Designing A general information literacy course for first-year postgraduate students: Improving academical and innovative abilities

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Abstract

In an era of information explosion, improving information literacy for academical innovation is essential for postgraduate students. However, the majority of these students lack information literacy knowledge, and even a few lack access to related courses. To improve the ratio and level of the information literacy of postgraduate students, we design a novel framework for general information literacy. It consists of four parts, namely, teaching process, methods, abilities, and applications. The methods part of the framework includes questionnaire, intensive teaching, embedded pedagogy, and free sharing. They provide support for the teaching process and abilities improvement. Notably, postgraduate students' abilities are expected to be enhanced, namely, learning(using search engines to enhance search quotient), academic research (conducting literature search, analysis, and assessment), and innovation (evaluating innovation and managing information). These abilities are applicable to academic research, internship, and academic competitions, among others. Moreover, we design a questionnaire to evaluate the effectiveness of the proposed framework. The statistical results demonstrate that the information literacy of postgraduate students maintained an upward trend, and the course was evaluated with a high level of satisfaction.

Keywords Information literacy · Literature search · Learning ability · Academical and innovative abilities

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1 Introduction

Since its outbreak, COVID-19 rapidly spread around the world, which led to substantial changes in education (Bourouiba, 2020; Shang et al., 2021; Hostetler and Luo, 2021). Online learning has been common worldwide and brought challenges for many people. The postgraduate students are no exception. In fact, the majority of postgraduate students are beginners in academic study, and lack training in information literacy (Li and Wang, 2009; Board, A.C.R.L, 2015; Wanze et al., 2021; Hwang et al., 2023).

The concept of information literacy was initially proposed by The Association of College and Research Libraries (ACRL) Board, A.C.R.L (2015), which includes several components such as information consciousness, information search, and information assessment (Chaiyama, 2015; Ouyang et al., 2016; Phillips and Jahanshahi, 2017; Kastner and Cheng, 2019; Xiao et al., 2022; Shen and Chang, 2023). Similar with information literacy, digital literacy (Reddy et al., 2020), computational literacy (Jacob and Warschauer, 2018), and data literacy (Schneider, 2013) all emphasize the importance of using computer tools to obtain the wanted information. In this paper, information literacy is regarded as the best suitable term for postgraduate or undergraduate students in high education. An information literacy person should have the following abilities:

1) Possesses comprehensive knowledge of information sources, has the high information consciousness. Be able of fast learning with the advanced techniques emerging.
2) Possesses a variety of skills: knows how to design the search strategies, how to search information efficiently from various information sources using advanced computer or AI tools.
3) Finishes a fast survey for an unfamilar topic. Assesses the searched information, removes the useless information and keep the useful information, manages the different kinds of literatures using softwares.
4) Has a good understanding of literature structures, familar with the review process for a conference paper, journal paper, patent, etc. Has the copyright consciousness, and obeys the academic rules.

Currently, the majority of first-year postgraduate students lack knowledge about where to find information sources, how to search for information efficiently, and how to evaluate the searched information (Keleher et al., 2011; Al-Bukhari et al., 2013; Zhu et al., 2014; Bettin et al., 2022; Fang et al., 2022). In addition, literature search and analysis is of great importance for beginners in academical research (Yunhong et al., 2008; Teng et al., 2016; Howard et al., 2018; Phillips et al., 2020). The literacy improvement means that students grasp the mentioned skills. Thus, improving the information literacy of postgraduate students is crucial.

This study aims to develop a general framework to improve information literacy of postgraduate students with different majors, backgrounds, and levels. Specifically, its objective is to improve the ratio and level of information literacy of postgraduate students.

In recent years, many scholars excessively invest into information literacy (Shi et al., 2022; Locoro et al., 2021; Vidal et al., 2021; Gao, 2021; Balint, 2016). For example,

Shi et al. (2022) proposes the CIAP method for improving the information literacy of college students from four aspects, namely, Conceptual level, Intelligent level, Action level and Process level. Locoro et al. (2021) defines visual information literacy, and designs a model for characterizing progress in development skills and a measurement scale standard for evaluating visual information literacy.

