# RESEARCH AND PRACTICE OF STUDENT-CENTERED PROJECT DRIVEN TEACHING MODEL

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## ABSTRACT

*In order to improve the practical engineering ability of students majoring in software engineering, the project-driven teaching method was introduced into the course teaching, the principles of selecting projects and decomposing projects were discussed, and the teaching mode of "one body, two wings and three stages" was proposed. Select projects familiar to students and decompose them into sub-tasks, and use course knowledge to continuously optimize and reconstruct tasks to achieve complete project functions. Practice shows that the project-driven teaching method can effectively improve students' practical ability.*

## KEYWORDS

*Project-driven, practical ability, dual-tutor tutoring, layered teaching.*

## 1. INTRODUCTION

The computer age has developed from the stand-alone age to the current Internet age, and its knowledge system has also changed, from a knowledge system that is biased towards hardware to a more and more software-oriented trend, and will become more and more complex [1]. With the adjustment of the knowledge system, the demand for talents has also changed. In order to meet the demand for talent training in the Internet era, the curriculum structure of college education has also developed from a knowledge system that is biased towards a stand-alone system to a more comprehensive knowledge system. The Computer Science Syllabus (CS2013) jointly released by the American Computer Society (ACM: Association for Computing Machinery) and the Computer Branch of the American Institute of Electrical and Electronics Engineers (IEEE-CS: Institute of Electrical and Electronics Engineers-Computer Society) in 2013, contains One of the platforms listed in "Platform-Based Development (PBD)" is the "Web Platform".

As a technical basic course for software platform development, Java Web programming is a professional course offered by many computer-related majors in applied undergraduate colleges. This course is based on Java language, and focuses on Servlet, JSP, JDBC, EL, JSTL and other technologies, so that students can master the basic theory and core technology of Web program development; Problem-solving ability; by using integrated development tools to write and debug programs, improve students' practical ability, so that students' theoretical knowledge and practical ability can be jointly developed [2].

As a practical course, in the teaching process, to strengthen the intensity of practical training, it is necessary to change the teaching method. Project-driven teaching method is a teaching method adopted to achieve teaching goals. It takes the teaching content as the main line and the realization of the project as the task to improve students' interest and improve their practical ability. While completing the project, students not only mastered the major and difficult points of

course knowledge, but also exercised their ability to solve practical problems, thus achieving the goal of talent training [3] [4]. Project-driven teaching method shows a clear goal for students. The process of project completion is the process of students' learning, and it is also the process of applying knowledge in series. Therefore, in order to improve the teaching effect, the project-driven teaching method is introduced into the course of "Java Web Programming".

## 2. PROBLEMS TO BE SOLVED

In order to solve existing problems, improve students' practical ability to solve engineering problems, and at the same time implement project-driven teaching method into course teaching, the following problems need to be solved:

(1) The problem of instructional design. Curriculum teaching design is not specific for the design of each class, does not clearly define the learning tasks and learning objectives of students in each class, and does not have the overall design and use of teaching methods and teaching methods. The teaching design of all courses is similar except for the teaching content. Therefore, it is necessary to redesign the teaching design to clarify the learning objectives, teaching methods and teaching methods of each class.

(2) Design of teaching projects. The project-driven teaching method takes the teaching content as the main line and takes the realization of the project as the task to improve the students' interest, thereby improving the students' practical ability. Therefore, it is necessary to design a project with suitable difficulty and can run through the course content, and at the same time, it is necessary to decompose the project into relatively independent small tasks corresponding to each course for implementation.

(3) The problem of layered teaching. Due to differences in students' knowledge and experience, there will be different levels of understanding in the process of receiving new knowledge, so teachers should allow such differences to exist and teach students in accordance with their aptitude. In the realization of project tasks, the teaching is carried out at different levels, and the realization methods of different degrees of difficulty are provided to solve the situation of differences in students' abilities.

(4) Teacher guidance issues. Adhere to the teaching concept of taking students as the main body and teachers as the guidance, change the teaching method of one-way instillation, and improve the initiative of students' interest in learning by assigning tasks, students' classroom discussions, and analyzing and solving problems. Introduce enterprise tutors to guide practical projects, and help students realize expansion projects through guidance.

