

Research article

How supervisors affect students' academic gains and research ability: An investigation through a qualitative study

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ABSTRACT

A supervisory system is an essential part of higher education and plays a vital role in cultivating the high-level talents needed for high-quality national development and social progress. This study aims to determine how supervisors affect students' academic gains and research ability. This study used a qualitative research method to select 10 postgraduate students and their 7 supervisors for in-depth interviews from May to July 2022. This study aims to address the following questions: 1. What are the modes of supervisor-student communication? 2. What impact do these modes have on students? 3. What factors affect these modes? Three discoveries were made in this study. When supervisors and students communicate only regarding the academic content and students tend to fully follow supervisors' instructions, students obtain more academic output in the short term but lack autonomy. When supervisors and students discuss academic issues and life trifles equally, it helps in promoting students' comprehensive quality. When students do not have much contact with their supervisors and they get along like strangers, it is beneficial to cultivate students' intellectual independence, but students grow slowly. The factors influencing the communication modes include the supervisors' educational philosophy, postgraduate learning attitude, and supervisory system. In conclusion, the three communication modes can coexist together in a group of students led by the same supervisor. Whether a communication mode can promote the growth of students depends on the awakening of the students' self-awareness, and the supervisory system is the most implicit factor underlying communication.

1. Introduction

A supervisor-student relationship is essentially an interpersonal relationship, and its formation and change cannot be separated from the interaction between supervisors and students [1]. A supervisory relationship not only is a matter of personal connection but also dramatically affects the cultivation of postgraduate academic research ability, achievement of personal academic goals, and realization of the teaching and research goals of schools and supervisors. A better supervisory relationship can help improving students' overall satisfaction with the study [2]. At the same time, a poor supervisory relationship can lead to depression and even dropout [3]. From a practical perspective, problems such as the alienation of the supervisor-student relationship and supervisor behavior deviation still occur from time to time, and the supervisor-student relationship still has the risk of utilitarianism and

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secularization [4]. Postgraduate students are restless and focus more on secular life outside academia. Therefore, they cannot concentrate on academic pursuits or cannot complete teaching and research tasks as required. This leads to supervisors' questioning and dissatisfaction with the students' learning attitudes and academic abilities [5]. Therefore, dealing with the supervisor-student contradiction is particularly necessary and urgent.

After the founding of the People's Republic of China, the country placed high importance on the cultivation of high-level talents. In 1953, the "Interim Measures for the Training of Graduate Students in Higher Education Institutions" was issued, officially establishing the postgraduate supervisory system [6]. Postgraduate supervisor candidates must go through a process of personal application and approval by school administrators through a voting process before they can assume the role of a supervisor. In the educational management system, postgraduate supervisors are responsible for comprehensively guiding students in aspects of academic research, life, and moral development [7]. In the aspect of the study, postgraduate students need to communicate with their supervisors in various aspects, such as enrollment, acquisition of professional knowledge, scientific research and training, thesis topic selection, thesis writing and defense, and degree awarding. In some aspects of life, supervisors need to communicate with postgraduate students and care about their physical, mental, and emotional statuses, which gives a parental role to postgraduate supervisors [8].

The positive manifestations of supervisory relationships are based on trust, support, respect, cooperation, and empowerment, which foster students' feelings of self-recognition and self-worth [9]. In the matter of building supervisory relationships, some scholars believe that the factor of power can never be neglected, and that the supervisory relationships should be built based on it. Supervisors have the right to judge students' academic performance [10]. Supervisory relationships metaphorically include authorship, discipleship, and apprenticeship, which have strong implications for superiors and subordinates [11]. There are five collaborative relationships between postgraduate students and their advisors, ranging from minor to major conflicts: supervisorship, task, love, passing, and resentment [12]. Meanwhile, many scholars have analyzed and constructed supervisory relationships from a psychological perspective. Suzanne analyzed supervisory relationships from the perspective of basic psychological needs, including autonomy, competence, and relatedness [13].

The main problems of supervisors include the lack of availability to schedule meetings with the students, lack of prompt and timely feedback, lack of practical and professional knowledge, and lack of flexibility and openness to different students' circumstances and many PhD students [14]. Supervisors clearly support impacts that can contribute to students' research and innovation efforts [15], and this support is the greatest predictor of doctoral student satisfaction [16]. The postgraduate supervisory system is also an essential factor influencing the supervisor-student relationship. Salinas Perez studied the factors affecting the completion of doctoral studies and grouped the key factors into four categories: institutional context, program context, support context, and personal context [17]. In the process of postgraduate cultivation, positive feedback from supervisors and postgraduate students is the most effective for the learning and teaching abilities of students and supervisors [18]. Interrupted communication and poor feedback are the essential causes of poor postgraduate student-advisor relationships [19]. Equal communication is a common understanding of the ideal supervisor-student relationship between postgraduate students and supervisors [20].

Regarding detailed construction strategies, Howells believes that gratitude is conducive to improving supervisory relationships, including building trust, enhancing communication, and improving self-motivation and creativity [21]. The conversation tool of storytelling is used to build a healthy shared knowledge domain and to ensure agreement between both parties [22]. The peer support mechanism between students can alleviate the supervisors' efforts in transitional guidance to some extent, help in improving the quality and efficacy of supervision, and thus promote the supervisory relationship [23]. The most essential difference is due to whether they feel continuous progress in a meaningful research project without much distress [24]. Their academic researchers are linked to funded projects that can provide students with a sense of goal, meaning, and self-motivation [25].

In previous studies, there are mainly five types of relationships between supervisors and postgraduate students. Apprenticeship: supervisors lead students during research, which is a typical type [26]. Employment relationship: supervisors act as the boss of the students [27]. Tutoring relationship: supervisors teach, preach, and dispel doubts [28]. Supervisorship: supervisors assume a supervising role, and students perform research independently under supervision [29]. Partnership: supervisors and students are equal in personality, and they cooperate to pursue common development and growth in specialty and values based on clearly defined rights and obligations [30].

Studies have shown that schools, supervisors, and students are all subjects in building relationships. Establishing a harmonious and healthy relationship requires joint efforts from the three parties. Research has been conducted on supervisor-student communication from the perspective of supervisor power, supervisorship, and the psychology of graduate-student reactions. Findings provide research ideas for this study. Previous studies cannot tell us how to examine the supervisor-student relationship and its impact on the growth of postgraduate students. This study will also examine the supervisor-student relationship and its impact on postgraduate students' growth from the perspective of supervisor-student interactions.

