# DEVELOPMENT OF TASK-DRIVEN TEACHING MODEL TO IMPROVE THE SCIENTIFIC LITERACY OF UNDERGRADUATE STUDENTS

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## Abstract

The objectives of this research were 1) to examine the factors affecting the scientific literacy of undergraduate students. 2) to develop task-driven teaching model to improve the scientific literacy of undergraduate students. 3) to study the results of task-driven teaching model to improve the scientific literacy of undergraduate students. There are 3 phases was conducted to answer research objectives 1, 2, 3. The sample group of Phase 1 were 75 formal students who enrolled Biochemistry course in the 1st semester of the 2022 and 3 lecturers who teach Biochemistry course from Guangxi vocation University of Agriculture l, Guangxi University and Guangxi Minzu University. 5 experts were confirmed the Task-driven teaching model in Phase 2, and the sample group of Phase 3 were 33 students who enrolled Biochemistry course of Guangxi vocation University of Agriculture semester 1 in academic year 2023 The research instruments were 1) a set of questionnaires for students and interview for lecturers, 2) a set of questionnaires for confirming instructional model, 3) Lesson plan and 4) Pretest and Posttest. Data were statistically analyzed by percentage, mean, and standard deviation.

The results revealed the following. There were 2 factors affecting scientific literacy of undergraduate students included internal factors and external factors from the students and the lecturers. The internal factors include psychology or physical, knowledge or skills, and Attitude. As for external factors include Method of Teaching, Materials, Evaluation and Environment, and Task-driven teaching model to improve scientific literacy of undergraduate students included 5 components: 1) Principle and Rationale, 2) Objectives, 3) Contents, 4) Method of teaching & Materials and 5) Evaluation. The model was 100% confirmed to utility, feasibility, propriety and accuracy standards as assessed by 5 specialists, and the study involves interviews with three lecturers to analyze factors influencing undergraduate students' learning achievement in biochemistry. Internal factors encompass the lecturers' physical and psychological well-being, emphasizing the importance of a balanced work-life, profound knowledge, and engaging teaching attitudes. External factors include the significance of appropriate teaching methods, rich learning materials, conducive learning environments, and comprehensive evaluation strategies. The lecturers stress the role of task-driven teaching models and cooperative learning in enhancing scientific literacy. Overall, the study

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underscores the interconnectedness of internal and external elements in shaping students' academic performance and fostering scientific literacy.

**Keywords:** Task-Driven Teaching Model, Scientific Literacy, Undergraduate Students

## Introduction

The Biochemistry course is the main professional basic course for animal husbandry majors, a basic discipline in life science, which intersects with chemistry, molecular biology, physiology and other disciplines, and can solve the practical problems encountered in chemistry and its teaching across disciplines , is a science that studies the nature of the chemical composition of living organisms and the laws of chemical change during their life activities at the molecular level, with organisms as the object of study. The theory and experimental methods of modern biochemistry have been widely used in animal production and research. Learning and mastering the knowledge of biochemistry lays the theoretical foundation for understanding the phenomena of life and the laws of animal growth and reproduction and lays the technical skill foundation for mastering the new technology of modern animal breeding, which is of great significance to the cause of animal production and animal health. Learning and mastering the knowledge of biochemistry lays the theoretical foundation for understanding the phenomena of life and the laws of animal growth and reproduction and lays the technical skill foundation for mastering the new technology of modern animal breeding, which is of great significance to the cause of animal production and animal health. Through the study of this course, students will be able to understand and master the relationship between the structure, properties, and functions of biological macromolecules (proteins, nucleic acids, sugars), the metabolism and regulation of biological molecules in the body, and the transformation and utilization of bioenergy and other basic knowledge and basic skills in biochemistry. Students can use biochemical knowledge to discover and analyze scientific problems and cultivate students' scientific literacy. (Guangxi Vocational University of Agticulture,2023)

At the same time, biochemistry is also a comprehensive course combining theory and practice. The traditional teaching method focuses on teaching, which makes the teaching process too structured. Students only pay attention to the memory of knowledge, but fail to deeply understand, practice, and apply it. At the same time, students' experience in the learning process and interest in learning biology are ignored. In the traditional education model, teachers play a dominant role, while students passively accept knowledge and lack autonomy and active thinking. The teaching process neglects the cultivation of students' independent thinking ability. When evaluating students in the traditional education mode, teacher pay more attention to the mastery of knowledge, ignoring students' innovation ability and problem-solving methods. (Guangxi Vocational University of Agticulture,2023)