## 3. PROBLEMS TO BE SOLVED

Project-driven teaching method is student-centered, project-based, and a teaching method that allows students to complete projects under the guidance of teachers. [5] Project-driven teaching uses relatively simple projects familiar to students as the teaching carrier, guides students to analyze the project, then decomposes the project into relatively independent functional modules, and introduces the theory that needs to be mastered to realize the function of the project knowledge and skills. Each class iteratively completes the functional modules and finally realizes all the functions of the entire project, so as to stimulate students' interest in learning, improve their practical ability, and achieve teaching goals.

### 3.1. Project Design

In project-driven teaching, the project runs through the teaching, so the design of the project is the key to teaching, which directly affects the achievement of teaching goals. The design of the project should be designed around the teaching objectives of the course. The teaching goal of a course determines the ability that students should have after completing a course. It not only defines the intention and direction of teaching and learning, but also provides a basis for formulating teaching methods and methods. Therefore, it is necessary to carefully design the project, so that students can not only master theoretical knowledge, but also exercise practical skills, and play a role as a bridge to achieve their goals. The design of the project should cover all the knowledge points of the course as much as possible. The theoretical knowledge of the course is the theoretical support for students to master practical skills. It is not knowledge stored dryly in memory, but knowledge that can be flexibly applied to practice and solve problems. The design of the project also takes into account the actual situation of the students. Choose moderately difficult and relatively common items, which can effectively stimulate students' interest in learning and continuously gain a sense of achievement in the process of their learning. If the project selection is inappropriate, the students are not interested, and there is no enthusiasm for active participation, then the project drive will lose its original meaning.

### 3.2. Project decomposition

As a project that runs through teaching, not only the overall teaching objectives and teaching content should be considered, but also the teaching objectives and teaching content of each teaching unit or each class. Therefore, it is necessary to decompose large projects into Several sub-tasks enable students to have clear tasks in each class, and they can apply knowledge practically. The division of subtasks should be relatively independent, and at the same time, it should start from local knowledge, gradually expand to global and comprehensive knowledge, and effectively combine theoretical knowledge with practice by completing subtasks. The functionality of the subtasks themselves can be expanded and improved as knowledge advances. For example, when implementing a function, it is cumbersome to use the knowledge just learned, but the knowledge involved is relatively simple and easy for students to accept. With the continuous accumulation of new knowledge, it can be improved. In this way, the function is relatively complete. , the knowledge is gradually enriched, and at the same time it is relatively simple to implement. Subtasks can be related to each other, and subsequent tasks are extensions of previous tasks; subtasks can also be independent of each other, which is the comprehensive application of knowledge learned by subsequent tasks. Each subtask should be visualized and runnable, and be able to fully demonstrate the running effect, so that students can have clear reference objects and learning goals. Project-driven is a method and a means. The purpose is to master knowledge and apply knowledge. Therefore, functions can be appropriately increased or decreased according to the content of the covered knowledge points.

## 4. PROJECT-DRIVEN TEACHING MODE OF "ONE BODY, TWO WINGS AND THREE STAGES"

### 4.1. Project-driven teaching process

In project-driven teaching, teachers pass knowledge by completing projects and solving problems in projects, and at the same time pass on the methods, means and ideas of applying knowledge to solve problems, so that students can clearly do what to do in the process of solving problems, that is, Clarify learning goals and tasks; and master how to do it, that is, the knowledge and program design used to solve problems; understand why to do it, that is, the principle, and think about how

to do it better, so that students can explore better and more complete solutions Program. There are two types of projects in project-driven teaching. One is teaching projects, which teachers explain and lead students to complete during class, and the other is expansion projects, which are completed by students themselves. The project-driven teaching method uses subtasks as the carrier to combine teaching units for teaching. The overall teaching process is as follows:

(1) Demonstration project. In the first lesson, the teaching project should be demonstrated, the teaching objectives should be clearly defined, and the students will know what they can do after learning this course, so as to stimulate the students' interest in learning. Then show the decomposed subtasks and introduce the corresponding knowledge modules. The knowledge modules here should be knowledge categories, not specific knowledge points. Each subsequent lesson will demonstrate the subtasks to be completed in this lesson, so that students know what they are going to do in each lesson.
(2) Analysis subtasks. Analyze subtasks, analyze functions, and analyze processes.
(3) Explain the knowledge points.
(4) Implement subtasks. After the students have clarified the method ideas and knowledge points, the teacher will lead the students to complete the project tasks. Talk and practice, talk and practice together.
(5) Implement expansion projects. Expansion projects are projects that students need to complete after learning the corresponding knowledge points. Since there are many functions of the extension project, multiple students are required to collaborate to complete it. The expansion project is completed by the students independently. The teacher needs to prepare multiple topics for the students to choose, or the students can provide the topics themselves, which can be used after the teacher's approval. From grouping, selecting projects, decomposing tasks, dividing tasks and integrating projects, they are all completed independently by students, and teachers can guide them when appropriate.
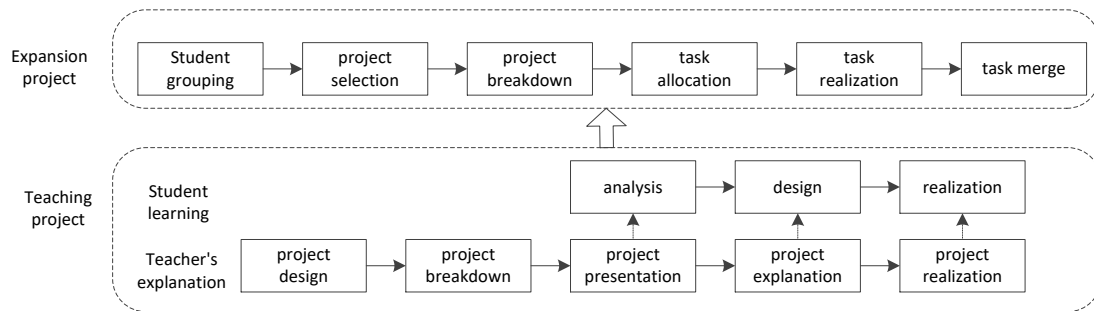
The project-driven teaching process is shown in Figure 1.



Figure 1 Project-driven teaching process

## 4.2. "One Body, Two Wings, Three Stages" Teaching Mode

Based on the project drive, the teaching mode of "one body, two wings and three stages" is proposed, as shown in Figure 2. One body refers to students as the main body; two wings refers to the dual guidance of school teachers and enterprise teachers. Among them, school teachers guide students to complete the teaching project, and students complete the teaching project by imitating and rewriting the program. The enterprise teachers guide students to complete the expansion project; the three stages refer to the classroom teaching stage, the experimental teaching stage and the expansion project stage. Based on the above model, a project-driven teaching system is constructed, which is based on course knowledge, takes classroom tasks as the main line, takes projects as extensions, and takes expansion projects as enhancements.
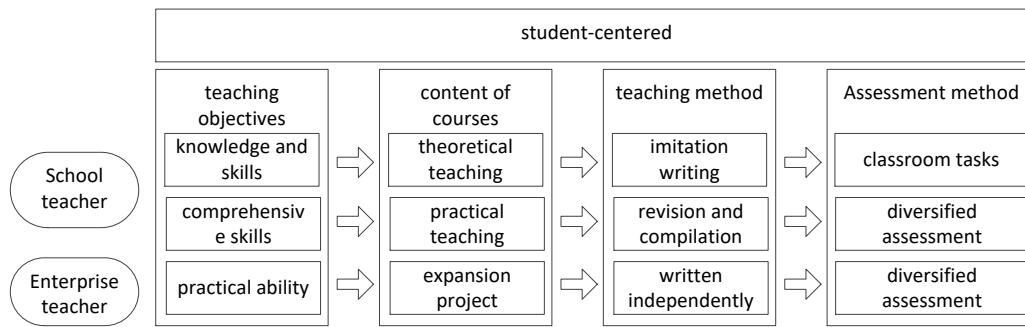
| student-centered | | | |
|---|---|---|---|
| teaching objectives | content of courses | teaching method | Assessment method |
| knowledge and skills | theoretical teaching | imitation writing | classroom tasks |
| comprehensive skills | practical teaching | revision and compilation | diversified assessment |
| practical ability | expansion project | written independently | diversified assessment |