This study aims to investigate how supervisors affect students' academic gains and which supervisory styles can contribute to students' academic gains. This study breaks through the traditional simple instructional relationship between supervisors and students and offers a new classification of the supervisor-student relationship from the perspective of communication modes. Communication modes provide a more diverse perspective for understanding and analyzing the supervisor-student relationship, which can also enhance the quality of graduate education. Building a suitable supervisor-student relationship is the key to solving the challenges of graduate education and is the essential aspect and pathway for innovative talent cultivation and quality development of graduate education. Effective strategies for building suitable supervisor-student relationships can be found from the perspectives of rational interaction and supervisory guidelines between supervisors and students. Therefore, this study will address the following questions.

1. What are the modes of supervisor-student communication?

2. What impact do these modes have on students?
3. What factors affect these modes?

2. Materials and methods

The authors obtained informed consent from all subjects who participated in the study. This study was approved by the Ethical Committee of Zhejiang Normal University (protocol number: ZSRT2023008) and was conducted in accordance with the principles of the Declaration of Helsinki.

2.1. Research methods

This study adopts a qualitative research method of empirical research. Regarding the data collection methods used in this study, although qualitative data collection techniques such as observation and documentation studies have unique values, they have distinct deficiencies. The method of observation may be influenced by the observer's subjectivity, leading to questionable objectivity and accuracy of the data. Documentation studies may not access the most recent or real-time data, and the quality, completeness, and availability of documents can affect the credibility of the research results. By contrast, in-depth interviews can delve into the complicated reasons underlying the interview subjects' responses, thus providing rich qualitative information. Therefore, an in-depth interview was adopted as the data collection method rather than other methods such as observation and documentation studies. The interviews were conducted according to the prepared interview outline and then the original corpus was established based on the collected interview data. The corpus was then analyzed, summarized, and encoded according to the grounded theory to answer the questions of what communication modes exist between supervisors and postgraduate students, and what impact do the modes have on both sides.

2.2. Participants and data collection

Among the 10 interviewed students from five different majors, namely, education, science, engineering, philosophy, and literature, 6 were postgraduate students and 4 were doctoral students, with 5 males and 5 females. Three of them failed to graduate on time. All interviews were face-to-face interviews. The interviews lasted from May to July 2022 for approximately 70 days. Each interview lasted between 40 min to an hour, and some lasted approximately one and a half hour. The interview venues, such as the student dormitory, restroom, offices, chat room, and classroom, were relatively quiet. The 10 postgraduate students' interviews with their supervisors had reached theoretical saturation, and the new concepts and genera could not be produced at the 11th interview. Therefore, only data from 10 interviews were presented in this study. The interview data of the 10 postgraduate students were called as follows: S1, S2, ..., S10. The characteristics of the student interviewees are shown in [Table 1](#).

The supervisors of the 10 students were also interviewed in this study. Students S1 and S2 had the same supervisor, S4 and S5 had the same supervisor, and S8 and S10 had the same supervisor. Although there were students with the same supervisor, the supervisor managed them according to their conditions and had different supervision modes for each student. Therefore, although seven supervisors were interviewed in this study, the actual interview asked each supervisor to discuss his/her views on each student alone. Finally, 10 interviews were mutually verified with the student interviews. The supervisors come from five specialties, including five professors and two associate professors. Among them, four were males and three were females, with teaching experience ranging from 8 to 33 years and students' successful graduation rates between 90 % and 100 %. The interview time and method were the same as those of the student interview. The interview venues were offices and empty classrooms. The interview data of the 10 postgraduate supervisors were called T1, T2, ..., T10. The characteristics of the supervisor interviewees are shown in [Table 2](#).

Table 1

Basic information of the interviewed students.

Student	Specialty	Sex	Po-d	Grade	Ra-i-c	Wh-r-s	Da-o-i	Ve-o-i
S1	Education	Female	Doctoral	Delayed	Last 10 %	No	2022-05-05	Dormitory
S2	Education	Female	Master	2 nd year	Top 10 %	Yes	2022-05-13	Office
S3	Science	Male	Doctoral	2 nd year	10%–20 %	Yes	2022-05-18	Classroom
S4	Engineering	Male	Master	1st year	70%–80 %	No	2022-05-20	Restroom
S5	Engineering	Male	Master	Delayed	Last 10 %	No	2022-05-23	Office
S6	Philosophy	Female	Master	2 nd year	50%–60 %	Yes	2022-06-05	Dorm
S7	Philosophy	Female	Master	3rd year	Top 10 %	Yes	2022-06-25	Chat room
S8	Literature	Male	Doctoral	3rd year	Top 10 %	Yes	2022-07-01	Office
S9	Literature	Female	Doctoral	3rd year	30%–40 %	Yes	2022-07-03	Restroom
S10	Literature	Female	Doctoral	Delayed	Last 10 %	No	2022-07-15	Office

Abbreviations: Po-d, postgraduate degree; Ra-i-c, ranking in class; Wh-r-s, whether respect supervisor; Da-o-i, date of interview; Ve-o-i, venue of interview.

Table 2
Basic information of the interviewed supervisors.

Supervisor	Specialty	Sex	Pr-t	Te-y	St-o-g	Nu-o-c-s-s	Da-o-i	Ve-o-i
T1	Education	Female	Professor	31	95 %	10	2022-05-06	Office
T2	Education	Female	Professor	31	95 %	10	2022-05-06	Office
T3	Science	Male	Professor	28	100 %	4	2022-07-18	Office
T4	Engineering	Male	Associate professor	18	90 %	11	2022-05-20	Empty classroom
T5	Engineering	Male	Associate professor	18	90 %	11	2022-05-20	Empty classroom
T6	Philosophy	Male	Associate professor	13	100 %	3	2022-07-05	Office
T7	Philosophy	Female	Professor	19	100 %	4	2022-06-21	Office
T8	Literature	Male	Professor	33	95 %	13	2022-07-09	Office
T9	Literature	Female	Professor	26	100 %	6	2022-06-13	Office
T10	Literature	Male	Professor	33	95 %	13	2022-07-09	Office

Abbreviations: Pr-t, professional title; Te-y, teaching years; St-o-g, students' on-time graduation rate; Nu-o-c-s-s, number of current supervised students; Da-o-i, date of the interview; Ve-o-i, venue of interview.

