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## Tutors' and Students' Views on Learning and Feedback in Problem-Based Learning

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**Abstract:** The successful application of the problem-based learning (PBL) approach requires feedback from the tutor to the student to guide the latter's learning process. The aim of this study was to characterise the views of a group of Chilean undergraduate students of Primary Teaching and their tutors regarding PBL methodology, and the role of feedback in it. Qualitative research was carried out based on a case study that gathered the views of students and tutors through a focus group. The methods of analysis adapted to the needs of this study are those derived from discourse analysis and especially from discourse in interaction in its three dimensions: interlocution (framework of participation), thematic (topic of discussion) and enunciative (enunciative positioning). The results indicate that students' views emphasised the inter-student collaboration involved in PBL, while tutors emphasised the motivational value of the methodology. However, both recognised the important role that feedback plays in enhancing learning opportunities. Knowing the views of both tutors and learners is central to improving PBL and feedback practices.

**Keywords:** *Views, discourse analysis, feedback, problem-based learning.*

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### Introduction

Problem-based learning (PBL) is a methodology that is being applied to education in the health sciences. Intrinsic to this methodology is the writing of a report by students in which they discuss the learning process they have undergone, which will henceforth be referred to as a problem-solving report (González Lillo et al., 2021).

The starting point for this report is the research question or questions which the student will then endeavour to answer. Due to PBL generally centres around the formulation and resolution of a genuine socio-scientific problem (Díaz-Moreno & Jiménez-Liso, 2014; España & Prieto, 2009, 2010), the preparation of the resolution report typically presents a range of difficulties for students because it constitutes their first experience of enculturation, that is, it requires themselves to adopt a role—such as a tutor or other professional—of which they have as yet no real-life experience (González Lillo & López Ferrero, 2021; Prior & Bilbro, 2012).

It is this set of difficulties that feedback from tutor to student seeks to address. Though it is certainly important to understand exactly what aspects of student output the feedback is intended to address, it is also essential to understand that the way by which feedback is given will condition the reformulation and rewriting of the research question being posed as well as its resolution.

There exists a certain gap in the research regarding the views held by students and tutors regarding the learning process that occurs when the PBL methodology is applied, and the feedback given to students during the production of their resolution report. In this sense, knowing the views allows tutors' training to be more solid and, therefore, their feedback practices to be more effective. It is important to characterise and contrast the respective views of these two groups. Cotterall (1995), states that both behaviours and actions are determined not only by attitudes, but also by beliefs.

The research questions to be pursued in the present paper are therefore as follows:

1. What are student and tutor views regarding the learning achieved and the feedback provided during PBL?
2. How do tutors' and students' views influence the processes of regulating PBL methodology and feedback?

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In the remainder of the introduction, the framework within which these questions will be addressed is presented. After a brief discussion of the learning objectives that the PBL methodology aims to achieve, it discusses how views are formed. Next, the concept of feedback is defined and characterised. Finally, the processes that regulate production as a function of feedback on learners' written texts are examined.

### Literature Review

#### *Learning Goals of PBL*

PBL methodology involves presenting a genuine problem whose resolution must be executed by students working together in small groups (Meza et al., 2019; Núñez López et al., 2017; Rodríguez & Fernández-Batanero, 2017). As part of the resolution process, by means of discussion and negotiation guided by a tutor, the students prepare a report—the aforementioned problem resolution report—in which they inform the learning they have experienced.

It is expected that the PBL methodology will enable the students to by establishing specialised relationships between concepts, and research skills by resorting to a variety of sources of information. At the same time, it is hoped that they will develop their critical thinking and reflective judgment skills as they tackle the socio-scientific problem in question. Finally, it is intended that the students should be able to work in a self-guided fashion but centre their activity around collaboration with their group. All these skills or learning objectives are favoured thanks to the interaction between the specialist tutor in the discipline and the students.

#### *Student and Tutor Views: Interlocutory, Thematic, and Enunciative Dimensions*

The construct of views or beliefs has been amply studied from within various schools of psychology, ranging from cognitivism and transactional analysis to gestalt therapy and neurolinguistic programming. In the present study views or beliefs are defined as the ideas to which an individual is subject but of which that person has no clear awareness. Beliefs thus mold human behaviour, being intrinsically linked to actions (Barcelos, 2000). In the more specific context of teaching/learning, those beliefs play an important role in the educational process. Knowing the views or beliefs of students and tutors allows us to understand their influence on the actions they take.

According to Francica (2012), views explain how people behave and thus a change in belief should lead to a change in behaviour. It is by no means easy to alter or eliminate such views, since this requires that the individual must question this view and dispense with the absolute certainty with which they have held it. This is particularly difficult because views or beliefs are typically closely tied to emotions. It is for this reason that in any discussion of the teaching/learning of writing in the context of PBL, it is of cardinal importance to examine the views or beliefs associated with the problem-solving task and the feedback given to the student by the tutor, given that they will profoundly inform the actions and strategies applied by both groups.