However, the current situation of students' scientific literacy is not satisfactory, mainly manifested in the following points: 1. Students are not fully aware of the importance of scientific literacy and the spirit of inquiry for future work and life. 2. Some students are not good at raising questions with scientific basis and exploratory significance by observing biological phenomena in life. 3. Students have mastered the basic knowledge of biochemistry but cannot analyze and solve problems with scientific thinking and research methods. 4. Some students are not good at consulting literature, comprehensively analyzing some practical problems encountered in learning, putting forward their own opinions and solving problems creatively. 5. Some students lack teamwork ability and need improvement in communication and expression. If the students cultivated by the school do not have the scientific literacy, they will not be able to adapt to the needs of the society after graduation and will not be competent for the job. At present, cultivating learners' scientific literacy has become the consensus of education circles in various countries, but it is not easy to successfully apply it to classroom teaching. Many countries carry out research from the aspects of curriculum standards and content, teaching methods and strategies, and evaluation methods. (Guangxi Vocational

University of Agticulture,2023)

Therefore, we should try to adopt a new teaching model to improve these problems. Task-driven teaching mode can connect the whole knowledge system to achieve the purpose of internalizing and applying students' knowledge. Task-driven teaching mode can integrate relatively scattered knowledge into a teaching task, requiring the student team to comprehensively use key knowledge points to complete the task, and effectively mobilize the awareness of students to participate in learning. It can enable students to actively participate in the whole teaching process in class and after class, with more frequent interaction between teachers and students, students can also ask deeper questions, and the cycle of tracking knowledge points can be significantly extended. Zhang (2018) applied the task-driven teaching mode to the talent assessment experimental teaching system in colleges and universities. The results indicated that the effectiveness of talent assessment experimental teaching and students' multifaceted competence quality were significantly improved. He (2017) proposed a teaching flow chart of task-designing, task-presenting, task-completing and task-evaluating in high school biology teaching. The experimental results show that task-driven teaching mode contributes to the formation of students' scientific literacy. Wang (2020) applied task-driven teaching model to high school biology teaching, the experimental results show that students are willing to participate in inquiry and actively construct the meaning of knowledge in the whole teaching process.

As the rationale shown above, the author realizes the importance of studying “Development of Task-driven Teaching Model to Improve the Scientific Literacy of Undergraduate Students”.

## Objectives

1. To examine the factors affecting the scientific literacy of undergraduate students.
2. To develop task-driven teaching model to improve the scientific literacy of undergraduate students.
3. To study the results of task-driven teaching model to improve the scientific literacy of undergraduate students.

## Material and Method

**Literature review**

In the study of “Development of Task-driven Teaching Model to Improve the Scientific Literacy of Undergraduate Students”, the researcher studied the documents concerning the following.

**Task-Driven Teaching**

The "task" in Task-driven teaching mode refers to an assignment designed by teachers according to the teaching objectives, teaching content and the existing knowledge and experience of most students, which can promote students to master knowledge and improve their ability to a certain extent. "Drive" means "push" or "prompt". Task-driven teaching mode emphasizes that the driving force of students' learning comes from their own intrinsic motivation. This intrinsic motivation to solve problems constantly drives students to complete tasks and solve difficult problems. Task-driven is not forced learning but enables students to actively construct inquiry after stimulating the motivation to solve the task.

In 1918, the famous educator William Hurd Kirkpatrick (1871-1965) published the Project (design) Method of teaching: The Application of purposeful activities in the educational process in Columbia University, which first proposed project teaching and aroused wide attention in the educational community (Kirkpatrick, as cited in Yin, 2014).

Task-driven research in foreign countries was initially mostly applied to language teaching. Prabhu (1987) proposed "learning by doing" and applied it to communicative teaching experiments, in which the teaching content was adapted into teaching tasks, and

students were required to achieve the teaching objectives by completing the tasks in the classroom. This is the original form of task-based teaching methodology. Nunan made an in-depth study of the design model of communicative tasks in Task Design in Communicative Classroom. Nunan (1989) believed that tasks could be divided into two types: goal and educational. He divided tasks into six parts, such as goal and context, and discussed in detail the nature, function, development and design of tasks in foreign language classroom teaching.