2.3. Interview outline

The interview questions in this study were designed with reference to J. Habermas' theory of communicative action. Starting from the actual state of social communication, Habermas divided interpersonal relationships into two dimensions: surface and deep. He believed that in reality, the best state of interpersonal relationships must correctly deal with the problems of interaction and communication [31]. Habermas' theory believes that any subjective consciousness cannot be formed in isolation and that ideas are always formed gradually in communication. Communicative actions are based on a strong consensus on language understanding. The function of language is to establish or maintain a certain social relationship, play a role of negotiation and coordination, and have a binding force on actions [32].

This study interviewed 10 postgraduate students and their 7 supervisors from one university. This school was chosen because of its early establishment and comprehensive range of disciplines, as well as its mature model for talent training, so the study's findings would be typical. The interviewees agreed to participate in all interviews. The interviews centered on the following five aspects: communication method, communication content, impact of communication (students' gains), factors (students' learning attitude, students' attitude toward supervisors, supervisors' educational philosophy), and problems and solutions. Details are shown in Table 3.

2.4. Data analysis

The interview materials were read and listened to several times, transcribed into texts, and finally written down as preliminary ideas for coding and analysis. The codes and larger themes were identified. During the open-coding phase, each transcript was reviewed section by section to identify themes, keywords, or phrases related to each research question, and then assign initial codes to them. During the axial coding phase, the previously open-encoded data were further examined to identify and classify discrete concepts, rather than perfecting the themes. This step focuses on the theme categories related to the research questions and analyzes the data in detail to form thematic coding. In qualitative research, data saturation refers to the point at which additional data (such as interviews and observations) no longer introduce new information or themes, and the existing data are deemed sufficient to describe and explain the research question. It is considered an indicator that data collection can be concluded. In this study, no new concepts or

Table 3
Interview outline.

Interviewees	Dimension of questions	Questions
postgraduate students	Communication way	1. How often do you contact your supervisor? What is the main content of the contact? What is the contact way (face-to-face, phone call, We Chat, etc.)? Is it you or your supervisor who contact the other?
	Communication content	2. What type of guidance does your supervisor provide (study, life, social skills, etc.)?
	Students' learning attitude	3. Do you dare to express your opinions in front of your supervisor? Why?
	Students' attitude toward supervisor	4. Do you like the way to communicate with your supervisor now? Why do you like it or not?
Supervisors	Students' gains	5. How do you interact with your supervisor to help you grow? What types of growth? If not, what do you think causes it? Are there any solutions?
	Communication way	1. How do you contact postgraduate students? How often do you contact them? Is it you or your students who contact the other?
	Communication content	2. How do you usually supervise and manage your postgraduate students? What types of supervision and management are mainly involved?
	Supervisors' educational philosophy	3. How do your postgraduate students respond to your supervision and management? What do you want them to do with your supervision
	Students' gains	4. Do you think your students have gained significantly under your supervision? What harvest do you think it brought?
Problems and solutions	5. What is your ideal supervisory relationship in your mind? What do you think supervisors should do to establish the ideal supervisory relationship? What should postgraduate students do?	

categories were found after analyzing the 11th interview data. Thus, we concluded that 10 pairs of supervisors and students provided sufficient and appropriate information.

This study verified the validity and credibility of the data in the following ways: First, guarantee the credibility of the data sources. This study used mutual verification of data between supervisors and postgraduate students to ensure the credibility of the information by interviewing both postgraduate students and their supervisors. Second, guarantee the representativeness of the data sources. Considering disciplinary differences and cultural variations, this study selected postgraduate students and their supervisors from the following five disciplines: education, science, engineering, philosophy, and literature. Third, guarantee the scientific nature of the data collection methods. This study prepared an interview outline before the interviews and conducted preinterviews. On the basis of the data collected from preinterviews, the interview outline was adjusted to arrive at a scientifically prepared interview outline. During the interviews, this study strictly adhered to research ethics and ensured that no leading words were used and appropriate follow-up questions were asked. Fourth, in the data analysis process, two researchers coded the interview materials simultaneously to identify the codes agreed upon by both researchers.

3. Results

3.1. Supervisor-student communication mode

3.1.1. Subordinate mode

In the subordinate communication mode, supervisors and students only communicate regarding academic content, which does not involve life or emotional interaction. In communication with students, supervisor shows absolute authority as a teacher, and the students should obey the supervisors. In this hierarchical relationship, the supervisors are used to being in a high position, using authority, and giving orders, and students tend to fully accept the supervisor's instructions.

From the students' point of view, the first manifestation of subordinate communication is that everything is determined by the supervisor. The supervisor's responsibility is to guide postgraduate students in professional training and scientific research so that they can achieve higher academic development. However, some interviewees said that in the cultivation process, the supervisor did not respect and ignored the scientific research interests of postgraduate students and forcibly required them to engage in their scientific research projects or the process of academic guidance. The supervisor did not want to give students the opportunity and chances to conduct their own proper research or opinions. This supervisor-student contradiction is mainly caused by students' derivative feelings because of the lack of expression and interests, and the weakened sense of supervisor responsibilities [33]. For example, the supervisor assigns a thesis topic to the student, or the usual experiments and projects of the postgraduate students must be completed according to the supervisor's ideas. Even if students have different opinions on academic research, they should follow the supervisor's ideas instead.

"The first rule of postgraduate students is to absolutely obey the supervisor's order unconditionally, regardless of whether the supervisor's order is right or wrong. My supervisor is a very powerful man who wants us to obey his orders unconditionally. When I first entered the school, he gave me a thesis topic on what I should conduct my research. I felt too big to do it down. I tentatively asked him if he could change the topic. He was very angry about the fact that I questioned his chosen topic. Since then, our communication has been my absolute obedience to his orders." (S6)

From the students' point of view, the manifestation of subordinate communication is that students perform everything on behalf of the supervisor's arrangement. Some of the interviewed postgraduate students said that they had no ideas and hoped that the supervisor arranged everything. These postgraduate students lack academic career planning, and communication with supervisors is not based on their need for supervisor support but assumes that their relationship with supervisors is like a superior-subordinate or employer-employee relationship.

"I am a person without any life plan, and I need my supervisor to tell me what to do, not to tell me how to decide. This makes me notice that when I communicate with my supervisor, our dialogue is limited. We are just like the relationship between employer and employee, and I am the executor of the supervisor's orders." (S8)

From the supervisors' point of view, the manifestation of subordinate communication is that a supervisor tells the students what to do. Even if the students cannot understand, they can think while doing and finally understand the supervisor's idea. Supervisors are essential guides for doctoral students, who advise on research issues, provide research opportunities, and serve as role models for students [14]. Interview results showed that supervisors tended to define the lead relationship as an interaction-related type of academic communication. Supervisors position themselves as persons with academic sense, profound knowledge, and clear logical thinking. The students are just considered new in the academic field. The unequal academic statuses of the supervisors and the students lead to the lack of academic dialogue between both parties. Therefore, the students only need to follow the supervisor's academic guidance.