School teacher

Enterprise teacher

Figure 2 "One Body, Two Wings, Three Stages" Teaching Mode

# 5. THE IMPLEMENTATION OF PROJECT-DRIVEN TEACHING METHOD IN THE COURSE OF "JAVA WEB PROGRAMMING"

## 5.1. Course Construction Process

The course "Java Web Programming" is a compulsory course for software engineering students. It is a comprehensive and practical course. In order to meet the needs of the society for talents, the reform and development of "Java Web Programming" has gone through the following stages: (1) Our school opened this course in 2003, and it is taught in multimedia classrooms, mainly teaching knowledge points. The assessment is in the form of a written test based on objective questions. (2) Our school has established the JavaEE software development direction in the 2011 version of the software engineering teaching plan, and cooperates with enterprises to jointly cultivate engineering application-oriented professionals who are suitable for both undergraduate education and enterprise needs. The JavaEE software development course system includes three parts: client-side technology, server-side technology and open source framework technology, each of which consists of several courses. Among them, "Java Web Programming", as a technology for server-side application development, plays a linking role in the JavaEE curriculum system. It not only requires the application of client-side technology to realize and beautify the front-end interface of web pages, but also provides a framework for the follow-up lightweight framework technology. The course lays the foundation. At this stage, the course was changed to be taught in the computer room, and case teaching was introduced at the same time, but the teaching process was still dominated by theoretical knowledge, and the assessment was also dominated by theoretical memory knowledge. (3) In the 2016 version of the plan, the course was adjusted from 80 hours to 48 hours, and the content was optimized accordingly. The teaching process began to focus on the cultivation of students' abilities, and the examinations were divided into written and computer-based tests. The test begins to evaluate the students' abilities.

At present, the reform of "Java Web programming" has entered the fourth stage. Taking into account the relevant standards and requirements of engineering education certification, the course mainly cultivates the following qualities and abilities of students: "For practical software engineering problems, be able to use Java Web The basic syntax and basic principles of programming are analysed and reasonable solutions are given, and dynamic Web programs can be written for processing; by using integrated development tools to write and debug programs, students' practical ability can be improved, so that students' theoretical knowledge and The practical ability is developed together." It can be seen that this goal emphasizes the ability to use knowledge to analyse and solve problems, but the above goals cannot be fully achieved in the current teaching. It is necessary to further improve teaching methods, update teaching methods, reasonably integrate teaching content, change the experimental content and mode, strengthen practical training, and highlight the combination of theory and practice. Through the construction

of this course, efforts are made to enable students to consolidate basic knowledge, improve practical skills, and cultivate innovative awareness, so that the teaching effect of this course can support the corresponding standards in engineering education certification.

The "Java Web Programming" currently offered by our school has a total of 48 class hours, including 8 class hours of experiments, which will be offered in the fifth semester. The course is based on courses such as "Web Front-End Development Technology", "Object-Oriented Programming" and "Database Principles and Applications". Among them, "Web Front-end Development Technology" provides front-end page development technology for this course, "Object-Oriented Programming" provides language support for server-side development, and "Database Principles and Applications" provides database-side technology for this course. At the same time, this course lays the foundation for courses such as "Lightweight Development Framework Technology", "Data Persistence Framework Technology" and graduation design.

Java Web programming is a comprehensive and practical course, which involves basic knowledge such as Servlet, JSP, Java Bean, EL, JSTL, etc. It also comprehensively applies Web front-end technology, object-oriented programming, database application and other courses. Knowledge. Therefore, in order to effectively integrate knowledge and exercise practical ability, the course changed the way of teaching in multimedia classrooms in the past. " method of teaching.

## 5.2. Project-Driven Teaching

The course takes a basic user information management system as a project, which runs through the whole process of teaching, and according to the course knowledge points, the project is decomposed into several sub-tasks, so that these sub-tasks are both complete and cover each part of the knowledge points. The specific project tasks and course content are shown in Figure 3. In the teaching process, the project is divided into three modules, namely the user login module, the user information display module and the user information modification module. The user information modification module includes adding user information, modifying user information, deleting user information and searching for user information, etc. four tasks. The user login module runs through the classroom teaching, and different versions of the login tasks correspond to different teaching contents. The login task of each version is an improvement and perfection of the previous login task. The user information display module and the user information modification module are completed in the experimental teaching link. At the end of the course, students have also completed the study and practice of the entire project.

