

In what ways does the use of sentence stems in small group dialogue support the students' ability to invite reasoning in peers and to make their reasoning explicit?

Summary:

This inquiry aims to explore whether students can take the initiative of inviting peers to elaborate and reflect more using sentence stems. The method used is based on coding and analysis of small group dialogue interactions using the *T-SEDA scheme*, a practitioner designed tool based on the SEDA analysis framework (Hennessy et al., 2016) as well as group self-evaluations. The study involved a small group of three year 12 biology students within a larger class from an international school in London suburbs. The findings so far indicate that students invite peers elaboration more with the introduction of the sentence stems tool. In response to this, students build on ideas and elaborate more, which could have a positive impact on the learning outcomes (Howe et al., 2019; Mercer et al., 2003).

Context:

This study took place in an international French-English bilingual school in Wembley, UK. This school is set in an urban setting and provides education for a population of students comprising of both local and expatriate pupils, many of them bilingual or trilingual, for whom English is the second or third language. The inquiry was run during higher level biology classes of a year 12 group (16-17 year olds) following the International Baccalaureate Diploma Program (IBDDP) curriculum.

Motivation for the inquiry, focus and inquiry questions

My inquiry draws on general and specific aspects of the dialogic theory that I will briefly present before exposing the motivation, focus and inquiry question that was researched.

Breaking away from the wide spread traditional low cognitive level Initiation-Response-Feedback type of classroom interaction as first described in Sinclair & Coulthard (1975) and widely studied (for example in Smith et al., 2004), a dialogic approach has been shown to encourage pupils to expand, explore, discuss, argue on, explain and justify theirs and their peers ideas (Alexander, 2008; Mercer & Dawes, 2014). Dialogue is believed to have an important impact on students learning. If most of the research about dialogic pedagogy has been made in primary schools, growing evidence seem to indicate that the findings in younger students groups are transferable to older ones, confirming the validity and importance of dialogic teaching in secondary school setting (Davies & Meissel, 2016 ; Higham et al., 2014). Research has hence aimed to identify forms of effective dialogue.

Described in its early stages by Barnes & Todd (1977), the concept of exploratory talk was developed by Mercer (1995 ; 2000) and defined as a type of oral interaction within a group

where students contribute to share ideas, provide reasons for what they say and build on each other's responses in order to reach an agreement. Exploratory talk is an effective form of dialogue, however, in real class settings, there is usually a low level of it between peers (Galton et al., 1999). In an attempt to facilitate the implementation of dialogic pedagogy in classrooms, resources have been designed for practitioners to explore, define and measure the various talk moves, such as the *Accountable Talk tool* (Michaels & O'Connor, 2015), or the *T-Seda scheme* (Hennessy et al., 2016) that will be used in this inquiry.

In my twenty years of practice as a biology teacher in different schools and curricula (swiss, French, IB), I noticed that my students are usually rather confident when it comes to orally express their ideas, make hypothesis about a process or try to find a common answer when they work as a group. They usually try to justify their assertions but tend to limit that to one short justification and won't deepen their reasoning unless invited by the teacher to do it. Asymmetry between students and teachers in the use of invitations has long been documented (Dillon, 1981). It might be interesting to consider this fact in the light of the Zone of Proximal Development ZPD defined by Vygotsky (1978, p. 86) as "the distance between the actual developmental level as determined by independent problem solving and the level of potential problem solving as determined through problem solving under adult guidance or in collaboration with more able peers". Mercer (1996 ; 2004) and Valsiner (1984) drew on that idea. Notably, Valsiner stated that the Zone of Proximal Development (named in his work Zone of Free Movement, ZFM) is a socially constructed cognitive structure of an adult-child environment. The concepts of ZPD and ZFM explain the belief of students that the teacher, or at least a peer they consider more able, is the resource person who can help them build their knowledge. In consequence, most students might not feel entitled to play this role by inviting others to elaborate. Several research indicate that attempts from students to understand a partner's thinking almost all the time derive from a teacher's invitation (Attard & Edwards-Groves, 2018 ; Hennessy in Kershner et al, 2020, p.127). However, when students work in small groups, the teacher is not always present to play this role. In consequence, the fact that students don't invite their peers to deepen their reasoning might result in less elaboration, leading to the group not fully exploring a topic. This could limit attainment, as the positive effect of dialogic pedagogy on subject attainment outcomes (Howe et al., 2019 ; EEF, 2017 ; Mercer et al., 2003) is better seen in contexts with high level of students participation, encouragement to elaborate and question ideas as well as effective group work organization (Howe et al., 2019 ; Lecture by Neil Mercer, May 2020).