#### *Feedback*

Considerable research has looked at feedback over the years. According to Tan et al. (2020), the purpose of feedback is to enhance learning and reduce gaps in order to improve knowledge and skill acquisition. According to Van der Kleij et al. (2019), the first definitions took as its point of departure a behavioural paradigm in which students were assumed to play a passive role. However, starting in the 1970s there was a change in perspective (e.g., Lipnevich & Smith, 2018; Mory, 1996; Van der Kleij et al., 2019) whereby feedback was interpreted as the delivery of information that the students could use to correct their errors, and hence assigning them a more active role. The ability to interpret information that helps to improve writing competence is a fundamental requirement in academic literacy.

Feedback-based assessment received by students can affect what and how they learn (Stobart, 2008). Given that feedback entails emotions, it can alter views and therefore the actions of students. This has given rise to the term feedback literacy (Carless & Boud, 2018; Chong, 2020), that is, the comprehension by students of the information obtained through feedback and their subsequent application of that information to improve their output or learning strategies. In fact, achieving feedback literacy can be quite challenging for first-year university students. According to Dawson et al. (2021), feedback that is properly implemented and communicated will allow students to experience what critical feedback feels like. Unquestionably, as noted above, student views regarding this process will greatly affect the strategies they deploy to improve their work.

#### *Regulatory Processes in Student Writing*

As previously stressed, views influence the actions of both students and tutors, and will also inform—whether positively or negatively—the processes by which student output is regulated and assessed during PBL problem-solving. Thus, self-regulation, that is, the student's ability to make decisions and reflect on their own learning process, will be directly affected by whatever views the student holds about that process. Furthermore, co-regulation, that is, the influence of the context through the mediation effected using learning tools or through the intervention of the person who is guiding the student's learning, be their teacher or tutor, will be only partial. The dialogue that takes place between the learner and

the tutor will be influenced by the learner's beliefs. Finally, socially shared regulation, meaning the regulation that is exercised among peers, will be very much affected by the views of the students with regard to the kind of collaborative teamwork that underlies that PBL methodology.

In this connection, it worth emphasizing that the communication of feedback provided by tutors to students throughout the learning process will be implemented in ways that are predetermined by the teachers' beliefs. Because feedback, as a type of formative assessment, is directly tied to improvement in learning, since, according to Hernández Rivero et al. (2021), it affords orientation and models for self-regulation strategies, it is imperative that this feedback not be purely unidirectional because in the end it is the student themselves that must take responsibility to assess their own work and progress (Fraile et al., 2021).

### Methodology

This research is framed within a qualitative approach (Creswell, 2007; Creswell & Maietta, 2002; Creswell et al., 2007), as its general objective is to characterise the views of a group of undergraduate students of Primary Teaching and their tutors regarding PBL methodology, and the role of feedback in it. A case study design (Yin, 2003) was used to carry out the research, as a limited context is explored through detailed and in-depth data collection in its real context. This case study was carried out during the second semester of the 2021 academic year with a group of first-year students who were taking a subject entitled "*The construction of thought in childhood: initial scientific skills*" at a Chilean university and also with the two specialist tutors who were teaching them.

#### Data Collection

Classroom observations, two in-depth interviews, and a focus group were used to collect data. However, for the purposes of this study, only the data collected through the video recording of the interviews and the focus group discussion are analysed.

The tutors involved in this case study were university lecturers. One of them had a bachelor's degree in Biology and a master's degree in experimental science teaching and had been teaching in higher education for more than 18 years. The other tutor had trained as a primary school science teacher and had a master's degree in experimental science teaching. She had begun to teach at university some five years previously. Each tutor was assigned a class group. One teacher supervised a group of 33 students and the other supervised a group of 28 students (61 students in total of the degree in Primary Teaching). Interviews were conducted separately to compare the views of the two participating tutors.

On the other hand, since the focus group aims to involve a small group of participants with the same profile (so that everyone has the opportunity to express themselves), a focus group with 12 students was carried out -7 from the first group and 5 from the second group-, which allowed for a very varied exchange of points of view. All students were in their first year of university and it was the first time they had done PBL. Of the 12 students, 6 were female and 6 were male and their ages ranged from 18 to 22 years old.

Both the interviews and the focus group discussions were centred on the following four open-ended questions:

1. What sorts of learning do students gain through the PBL methodology?
2. What are the main strengths and weaknesses that students bring to PBL?
3. What role does feedback play in the PBL process?

The language of interaction throughout was Spanish, the native language of all those involved as well as the language of instruction for the subject in which the PBL methodology had been applied. The data were collected after implementing the didactic sequence, by which time the students had already had a full experience of the PBL methodology. The data collection procedure is summarised in Table 1.

Table 1. Corpus of Analysis: Length of Interviews and Focus Groups

	Source	Total time
2 tutors	Interview with tutor 1	27:18 minutes
	Interview with tutor 2	30:06 minutes
12 students (7 from tutor Group 1 and 5 from tutor Group 2)	Focus group	35:07 minutes

#### Data Analysis Procedure

The contents of the video-recordings of interviews and focus group discussion were transcribed. The transcript was not phonetically rendered since this was not necessary for the purposes of the study. The data were analysed in Spanish and the results were translated into English. Pseudonyms were used to identify the various speakers, whether tutors or students.

