Research on the Reformation of Automotive Design Course Teaching

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Keywords: Practice teaching; reform; experiment; design

Abstract. Through the analysis of the present situation of the Automotive Design course teaching, which includes the single teaching form and poor teaching effect of experiment and curriculum design, and on the basis of adequately analyzing the problems, this paper brings forward the content and scheme of the Automotive Design curriculum teaching reform, optimizes multimedia courseware, diversified classroom instruction, diversified curriculum design and curriculum experiment, as well as the courses assessment reform. Through the Automotive Design curriculum teaching reform, the teaching quality and efficiency of all the teaching process has been enhanced. Students have grasped the elementary theory and knowledge of Automotive Design, as well as the automotive design methods and thoughts effectively.

1. Introduction

Automotive Design is one of the compulsory and significant main courses of Vehicle Engineering. In order to be suitable to the development requirements of current automotive technology, the teaching of this course should be conformance to the requirements of the current situation, and unite theory with practice. No matter the students engage in whole automobile, automobile components, automobile parts design and research and development, or the production and manufacture, they all need solid theoretical basis and professional knowledge. Automotive Design is full of great importance. Based on the years of teaching summary, observing and discovery, students do not have high learning enthusiasm towards this course, and the phenomenon of absences and late surface from time to time. They cannot finish the usual homework. If they have finished them, they are just aimed at finishing the task and doing them carelessly. Through the discussion with students and survey, we have acknowledged that the students are not interested in the content and system setting of this course, and the term of this course is not suitable. The students believed that some content does not follow the current development situation of the automotive technology and the content is relatively single. The teaching team have done a lot of work and discussed the course deeply and intensively, who have reformed the teaching contents and system of Automotive Design drastically, and put forward a set of useful teaching method and teaching ideas. They have practiced in the teaching process and achieved a better effect.

2. Course Teaching Present Situation

2.1 Course basic situation

Automotive Design is a professional course, which has been set on the seventh semester. At present, the total teaching hours set by the teaching program is 48 hours, among which the theory teaching in classroom is 44 hours and the experimental course is 4 hours, and the teaching practice is not arranged. The teaching method adopted is single classroom teaching, with using the own designed multi-media courseware. Besides, the practical course (course design) is three weeks.

2.2 Problems existed in course teaching.

This course has three steps: classroom lecture, computer operation and curriculum design.

2.2.1 Classroom lecture.

As an important major course, the curriculum teaching period set is less; teaching form is single. Classroom teaching, with teacher as the dominant role, belongs to the infuse-teaching style, which cannot stimulate the self-directed learning function of the students effectively; Multi-media
courseware is relatively rough, and the amount of information is not enough. Since it belongs the
infuse-teaching style, students listen carelessly. Usually there are absent students.
2.2.2. Computer operation
There are four hours for computer operation. At present, those four hours have not being utilized
well. Actually, those four hours are actually for draw the characteristic curve of diaphragm spring on
computer; students do not use these four hours well. Most of the students copied the final program
form other students, without getting good exercising themselves. This does not meet the purpose of
the computer operation; as a strong practical and important professional course, it is inappropriate
without arranging practice teaching.
2.2.3 Curriculum design
Curriculum design is a design of motor vehicle assembly. In the process, students are not so
responsible for their calculation. Although some students know the difference in the given data, they
copy the intermediate data when the result is same; some students have not figure out the assembly
structure and the view relationship is wrong; many students do not even know the technical drawing
norm. Finally, curriculum design has poor quality, and many students do not meet the teaching aims
with their perfunctory.