Alternatively, Vidal et al. (2021) presented an active learning format for searching for the needed information. The results demonstrate that students perceived a state of maturity after the experience. Gao (2021) claims that universities play an irreplaceable role in the information literacy of colleges students. The author formulates a framework that includes support, evaluation, and application systems. Balint (2016) develops a set of tasks to help undergraduate students establish critical web- and technology-based information collection skills. In addition, other strategies can be used to achieve this goal (Mantei et al., 2018; Wong and Cheung, 2010; Cao et al., 2010; Zhou, 2020; Cheng et al., 2019; Zhao et al., 2021). However, the above mentioned studies do not highlight generality and systematicness.

Thus, this paper proposes a framework for improving information literacy on the basis of our course entitled "Literature Knowledge Mining and Analysis Management". The contributions of this paper are listed as follows:

- This paper proposes a novel framework to improve the postgraduate students' ratio and level of information literacy. It adopts four methods in the teaching process, and concentrates on the improvement of three abilities, namely, learning, academic, and innovation.
- This paper designs a questionnaire to assess the information literacy framework. It provides a reference for researchers about the study of students' information literacy in universities.
- Practical results on the first-year postgraduate students demonstrate that the proposed framework can significantly improve the first-year postgraduate students' information literacy.

2 General information literacy

The general information literacy course is designed for students with different majors, backgrounds, ages, and races. Its contents mainly include three aspects, namely, information consciousness, information search, and information assessment.

2.1 Information consciousness

Information is extracted, processed, evaluated, and transformed into knowledge. Once the knowledge is recorded using certain materials, it forms literature. Currently, researchers typically obtain valuable information from the literature. Information sources are of importance to daily life. Figure 1 presents 10 representative information sources.

Possessing a good understanding of these information sources can help improve information consciousness, that is, one's cognition about information search to solve
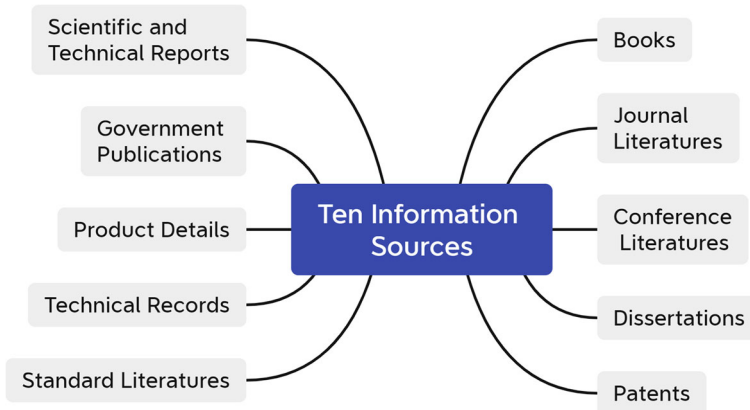
Fig. 1 Representative information sources in daily life

certain problems. It indicates one's learning and problem-solving abilities by quickly and accurately finding the required information. It is also called the search quotient(SQ, the ability to solve problems through search skills)(Zhang, 2016). It is crucial for postgraduate students in enhancing their information consciousness.

2.2 Information search

According to the methods, the search for information can be grouped into three categories, namely, Internet, local, and literature database. The proposed course covers these categories.

Search engines are essential tools for Internet search. The techniques include but are not limited to basic, advanced, command, and image search. To improve search efficiency, several questions should be considered. Who will release the information? How will people describe information? Where to search is the most efficient way? To obtain the expected results, information search requires enthusiasm and patience, which simultaneously improves search and learning efficiency.

