learning process. Therefore, it is important to design teaching strategies that not only go beyond the content in textbook but also along the theme of the knowledge in it.

In the paper, what we concern is achieving better student learning outcomes by Academic Frontier-based Approach **(AFA)** that centers students' learning in collaborative learning.

2 ACADEMIC FRONTIER APPROACH IN COLLABORATIVE LEARNING

Academic Frontier-based Approach (AFA) (Liu, 2013; Liu, 2013; Liu, 2014) is an approach to achieve the new learning outcomes of courses related to the content in textbooks — expansive

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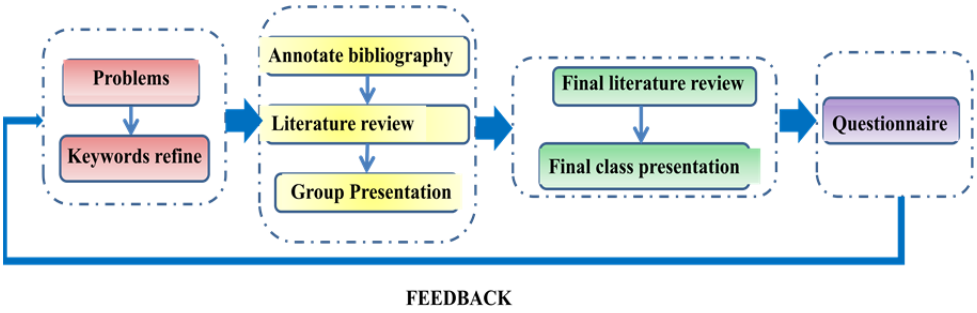

Figure 1: The implementation of AFA.

learning. In order to keep courses content up-to-date and build the intellectual curious and inquiring mind that characterize good academic motivation for learners, we developed Academic Frontier-based Approach (AFA) in collaborative learning.

Its implementation includes four basic steps: (1)Instructors propose questions from textbook, then refine keywords related to the development of subject; (2)group work and (3)team work are conducted; (4)Questionnaire for the purpose of feedback to improve the teaching. Obviously, the implementation of AFA in collaborative learning is a cognitive constructivist epistemology which concludes from science literatures that learners gain more through relating academic material and papers to their own interests and academic vision, and that such experience informs their ability to conceptualize content (Duffy, 1992; Jonassen, 1949).

3 THE VALUES FROM STUDENTS' SURVEY ON AFA IMPLEMENTATION

3.1 Consolidation of Academic Knowledge, More Contact with Frontiers of Science and Technology and Open Horizon

Through the presentation of each group, students can get to many interesting branches of subjects and fields of scientific research, know forefront of many scientific information and broaden their horizon. Besides, they will have a better understanding about their own major and practical application of that. They can learn the newest knowledge automatically, and expand their knowledge of semiconductor. On the one hand, students feel interested in learning. On the other hand, they enrich their knowledge, have better understanding of related knowledge and improved their professionalism. They can have a better understanding of things like graphene，carbon nanotube，organic semiconductor，SOI devices, the process of energy-band engineering, heterojunction and semiconductor of third generation.

3.2 Improvement of Comprehensive Ability

In the aspect of comprehensive ability, students have obvious improvement of organizational competence, speech, resistance to pressure, communication and operation. What AFA brings to students is what the traditional class which is centralized in teach cannot provide.

Because the speech time is limited within 5 minutes, the students' ability of summary and organizational competence as well as resistance to pressure will be improved. Students get to know each other more and deepen their friendship. And they will practice their ability of communicating and cooperation. Moreover, students will have more courage to stand in front of people to make a statement.

The skills of using modern office software will be greatly improved, such as making PPT. They will gain precious experience of making a presentation. Through looking up documents in all kinds of fields, students will have a fairly deep understanding about the topic. It is also a very good chance to improve eloquence, which is even better for those students who are introvert and seldom get on to the stage. Furthermore, student will clearly see their weakness and can get better through the experience.