"I tend to define the supervisor-student relationship as a formal professional relationship, and the supervisor should take a formal attitude of authority. The first time I met my students, I told them clearly that the supervisor is only responsible for their studies, that the supervisor's ideas are carefully considered and that the students do not need to question the supervisor's authority to follow instructions." (T8)

From the perspectives of the students and the supervisor relationship, the logical starting point of the subordinate communication between the supervisor and the students is as follows: the supervisor is the academic leader, the student is the follower and listener and

the supervisor is the academic authority in the eyes of the students. This type of communication always generates academic hegemony between supervisors and students. The hegemonic supervisor wants to decide what the student does academically, and students with no ideas want the supervisor to help them decide regarding all affairs. In addition, in the postgraduate education field, students will rely on the guidance and evaluation of their supervisors, usually obeying the authority of the supervisors in return for guidance and evaluation.

3.1.2. Friend mode

In the friend communication mode, supervisors and students discuss academic issues and life trifles in an equal way. In terms of academia, supervisors assume the responsibility of preaching, teaching, and communicating academic issues and research methods with students on an equal basis. In terms of life, supervisors and students are like friends who dine together; exchange life experiences, life confusion, and emotional twists and turns; and give warmth to each other. In the eyes of doctoral students, supervisors represent reliability, confidence, inspiration, professional knowledge, rich information, and an active sharing person [16]. Supervisors should know how to listen, encourage discussion and debate, provide continuous feedback and support, show enthusiasm, and understand others. This supervisory method shows that the relationship between supervisors and students is very harmonious and easy-going.

From the perspective of the students, supervisors are similar to leaders on formal academic occasions and intimate friends on formal occasions. Supervisors are serious regarding academics and are interesting persons in daily life. Therefore, when supervisors associate with students, they will be serious on formal academic occasions, and on informal occasions, they will talk with students regarding life. Doctoral education is not only a social activity regarding all-round development of students but also an emotional practice of learning [34]. It is crucial to construct the structure of the interrelated and mutually influencing emotional relationship between supervisors and students.

“I communicate a lot with my supervisor, and she is like my academically and my friend in life. In my studies, she gave me a lot of help, helped me recommend relevant references, discussed the paper with me, and gave me suggestions on how to revise my papers. In life, she taught me her philosophy of life and is willing to share life trifles with me. I learned a lot from my supervisor, and I am glad to have met her.” (S3)

From the perspective of the supervisors, the friend mode is shown as follows: students are willing to communicate with supervisors. Supervisors can understand students' academic progress and emotional state in a timely manner through communication with students and give them academic and life help according to student conditions. In friend communication, supervisors regard themselves as “elders” and help students to grow up and develop their skills. Supervisors believe that postgraduate students should read a number of literature reviews to improve their professional quality, actively participate in academic conferences and social investigations to train their academic thinking and scientific research ability, and finally form a rigorous academic attitude and correct academic pursuit. As “academic gatekeepers”, supervisors have their own academic standards and judgment principles. They stick to their academic bottom line in complex social situations and interpersonal relationships and should urge students to meet requirements.

“Although I am a supervisor now, I was also a student more than a decade ago, so I can quite understand my students' confusion in their study and their distress about life. I hope to use my own experience to help them growing up smoothly in their future endeavors. When they recall me in the future, they will not feel any waste of time or nothingness in their study. Supervisors are not only academic guides but also a helper in life for students.” (T3)

Friend communication is based on a good supervisory relationship. The so-called relationship refers to a relationship formed by postgraduate students in completing professional courses under the guidance of their supervisors, participating in scientific research, writing courses and dissertations, publishing academic articles, and learning to do things and behave in this process. The main task of students is to study and develop their skills. The supervisor is the instructor of postgraduate academic work, teaching scientific research methods and academic norms. When supervisors guide students, treating students as professionals should pay attention to their intelligence and emotion to cultivate students' academic research ability and achieve all-round development.

3.1.3. Stranger mode

Stranger communication mode means that students usually do not have much contact with their supervisors and get along like strangers. The alienation between supervisors and students is manifested as caring of their own behavior [35]. When they get along with the students, they have a careless attitude and casually guide them. The students will also feel that getting along with the supervisor will make them feel depressed and uncomfortable, and they do not contact the supervisor unless necessary. This type of communication is just out of a nominal supervisor-student relationship. Essentially, they communicate nothing substantial.

From students' perspective, stranger communication is manifested as follows: they avoid contact with the supervisors. Students choose not to contact the supervisors because they do not want to disturb them, are unwilling to get along with the supervisors, or want to have their independent activities. If they encounter problems in the learning process, they will seek help from their classmates, seniors, and peers and will not contact their supervisors unless necessary.

“I never contact my supervisor unless I have to sign him and cannot solve it myself; I will contact him. It takes only 5 minutes at most, even if you find a supervisor. I don't like bothering my supervisor, so I will never ask for his help. I usually have my schedule, and I am afraid that contacting my supervisor will disrupt the pace of my life. Not connecting is my ideal relationship with my supervisor.” (S7)

From the supervisors' point of view, stranger communication is manifested as follows: Supervisors should not disrupt the pace of

students' independent growth. Supervisors think that students should be responsible for their growth. When students do not take the initiative to seek help from them, they will not take the initiative to contact students or help them. In this type of communication, supervisors are regarded as academic partners to students rather than as guides. Students are independent adults who need to be responsible for their behaviors and have their own pace of life and learning style.

“Supervisors and students are equal academic partnerships, so I never contact my students to give them suggestions. They have reached the legal age of adulthood and are adults. Adults need to know what to do, what plans they need, and when to seek help. If the supervisor takes the initiative to contact the students, it will destroy their growth and is not conducive to the growth of the students.” (T7)

When strangers do not take the initiative to contact others, supervisors and students follow independent communication principles and are unwilling to disturb each other's lives. However, supervisors and students maintain their relative independence. Such a supervisor-student relationship will also expose the lack of care and guidance for students, and students lack recognition and trust for supervisors.