The analysis methods most adapted to the needs of this study are those derived from discourse analysis and especially from discourse in interaction (Kerbrat-Orecchioni, 2005) since it is expected to analyse what the participants say and how they say it. To determine views, following the line adopted by the PLURAL<sup>†</sup> group at the University of Barcelona in this research, the interlocutory dimension is understood as the participatory framing of the discourse, the thematic dimension corresponds to the specific issues studied here and, finally, the third dimension, related to enunciation, represents the way in which the participants position themselves in relation to what they are discussing (Camarena & Palou, 2010; Cambra & Palou, 2007; Fons & Palou, 2014).

In the course of this analysis, various key phrases were identified, the term being used here to refer to any phrase consisting of one or more words that give a direction to the discourse and therefore represents an idea or important social fact. In identifying such key phrases, the number of times an item recurred in the transcript was not regarded as an important criterion. Rather, the main basis for selection was whether the phrase served as an indicator of the speaker's positioning because it expressed, for example, a judgmental or evaluative attitude. Among such deictic elements are included references to space, time, or persons, and expressive linguistic resources such as adjectives or adverbs. Table 2 lists the key phrases resulting from this analysis, grouped into the three dimensions mentioned above.

Table 2. Goals of Interaction and Indicators for Analysis by Dimension

Goals	Indicators
Interlocutory dimension Framework for participation Language Organization	Who addresses whom?
Thematic dimension	What topic is being dealt with? Keywords? Word constellation?
Enunciative dimension Enunciative positioning Persons Situation in time Critical points Expressive resources Expression of emotion	How do they position themselves related to what is being said? Do they state judgments or evaluations? Do they use verbal periphrasis? What verbal modality predominates? Discursive behaviour: Do they justify, provide arguments, etc.? What personal pronouns do they use? Do they distinguish between now and previously? Is there a contrast between desire and reality? Do they use metaphors or other images? Do they express preferences and talk about how they feel? What prosodic resources do they use?

In order to validate the results, the data were subjected to the same analytical process independently by a second researcher, following the Peer Code Review procedure (Arafat et al., 2022), through tool-assisted code review. The software used to process the data was Atlas.ti, a qualitative analysis tool that allows the processing of texts, videos or audios.

Though the bulk of the two analyses agreed, there were a few transcript excerpts that elicited differing interpretations. One such excerpt, taken from a student's intervention during the focus group discussion, is reproduced in (1) (here and throughout the text, the original Spanish of the transcript has been translated into English):

(1) "PBL needs, needs to generate interaction, an experiment, a project, where there is debate, discussion, where one—I insist on the importance of interaction—has more interaction because of what one is doing."

In analysing this excerpt, the reviewing researcher considered that the appearance of the word "interaction" three times showed the great importance that the student attached to the concept. However, though the repeated use of this word in the excerpt is indeed significant, the selection of a key phrase should be based not merely based on frequency of appearance. It should rather be based on whether it represents the ideas or positioning of the speaker. For this reason, the key phrase in this instance more properly should be "needs to generate interaction" rather than just the noun "interaction" alone. Nonetheless, the reviewer supported her identification of "interaction" as a key phrase by referring to a second excerpt, also from the discourse of a student, reproduced in (2):

(2) "I think that, that one of the things the one can learn from and get out of PBL is, obviously, the topic of the discussion and oral expression, where one has to generate dialogs and instances where points of view are shared, healthy debate is generated, and in this we do need interaction, it is what can be gained from PBL, in my perception."

<sup>†</sup> The full name of the group in Catalan is *Plurilingüismes Escolars i Aprenentatge de Llengües* ('School Plurilingualisms and Language Learning').

When discussing the interpretation of the second fragment with the other researcher, it was agreed that although there is a clear allusion to debate and dialogue in the excerpt, multiple changes in point of view were observed, from the first person singular ("I believe"), through impersonal forms ("can", "have to", "share", "generate"), to the first person plural ("we need"). This element was therefore included in the analysis.

### Findings / Results

The results of the recorded discourse analysis are presented below. Each of the dimensions is analysed by contrasting the students' views with those of the tutors.

#### *The Interlocutory Dimension*

First of all, with regard to the interlocutory dimension, in the focus group with the students' discussion it was the interviewer that spoke first, outlining the goal of the activity and stressing the confidential nature of everything that would be said. She then asked the student participants what they felt were the sorts of learning that could be achieved through the implementation of the PBL methodology. Subsequently, the focus of the discussion shifted to collaborative work. Finally, the discussion concluded with students reflecting on their views of the feedback they had received from their tutors. The discourse began with each tutor describing the different kinds of learning that they believed students could achieve by carrying out an assignment using PBL methodology and closed with the tutors expressing their views on how they gave their students feedback and the impact they thought it had.

#### *The Thematic Dimension*

With regard to the thematic dimension, the focus group discussion revolved around three general axes: the sorts of learning that PBL methodology fosters, student collaboration as a strength of the methodology, and the role played by feedback in improving student written output. For its part, the discourse of the tutors was organised along three axes, in this case the goals of PBL, the principal strengths and weaknesses of the students in this regard, and the role played by feedback in PBL.