Based on my experience and drawing on the previously cited theory, I focused my reflection on how to help students engage in inviting others to elaborate more. I decided to explore the use of sentence stems as a tool to facilitate that process, and designed an inquiry aiming to answer the question: In what ways does the use of sentence stems in small group dialogue support the students' ability to invite reasoning in peers and to make their reasoning explicit?

I chose to run this inquiry in a higher level year 12 IBDP biology class, during lessons on plant physiology. This is a complex topic which requires a great mastery of new vocab and understanding of difficult and intricated processes. When I taught that subject last year, I appeared to be very tricky for most students to understand the big picture and to link the different notions of the topic together. I wanted to explore whether a structured dialogic approach could help students navigate those complex knowledges. Using dialogic teaching was a pedagogical choice of interest for a science class (Michaels and O'Connor, 2012) aiming to improve both engagement and attainment of students through quality improvement of classroom dialogue.

Resource created for this investigation

I drew on the idea that the teacher should model and teach the dialogic moves that enable students to independently express and challenge ideas, as well as expand and justify them (Reznitskaya & Wilkinson, 2017). Hence, I designed a tool to introduce and scaffold the use by students of invitations to peers to elaborate or justify their ideas. This tool is a paper printed set of 17 cue cards (Annex 1) presenting invitation sentence stems such as 'Can you tell me more about...?', 'How did you come to that conclusion?', 'Why do you think that...?'. Students were introduced to that tool between the baseline recording and the first trial session. They practiced dialogue with the help of the cards during two non-recorded sessions, when they randomly received two cards with the instruction to try and 'play' them before the end of the dialogue.

Inquiry plan and activities

One of the reasons dialogue is often not as productive as it could be in a classroom, is that students don't know how to think together effectively, whereas their teachers assume they do (Lecture by Neil Mercer, May 2020). Having the chance to work in a school that promotes dialogic teaching, I indeed had made this assumption: the self assessment I did at the beginning of the PPD Dialogue in Education course showed that I had never set explicit talk rules in my classroom. So before starting the inquiry, my students and I negotiated a set of talk rules based on the *epiSTEMe intervention* (Ruthven et al., 2017) and on the *Philosophy for Children (P4C)* framework as described by Phillipson & Wegerif (2016, p.20). If the rules covering the 'people' and 'talk' sides of those rules, were rather clear for the students, the 'Ideas' dimension (Hofmann & Ruthven, 2018) required to be suggested and discussed. Those talk rules were introduced and practiced regularly in class for three weeks before the baseline session was recorded. Moreover, students were rendered aware of how they talk and learn in groups and how dialogue can improve learning outcomes using elements of the *Thinking Together program* (Phillipson & Wegerif, 2016), notably parts of the 'Talking points about group talk' resource (Mercer & Dawes, 2008).

Due to the limited time allowed for this study, only one inquiry cycle containing three repeats has been completed.

I video recorded the dialogues of the same group of 3 female students over the course of three sessions:

- 1 baseline was recorded before the introduction of the sentence stems tools
- 2 trial sessions were recorded after the introduction of the tools

For each of the trial sessions, all of the sentence stems cards were displayed on the table in front of the students. On top of the curriculum related objective, the students were given a clear dialogic objective. This is recognised in promoting student's 'metacognitive awareness of productive dialogue' (Warwick et al., 2020) and can impact students outcomes (Flick and Dickinson, 1997).