3.2. Impact of supervisor-student relationships

3.2.1. Subordinate mode makes students have academic output in the short term but lack autonomy

The subordinate communication mode has two effects on students' development. It helps students obtain academic achievements in a short given term but is not conducive to cultivating students' creativity and independent development ability, which makes students lack autonomy. Good interpersonal relationships between supervisors and students are associated with good academic progress and student satisfaction. Research on supervisor behaviors shows that psychological and social counseling directly affects doctoral students' self-efficacy, self-confidence, and self-identification [36]. Students need supervisors early in the research field to help them find the right path of academic research. In the early stage of academic research, students obey the orders of their supervisors and get along with them in the superior-subordinate mode, which facilitates students' academic output. However, from the perspective of the students' entire academic careers, students who blindly obey the orders of their supervisors will lose academic thinking and desire academic exploration. Once they are separated from the guidance of their supervisors, their academic careers will be very difficult.

Supervisors play a crucial role in the success or failure of the early stage of the postgraduate academic career. The communication between superiors and subordinates will give students' academic output in the short term. Superior and subordinate obedience communication is supervisor-centered and academic-oriented, the supervisor is the publisher of instructions, and the student is the executor of instructions. At the beginning of their postgraduate academic career, students' knowledge reservoir, learning methods, learning attitude, and learning habits are all fully mature and their cognition of scientific research is in the initial stage, requiring the guidance of supervisors. Therefore, students executing the supervisor's order according to the supervisor's requirements will avoid the process of experiment and exploration, can quickly obtain the expected research results, and can obtain academic output in the short term.

“I do projects completely with my supervisor. The supervisor is my boss. I will do what my boss asks me to do. Now I have been in school for more than a year, and I have sent two academic papers, which should be the person who sent the most papers in our grade. I also won this year's national scholarship. I don't need to think about what I need to do. My supervisor will tell me the outline of the papers, and I will just fill it in. I can't think about anything, and my supervisor won't listen to me.” (S8)

The process of postgraduate students' study in the academic field is also a process of separation from the protection of their supervisors and continuous growth. Subordinate communication is not conducive to the cultivation of students' innovation and creativity. The controlling style greatly influences less active postgraduate students [37]. Students follow supervisors' research methods, thinking logic, language expression skills, etc. Students will eventually break away from their supervisors and use the knowledge and skills learned from their supervisors to conduct research independently and become excellent researchers. Knowledge innovation requires scientific researchers to constantly explore, maintain persistent enthusiasm, and always maintain a state of innovation. Essentially, they should be courageous to not give up despite setbacks. Subordinate communication is the process of students implementing the supervisor's thinking, which is the repetition and verification of the supervisor's labor. From the perspective of a student's entire academic career, this communication mode cannot cultivate students' ability to think independently and the courage to perform experiments independently.

“Although I have been studying with my supervisor for 3 years and will soon postgraduate, I seem to have been following my supervisor's thinking. I will not design my research projects or publish academic papers by myself. I sometimes feel like I'm just the implementer of my supervisor, not the creator of my ideas, and that's pretty good. If I can rechoose my postgraduate life, I am willing to leave the guidance of my supervisor and find the research field and issues in which I am interested.” (S9)

Subordinate communication is an efficient academic guidance method. The supervisor tells the students his or her ideas, and the students unconditionally implement the supervisor's ideas. In the early days of their academic career, this type of communication helps students quickly enter the academic path. However, in the long run, the goal of postgraduate students learning with their supervisors is not to imitate them successfully but to surpass them. This society does not lack people who can execute orders; it lacks people who can innovate and create.

3.2.2. *Friend mode promotes students' comprehensive quality*

The friend communication mode plays a crucial role in promoting students' comprehensive quality. Supervisors evoke and cultivate intellectual and moral qualities in students to adapt to the demands of society. Postgraduate education is essentially an educational interaction based on profound knowledge. On the one hand, postgraduate students receive guidance in academic communication from their supervisors to promote their academic level and ability; on the other hand, postgraduate students are influenced by the academic attitude, personality, and character of their supervisors and enhance their thinking ability and morality.

The supervisor is the academic and life guide in the postgraduate study process. The supervisor's guidance to postgraduate students includes both the awakening of academic ability and emotional satisfaction in life. In the process of getting along with their supervisors, the care that the students feel will stimulate their motivation to study, help them cope with the difficulties and obstacles in the process of academic exploration, help them adjust their emotions in time, and always appear to the public as a lover of life.

"At the very beginning, I was very confused about postgraduate life. My supervisor gave me great help. With the help of my supervisor, I not only gained my academic ability and the courage to face life actively. My supervisor is a highly respected scholar. He always answers my every question patiently and carefully, carefully changes every paper I submit from beginning to end, and often cares about my recent situation in my life. Getting along with my supervisor makes me feel very warm." (S3)

Supervisors can be students' academic explorers, can sit and talk with them, and can give them help and care when they are confused and have self-doubt. More than one interviewee said that the most conducive to their growth and ideal communication mode is strict and tentative supervision in academics, caring of students' daily life, and sharing their daily fun.

3.2.3. *Stranger mode cultivates students' independence but makes them grow slowly*

The stranger communication mode makes students find solutions to their problems and have a strong ability to solve problems independently. However, the lack of guidance from supervisors makes them grow more slowly. There is little contact between the supervisors and the postgraduate students. They neglect their guidance to postgraduate students because of their busy work, heavy scientific research tasks, and lack of sense of responsibility. Intimacy and alienation are related to regulating the distance between the supervisor and the educated. Education is a type of relational practice that promotes the growth of a new generation through interpersonal influence. If supervisors do not establish relationships with students and do not informalize the relationship to reach some degree of affinity, it is difficult to gain trust from students and impossible to implement real education. Poor communication can cause students to feel insecure, and psychological safety is crucial for supervisory relationships. High psychological safety will make students perform better in their studies and research, whereas low psychological safety will hinder innovation and cooperation [36].

The lack of communication between supervisors and students and emotional interaction is not conducive to cultivating students' abilities. Supervisory relationships are critical to students' professional, cognitive, and emotional development [15]. When the communication between a doctoral student and his/her supervisor is interrupted or the supervisor's guidance is lost, similar to orphans, students' research experience will be hindered, affecting their academic identity and ability development [38]. Because of students' timidity of supervisors and the lack of timely positive and effective communication, the gap and distance between supervisors and students will become increasingly larger as time lengthens, affecting the emotions of supervisors and students. To cultivate students' abilities, a supervisory system with communication and clash of ideas as the core is more conducive to promoting the development of students.