In this mode, the course content is integrated and divided into four modules, including an environment configuration and eight technologies, each technology corresponds to a user login task, and the latter login task is an improvement and perfection of the previous login task. The knowledge of these four modules is connected in series with user login as a chain.
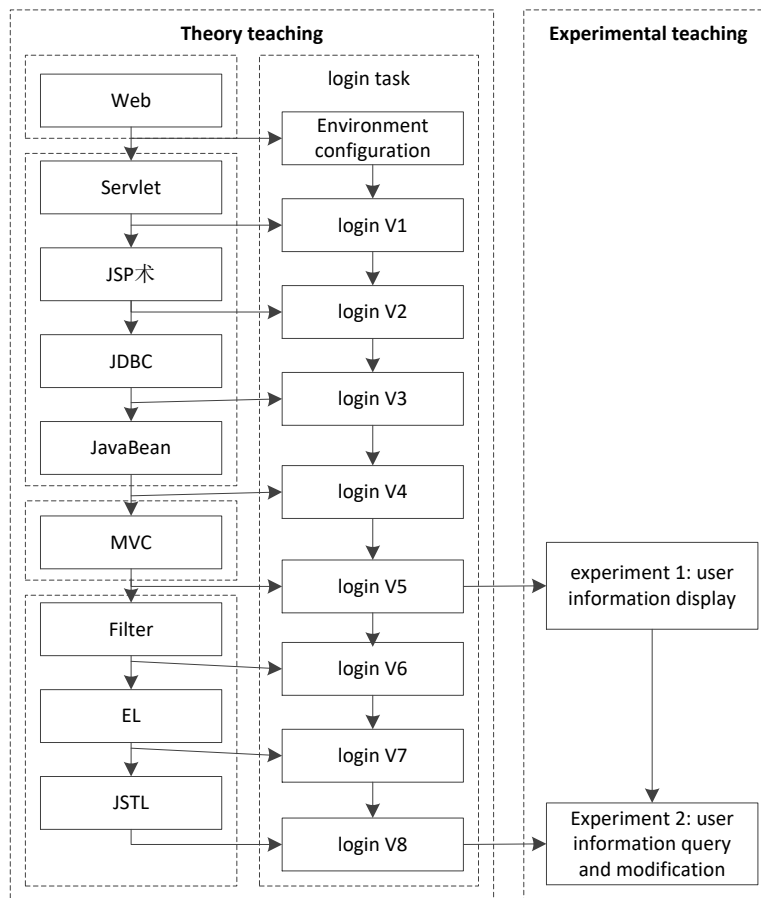
Figure 3.  Project tasks and course contents

## 5.3. Layered teaching

Project-driven theory is based on constructivist theory. Constructivism believes that learning is not a simple one-way process in which teachers transmit knowledge and students receive knowledge, but a process in which students actively recognize, identify, and choose to accept new knowledge with their existing relevant knowledge and experience [6]. Therefore, in the process of teaching, teachers should firstly clarify the students' existing knowledge and experience related to the course, and use this as the basis for the growth of new knowledge. In addition, due to differences in students' knowledge and experience, there will be different levels of understanding in the process of receiving new knowledge, so teachers should allow this difference to exist and teach students in accordance with their aptitude [7].

Based on the above principles, this course adopts hierarchical teaching for students with different knowledge and ability levels. Students with strong ability are required to complete not only teaching projects but also expansion projects; intermediate level students are required to complete teaching projects and can complete expansion projects under the guidance of teachers; students with poor foundation are required to use course knowledge to complete teaching Project, through repeated practice to master the most basic skills, and can complete the basic functions of the expansion project under the guidance of the teacher. Hierarchical teaching can be aimed at students' abilities, so that each student can complete tasks that conform to his or her ability, so that each student can gain something and improve his ability.

## 5.4. Dual-Tutor Tutoring

Give full play to the role of "dual tutors" of schools and enterprises. Based on the project, students play the active role in teaching activities, and school teachers and corporate lecturers jointly play the auxiliary role of teaching activities. Teaching mode. Students freely form teams to develop the conception, design, and implementation of expansion projects. School teachers and corporate teachers provide dual guidance to give full play to their respective advantages. School teachers focus on the teaching of teaching projects and the application of theoretical knowledge, while corporate teachers can provide technical support and control program design for students to realize expansion projects from the perspective of social practice projects. Teachers guide and support the development of the entire project, and in the process of project development, the skills of actively acquiring knowledge, analyzing problems, and solving problems are imparted to students subtly. The organization of teaching activities in this way is conducive to giving full play to the subjective initiative of students, cultivating students' teamwork ability, autonomous learning ability, and the ability to actively analyze and solve problems. Ultimately, it achieves the teaching purpose of cultivating students' ability to acquire knowledge, rather than instilling knowledge.