At the end of each session, each member of the group filled in a self evaluation questionnaire, which consisted of a slightly adapted template G for secondary students from the T-SEDA scheme with one added G11 line 'We actively invited others to justify or expand their ideas' (Annex 2).

The sessions were then transcribed (See sample in Annex 3) and coded using the template A of the T-SEDA scheme. The project focused on specific codes for talk moves originating from the students: IB (invite to build on ideas), B (build on ideas), IRE (invite reasoning) and R (make reasoning explicit).

Change was evaluated by comparing the number of occurrences of each of these specific talk moves before and after the introduction of the sentence stems tool.

Self-evaluation questionnaires results were compared along the process.

Ethical considerations

In order to limit the risk of encountering any ethical dilemma, it was crucial for this project to think about ethical issues both before the beginning of the research and all along its running.

A. Ethics considerations in schools

In a school setting, children will be taking part in the research. In this context, it is essential to have a solid ethical frame for projects, here the *2019 BERA Ethical Guidelines*. Students being minors, a parental consent was required. Both parents and students received a written information about the projects aims and content, GDPR complying data collection and storage, as well as their rights, such as for example the right to access their information and to withdraw from the project. Their consent was obtained through a Google Form. My senior management was previously informed of the project and had given their consent. They required that I also obtained consent from students, considering that they were old enough to be included in the decision.

B. Ethics considerations specific to my context

My school is the only French English bilingual school in this part of London, hence easily identifiable. Moreover, the IBDP track in that school for that level has only one class with a small number of students, making the individual identification possible. In that context, it was crucial to discuss with all parties that, if protection of privacy was paramount, I could not promise confidentiality (which would imply that the subjects could not be identified in the report), even less anonymity.

The fact that I was the sole researcher on that project required in itself ethical considerations and the setup of a strict critical frame in order to assure integrity and limit bias.

It was also a concern in my context that the expectations of my senior management may not be aligned with my results, which could put pressure on me when it came to the interpretation of data. In consequence, I found it essential to discuss that point when asking for senior management consent.

C. Ethics considerations specific to a pandemic context

In this Coronavirus pandemic context, I had to make sure that the running of the research would not deprive students from learning time or opportunities. This was addressed by designing a project that could be run during regular class time and on already planned curriculum content.

Findings:

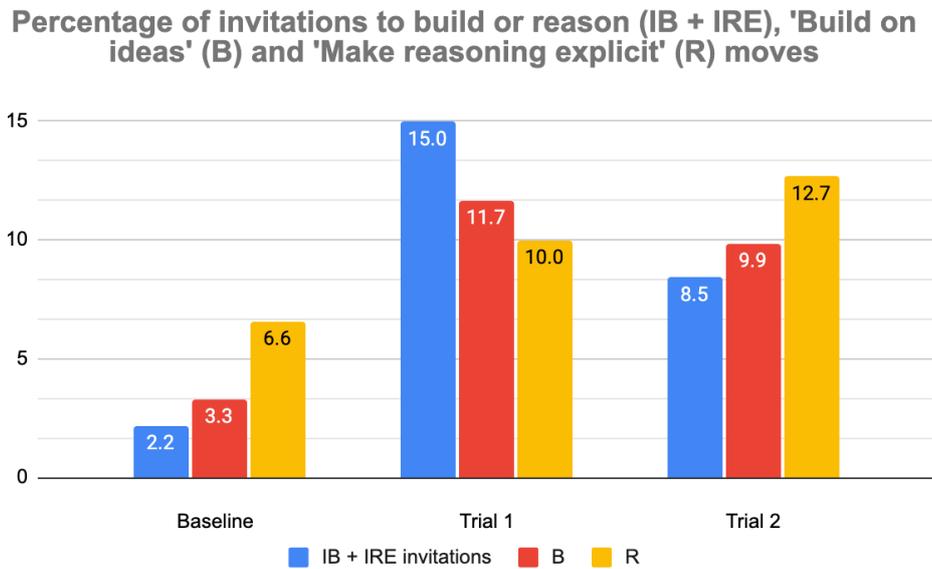
During the baseline trial, students asked each other very few questions, with only two occurrences of invitations over 91 dialogic moves. This was despite the fact that the task the students had to solve (a hexagonal thinking task on flowering in plants) required a high level of communication to reach an agreement. The number of occurrences when students built on each other ideas was low and the reasoning slightly better as the students were trying to make sense of the complex biological processes involved.