"Their exploration process of relying on their own. In this process, they must make trial and error, and finally, they can find the right answer. However, many times, they can find the right after trial and error. Trial and error are a lot of costs, usually a waste of time, energy, and sometimes a waste of money." (S5)

Communication is the internal power of the supervisor-student relationship. There is no fierce conflict between the two sides. They are in a state of superficial harmony and peace, but the actual communication frequency is not high. The low frequency of communication between supervisors and students, less attention from both sides, and little dialogue and communication are not conducive to the guidance of postgraduate students or the growth of students. In that case, they will feel like lonely explorers with too little support and guidance and a lack of clear goals and direction, thus leading to low scientific research efficiency and low self-efficacy [39]. The positive emotional interaction between supervisors and students will help students improve their academic ability and help students develop a correct attitude toward life. Just like communicating with your acquaintances and friends, you can get ideas and methods to solve problems and can cultivate the courage and attitude to treat problems correctly in the process of solving problems. Moderate, regular, and active communication helps in improving students' comprehensive quality.

3.2.4. *Influencing factors*

The influencing factors of supervisor-student communication can be summarized into three aspects: the supervisor's educational philosophy, students' learning attitude, and supervisory system.

3.2.5. *Supervisors' educational philosophy*

Supervisors and students are the subjects of communication. From the side of supervisors, it can be found that the supervisor's educational philosophy is the most essential influencing factor. In particular, the educational philosophy of supervisors can be divided into two types. One is that supervisor practice the teaching style and intervene in students' growth. The other is that they advocate the inductive style and assume that students are willing to bear responsibility for their study without any intervention from supervisors. Supervisors have two different educational philosophies, which come up with different ways to get along with students. The two ideas

have different effects on students' academic gains and research ability.

Supervisors interfere with the academic gains and research ability of students. On the basis of students' knowledge accumulation degree, learning ability, and academic accomplishment, supervisors regard students as learners or followers rather than as equal counterparts. In this educational philosophy of supervisors, the students' and supervisors' academic statuses are not equal. Supervisors are at a high level, and students are at a low level. This educational philosophy is not entirely to suppress students. Instead, it helps students grow up rapidly in some cases. The supportive guidance of supervisors can cultivate students' academic interests and can create development opportunities for them [40]. Supervisors regard the process of student execution as the process of students' academic practice. Supervisors hope that students can practice and will eventually become scholars who can conduct research independently according to supervisors' academic research paradigm.

“Students are not qualified to question. A student does not understand the supervisor's instructions now. This does not mean that the supervisor's suggestion is wrong. If a student has a certain academic accumulation, it is easier for him to understand what the supervisor said. The only thing that students can do is to execute the supervisor's instructions and improve themselves in the implementation process.” (T2)

Concerning nonguiding teaching methods, supervisors do not actively interfere in the growth of students. Under the guidance of this educational philosophy, supervisors do not contact students for the following reasons. They regard students as independent individuals who can find research problems and conduct research, so they do not take the initiative to contact students. Supervisors are too busy with administrative affairs, so that they have no time to guide students. Supervisors themselves grew up in the academic background of independent exploration, so they guide students according to their growth history. They will feel that intensive help for students is a failure of education, so they do not guide students.

“Education is an interactive activity of influence, not an activity of command and execution. I do not advocate interfering in the growth of students. I encourage them to read literature, find research problems, and solve them themselves. The results of the students exploring are their things. Of course, some supervisors are too busy to guide their students. Whether guided or not, students need to understand that they are independent scholars.” (T5)

The educational philosophy affects educational action. The different educational philosophies of supervisors are reflected in the supervisor-student relationship as the communication modes of subordinates, friends, and strangers.

3.2.6. *Postgraduates' learning attitude*

Student learning attitude is the greatest factor affecting supervisor-student communication. Student-related causes include avoidant relationships, perfunctory relationships, and conflicting relationships, and complex causes include academic-bewildering relationships and misconduct relationships [41]. Students who rely on supervisors as a normal state will not try their best to solve problems by themselves. They do not want to break their limits to cultivate their abilities but hope that supervisors can help them as much as possible. There is a two-way interaction between supervisors and postgraduate students. The academic supervising practices of supervisors affect the relationship. Whether postgraduate students have a strong thirst for knowledge, whether they can study consciously, and whether they are mature enough are also crucial factors affecting the relationship. The stronger the academic curiosity and initiative that postgraduate students have, the timelier the guidance and feedback are received, and the more interaction occurs between the two sides. By contrast, if postgraduate students are indifferent or perfunctory to the tasks assigned by supervisors, supervisors will certainly not give timely feedback and effective guidance, which will affect the relationship between the two sides.

The postgraduate learning attitude also affects the attitude of how supervisors treat them. An inactive learning attitude will hinder communication between supervisors and students. Each supervisor has his research field, main research direction, and unique research style. If postgraduate students do not have a correct learning attitude and are not interested in the research direction of their supervisors, they may feel that they do not like their supervisors' supervising style or the supervisors cannot give them effective guidance. This will consequently make them unwilling to communicate with supervisors. The inactive learning attitude of some students is also reflected in their low academic efficiency. Students feel that the gap of academic merits between the supervisor and themselves is very large, so they have some sense of fear and inferiority toward their supervisor and worry about being disliked or blamed by their supervisor. Thus, they do not communicate with them.

“I do not communicate with my supervisor now; it can be said that because my learning attitude is wrong. I am not interested in the content of my supervisor's research, I like theoretical discussion, and my supervisor is engaged in quantitative research. I felt my supervisor's advice did not make sense to me, so I did not want to meet my supervisor. I always think studying for a PhD. means learning to be my supervisor.” (S1)

The active learning attitude of postgraduate students will encourage them to keep up with their supervisors and actively seek help. Some postgraduate students said that their choice and determination of their research direction during their postgraduate study are closely related to their supervisors, usually choosing a field of interest from the research field of their supervisors as their specialized direction. For most postgraduate students who have just entered the field of scientific research, it is difficult to quickly determine their research interests and it is more crucial to gradually find research problems in the process of learning and exploration. An active learning attitude can encourage students to obtain timely guidance and feedback from their supervisors and avoid academic detours. After being supported by their supervisors, students will stimulate their creative motivation and bravely try to study their ideas [42].

“Now I can successfully meet the graduation requirements. It is much related to my learning attitude. I am an active person. When you don’t know anything, go ask the supervisor. We are academic beginners, and the supervisor has been in the academic community for many years. Therefore, following the pace of the supervisor won’t be wrong. I’m very willing to follow my supervisor.” (S2)

The supervisor-student relationship focuses on interpersonal dialogue and communication with common interests and ideas. As people with subjectivity, both supervisors and postgraduate students should inevitably get out of their subjective rationality and embrace the rationality of collective and multidirectional communication in various academic exchanges. Therefore, students’ learning attitudes affect the emotional communication and establishment of intimate relationships between supervisors and students.