Willis (1996) proposed that task teaching takes tasks as the main line through the teaching process, and the tasks are designed based on the objectives, and the teaching process of task-driven teaching mode is divided and elaborated. Skehan through an in-depth study of Willis's viewpoints, conducts empirical research on task-based learning. Skehan (1998) considers that task-based learning activities emphasize the individual's active participation, and attach importance to how students communicate information, and emphasize the design of learning tasks that relate to real life, and students should focus their learning on how to complete the tasks. According to Skehan, the main purpose of pre-task preparation activities is to increase the opportunities for learners to reconstruct their internal linguistic knowledge, including the incorporation of new linguistic items and the reorganization of acquired linguistic knowledge. Nunan analyzed the task-driven teaching model from multiple perspectives and believed that teachers should adhere to the bottom-up education mode and emphasize that the effectiveness of teaching can be reflected by running tasks through the teaching process (Nunan, 2004).

Li (2009) understands the concept of task-driven model as: task-driven is an effective classroom teaching model that can greatly expand and enrich students' knowledge, combine their knowledge with their practice in a timely manner, and help to promote the integration of subject teaching and modern information technology. Li (2009) pointed out that one of the greatest advantages of this task-driven teaching model is that it can eliminate as many blind spots in students' learning as possible. One of the greatest advantages of this task-driven teaching mode is that it can eliminate the blindness of students' learning as much as possible and can greatly improve students' learning efficiency in its application.

**Theory**

There are theories for Task-driven teaching model as follows:

**Constructivism learning theory**

Task-driven teaching method is based on constructivism learning theory. Constructivism learning theory was first put forward by psychologist Piaget. It advocates that learning is not simply the transfer of knowledge by teachers to students, but the self-active establishment of cognition by students in the learning process, which is a process of interconnection between old and new knowledge (Deng,2020). According to the learning theory of modern constructivism, Jiang (2012) believes that students' basic knowledge is not acquired through classroom teaching of schools and teachers and passive review and memory of students, but through construction activities based on their existing basic knowledge and practical experience in a certain time and environment. At the same time, it especially emphasizes the overall learning management mode of "student-oriented, teacher-guided", that is, in the learning process of the overall construction of basic meaning knowledge, students are the active constructors of meaning, and teachers play a role in helping and promoting.

In constructivist learning theory, learners are actively absorbing knowledge with the assistance of an instructor or other learners. Learners actively construct meaning of knowledge by using necessary learning materials or cues in a prescribed context. Therefore, constructivist learning theory suggests that there are four major elements in a learning environment, which are situation, collaboration, conversation and meaning construction (Wang, 2017). " Situation" means that a certain scene should be created in the learning environment and it is helpful for learners to complete the learning activities; "collaboration" exists in the whole learning process and plays a great role in accomplishing the meaning construction of knowledge; "Conversation" means that students need to discuss how to complete the learning task through conversation, which is an indispensable element, and "meaning construction" refers to the final goal that learners need to achieve after completing the learning process (Yan, 2005 & He, 2021).

**Humanistic learning theory**

Humanistic learning theory emphasizes the self-realization of individuals, so the learning content should be the knowledge experience or method that can make students feel valuable and meaningful, make students realize the practicability of the knowledge content, and enable students to learn better and more effectively (Hang, 2017). This view also emphasizes that students' interests should be paid attention to in the learning process. In addition, the basic viewpoints of humanistic learning theory are as follows: first, the teaching concept of knowledge integration, emotion and cognition are interrelated, learning is not only the development of cognition, but also the coordinated development of knowledge and emotion; Second, the concept of meaningful autonomous learning, which not only refers to learning to increase knowledge and experience, but also refers to learning that can integrate existing experience; Third, the student-centered teaching concept emphasizes that teachers only provide students with various learning resources to create an atmosphere that can stimulate learning, and students can use various resources independently to exert their potential and better adapt to changes, so as to obtain valuable and meaningful knowledge content (Gu, 2020).

The humanistic viewpoint has a very good guiding significance to task-driven teaching practice. In the process of task-driven teaching, students take the initiative to accept tasks, analyze tasks and solve problems; The process is full of reflection, insight, introspection, and the joy of success. Students can not only improve the learning of professional knowledge and skills, but also improve the ability to cooperate with others, language expression ability, and innovation ability. These are conducive to the overall development of students.

**The theory of the zone of proximal development**

Wirzki is a famous researcher in education science, put forward the "zone of proximal development" education theory. He believes that: "The individual development of students should be divided into two levels: one is the current level of development of students themselves; Another is the student's potential level of development. Vygotsky calls the difference between a student's ability to complete a task independently and their ability to perform it with the help of others the "zone of proximal development" (Wirzk, as cited in Zhong, 2018).