3.3 The Ability of Looking up and Screening the Documents Independently

Students will learn how to find a certain needed

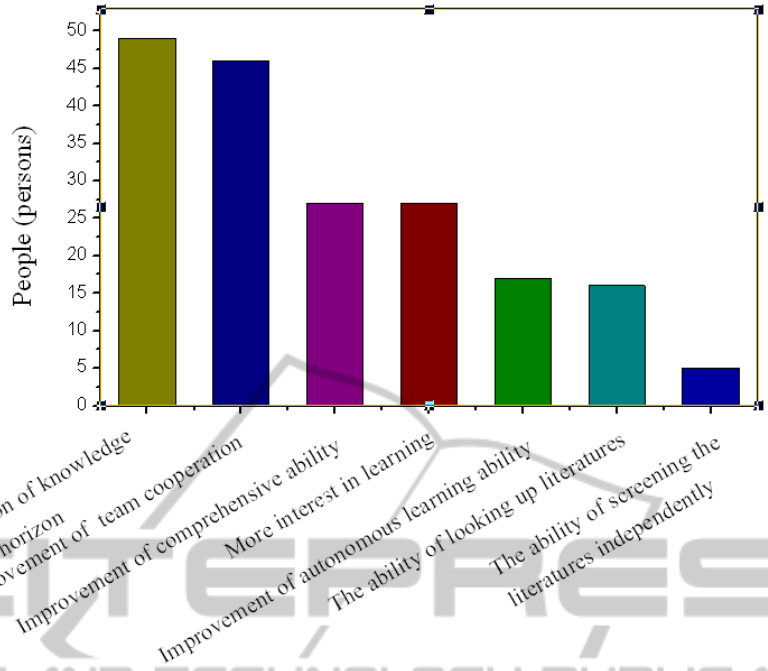

Figure 2: The students' Questionnaire survey.

document. Also they will master many ways to look up the newest materials. For example, student will make full use of the electric resources so that they strengthen their ability of looking up documents.

Students learn how to look up, read and screen a certain literature. Then they get the ability to find something they are interested in, so that they gain a good habit of learning beyond the textbook.

Students will improve their ability of finding and summarizing knowledge.

3.4 The Team Cooperation

Students can learn how to help each other, communicate and cooperate with the teammates. Through the teamwork and sharing, students form the awareness of teamwork so that their group cooperation and communication have improved.

3.5 More Interest in Learning

Their interest in semiconductor physics will be raised. "The key point is that the freedom brings plenty of interest." It is convenient for students to choose a certain field they are interested in and continue studying. They feel good about the presentation on the stage, so the class becomes more compelling for them. Thus, students will be more interested in the field of microelectronics; moreover, they can feel the fantasy of their major and raise the interest in scientific researches.

3.6 Improvement of Autonomous Learning Ability

As a result of interest rising, the individual initiative of learning is strengthened. The ability of self-studying is improved.

3.7 Getting the Key Points of a Paper Quickly.

Students will know how to read a newly paper and get brief view of a paper, and they should also learn the way to catch the key point of a paper.

3.8 The Difficulties in the Implementing Process of AFA

In the step of listing the difficulties freely, 'the difficulty of looking up documents and selecting the materials' is listed first. At the same time, students share experience according to their own experience, which shows the confidence to solve problems.

They lack the ability to look up English documents, the sensibility of the materials, the ability of caching useful information accurately and finding useful data quickly. The understanding of English documents needs improved, since students nearly have no idea what the English papers are

talking about. To solve the problem of reading documents, reading more is the only way. Students should learn more key words of the major, master a certain proper way to read and practice as much as possible.

While choosing materials, students should start with small points and expand it later to more aspects. What really matters is not the quantity, but the quality. Also, students need to read more literature in the daily life to get access to the frontier knowledge, and when they encounter some literature which is strongly professional, they can deal with it more calmly.

Students do not have adequate preparation, and cannot arrange their time on the stage well. And it is also important to adjust the psychological states to face the problem of performance anxiety. Students need to take part in more implements, to prepare well before making the presentation. Practice always makes perfect.

It is important to have a comprehensive grasp of the topic and clear mind.

About the production of PPT. It is important to have a clear and concise content of PPT, instead of gorgeous appearance. Making more PPTs is a good way to promote the level of making PPT. PPT producing is a basic ability; students should master it and deal with problems by themselves.

Thus, speech time and the topic of the speech are two aspects that need improve. And direction that needs to be adjusted in the next step of education is listed.

3.9 The Questionnaire Survey-- Suggestions for Improvement for AFA

Extending the speech time. Too short speech time cannot clarify the statement clearly, which reduce the quality of sharing. Although some students have a deep understanding about the topic, limited presentation time makes students just state some of the content in stead of all of them. This may result in decrease of audiences' understanding, because the basic content is skipped. For example, the students really want to share the alloy method, heterojunction method and the lattice strain method of energy band engineering when they introduce energy band engineering. However, considering 5 minutes' time for this part, they cannot elaborate it. Topic of the speech.

This kind of presentation should focus on stimulating the interest and increasing knowledge. So if students combine the topic with subjects that students may encounter in their graduate period, their enthusiasm will be improved and that can set a good basis for their further study.

Add the part of interaction. More interaction and more chances for audience to ask questions will help the audience understand the presentation better.

4 CONCLUSIONS

It is found that a few do not approve the aspects of autonomous learning ability and getting the key points of a paper quickly. First of all, it is the first time to be involved in such programs for students who take part in AFA. During the past four years, we chose 6 classes to implement the AFA program. For students used to the mode that takes teacher as the center, their ability of autonomous learning is expected to improve on the basis of rising interest. In the aspect of document reading, it is reasonable that not many students approve the achievement. Because for students who just begin academic English reading, lacking training will lead to the result that the difficulty of reading and understanding new knowledge will restrict each other. If we persist in implementing AFA, students' academic English will get better and that will bring promoting effect to them for in the future in some degree.

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