Regarding the first axis, all the students reported that the methodology employed had been a new experience for them, given that were coming from a lecture-based model of learning in which the tutor essentially delivered content and the students replicated it. They reported finding problem-solving as an educational task quite difficult because they were not accustomed to having control over the contents they were dealing with. The students all agreed that the task of generating research questions was extremely challenging. They also described having difficulty adopting the perspective of an experienced primary-level teacher, being themselves only in their first year at university and with no actual teaching experience under their belts. They admitted that while two areas of learning where they had made gains as a result was critical thinking skills and the use of dialog to negotiate ideas with their classmates.

For their part, the tutors concurred in some of their views but diverged in others. With regard to the goals of PBL, they both indicated that learning to work in a group was one such goal. However, they disagreed about the goals of the PBL. One tutor felt that a key benefit of this methodology was that it allowed the integration of multiple disciplines and areas of knowledge, whilst the other attributed its facilitating aspect to the fact that it involved situated learning. In other words, for one tutor PBL implied the integration of different orders of knowledge, for the other it was more closely related to the immediate context.

As noted, for the students the second axis of the thematic dimension was the fact that group collaboration required by the PBL was a major strong point, because it generated and enriched channels of communication among the peer group. Nevertheless, they noted that despite the benefits of group collaboration it was in practice rather complex to manage because of the pressures of their academic workload. For the tutors, the second main axis in this dimension was the strengths and weaknesses that the students revealed as they attempted to carry out the problem-solving task. Here again, the two tutors revealed a discrepancy in their beliefs: though they had initially described the fostering of motivation as one of the goals of PBL, they here indicated that this was an asset that students themselves brought into the activity. They did, however, agree with regard to the main student weakness, which they felt was a general lack of the scientific skills necessary to assume a holistic perspective of the problem they were confronting. Though this was not a point of contention between them, one of the tutors added that among student strengths it was important to include both students' capacity for organization as well as their ability to work with digital technologies.

Finally, feedback was felt to be a key issue by the students, though they acknowledged that it was since feedback that they were able to improve their work and learn more. They admitted that while feedback was something that they valued very highly, it had to be given to them in a timely fashion in order for them to be able to improve their work. The reason behind these claims was that on occasion, though the feedback offered meaningful insights, it had reached them too late to apply to the task at hand. At the same time, there was a consensus among students that no matter how dense or directive feedback might be, it was still of great interest to them because they were keen to correct their work at as detailed a level as possible. The two tutors, concurred in their views on the role of feedback in PBL, seeing it as an

invitation to the student to take a stance regarding the comments the tutor offered and then decide whether to accept or reject them. Student views are summarised in Figure 1 below and tutor views in Figure 2:

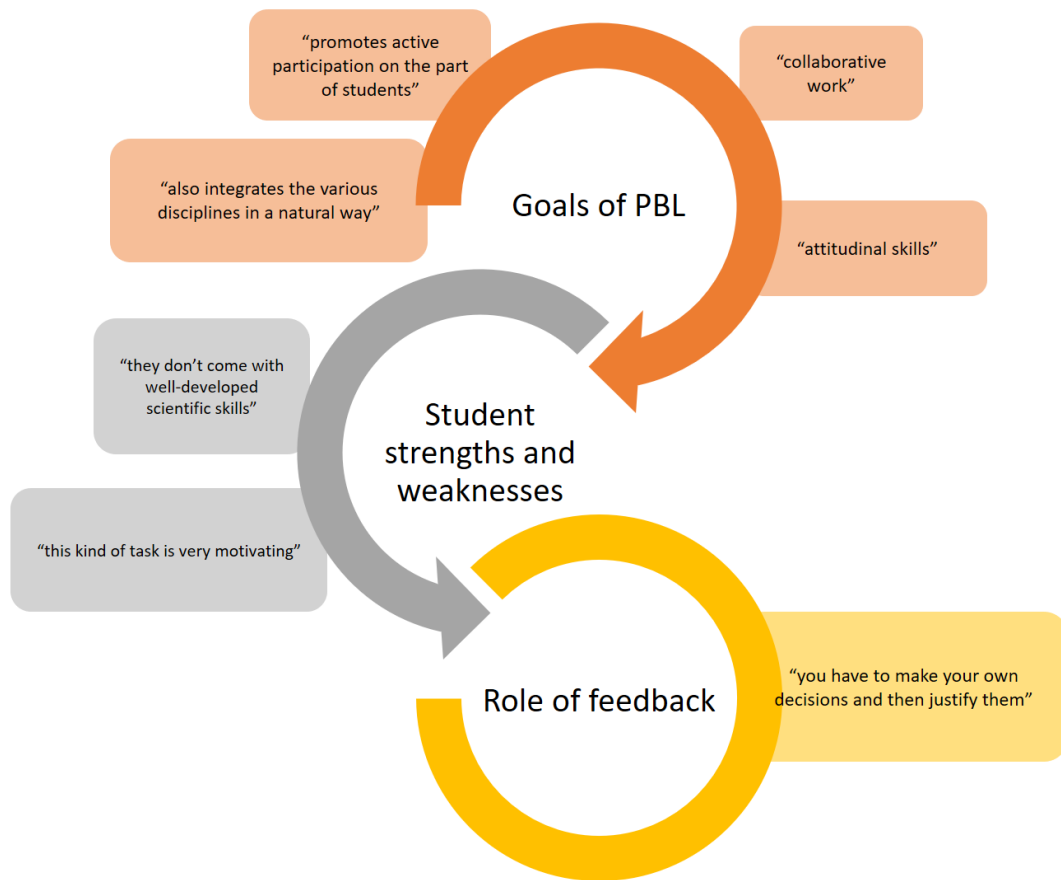


Figure 1. Constellation of Student Perceptions with Illustrative Quotes from Transcripts