According to Vygotsky's theory, to implement task-driven teaching, teachers should analyze students' current learning situation when designing lesson plans, and then select appropriate teaching activities to help students successfully reach the zone of proximal development (Zhou, 2012). When applying task-driven teaching mode in biochemistry classroom, task design should follow the principle of proximal development zone. The teaching activities designed by teachers should not only conform to students' existing level, but should be based on students' possible cognitive level, grasp the differences between the two, and reasonably set the difficulty and gradient of tasks. And the tasks should have certain exportability and maneuverability to guide students to reach a higher level of development.

**Achievement Motivation Theory**

In the 1950s, Professor David of Harvard University proposed the theory of achievement motivation by studying human needs and motivations (David, as cites in Man,1994). The theory of achievement motivation means that people want to engage in activities that are significant, difficult and challenging to them, and can achieve satisfactory results in the activities. Motivation includes internal and external motivation, internal motivation includes students' self-efficacy and expectation of success, and external motivation refers to interest and environment, etc. (Xie, 2010). When choosing different situational materials, teachers need to consider the influence of situational materials on students' external motivation and whether the selected situational materials can help students persist in completing tasks. When designing different types of tasks, teachers need to consider students' sense of self-efficacy, and how students maintain a state of vitality when performing tasks is closely related to students' intrinsic motivation in choosing to complete tasks.

There are 4 theories for task-driven teaching model 1) constructivism learning theory, 2) humanistic learning theory 3) the theory of the zone of proximal development and 4) achievement motivation theory.

**The Scientific Literacy**

As for the interpretation of the connotation of scientific literacy, scholars in different times have different interpretations of it, and its connotation is also full of distinctive characteristics of The Times. The term scientific literacy was first proposed in the 1950s by the American educator Conant in his book General Education in Science. Since then, scientific literacy has been widely paid attention to by researchers because of its universal educational value. International discussions on the concept and connotation of scientific literacy have never stopped, and the construction of the concept of scientific literacy has gone through a complex and difficult process of understanding.

1960s, Pella divides scientific literacy into six distinct areas: the interrelationship between science and society, the ethics of science, the nature of science, conceptual knowledge, science and technology, and science in the humanities (Pella, O'Hearn and Gale, 1966).

In 1974, Showalter analyzed the literature published in the following years and divided scientific literacy into seven dimensions, arguing that a scientifically literate person should be able to 1) understand the nature of scientific knowledge; 2) apply scientific concepts, principles, laws, and theories to everyday life; 3) use the scientific process in problem solving and decision making; 4) face all aspects of daily life with scientific values; 5) understand and appreciate the intersection of science and technology, their relationship to each other, and their relationship to society; and 6) face all aspects of daily life with scientific values through science, 3) use scientific processes in problem solving, decision making, and increasing understanding of the universe; 4) approach all aspects of daily life with scientific values; 5) understand and appreciate the intersection of science and technology, their relationship to each other, and their relationship to society; 6) cultivate a richer and more exciting view of the universe through a science education that lasts for a lifetime; and 7) develop a variety of ingenious skills related to science and technology (Showalter,1974).

Showalter's definition reflects differences in the degree of scientific literacy. Shen (1975) divided the concept of scientific literacy into three categories: 1) practical scientific literacy, which refers to the ability to use scientific knowledge and information to solve problems in daily life related to food, health, shelter, etc.; 2) civic scientific literacy, which refers to the right of citizens to participate in decision-making based on adequate information; 3) cultural scientific literacy, which refers to the right of taxpayers to be informed about the investment and output of their money; and 4) the right of citizens to participate in decision-making based on adequate information. It means that citizens have the right to participate in scientific and technological decision-making based on sufficient information, and as taxpayers they should have the right to know the investment and output of their own money; 3) cultural scientific literacy, which means that scientifically literate people should be able to realize that science belongs to a part of the cultural achievements of human beings. This categorization provides multiple functions of scientific literacy for different social contexts.

Branscomb (1981) expanded on Shin's work, first defining "scientific literacy" as "the ability to read, write, and understand systematic human knowledge," based on the Latin roots of "science" and "literacy." She then divides scientific literacy into eight categories: methodological science literacy (methodological science literacy), professional science literacy (professional science literacy), universal science literacy, technological science literacy, amateur science literacy, journalistic science literacy in the media science policy literacy, science policy literacy and public science policy literacy. Each kind of scientific literacy corresponds to a specific background, for example, scientists should have professional scientific literacy, ordinary citizens should have general scientific literacy, etc. (Branscomb,1981).