3. Course Teaching Reform
3.1 Updating and optimizing the teaching content timely[2]
Teaching content reform is the core of the curriculum reform. We have connected with practical
production closely and updated and optimized the teaching content timely, through which the
advancement, targeted characteristic, practicability and practicalness of teaching content will be
reflected.
Advancement of teaching content: With the widespread using of new technology, new arts and
crafts, new material and new equipment in automotive design and manufacturing, as well as the rapid
development in automotive industry, great influence has been produced on automotive design and
manufacturing technology. Due to various kinds of factors, the content of present teaching materials
is timeworn and updated slowly, which has a big gap with enterprises. Therefore, on the basis of
keeping and teaching the suitable contents in the present teaching materials, we have strengthened the
teaching of the modem design.
Targeted characteristic of teaching content: Automobile manufacturing enterprise is the main
employment channel for our students of vehicle engineering major. With a main basis of the need of
automobile enterprise, we have updated and optimized the teaching content timely. The teaching
cases have been selected from the related enterprises. The design idea followed and the methods
adopted connect with the actual production.
Practicability of teaching content: In the meanwhile of teaching the basic theoretical knowledge
and professional knowledge, teachers have stressed on the teaching of design practical technology.
Teaching knowledge and the fostering of the ability of solving practical problem has been connected,
with an emphasis on the latter one.
Practicalness of teaching content: Automotive Design is a course with strong practicalness. To
become an automotive design staff needs long-term practical training, through which they are able to
possess adept design knowledge and rich design experience. Therefore, the teaching practice
procedure has been strengthened. Besides the teaching practice procedure already existed (curriculum
design and computer operation), Automotive Design combined training, a new practice course has
been set. Through the relative practice and training, students have strengthened the understanding of
the learned theoretical knowledge, and basically grasped the methods and idea of automobile design.
3.2 Optimizing the multi-media courseware.
The verbal content on the basis of the original courseware has been simplified. New pictures and
video information have been added. Teachers have added more updated whole automobile,
sub-assembly animation and video with design cases, through which the perceptual knowledge has been consolidated multi-dimensionally.

3.3 Diversified teaching methods [3].

Firstly, specialists outside the school have been invited to give lectures on special topics. Based on the situation, appropriate class hours (four hours) have been selected from the teaching plan hours and being divided into two units (each unit has two hours). Two specialists who have been long-term engaged in automotive technology (automotive design, automobile technology development, automobile technology research, automobile manufacturing, automobile test and so on) have been invited into the class. They have face-to-face communication with students and talking about the successful experience achieved in automotive technology. This is what the students hoped, and a light spot in the future reform of this course. According to information, most students wish to communicate with specialists outside the campus, and this has made the basic foundation for the feasibility of this teaching mode. According to the content of the lectures, two specialists divided the work as following: one gives a lecture on automotive design technology and the successful experience; the other emphasizes on the automotive manufacturing technology and the successful experience. The characteristic of this teaching mode lies in giving lectures by strivers and winners based on their own experience, which do not only show affinity, but also strong appeal and shock. The power of examples is infinite. The successful model of specialists is able to further correct the students’ professional thinking and arouse their confidence, and their teaching and educating effect is much better than teachers. Secondly, the teaching mode of students as main body and teachers as the main guide has been chosen. The classroom teaching of teachers should be aimed at realizing the guiding function of exploring knowledge, inspiring and motivating students to do self-directed learning. The specific methods adopted are as following: establishing the fundamental unit of self-directed learning. Teaching class is divided into several study groups (nine or ten persons per group), and each group students elect one student as organizer and representative of this group. The responsibilities of the organizer is: acting as the core of the learning group, responsible for the study, discussion, collecting, summarizing the opinions, and the final summarizing of the learning group; representing the learning group answer the questions asked by teachers and giving a speech about the relative study in the class. Secondly, carrying out class discussion teaching. Several chapters selected by teachers will be discussed by students in class, through which the students are able to acquire knowledge by themselves. The specific methods are: teachers assign the discussion content one week before the discussion, and highlight the key points and present several questions. Students are able to study with considering the key points and questions. The learning efficiency and effect has been improved. When the class discussion started, teacher asks several questions based on the situation and let students discuss and search for answers in groups. The discussion time is 25 minutes. During this process, teacher can provide guidance based on the specific situation. After the discussion, one-to-two minutes have been given to each group representative to summarize the discussion result. And then answer the questions asked by teacher. After the representative finishes answering the question, the members in the group can add supplemental answer, and then other groups raise objections or supplemental answer. If different opinions appeared among groups, firstly teacher let students to declare their opinions adequately, then adopts the comment method to give reasonable answer, through which students can deeply understand the problems. After finished answering all the questions, the discussion class comes to the end. Teacher gives scores instantly based on the discussion and performance of each student in the class, and the scores can be regarded as a part of the usual performance. This teaching style is active, and the atmosphere is relaxed. During the process of discussing and answering questions, it not only contains the performance of individual competition, but also contains confrontation among groups. It contains a component of “game”, which is willingly accepted by students. Thirdly, the teaching method of students’ self-study and self-teaching. The suitable chapters elaborately selected by teacher assign to students for self-study and self-teaching. Based on the teaching progress situation, teacher assigns some course content with suitable class hour to several students. At the meanwhile teacher does some suitable explain about the course content.
Each student is responsible for the course content about half class, and does the self-study and consults the relevant material, then gives the presentation to the whole class about the knowledge acquired in the study through multi-media courseware, and shares the experience. After the presentation, five minutes are used to answer the questions put forward by teacher and students. Teacher should give the on-site supplemental answer, through which the rationality of the questions has been assured. At last, teacher gives scores based on the teaching level and answering quality of each student, and the scores can be regarded as the basis for usual performance assessment. Since this teaching method is self-study with tasks, students will feel definite stress and study motivation, which urge students to study carefully and consult relevant material; otherwise they may shoulder the result of “losing face” in front of the whole class. The youth desire to excel over others and have strong performance desire. Letting student teaching students will arouse their unyielding spirit: you can do it and I can do it also, or even better. This method is easily to arouse the learning enthusiasm for students and it is even more effective.