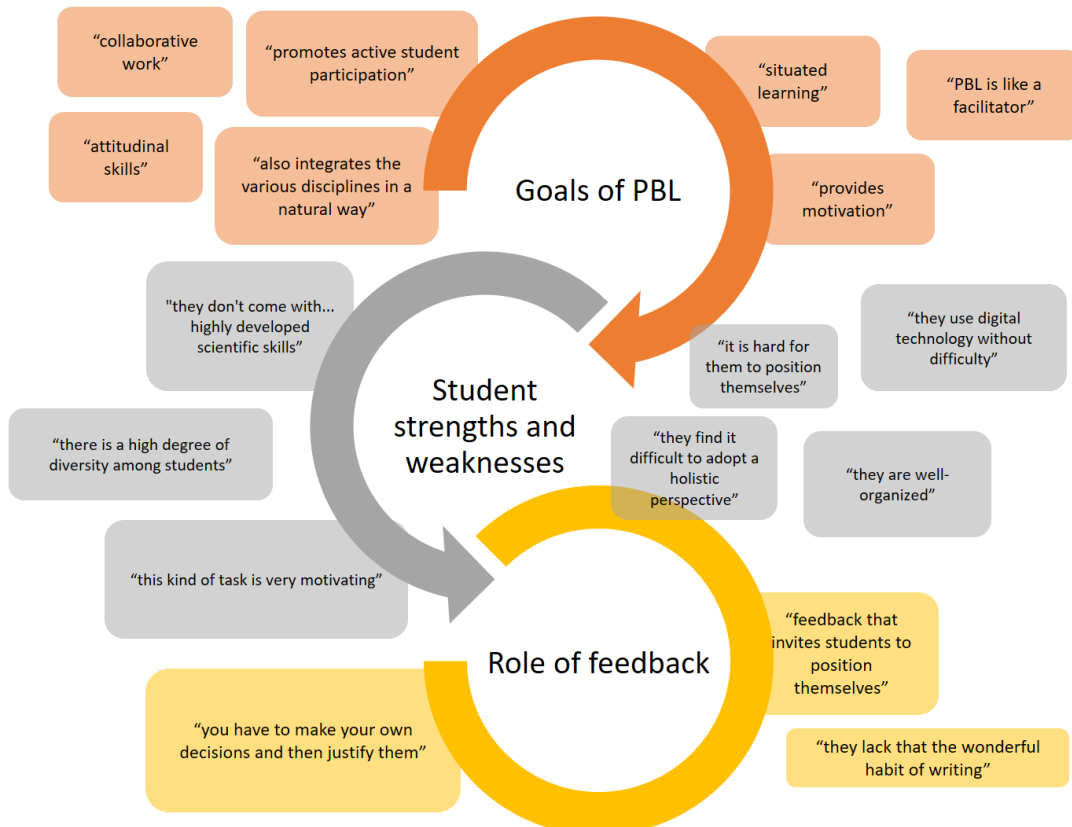


Figure 2. Constellation of Tutor Perceptions with Illustrative Quotes from Transcripts

As can be observed in the two figures, there is a certain convergence in the first and third axes between tutors and students, but not in the second axis. All groups refer to collaborative work and attitudinal skills as well as to the taking of a position to confront the problem posed, which implies the taking of decisions in response to the feedback received.

### *The Enunciative Dimension*

The enunciative dimension was the most difficult of the three to analyse given that the students offered important observations on all the topics presented to them. Regarding the sorts of learning favoured by the PBL methodology, they indicated, first, that it was a difficult methodology simply because it was something new. This is reflected in the excerpt from the focus group discussion transcript reproduced in (3):

(3) "Well, I want to share my experience a little bit. For me maybe PBL was complicated because I was just getting familiar with it for the first time. I didn't know anything about it before, nothing..."

With regard to the kinds of learning they had experienced, the students indicated that, as noted above, one was related to the interaction and debate that took place during the group work based on the PBL methodology. This can be seen in the quotes by two different students that I saw above in (1) and (2), reproduced here as (4) and (5):

(4) "PBL needs, needs to generate interaction, an experiment, a project, where there is debate, discussion, where one—I insist on the importance of interaction—has more interaction because of what one is doing."

(5) "I think that, that one of the things the one can learn from and get out of PBL, obviously, the topic of the discussion and oral expression, where one has to generate dialogs and instances where points of view are shared, healthy debate is generated, and in this we do need interaction, it is what can be gained from PBL, in my perception."

Both students emphasise the dialogic nature of PBL, revealing an understanding that only by means of interaction and discussion could the problem posed be solved. In excerpt (4), the student uses the third person singular impersonal pronoun ("one") in reference to PBL. By contrast, he employs the first personal singular ("I insist") to make a metadiscursive observation. In excerpt (5), the other student reserves the first person singular for describing beliefs or opinions, employing instead impersonal forms when referring to PBL-related classroom activities. Finally, his use of the first-person plural pronoun ("we do need interaction") can be interpreted as his momentarily assuming a tutor's perspective.