In the early 1980s, the United States began to discuss issues such as science, technology, and the role of scientific decision-making in society. Miller published the most influential article, "Scientific literacy: A conceptual and empirical review." Miller (1981) proposed the multi-dimension of scientific literacy, realized the social dimension and cultural dimension of scientific literacy, and established the evaluation system of sociological methods. He believes that the concept of scientific literacy should be in line with the contemporary situation and divides scientific literacy into three dimensions: the norms and methods of science, the main terms and perspectives of science, and the impact of science on society.

In 1989, the American Association for the Advancement of Science (AAAS) launched Project 2061. It is a long-term project aimed at improving citizens' scientific literacy. The AAAS, in Project 2061: Science for All Americans, defines "the knowledge, skills, and attitudes that students should possess during their time in school in order to become a scientifically literate person." At the same time, the document also put forward a comprehensive and general definition of "science literacy" : a person with scientific literacy should master scientific knowledge should not only be limited to the traditional key concepts and principles of physics, chemistry, biology and other disciplines, but also understand the key concepts and principles of mathematics, technology and social sciences; Familiarity with the natural world and recognition of its diversity and unity; Understanding science is the common cause of mankind; Scientific attitudes, such as open acceptance and skepticism of curiosity and new ideas, and values that view science in a positive critical rather than confrontational way; The ability to use computers and calculators to calculate, estimate and operate, as well as to observe, communicate, criticize and react.

Shamus (1995) divided scientific literacy into three levels: 1) cultural scientific literacy, which is the simplest level, and he believes that most educated adults have some level of cultural and scientific literacy; 2) functional scientific literacy refers to the ability of people not only to use scientific terms correctly, but also to communicate, read, and write smoothly in a meaningful and non-technical context; 3) True scientific literacy, which is the most difficult level to achieve, requires an understanding of the development process of scientific theories, the role of experiments in science, the elements of scientific inquiry, and the ability to raise and solve problems on the basis of the first two levels.

In the 1990s, the United Kingdom initially put forward relevant educational goals and requirements for students' biological science literacy in documents such as Biology Syllabus (Qiao,2018). By the beginning of the 21st century, the British education Department issued the "Biological Subject Standards" for junior high school. In this document, attention should be paid to the development of students' mathematical literacy, and scientific inquiry activities should be integrated into every link of educational activities. Through this series of educational reform measures, it can be understood that the United Kingdom attaches great importance to biology education in science curriculum education and pays attention to the integration and comprehensive application of knowledge among various disciplines. For example, British educational institutions integrate biology with other subjects to form a science curriculum, breaking the traditional block teaching method in the teaching process, and conducting classroom teaching through a comprehensive knowledge system (Yang,2018).

Between 2000 and 2015, the Organization for Economic Cooperation and Development (OECD) definition of science literacy was also in flux. In 2000 and 2003, the OECD measured science literacy mainly in terms of scientific knowledge or concepts, scientific processes and skills, and social contexts, and defined it as: "Scientific literacy is the ability to apply scientific knowledge, identify problems, and draw conclusions based on evidence in order to understand the natural world, the impact of human activities on it, and to make good decisions." Unlike before, in 2006 the OECD added to its definition of science literacy knowledge about the "relationship between science and technology", although this was envisaged in the 2003 PISA science literacy framework, but not discussed in detail. In addition, the 2006 PISA science literacy assessment framework also adds the dimension of scientific attitude, and evaluates it from three aspects: scientific interest, environmental

awareness and support for scientific inquiry. In the 2015 PISA science literacy assessment framework, "support for scientific inquiry" in the dimension of scientific attitude was further revised to "emphasis on scientific inquiry methods".

Building on the 2006 definition of science literacy, the OECD has further developed it in the 2015 Assessment Framework for Science Literacy, which defines science literacy as: "A scientifically literate person should be able to interpret scientific phenomena, evaluate and design scientific inquiry, interpret scientific data and evidence, and actively participate in logical discussions related to science and technology." Compared with before, the biggest change is the more in-depth interpretation of "knowledge related to science", and it is divided into content knowledge, process knowledge and cognitive knowledge. Since this study is mainly from the perspective of school education, the definition of science literacy mainly refers to the research of science educators. Therefore, referring to the previous definition of scientific literacy, this study defines scientific literacy as: a person with scientific literacy should have basic scientific knowledge and science-related knowledge, including the understanding of the nature of science, and be able to use scientific knowledge to explain scientific phenomena; Ability to evaluate and design scientific inquiry and interpret scientific data and evidence; Understanding the interaction between science and human activities; Have scientific interest, environmental awareness, support for scientific inquiry, acceptance and skepticism of science.