Prompt engineering is a fundamental method of search for information currently. Incorporating "prompt engineering" into the information search process can further enhance its efficacy. This approach involves skillfully crafting search queries to generate precise and relevant results. This technique is particularly crucial in the context of the Internet search, where refining search terms and structuring queries effectively can significantly impact the quality of retrieved information.

For local search, the most important issue is building an index database. It needs to establish certain software in advance, for example, Everything. Then, we can rapidly search for local information. This scenario typically occurs in the file search of personal computers, which creates an effective method for people to quickly find files and improve their management of files.
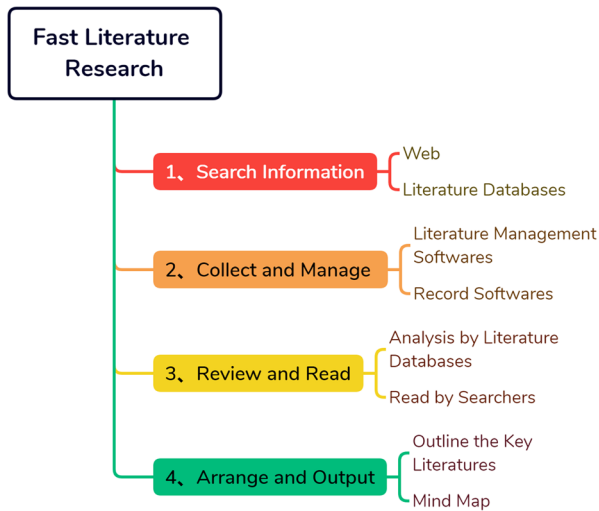
Fig. 2 Process of fast literature search. A process-oriented strategy can speed up research

The literature database search includes several aspects such as how to use common literature databases (like WOS, EI, IEEE Xplore, ScienceDirect, and Springer); how to Improve Search Efficiency with prompt engineering; how to manage and analyze the searched literatures using commercial software such as EndNote, E-Study, NoteExpress, and NoteFirst; and how to discover valuable publications from a large amount of literatures. In the course, theory and practical guidance are introduced to help students understand these skills. Figure 2 presents the process of a rapid literature research.

2.3 Information assessment

For the searched results, information assessment is used to determine whether the results are useful for current task or not. The common assessment metrics include speed, correlation, index size, and currency. The effective information search has obvious characteristics, namely, fast speed, high correlation, large index scale, and current relevance.

To ascertain the accuracy and authenticity of information, verification holds crucial significance across various projects. Critical thinking and cross verification are very effective for postgraduate students in determining the truthfulness of information. Thus, students are equipped with the information assessment ability. This capability can be executed through two approaches: the mutual verification of multiple information sources, and information back-lookup to determine whether or not the information source is authoritative.

In summary, postgraduate students should possess information consciousness and skills in searching for information and its assessment. The course provides more than 10 source of information, the fast literature research strategy, and information assessment methods, which can improve the information literacy of postgraduate students.

3 The proposed general information literacy course

Figure 3 presents the framework for general information literacy. The framework consists of four parts: Teaching Process, Methods, Abilities, and Applications.

3.1 Teaching process

The teaching process consists of three stages, namely, before class, in class, after class.

3.1.1 Before class

In this stage, the responsibility of teachers is to release some small tasks, provide supportive materials, and assessing students' progress. The responsibility of students is to solve the tasks and learn what is taught in class. It is implemented by educational social media or platform.

3.1.2 In class

In this stage, teacher conveys theory to students. The fundamental theory covers the use of search engine, literature database, personal knowledge management, innovation assessment, etc. Students are required to study fundamental knowledge, give a short presentation, and participate in group discussions.