Another area of learning that the students point to is linked to searching for information and how the PBL methodology obliges them to investigate a topic in depth. This is referred to by the student in (6):

(6) "I really liked the PBL methodology a lot. What I liked most and what I really got most out of it was that one, it... it forces one to look for a ton of information, it forces one to, like, investigate in depth, it forces one to put oneself in various positions."

The same student adds that the methodology had been interesting and had allowed her to discover new things, as can be seen in (7):

(7) "It was super interesting because also, I mean, because of the tutor who helped us and sent us a map about socio-scientific conflicts also to help us in this `point. We, like, I mean, me, for example, I feel like it has opened a whole new world."

She goes on in (8) to emphasize how enriching she found the experience:

(8) "But I feel like this methodology was super enriching and that... knowing how to use it in the classroom also, I think that it's going to be really good in general."

Finally, another area of learning mentioned by another of the students is critical thinking, as can be seen in the quote from (9):

(9) "I want to add one small thing, another thing that we have discussed in connection with the classes is that they generate critical thinking, and I think that this helps us quite a bit to set our arguments on the table so they can be debated and discussed, generating critical thinking not only for us but also for the students that we are training."

There was one student who noted several areas of learning which he felt were fostered by the methodology employed and freely acknowledged the value of the task they had carried out. However, he said that he did not feel capable of either solving problems, or did he feel he would be able to apply the methodology when he himself became a teacher (10):

(10) "Yeah, right, yeah, I agree with what my classmates have said and the truth is that at the point where I understood PBL I think I like managed to understand more than anything else conceptual elements, like when it would be useful, why it's important, that sort of thing, and obviously it's all very valuable, but I don't feel capable of, of really utilizing it."

This is important because it means students are using PBL as a teaching methodology (students see themselves using PBL as future teachers) compared to PBL being used as a learning methodology (students think about how they liked

PBL as a student). Similarly, another participant recognised that the difficulty with this sort of methodology lay in the formulation of research questions, as he notes in (11) and (12):

(11) "What I was saying is that the most difficult thing at least for me about PBL, at least for me, is coming up with a good research question, because it requires first being able to grasp the topic that that we're talking about."

(12) "In the case of my group, we found it very hard to formulate the [research] questions, put ourselves in the shoes of the teacher in planning what to call the activity [...], because it was, like, something new for us and many of us are coming from a kind of education that was more traditional where the teacher, like, brought everything all ready and told us 'OK, you have to do this' and didn't give any space to the students to investigate the topic or reason a little more, and it was also hard for us to reach agreement on things. All the same the dialog that arose was enriching."

For their part, the tutors are continuously aware of their evaluative stance. They position themselves using the first-person plural, which suggests that they are justifying their views not merely in terms of their own individual point of view but as one that would be shared by their fellow tutor. Illustrative of this is interview excerpt (13), in which one of the tutor's states that a high degree of learning can be achieved through applying the PBL methodology:

(13) "I no longer think as if I were a teacher working alone, it no longer works for me, though I would like... well, I was saying, it's an achievement. [...] So, I think it's a super important discovery, it isn't arbitrary, it isn't just a perception that we have, rather it's what we actually did."

Similarly, in (14), the same tutor notes that among the challenges they had to face as tutors was the task of dissolving the preconceptions with which students start the term:

(14) "[...] with regard to the discipline-related content of the subject, already, for a variety of reasons, there are these alternative concepts, theories that they [the students] imagine, implicit theories that come out of their experience of schooling, that come from their experiences of daily life, inaccurate concepts, and as a result, there is a, a point where we have to cover a lot in class, these alternative concepts relative to the discipline-related content, [so] at times, of course, we don't get to that content, or we cover it very little."

As for the second thematic axis, that linked to collaborative work, the students indicated that though the dialog they experienced was a rich experience, it required considerable time. This can be seen in excerpts (15) and (16):

(15) "...It generates, the great thing is that it generates a lot of dialogs, but at the same time what is working against it is time."

(16) "So... with regard to this collaborative work, it was really great, but it requires time, it requires a lot of time, but I think it offers a lot."

Finally, when asked about the role of feedback in the learning process. The students expressed the absolute conviction that it was fundamental to transform weaknesses into strengths, as seen in the comment in (17):

(17) "... Because it lets us strengthen our weaknesses, understand how to do things well, what things we need to improve, or maybe, since all this is completely new for us, we stray somewhat, we tend to fall back on the traditional approach, we tend to get mixed up, obviously, this helps us improve our weaknesses and create strengths. About reflection, it is always a good idea to generate some reflection when you finish an assignment to think about everything, about whether we learned something or didn't. This implies, produces a good conclusion. I think that, yes, feedback is important, and you get a lot of good things out of it, when it is done well."

Students also note that the more detailed the corrections and feedback they receive, the better, as seen in the comments by two different students in (18) and (19):

(18) "Personally, I prefer correction to be as detailed as possible, because only to the extent that I know what I'm doing wrong, can I correct it."