3.2.7. Supervisory system

The supervisory management system refers to the factors that will affect the communication mode, except for the subjective factors of supervisors and postgraduate students. Supervisory relationship is in an intersubject relationship that affects each other [43]. The unclear definition of supervisors’ responsibilities in student management is a crucial factor causing the different communication modes between supervisors and students. In the current system of higher education, supervisors are responsible for students’ affairs in school. However, the supervisors’ responsibilities in each school are not specified or clear, and there are no specific rules and regulations or legal provisions governing the supervisors’ power. The authority of supervisors is flexible, and each school has different regulations on the power enjoyed between supervisors and students. Some schools implement the signature responsibility mechanism for the development of students. Postgraduate activities need supervisors’ recognition, but postgraduate students have less choice to act independently. In some schools, supervisors are responsible for students’ academic affairs, counselors and administrators are responsible for students’ nonacademic affairs, and supervisors have limited management power over postgraduate students. In schools where the power of supervisors is vague, students tend to establish a stable communication mode according to the supervisor’s guidance and educational philosophy. The relationship between supervisors and students is unequal in the postgraduate education and cultivation mechanism. Supervisors play a crucial role or even a dominant position in students’ scientific research direction, research subsidies, paper publication and signature, and graduation, which largely affects communication.

4. Summary of the findings

On the basis of the previous findings, the causes, communication modes, and influence of supervisor-student relationships are illustrated in Fig. 1. The figure explains how postgraduate students’ academic gains are influenced by different communication modes

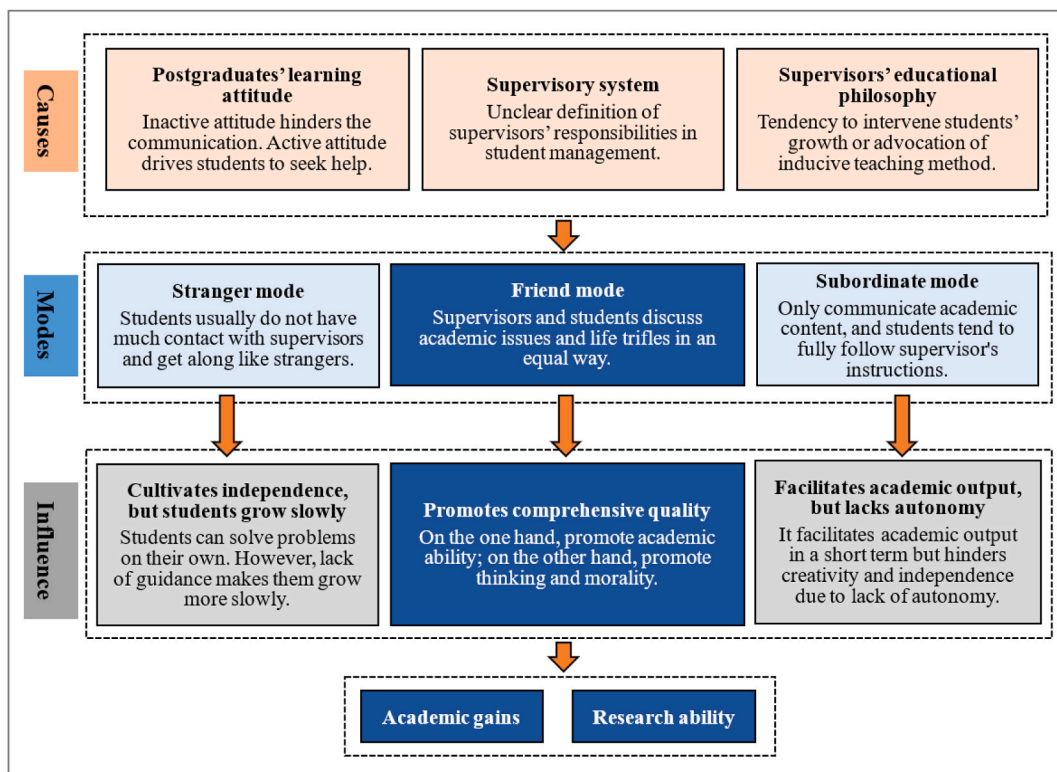


Fig. 1. Illustration of supervisor-student relationships.

and the cause of the formation of these modes. “Postgraduates’ learning attitude”, “supervisory system”, and “supervisors’ educational philosophy” are the main factors that contribute to the formation of communication modes. Under the influence of these three factors, three distinct communication modes emerge: the “stranger mode”, the “friend mode”, and the “subordinate mode”. In the “stranger mode” although students’ independence is fostered, they tend to grow slowly. In the “friend mode” students see significant progress in their academic gains and research abilities. The “subordinate mode” while promoting students’ academic gains, deprives them of autonomy. In summary, the “friend mode” is the most beneficial one for fostering students’ academic gains and research abilities, and therefore, it is highlighted in figure. A variety of factors need to be considered in the cultivation of postgraduate students to determine the educational mode that best suits the students and promotes their holistic development.

5. Discussion

5.1. Three communication modes can coexist in a group of students sharing one supervisor

Studies have believed that supervisory relationships have three types: the boss-employee type, the shepherd-sheep type, and the subordinate type [44]. Considering the supervisors’ educational philosophies and the students’ learning attitudes, this study identified three communication modes in the supervisor-student interactions. This study also further notes that the three communication modes can coexist. The three modes depend on how supervisors interact with students. When a supervisor instructs multiple students, each student can communicate with the supervisor in various ways. Supervisory interaction is an interactive process between supervisors and students. Interaction involves two subjects, so the formation of the communication mode depends on the supervisor’s educational philosophies, students’ learning attitudes, and adjustment of the communication mode of supervisors and students.

The communication modes have the following combinations: If the supervisor is a very arbitrary scholar and does not allow his or her students to raise objections and students are willing to follow the supervisor’s instructions, hopefully, they will fall into the subordinate mode. If the supervisor tends to give instructions but the students are not willing to follow but want to explore their own research interests, the supervisors and the students will develop a stranger mode. Suppose that the supervisor regards education as a process of equal dialogue between supervisors and students. In that case, although the students are willing to get along with the supervisor appropriately, they will fall into the friend mode. Suppose that the supervisor tends not to take the initiative to contact the student, and the students grow up freely unwilling to bother the supervisor too much and rely on themselves when encountering problems. In that case, they will eventually develop into the stranger mode. If the supervisor tends not to take the initiative to contact the students but the students often ask the supervisor for help and actively interact with the supervisor, they will eventually develop into the friend mode. Therefore, students sharing one supervisor can possibly have different communication modes with their supervisor. Therefore, as has been pointed out in the existing studies, the supervisory style of supervisors is determined not only by student initiatives but also by appropriate adjustment to students’ grade growth at different stages [45]. This study also provides evidence to Salinas Perez’s study, which specifically highlighted supervisor support factors in a literature review on influencing factors of successful postgraduate graduation.