During trials one and two after introducing sentence stems, the occurrences of invitations increased as well as the overall reasoning and building on each other ideas, as shown in table 1 and figure 1 below.

Table 1: Occurrences of Invitations to build or reason (IB, IRE), Build on ideas (B) and Make reasoning explicit (R) during baseline and trials 1 and 2.

	Baseline		Trial 1		Trial 2	
	Turn occurrence / 91 total turns	Percentage of occurrence	Turn occurrence / 60 total turns	Percentage of occurrence	Turn occurrence / 71 total turns	Percentage of occurrence
Invitations to build or reason (IB, IRE)	2	2.2%	9	10%	6	8.5%
Build on ideas (B)	3	3.3%	7	11.7%	7	9.9%
Make reasoning explicit (R)	6	6.6%	6	10%	7	12.7%

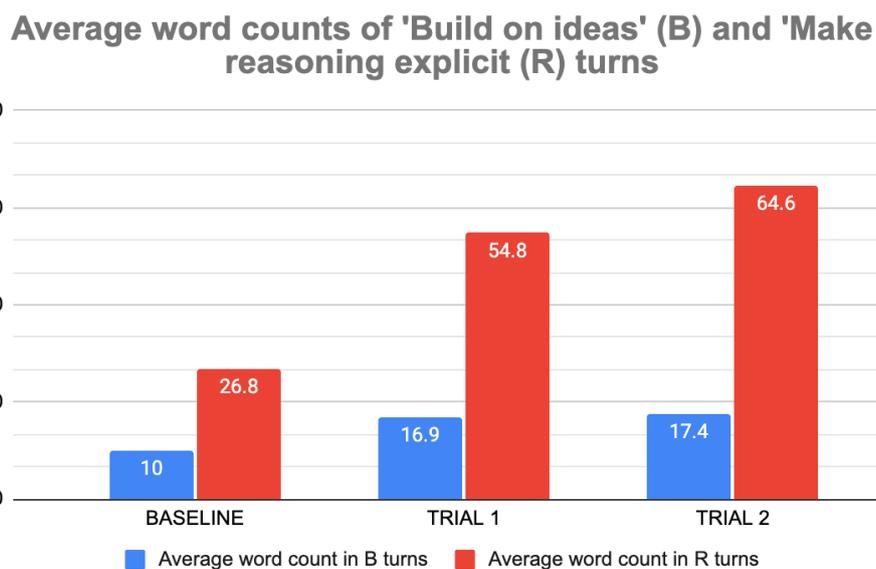
Figure 1: Percentages of occurrence of Invitations to build or reason (IB, IRE), Build on ideas (B) and Make reasoning explicit (R) during baseline and trials 1 and 2.



As seen in figure 1, the number of invitations from students increased, especially during Trial one, possibly due to the novelty effect of the dialogic task they were asked to focus on. But more interestingly, the overall quality of dialogue improved: students built more on their own or their peers’ ideas, and they made their reasoning more explicit.

One unexpected finding was that the average word count of the B and R moves was higher after introducing sentence stems than it was before. B turns showed an average word count increase of around 70% in trials 1 and 2 compared to baseline. R turns average word counts increased by 104% in trial 1 and 140% in trial 2 compared to baseline, as shown in figure 2.

Figure 2: Average word count of Build on ideas (B) and Make reasoning explicit (R) turns during baseline and trials 1 and 2.



That suggests that not only was reasoning happening with a higher frequency, it was also gaining depth, which could have a beneficial impact on the learning outcomes.