## 5.5. Diversified Assessment and Evaluation

Course assessment is an evaluation of learning effectiveness and a closed loop of course learning. The assessment content of this course includes both the evaluation of the project and the test scores, mainly including the following parts.
(1) Classroom tasks 30%: The evaluation is based on the students' completion of the class tasks in the classroom;
(2) 20% of the experimental project: the evaluation is based on the students' completion of the experimental project;
(3) 10% of the expansion project: Since the content of the projects completed by students at different levels is different, the evaluation is based on the completion of the basic functions of the expansion project;
(4) Final exam 40%: assess students' ability to comprehensively apply knowledge to analyze and solve problems within the specified time.

## 6. TEACHING EFFECT

In the actual teaching process, four classes of software engineering major 18 study Java Web programming course in the same semester. Among them, software 18-1, 2 classes implement project-driven teaching method, software 18-3, 4 classes still adopt traditional teaching . The topics of the final exam are exactly the same, mainly based on program analysis and program design, and a combination of written test and computer test is adopted. The distribution of final exam scores are shown in Figure 4 and Figure 5, respectively. It can be seen from the figure that the average score and high score ratio of the project-driven teaching class is higher than that of the traditional teaching class. Judging from the answering results, the item analysis and design of the project-driven teaching class is more standardized than that of the traditional teaching class.
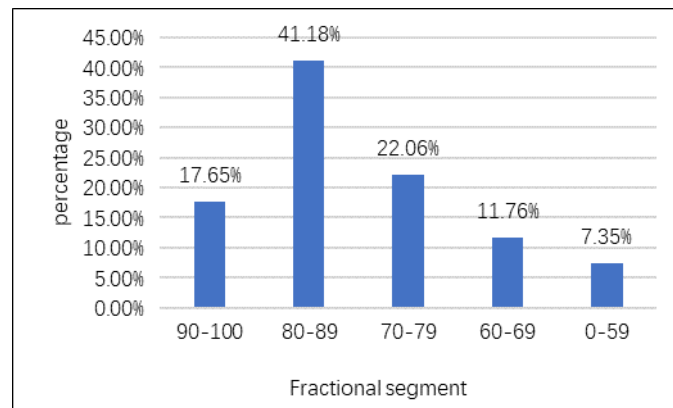
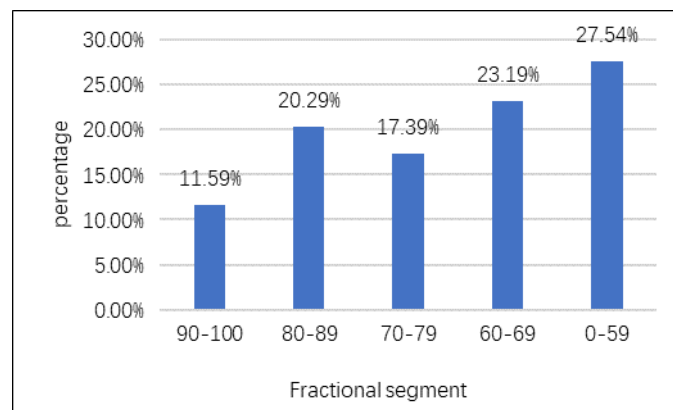Figure 4. The distribution of grades in project-driven classes (software 18-1, 2)



Figure 5. The distribution of scores in traditional teaching classes (software 18-3, 4)

## 7. CONCLUSIONS

This research topic takes the course construction of "Java Web Programming" as the research object, mainly for undergraduate students majoring in software engineering in the School of Data Science and Application. In the follow-up, the course team will summarize the experience and combine the feedback results to form a more complete teaching method. Promotion of other professional courses. Since the teachers of the course group also undertake courses in network engineering and other majors, and subsequent majors such as big data technology and artificial intelligence will also offer this course in succession, relevant teaching methods can also be extended to the teaching of students of related majors.

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