**Biological Scientific literacy**

The term bioscience literacy was first innovated in 1987 by Ewing et al. in their publication of research on biology education in The American Biology Teacher. Subsequently, in 1993, the BSCS published Developing Biological Literacy to guide the development and construction of biology programs. In the book, it is pointed out that people with bioscience literacy should be able to understand the terminology and principles of biology, understand the impact of human beings on nature, and master the learning style of scientific inquiry. Meanwhile, BSCS classifies the level of scientific literacy into four levels, which are superficial, functional, structured, and multidimensional bioscience literacy (Tian,2017).

In China, Biology Curriculum Standards for Senior High Schools（2003）proposed that biological science literacy refers to the biological science concepts and scientific inquiry ability required for participation in social activities, production practices and personal decision-making, including understanding the nature of science, the interrelationship between technology and society, and the formed scientific attitudes and values. By examining the level of an individual's biological science literacy, it can reflect the individual's understanding and application of biological basic content within the scope of biological science and reflect the individual's ability to improve their scientific literacy based on their own cognition (Wang,2017). Biology Curriculum Standards for Senior High Schools (2020), it is clearly stated that students should learn biological knowledge, develop biological experimental skills, develop a scientific and rigorous attitude and thinking, and promote the development of students' biological science literacy in the process of hands-on activities.

The 21st century is the century of biological science. With the continuous application of biological science and technology in daily life, biological science literacy has become an important part of the basic scientific literacy that citizens must possess in the new era. Schools at all levels and of all types should, based on the learning of biological science knowledge and skills and the understanding of the connection between science, technology and society, establish correct scientific values for students, cultivate the emotion of harmonious coexistence between man and nature, help students develop rigorous scientific logical thinking in the learning process, and improve students' biological science literacy (Zhang, 2018).

**Material and Method**

This research used Mixed Method of Research. This research is divided into 3 phases.

Phase 1 was conducted to answer research objective 1: To examine the factors affecting the scientific literacy of undergraduate students. Obtain important information that is used as a basis for examine the internal factors and external factors to Improve scientific

literacy for undergraduate from the former students and lecturers. And take the result to do task-driven teaching model.

**Table 1** Summary how to conduct research from Phase 1

| Topics | Details |
|---|---|
| **Research process** | Analyzed both internal and external influencing factors from students and lecturers. |
| **Research objective** | To examine the factors affecting the scientific literacy of undergraduate students. |
| **Conduct research** | Designing instrument 1 (The questionnaire for students)<br>Designing instrument 2 (The interview for the lecturers)<br>Assess the validity by 5 experts (List name from Appendix A) |
| **Target group** | 1. 75 former students from three universities in Guangxi Zhuang Autonomous Region<br>2. 3 lecturers from Guangxi Vocational University of Agriculture, Guangxi University and Guangxi Minzu University. |
| **Instrument** | 1.Questionnaire for students<br>Part 1: The information about common data of the respondents.<br>Part 2: The information about internal and External Factors.<br>1.1 6 items of internal factors<br>1.2 6 items of external factors<br>Part 3: Suggestion<br>2. Interview for lecturers<br>Part 1: The information about common data of the respondents.<br>Part 2: 10 questions.<br>5 questions for internal factors.<br>5 questions for internal factors.<br>Part 3: Suggestion |
| **Data analysis** | Descriptive Statistics i.e., Frequency, MEAN (), Standard Deviation (S.D.) for questionnaires.<br>2.Content analysis for interview |
| **Output** | The results show that the internal factors that affect the scientific literacy of undergraduate students include psychology or physical, knowledge or skills, and Attitude, while the external factors include Method of Teaching, Materials, Evaluation and Environment. These were obtained from both students and lecturers. |

Phase 2 was conducted to answer research objective 2: To develop task-driven teaching model to improve the scientific literacy of undergraduate students.