Interestingly enough, the self evaluation questionnaires filled individually by each team member did not reflect that: they showed no change at all from the baseline to the trials. The students unanimously gave the same evaluations: they considered every criteria of the grid consistently 'very true', except form criteria G3 'Most of our talk was about the task we were doing' that they rated 'partially true' on all recordings.

Reflective evaluation

A. Evaluation of the findings

The findings seem to indicate that students engaged well in the dialogic task and were able to issue more invitations with the aid of sentence stems aids. This also seemed to have positively affected the overall quality of dialogue in this group. However, it is important to remain critical of the validity of these findings, considering a range of factors.

The first one is obviously the small scale of the project, as far as number of trials and number of groups or students considered. Hence these results should be considered for what they are: observations based on one triad of students over the course of three sessions. To be able to solidify these findings, the project should be repeated on a higher number of students, from different classes and on a variety of topics. The number of trials should also be multiplied, in order to allow for observations when gradually fading away the dialogic prompt by putting it farther away from them (on the board for example), or eventually to totally hide it. Running the research over a longer time would also mitigate the novelty effect of the dialogic task and allow to explore whether or not the students really integrated the invitation to peers process. Indeed, what I observe so far remains a rather artificial use of invitations, a student answer to a teacher's request, rather than a natural and spontaneous behavior. It would require practice and time for the process to become natural and implicit (Wegerif, in Kershner et al., 2020, p.37)

It should also be considered that I was the sole researcher on that project, which despite all efforts to prevent bias is a fragility to the project. The coding part particularly should have been made or at least discussed by multiple researchers, who ideally don't know the students as well as I do, in order to assure robustness and impartiality of the findings.

The tight timing was also an issue. Students had little time to integrate the negotiated talk rules, and the teacher to reinforce them. That makes it difficult to evaluate to what extent the mastery of the talk rules that the students were gaining overtime was impacting the findings, rather that the sentence stems tool. The same reflection applies to the introduction of clear dialogic intentions as a session objective, which happened at the same time as the beginning of the project. That accounts for a limited control of variables, too many novelties being introduced in a very short amount of time.

The fact that students self evaluation questionnaire did not reflect the change observed in the different steps of the project is also intriguing and should require further investigation. One possible lead to follow could be the fact that the students need to be trained to evaluate and monitor their metacognition strategies better (Tobias and Everson in Hacker et al., 2009, chapter 7). This could start with asking them to reflect and report on the cognitive processes they used while solving specific tasks.

B. Evaluation of the process

I consider that this project went overall well. The students were enthusiastic about the idea when we discussed it before starting it. They showed good understanding of how dialogue can improve their learning outcomes and appreciated that they were explained tools that brought them in charge of their own progress. I believe that sharing with them the research on which I base my pedagogical approach is very beneficial in the age group I work with: months away from entering higher education studies, they are eager to better understand how they learn in order to become more autonomous students. Before the beginning of the last trial session, one student asked me if 'we were going to do that thing when we focus on asking each other questions', because she felt it helped her better understand the previous lesson. She was willing to use this tool in my class and others.

I also felt supported by my senior management. My colleagues showed interest in the project. My head of department visited me to observe the session when I introduced the sentence stems tool and asked me to present it to our science colleagues. I shared the resource with them and one of them started using it in his class. I will be asked to present the project to the whole school teaching team next term.

One of the hardest things for me in this inquiry was getting everything ready to start it: school, parents and students consents, ethical and risk assessment validations from University. This left very little time for the inquiry itself. Also, the uncertainties around the sanitary situation framed my inquiry design, as I decided for a method that could be run in class as well as in distance learning or in hybrid. I would recommend to anyone running a similar experiment to make sure they allow plenty of time for the more administrative part and that they consider that designing a flexible setting inquiry is very time consuming.

I also felt that I read the most useful pieces of literature late in the process, when my inquiry was already well underway. A project should draw on on preexisting research, and identification of questions remaining, as well as personal interest and specific observations, and I felt my knowledge of the context was not sufficient, or too fresh, before starting the inquiry design. If I were to do it again, I would make sure I go over more literature and get a solid theoretical knowledge before deciding for a research question and designing the project.