(19) "I think that in this case a high number of corrections can be very useful for us, because beyond [the blow to] your ego and feeling overwhelmed, which you can recover from after a little while, but when you have doubts and these doubts are not resolved, are not answered, you end up stuck and you can't make progress."

Finally, though one of the tutors admitted that she did not always offer feedback to students the same way as her co-tutor. They both gave students feedback that included explanations about errors rather than simply identifying the error. Her comments from the interview are reproduced in (20):

(20) "The way the two of us give feedback is different, I think, but even here we, like, invite the student to... we try to position... both of us... in not saying 'This is wrong just because it's wrong', but rather 'Be careful! You have to watch out, I recommend that you...'"

In general terms, the two tutors position themselves similarly regarding their functions as tutors, adopting a first-person singular perspective, as seen in the comments by one of them in (21) and by her colleague in (22):



(21) “[...] From the point of view of strengths that I see when we do this kind of assignment is that the students get really motivated to do it and that is a super important starting-off place in the classroom, in this case my job in the classroom with them when I present them with this sort of challenge it’s like sowing the seed in their first year [...] This motivation that they have to do the task is an incredible strength, and their readiness to learn.”

(22) “I think that this was very hard for them at first and it is difficult to feel like... like putting it all together, adopt the view, the holistic view of what is... of what all of this may entail...”

### Discussion

Though a number of studies have been published on student views or beliefs of feedback (Schillings et al., 2021; Kasch et al., 2021), less work has been done on tutor views or beliefs (Brown et al., 2012) and most such studies have been concerned with the teaching/learning of additional languages (Ha et al., 2021; Junqueira & Payant, 2015; Li, 2017). Likewise, few studies have addressed student views—and even less so—teacher views in connection with the areas of learning fostered by PBL and how these views affect regulatory processes. In other words, these prior studies have compared this methodology with others in terms of effectiveness, but they have not considered student and tutor views.

While it is true that there is a lack of research on student views or beliefs regarding the critical thinking generated by the PBL approach, there exist numerous studies from a variety of disciplines—particularly medicine, health sciences, and engineering—that examine whether PBL in fact generates such skills. For example, Oja (2011) reported that PBL led to improved critical thinking among students of nursing, lending support to its application in the field.

By contrast, results by Núñez López et al. (2017) suggested when applied in the field of nutrition education the PBL methodology did not have any effect on the development of critical thinking skills, though it did have a positive impact on the acquisition of competences linked to judgment in specific situations. Another study, by Quintero et al. (2017), yielded similar findings, showing that students of biomedical engineering who were taught through PBL revealed critical thinking skills that were not significantly different from those of students trained using a different approach.

Therefore, the findings of this research indicating that PBL fosters critical thinking skills in students must be partly related to the question of students' views, since the gains described here are essentially self-reported by the students themselves. In this study, the clues provided by students' statements about the formation of critical thinking through PBL methodology are paramount. Students highlight the opportunity to generate debates and defend their opinions, which fosters the development of critical thinking (cf. (4), (5) and (9)).

In general, regarding the sorts of learning obtained through this methodology, Yew and Goh (2016) reported that, in comparison with traditional lecture-based methods, PBL was effective in favouring students' long-term acquisition of knowledge. In a similar vein, Dolmans et al. (2016) found that PBL appeared to improve deep learning but had less effect on superficial learning. This is demonstrated by the participants in this study, when they point out that the learning from the PBL methodology goes beyond the merely conceptual, but that they also learned how to investigate (cf. (6)). However, with regard to student end-of-term test scores, Rodríguez and Fernández (2017) found that not only was the variability in test scores achieved by students who had engaged in PBL was high, but it was higher than that seen in the scores of students who had experienced traditional methods of teaching/learning rather than PBL.

Nonetheless, these findings do not coincide with the views of the two tutors interviewed here. They felt that the PBL approach favoured collaboration among students, facilitated the integration of various fields of knowledge, generated a high degree of motivation among students, and helped students develop their attitudinal skills.

Students reveal a negative view of this methodology when they state that they found the PBL task difficult to carry out, particularly because they are first-year students who do not yet know how to put themselves in the place of a teacher (cf. (10)). This hints at a latent sensation of insecurity about their skills and the difficulties that they perceive being a professional teacher in the future will entail.

As for the role of feedback, students and tutors alike place considerable importance on it. For these two tutors, they admit that they are aware that they differ in how they give feedback, but they agree that the focus of feedback must be an explanation of errors and not merely their identification (cf. (20)). In this sense, they feel that feedback should be positive in nature and not, in accordance with the traditional approach, corrective (Ferreira, 2007).

As for views connected with feedback, a previous study by Ha et al. (2021) found that both teachers and students place value on feedback, especially when it is explicit. Like the students who participated in the present study, they also preferred feedback to be immediate. That said, given that the overall sparsity of research specifically focuses on student views about feedback in the PBL context, claims in this regard must be limited to the fact that the participants in this study, both tutors and students, all shared the view that feedback played a fundamental role in moving the learning process forward.