5.2. Student gains depend on students’ self-awareness

A suitable communication mode for students’ needs can help students grow up. The students’ needs include awakening their personal awareness of academic research and research ability. This research finding is a supplement to the existing research conclusions. Because the supervision of supervisors is related to task orientation and result orientation, the connotation of controlling supervision is mostly related to being strict and authoritative in practice. Some scholars even think that controlling supervision is an inappropriate guidance method [45].

According to the interview results, the friend communication mode has no negative effect on the development of students and can greatly promote their growth. However, if students accept and like the hierarchical subordinate mode or stranger communication mode, the two modes help in improving their comprehensive quality. In this case, these two modes will also have a positive role in promoting the development of students. The cultivation of postgraduate students requires students to read more, accumulate more, focus on reality and frontier theories, think more, and find and solve more problems. Study the problems in the process of accumulation, thinking and driving learning through research. In this process, students will have doubts or new ideas and need to communicate with supervisors. Reading aims to generate research results and to exercise research ability, cultivate research visions, and realize the transformation from students to scholars. This transformation not only relies on the supervisors’ guide but also requires their efforts. Suppose that the doctoral students cannot master the ability to solve problems independently and experience all academic research process but completely depend on the instructions and supervisor arrangement. In that case, the students cannot grow into talent with innovative ability [46]. Postgraduate students can have reasonable expectations of their supervisors, but cannot completely rely on them. Postgraduate students should highlight the autonomy of learning in education. Their core task is to develop independent learning ability and become talented in an all-round way in the society.

5.3. Supervisory system is the most implicit influencing factor

The supervisory system is the most implicit influencing factor of supervisory communication. This finding is consistent with the existing research conclusions. The system should clearly define the responsibility boundary in the supervisor-student community, specify the list of internal responsibilities of the community, build the external responsibility system of the community, and adjust the

interest distribution of the community [47]. In Germany, for example, a contract is often signed between supervisors and students, which defines in detail the rights and obligations of both parties, as well as the manner of the supervision¹³. As an educational system, the supervisory system that originated at the University of Oxford in the 14th century was used for undergraduate education at Oxford University. In 1810, Germany founded the first university and introduced the system of postgraduate education. Later, the United States, the United Kingdom, France, and other countries also learned from Germany to open postgraduate schools, adopt the system, and constantly enrich the system forms. In the early 20th century, Peking University and Tsinghua University introduced the postgraduate supervisory system in China and stipulated the appointment qualifications, procedures, and guidance methods of postgraduate supervisors.

Supervisors have two commitments: one is in the academic domain and the other in the personal domain. The supervisory system implies the content and communication between supervisors and students. From the institutional level, the system can be regarded as a part of the teaching management system, where supervisors give guidance and take overall responsibility for various aspects of postgraduate study, scientific research, morality, and life. This role has both professional support and psychological guidance regarding roles and responsibilities. Supervisors provide students with career support by giving academic guidance, assigning challenging tasks for academic training and practice, helping students improve their academic results, and helping students prepare for career promotion. From the perspective of the supervisor-student relationship, the system emphasizes the inductive learning relationship between supervisors and students. This system requires supervisors to teach students by following their aptitude and to provide targeted guidance toward helping in their study and life according to their circumstances. The supervisor is an auxiliary role, but the role is also required to be responsible for the quality of the student's thesis. The supervisor is both the assessor and the supervisor, which creates a sort of contradiction between the two.

6. Conclusions

In this study, through interviews with students and their supervisors, we concluded that students have the following three communication modes: subordinate, friend, and stranger. The influence of student communication is a short-term academic output. Nevertheless, sufficient autonomy improves students' comprehensive quality and cultivates their independence but leads to slow growth, depending on the awakening of students' self-awareness. The influencing factors of the supervisor-student communication mode are supervisors' educational philosophies, postgraduates' learning attitudes, and supervisory system, among which the supervisory system is the most implicit influencing factor. Education requires both self-management and external control and should respect students' ideas and supervisor guidance. Supervisors must devote themselves and keep a proper distance from students. Colleges and universities can take measures to arouse postgraduate students' consciousness of communication. Postgraduate students should solve problems independently within the scope of their abilities. When encountering problems beyond their abilities, they should actively seek advice from their supervisors or family members and should dare to express their ideas. Conversely, supervisors should moderately take care of the well-being and holistic development of their students.

This study has significant theoretical implications, i.e., extending the understanding of supervisor roles and offering useful references for optimizing supervisory systems and enhancing educational quality. In terms of practical implications, this study is conducive to better understanding students' needs, adjusting supervisory strategies, and thus promoting students' academic growth. However, this study had some limitations. First, in spite of five disciplines involved, the sample size was relatively small within a single university of China, which made the sample not representative of China. Future research is thus recommended to collect data on a larger base to generalize this study. Second, this study used qualitative research methods, which are conducive to revealing the essence of the phenomenon but may omit some quantifiable information. Future research should integrate quantitative research methods to more precisely reveal the patterns and mechanisms through which supervisors affect students' academic growth. Finally, although this study surveyed postgraduate students and their supervisors from five disciplines, it did not delve into the potential differences in the communication modes across different disciplinary backgrounds, which could possibly provide more comprehensive insights and empirical evidences for references. It is thus valuable to make comparative analysis on the communication modes across disciplines in future research.

Ethics statement

Authors obtained Informed Consent from all subject participated in the study and the following study was approved by the Ethical Committee of Zhejiang Normal University (protocol Number: ZSRT2023008), and followed the Declaration of Helsinki.

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Data availability statement

The data used to support the findings of this study are available from the corresponding author upon request.

CRediT authorship contribution statement

Shujie Wu: Writing – review & editing, Writing – original draft, Validation, Supervision, Investigation, Conceptualization. **Mohamed Oubibi:** Writing – review & editing, Software, Project administration, Formal analysis. **Kaixin Bao:** Writing – review & editing, Validation, Supervision, Resources, Funding acquisition, Data curation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.heliyon.2024.e31079>.

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