3.1.3 After class

In this stage, the teachers' work is to release a comprehensive task, organize exercises and guide students in their practice. Students can make literature study on their own
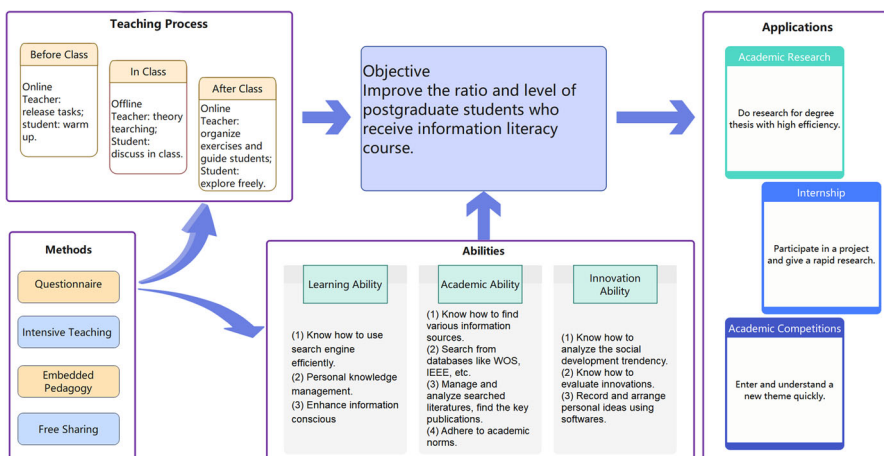

Fig. 3 Course framework of information literacy improvement

research directions. It is a good combination for them to use the learned techniques for innovative exploration.

In summary, the entire teaching process aims to improve problem-solving ability of the students. Students' abilities, such as learning ability, academic ability, and innovative ability, will be cultivated.

3.2 Abilities

3.2.1 Learning ability

In the past few decades, there have been significant changes in the way knowledge is disseminated: knowledge is continuously expanding, and updates happen faster than before. This requires people to learn more than they used to. Enhancing learning efficiency is necessary to adapt to knowledge growth. For example, if one wants to find something about COVID-19 from the Internet, a command search may be a good choice. "COVID-19 filetype: pdf site:com" means that one wants to search some pdf files about COVID-19 released by companies. This strategy is very efficient, and is taught in class.

In addition, our course introduces manage personal knowledge (MPK), which can improve one's productivity. It is a cycle process, which includes four steps, namely, collect, organize, innovate, and share knowledge. Thus, MPK can help one develop a habit of recording, and improve learning ability.

3.2.2 Academic ability

This ability is closely connected to information sources. For one information source, its definition and brief history are described in detail. For example, Journal, how to judge one journal's quality, what are its aim and scope, how one journal paper is published, etc. In this process, students are expected to learn the methods of how to evaluate a journal and collect valuable literature.

Practice is necessary to improve the academic ability of students. In our course, each student is assigned with an unfamiliar research task. It is required to finish the literature study within a given time, such as 6 hours. This part composes training in fast literature research in Fig. 2. It is a representative of high-level information literacy.

3.2.3 Innovative ability

As illustrated in Fig. 3, innovative ability includes analyzing the trends in social development, evaluating innovations, being skillful in recording and arranging personal ideas using software. Students are trained to know how to evaluate whether a new idea/product is innovative or not. The course also teaches about the possession of deep insight into social topics and a good understanding of research advances. An effective approach called the mind map is also used to record the students' innovative inspirations.

3.3 Methods

3.3.1 Questionnaire method

The study designs a questionnaire for the information literacy of postgraduate students in the course. It aims to foster a profound comprehension of the students' information literacy proficiency. It is implemented by fused media, including websites, social media, and sharing.

3.3.2 Intensive teaching method

The proposed framework is a constant and systematical course. It is mainly designed for the first-year postgraduate students or research beginners. It includes approximately 20 lessons for teaching, which helps students set their goals and prepare for future study.

3.3.3 Embedded pedagogy

In the course, information literacy is embedded into the research directions of students. In other words, one student can directly apply what they learned into their research tasks. For example, one can finish a review or survey on a research direction using literature mining and analysis technique. This practice is helpful for improving the abilities of students.