Individual views have a direct impact on the actions that that individual takes. There are no prior studies that have examined the role played by the views or beliefs of students and especially tutors in the regulatory processes associated with learning. Nevertheless (though this may seem obvious), it may be inferred from the data analysed here that, if both

groups share the same understanding of both the PBL methodology and the role of feedback, the learning thereby attained will be greater in quality and quantity. For this reason, effective communication between students and tutors is essential.

Regarding the impact of these views on PBL and the feedback on the processes by which this learning is regulated, these results show the students self-regulate constantly as they carry out the PBL task and prepare their final problem resolution report. Even though they believe that the methodology is difficult because it is new to them, this belief itself obliges them to unconsciously apply strategies of self-regulation when they search for information to select a socio-scientific problem, create research questions, and then answer them. The students work individually to search for information to bring to the group, that is, they engage in autonomous learning each time they reflect on their decision-making abilities (López Ferrero et al., 2019).

With regard to co-regulation, the data shed light on two aspects, the mediating role of the instructor, and the mediating instruments used to guide the feedback process. As highlighted, it is important that both tutors and students recognise the importance of feedback, as it has a direct impact on students' performance at university. For this reason, it is necessary for the tutors not only to create a context whereby students must position themselves to address the socio-scientific problem they have come up with, but also to allow students access to the tools they will use to mediate their learning, such as assessment rubrics or models of the genres of discourse they expect the students to produce, such as, in this case, the problem resolution report (González Lillo et al., 2021).

Because collaborative work is quintessential to the PBL methodology, the type of regulation that occurs most frequently in this context is socially shared. According to the views expressed by the students here, PBL allows them to acquire critical thinking skills, but it also allows them to engage in discussion with their classmates. This recognition of the dialogic character of the PBL methodology is important since it is what permits them to apply strategies such as correction and organization, and, from the attitudinal perspective, to ask for help when confronted with a difficulty that is too challenging for them to deal with individually. In other words, it is important that there exists solidarity among peers. That said, it must also be pointed out that even though collaborative work requires the sort of positive interdependence (Johnson et al., 1998) where dialog and negotiation enhance opportunities for learning, this does not guarantee the success of the group, because interactions—and hence their results—are unpredictable.

### Conclusion

Two main conclusions can be drawn from the results obtained in this study. The first is that both learners and tutors clearly perceive PBL as an effective tool for learning. At the same time, both learners and tutors. View feedback as a key step in the PBL learning process because it obliges students to position themselves within the work they have performed. In other words, giving learners a problem to solve should not only consist of stating the issue, but should also involve the generation of hypotheses that capture the different perspectives from which the learners should situate themselves. It should be added that, in the case of students, feedback should be provided to them as soon as possible after preliminary work is submitted, since otherwise, they will not achieve the intended objective of allowing them to correct their mistakes.

On the other hand, as far as self-regulation is concerned, even if students apply strategies, the next step is to make sure that they become aware of these strategies so that they apply them in any future encounters with PBL methodology or, better still, start applying them as a matter of habit. This requires explicit mediation of the strategies they apply. As for co-regulation, the challenge here is to generate a type of assessment that is communicative and bidirectional. If both tutor and learner understand in the same way how their work is to be assessed, the likelihood that the learner will achieve the objectives set will increase. Finally, socially shared regulation also presents challenges. In a collaborative enterprise of the kind intrinsic to PBL, dialogue, and discussion are essential to build consensus and thus enable learning to progress. While our results show that students believe that PBL is a methodology that enables this kind of negotiation with their peers and recognise that this collaboration is an element that greatly enriches the problem-solving task, they also complain that it is time-consuming. This suggests that students also need to learn how to organise themselves optimally, and that sufficient time should be allocated for them to do so.

### Recommendations

Knowing the beliefs of both tutors and learners is essential for the improvement of PBL and feedback practices. To the extent that tutors know what students' views on these aspects are, they will be able to improve their implementation and thus achieve better learning outcomes.

Some recommendations regarding students' and tutors' views on learning and feedback in problem-based learning from a practical perspective are, firstly, to generate instances for students to develop the ability to produce hypotheses independently of the problem they are confronted with. Secondly, regarding regulatory processes, it is important that students are aware of and apply the strategies learned through feedback and collaboratively generated learning.

On the other hand, recommendations can be made from an academic approach. Further research is needed to investigate what students' and tutors' views are on the relationships between learning outcomes and feedback. The teaching-learning-assessment process should be shared by all agents involved. Therefore, it is suggested that future research in this field should address the issue by including different data collection instruments, such as, for example, logbooks that collect participants' experiences without an intentional script for data collection. Furthermore, it is recommended that this type of research be applied in other areas of knowledge, different from Biology, as it is not known so far whether the results of this research can be transferred to other areas and in other academic contexts.

### Limitations

Some of the limitations of this research are related to the generalisation of the results, which is a limitation of case studies. Due to the small sample of students and tutors participating in the study, it is not possible to generalise to other populations. To overcome this limitation, it would be necessary to apply another methodology that allows a bigger sample to be represented. However, because the purpose of the case study is to make an analytical and not a statistical generalisation, this research has allowed for theoretical abstractions.

Another limitation related to the period of data collection should also be noted. It is necessary to collect longitudinal data to find out whether students' views change as they progress through the degree.

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