3.4 Diversified curriculum experiment [4][5].

This course is a strong integrated specialized course, with an aim of strengthening the perceptual knowledge, raising the operational ability and application ability. The specific methods are: firstly, vehicle and component location measurement experiment. In the experiment process, students measure the parameter, such as length, width, height, front overhang, rear overhang, axle base, tread, angle of approach, angle of departure and so on, and fully understand the main geometric parameter, measure the location of the main parts, such as engine, fuel tank and so on and understand the location of the main parts. Secondly, CAE experiment. The teaching material of Automotive Design mainly introduces the traditional design methods, aims at cultivating the modern design idea and raising the application abilities of the students. Through CAE experiment, modern design methods are introduced specifically: based on teaching situation, some suitable components and parts utilizing software platform (ANSYS, ADAMS, UG, CATIA, SOLIDWORKS and so on) are selected. And finite element method, dynamics analysis or kinematics analysis have been conducted. At last each student should write their own report. Thirdly, programming the computer experiment is needed. Based on the teaching plan, teacher selecting some suitable content (the calculating workload of design is large with strong repeatability, and the conditions which should be meet are large). Students do the self-programming, debug routine, calculate the reasonable results and write the report.

3.5 Diversified curriculum design

At present, the topic of curriculum design is assigned by the teacher, that means the students using the comprehensive knowledge which have been learned and finishing the structural design of clutch and other components, strength calculation and engineering drawing. Since students lack the grasp of the structure of clutch, usually they mechanically copy them in the design process, and they could not combine with the engineering practice. Therefore, it is hard to play the role of fostering the design ability and engineering practice ability. The current situation should be changed. The specific methods are: firstly, based on the reverse design principle, students can choose the topic by themselves. They are able to choose the topics according to their interest, even the topic about the vehicle components which they are familiarized as the design patterns to do the curriculum design. At the aspect of design content and innovation space of self-choosing topics, students can promote their activeness and creativeness. Because of the influence form test-oriented education, many students have dependent psyche. Teachers should guide students to think by using the divergent thinking mode, and broaden the mind. Based on the reverse design which has been on the basis of present cases, students put forward their own innovative schemes and therefore obtain the structure or size design result different form the sample cases. Secondly, by using the CAD technology, the actual engineering ability of students will be enhanced. With the development of the computer-aided design, CAD technology should be applied in the curriculum design either, which includes three aspects: parametric design, plane drafting and 3D modeling. Using CAD not only enhances students’ ability of computer drawing, what's more, it can enhance the abilities to solve practical engineering problems with using computer. In the process of curriculum design, repetitive calculation and modification
should be done. The workload is large, and the design process is boring. The accuracy of design result is low. Through using CAD technology, the advanced design theory and methods can be combines to do the parametric design. Plane drafting, three-dimensional modeling and modeling are finished on this basis. Then the virtual assembly should be done furtherly.

4. Curriculum Testing Pattern

Student’s scores are evaluated by the comprehensive examination method. More specifically, the total scores in 100, among which, usual homework is accounted for 20%; class discussion is accounted for 40%; closed-book exam is accounted for 40%.

5. Conclusion

Through the curriculum teaching reform of Automotive Design, the teaching quality of this course, students’ interest towards this course, teaching efficiency, the grasp of theoretical knowledge and the fostering of practice abilities can be further enhanced. And the engineering practice ability has been reinforced. Teacher should constantly change the education concept and explore the new teaching methods and modes, thus to meet the requirements of cultivating the 21st-century talents.

6. References