3.3.4 Free sharing

We also establish a platform for postgraduate students to freely share their special experiences with others, such as a useful software or tool. This avenue not only adds knowledge about information literacy into classes but also expands the horizons of the students. Meanwhile, the involved students may also improve their ability in making presentations and enhance their sharing consciousness.

3.4 Applications

The course is expected to enhance students' abilities in many applications, such as academic research, internship, and academic competition. The first application is for the pursuit of a degree by completing a high-quality thesis. For the majority of students, investing much time into one direction for two or three years is a very valuable experience. Publishing a paper or a patent is an excellent method for verifying academic ability. By embedding the course into their research directions, they can be aptly prepared for future exploration.

For internship and academic competitions, students continue to face new and unfamiliar tasks. Thus, they may need to propose practicable solutions obtained over limited periods. Thus, quickly identifying solutions to problems is crucial. The search consciousness presented in the course is a good method, as it offers strategies for locating

valuable information sources, insights from peers, and cutting-edge literature. In this process, students can broaden their international vision, foster knowledge in their majors, and pave the way for a sustainable future.

4 The Practice and discussions

This section presents the practical results and discussions and is composed of three parts, namely, questionnaire, grading assessment, and limitations and future work. Notably, the practice of our study is conducted on postgraduate students at Northwestern Polytechnical University in China.

4.1 Design of the Questionnaire

The questionnaire includes 16 questions (Fig. 4). It comprises three segments: fundamental information, student evaluation, and recommendations, each represented by a distinct color-red, green, and blue, correspondingly. We have received responses from 45 questionnaires submitted by postgraduate students who attended the course. A detailed analysis is presented as follows.

4.2 Basic Information

Figure 5 indicates that the majority of students are male(86.67%) among all the students. Their majors are science and engineering, in which software engineering accounts for 57.78%. Notably, 75.56% of the students never attended information literacy classes, whereas 11.11% of students once attended a few lectures about infor-
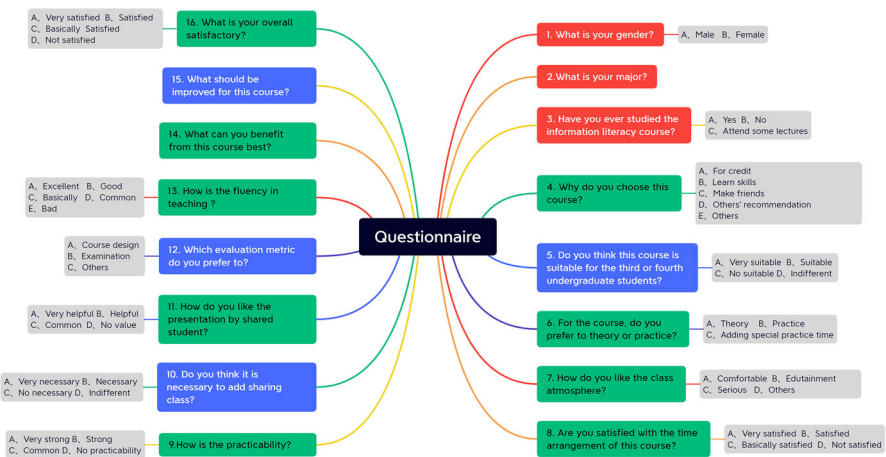

Fig. 4 Design of the questionnaire for information literacy. It includes 16 questions for basic information(red), students' evaluations(green), and students' suggestions(blue)
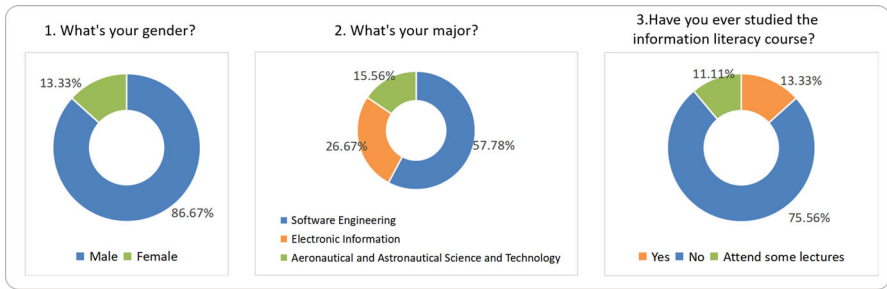
Fig. 5 Analysis of basic information

mation literacy. This finding indicates that the majority of the postgraduate students lack information literacy.