**Table 2** Summary how to conduct research from Phase 2

| Topics | Details |
|---|---|
| Research process | Develop Task-driven teaching model in terms of accuracy standards, propriety standards, feasibility standards, and utility standards. |
| Research objective | To develop Task-driven teaching Model to improve scientific literacy of undergraduate students. |
| Conduct research | Design handouts according to the principles and rationality, goals, content, teaching methods and materials and evaluation of Task-driven teaching model. |
| Target group | 5 experts to confirm model. |
| Instrument | Part 1: Assessor's information<br>Part 2: Assessment of the quality of Task-driven teaching Model on 5-point rating scale basis in 4 aspects 1) Utility Standards 2) Feasibility Standards 3) Propriety Standards and4) Accuracy Standards.<br>Part 3: Suggestion |
| Data analysis | Descriptive analysis, i.e., frequency and percentage. The acceptable items must not be less than 100%. |
| Output | Assessment of confirm the quality of Task-driven teaching model, which is confirmed by 3 experts for further implementation. |

Phase 3 was conducted to answer research objective 3: To study the results of task-driven teaching model to improve the scientific literacy of undergraduate students.

**Table 3** Summary how to conduct research from Phase 3

| Topics | Details |
|---|---|
| **Research process** | 1.Deign lesson plan<br>2. Design pretest and posttest |
| **Research objective** | To study the result of Task-driven teaching to improve scientific literacy of undergraduate students. |
| **Conduct research** | Designing instrument (evaluate the Instructional Model)<br>Assess the validity by 5 experts |
| **Target group** | 33 students from Guangxi Vocational University of Agriculture, who enroll in Biochemistry course. |
| **Instrument** | 1. Lesson plan<br>2. Pretest and Posttest |
| **Data analysis** | Content analysis for analyzing difficulty value (p), discrimination power (r), and reliability (KR-20). |
| **Output** | Assessment of confirm the quality of Task-driven teaching Model for scientific literacy of undergraduate students. |

## Results

In the study of "Development of Task-driven Teaching Model to Improve the Scientific Literacy of Undergraduate Students", the researcher studied the documents concerning the following.

Part 1: Analysis results serving objective 1–To examine the factors affecting the scientific literacy of undergraduate students.

This section presents analysis results serving objective 1 using table and description in terms of MEAN, standard deviation, interpretation (Level of Attitude), and ranking of all factors in overview. After that, items of all factors are presented likewise.

**The Common data of the respondent in overall (n-75)**

The common data of the respondent in overall the most gender is Female,58.67%. Significantly more women than men participated in this questionnaire. The most age is 18-20, 52.00%.

**The result of questionnaire from students in overview (n=75)**

The Indicates that internal factors affecting the scientific literacy of undergraduate students in Guangxi province overall found at high level ($\bar{x}$=4.40). Considering only each item, it was found that factor No.4 Do you think scientific attitudes include curiosity, honesty in the recording and validation of data, flexibility, persistence, open-mindedness, willingness to tolerate uncertainty, and an acceptance of the provisional nature of scientific explanation ($\bar{x}$=4.51), follow factor by No.4 Do you think scientific attitudes are a mixture of the willingness to know and apply a scientific approach to face any task of problem-solving with respect for logic and critical thinking is the highest mean ($\bar{x}$= 4.47) and the fewest mean is factor No.2 Students think the knowledge form Biochemistry Course， in which scientists study the natural world and propose explanations based on the evidence derived can improve more the Scientific literacy for you ($\bar{x}$=4.24).

For external factors affecting the scientific literacy of undergraduate students in Guangxi province overall found at High level ($\bar{x}$=4.32). Considering only each item, it was found that factor No.5 Do you think if the university has a specialized biology laboratory, a stable high-speed network, the modern textbook, a relaxed classroom atmosphere and the suitable class size can improve the scientific literacy is the highest mean ($\bar{x}$= 4.52), follow by factor No.3 Do you think if the lecturer chooses the method of teaching, utilizes modern educational technology methods, suitable contents, has various activities in the classroom, participates in and out the classroom can improve the scientific literacy ($\bar{x}$=4.45). and the fewest mean is factor No.2 Do you think the lecturer who has the experience to teach more 3 years or finish the education directly to teach Biochemistry Course can improve the scientific literacy ($\bar{x}$=4.16).

**The lecturers interview analysis results**

The amount of lecturers' university. Common data of the respondents in overall (N=3)

The common data of the respondents in Guangxi province. The respondents were all female, 100%, the most Experience teaching is 7- 9 yrs.,66.7%, the most age is 36-49 yrs., 100%.

**Interview Lecturers Results**

After the results from interview with the 3 lecturers, the factors affecting students' learning achievement can be concluded as follows.