4.3 Evaluations of the students

Figure 6 presents the analysis of the evaluations of the students. In general, the evaluation results are very positive. Specifically, the results for Question 4 demonstrate that the majority of students want to learn skills in information search and obtain certain credits. Approximately 60% of the students prefer to practice, and 31.1% intend to add special practice time. Meanwhile, more than 95% of the students perceived that the class atmosphere is comfortable.

In terms of sharing, more than 90% agree that it is helpful. The teacher's expression is fluent, overall satisfaction is approximately 92%. However, 15.56% of students are basically satisfied with the time arrangement. Thus, this aspect should be considered carefully in the future.

According to the results, many students obtained a systematic training in information literacy. The positive effects can be concluded as follows:

- They learned many techniques regarding the use of search engines, especially command search. The process is very simple and efficient. Personal learning ability is enhanced significantly.
- They learned how to use large literature databases such as Web of Science, Springer, and CNKI. Many students mastered their skills in literature search through the course.
- They acquired a comprehensive grasp of diverse information sources and adeptly utilized literature management software such as EndNote.
- The course task was embedded in their research directions. Tshus, they received good training in their academic abilities.
- They became confident in academic research and working as an intern when faced with unfamiliar projects or tasks. Mastering fast literature study improved their working efficiency.
- The course fostered their lifelong learning ability. Students can use software to record the acquired knowledge, which is very helpful for building up personal knowledge.
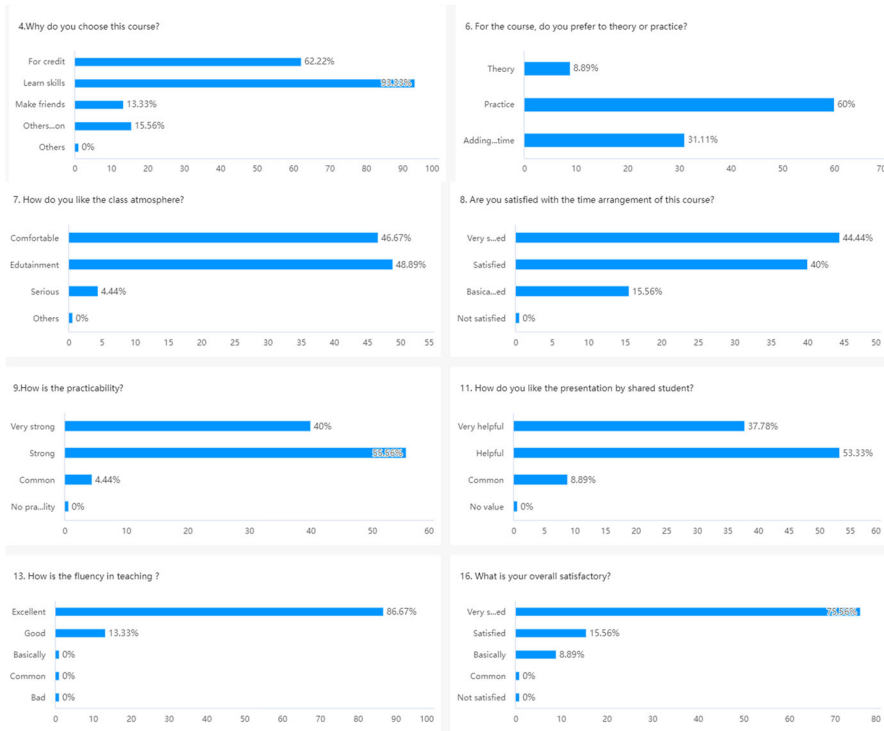
Fig. 6 Analysis of students' evaluations

4.4 Students' suggestions

Figure 7 indicates the analysis of students' suggestions. Approximately 84% of the students agree to add the sharing platform, and 96% preferred the course design as a test metric. They reported that the course is suitable for postgraduate students with different majors, backgrounds, and levels. Thus, we will adopt these positive suggestions in the future.

However, according to the suggestions from Question 15 in Fig. 4, the course has potential limitations:
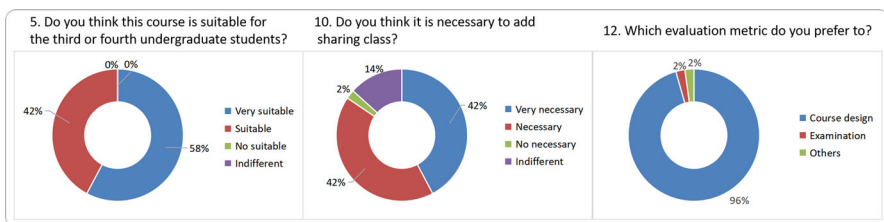

Fig. 7 Analysis of students' suggestions

- Theory teaching accounts for a large part of the course. As a result, the time for practice is insufficient.
- Online communication seems insufficient; this should be given more importance.
- A few students continue to express difficulty in identifying the top journals and conferences in one direction.
- Sharing time is insufficient.

To address these concerns, we will take specific measures in the future:

- Course contents should be optimized. Give students more time for practice. Teachers should answer questions from students in a timely manner.
- Offline teaching is encouraged to overcome the negative effects of COVID-19. Class communications will be improved.
- Examples for teaching students in conducting high-quality research and rapidly searching for the top literature should be designed.
- Sharing time will be extended, and sharing consciousness will be promoted.

4.5 The grading assessment and analysis

The grading evaluation includes two aspects, namely, ordinary (30%) and project (70%) grading. Ordinary grading is mainly based on the test records, whereas project grading is key and consists of five parts, namely, information source, literature search, literature management, literature analysis, and project report. Figure 8 presents a grading comparison between 2021 and 2022. The year 2022 students performed better (49% excellence) than the students (21% excellence) in 2021. Thanks to the establishment of the framework for information literacy, the study is hopeful that the course could provide help for prospective students.
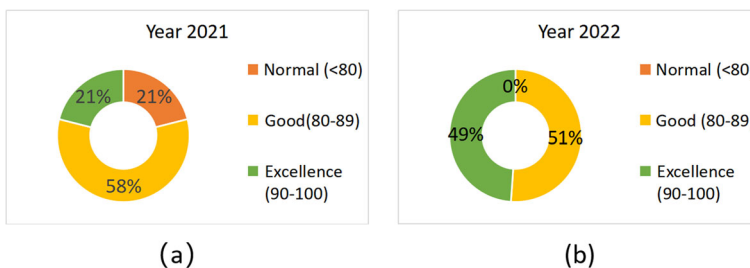

Fig. 8 Grading ratios for years (a) 2021 and (b) 2022

5 Conclusion

This paper proposes a framework for general information literacy and aims to improve the ratio and level of the information literacy of postgraduate students. The results indicate that it can enhance three abilities in students, namely, learning, academic, and innovation. After the training in information literacy, the students became confident when faced with unfamiliar projects. They can quickly search the literature and present a detailed analysis for the advances. Practical results demonstrate that the students recognized the course with a high level of satisfaction. Moreover, certain potential limitations, such as less time for practice, were pointed out. Although the framework is originally designed for postgraduate students, it is also applicable for undergraduate students, beginners for scientific research. In the future, we will constantly optimize the framework in the hopes that it can be used to enhance the abilities of more postgraduate students to solve problems.

Data Availability The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request

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