**Internal Factors**

**Psychology or Physical**

Lecturers believe that a lecturer's personal life, including physical health, mental health, family responsibilities and work-life balance, affects teaching performance and the development of students' scientific literacy. Good health physique and fine psychological quality are an important guarantee for teaching performance, and only lecturers with good psychological quality can teach each student with mental health. In the personal life of lecturers, if work and life cannot be balanced and work pressure is too high, lecturers may suffer from mental exhaustion, depression, anxiety and other symptoms. Lecturers lose enthusiasm for teaching, become indifferent to students, and the effectiveness of teaching decreases, which in turn affects students' academic performance. Lecturers need to have good psychological qualities and a passion for teaching.

**Knowledge and skill**

The three lecturers believed that the lecturers' profound professional knowledge and high scientific research ability could help to improve the students' scientific literacy. Scientific research ability mainly includes the ability to identify problems, review literature, summarize and conclude, design experiments, organize and implement, and express scientific research. These factors are partially consistent with the dimensions of developing scientific literacy. Lecturers with strong scientific research ability can improve students' scientific literacy by introducing scientific thinking into the teaching of the curriculum. Lecturers also believe that it is important for lecturers to use certain techniques to motivate students to learn. Because the course is highly theoretical and some of the knowledge points are obscure, an interesting instructional design can reduce students' psychological resistance and lack of confidence. Lecturers' teaching experience and teaching methods should be able to stimulate students' interest in courses and knowledge, and trigger students' active thinking and exploration. By closely linking the lesson content with daily life, lecturers help students improve their knowledge of natural science and scientific literacy.

**Attitude**

All three lecturers believe that the classroom teaching process is a bilateral activity process between lecturers and students, and teaching and learning complement each other. Students' learning attitude is positively correlated with lecturers' teaching attitude, and students will imitate lecturers' behavior in unknown areas, such as professional habits and scientific attitude. Biochemistry is a basic core course, with many complicated knowledge points and a lack of interest, so lecturers need to have sufficient preparation before class, design teaching sessions, introduce examples, design experiments and so on. Experienced lecturers are good at understanding students' needs, being aware of their every move, and are good at organizing every aspect of classroom teaching through appropriate attitudes, behaviors and rational methods. Therefore, in classroom teaching, the lecturer's teaching attitude has a greater impact on the students' learning attitude.

**External Factors**

**Method of teaching,**

Lecturers believe that appropriate teaching methods have an important impact on students' academic results. Lecturers should choose appropriate teaching methods according to the teaching objectives, teaching contents and actual characteristics of students. Lecturers

believe that appropriate teaching methods have an important impact on students' academic results. Lecturers should choose appropriate teaching methods according to the teaching objectives, teaching contents and actual characteristics of students. One lecturer said that the use of mixed online and offline teaching methods will improve the learning autonomy of learners, which can ensure full communication between lecturers and students, as well as receiving more knowledge through online learning. The other two lecturers indicated the adoption of project-based or task-driven teaching methods, which would improve students' initiative and problem-solving ability by completing a project under the guidance of the lecturer. Meanwhile, all three lecturers believed that the task-driven teaching mode could improve students' scientific literacy.

**Materials,**

Each instructor uses various teaching materials, including textbooks and online learning resources. Lecturers believe that rich teaching materials are conducive to students' understanding of teaching content and can enhance their interest in learning, which directly affects their learning results and the development of their abilities. The textbook that matches students' abilities, cases that are close to their lives, demonstration animations, online courses, the National Public Service Platform for Educational Resources, and so on, are resources that can meet the learning needs of different students.

**Environment**

Teaching environment is an important basis for the effective implementation of teaching activities. The teaching and learning environment are an important foundation for the effective implementation of teaching and learning activities. All three lecturers said that appropriate class size, multimedia equipment, and good lecturer-student relationship can provide a favorable learning atmosphere for students. Biochemistry is a discipline that studies the chemical composition of living organisms and their changing patterns through experiments. Therefore, an open professional biology laboratory, as well as sufficient experimental consumables and experimental equipment, can provide guarantee for students' independent experiments and improve their ability to design experiments and implement them. A good experimental environment is conducive to cultivating students' scientific attitude and scientific thinking.

**Evaluation**

The lecturer believes that students should be evaluated from several aspects, learning attitude, classroom performance, quality of homework, completion of tasks, experimental design, laboratory operation, etc., which should be able to comprehensively reflect the students' academic situation. It is important to recognize students' efforts and progress, but also to point out deficiencies and focus on the development of competence. Lecturers should also use a variety of assessment methods, such as self-evaluation, evaluation by others, diagnostic evaluation and developmental evaluation.

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