Changes to practice:

Entering the classroom as both a teacher and a researcher definitely came with its challenges, but mostly positive and stimulating ones. The curriculum to cover is heavy and requires to keep up with a high pace, but looking at my students with the eyes of a researcher made me want to slow down and take more time for observing and reflecting on my practice and the effects on my student's learning. I have always been willing to try new tools in my classroom, but now also want to better understand the 'pedagogical mechanics' of the tools I use. I now have a hard time being satisfied with the sole impression that a session went well or not, but have the will to deeper analyze the outcomes and quantify them if possible.

This project also triggered interest in my colleagues who were willing to know more about what I did in class or learned in the module. In the past weeks, our exchanges on practices have been very rich, everyone was more eager to share what they had tried in class or what research paper they had read.

Next steps and conclusion:

I aim to keep working with the dialogic tool I designed and fade the cue away gradually. I plan on doing more recordings and coding before the end of school year to see whether or not long term effects can be observed. I'd like to collaborate with the colleagues who teach this class to use a common dialogic approach and see if what I now observe in my biology class transfers to and can be reinforced by use in other topics.

A question emerged from my enquiry that I'd like to explore further: I noticed the length of the turns increased after introducing the sentence stems tool, which I did not expect. I hope to research and reflect on that aspect in the coming months.

After completing this inquiry, I would conclude that, despite its limitations, this inquiry has contributed to develop my practice and had a positive impact on the students, who expressed interest for the dialogic process and a strong will to better understand their own learning process. The results show an encouraging effect on dialogue's quality, on which it would be interesting to keep working. It also had an invigorating effect on the teaching team, shedding light on the role of research in the classroom and the opportunities that exist for practitioners to be part of it.

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- This report
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If you have given permission to share would you prefer:

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Annex 1: *Sample of the sentence stems cards tool.*

Why do you think that...?	How do you know that...?
Can you explain... ?	Can you justify... ?
Do you think that... ?	In what way... ?
Which fact did you use to....?	How did you check...?
Why did you decide to...?	Why do you think we should change...?

Annex 2: *Student self evaluation list*

Student Self-evaluation: Group Work

A self-evaluation helps you to think about your group work. For each of the statements below, tick the box that fits best: not true, partly true or very true. Everyone in the group should fill in their own self-evaluation.

Criteria	Not true	Partly true	Very true
G1 – Everyone in the group participated			
G2 – We worked as a single group and didn't split up			
G3 – Most or all of our talk was about the task we were doing			
G4 - We shared our own ideas and built on each other's			
G5 - We listened carefully when others were speaking and took on board what they were saying			
G6 – We enjoyed working together in a group			
G7 – When we made suggestions or agreed/disagreed with others, we gave reasons			
G8 – We challenged or commented each other's ideas in a respectful and constructive way			
G9 – We tried to reach consensus or compromise if there was disagreement			
G10 – Our discussions and disagreements helped us learn from each other			
G11– We actively invited others to justify or expand their ideas			

Annex 3: Sample from a transcript (Trial 2)

Turn	Speaker		Code
1	A	Ok (<i>reading the sentence on the board</i>) so what strategy would you have if you lived in the desert?	
2	H	so I would Only open my stomatas in the night, because in the sun I would lose too much water and get all (<i>mimes shrinking</i>)	R
3	A	that is very true, I was thinking about that too. To sort of transpire at specific times (<i>emphasis</i>) in order to keep healthy.	R
4	H	Yeah, and can you explain why you made that decision	IRE
5	A	Because you know as you said if the stomata open during the day and let out too much water the plant would dry out very fast because it doesn't have water to stay good and hydrated and and healthy it could really hurt the plants even to the point of death, so it's important to open it during the night but also to do shorter transpiration periods so that it doesn't let out too much water, because it really needs to keep that water in and hydrated.	R
6	H	M****, can you tell me more about what you (<i>emphasis</i>) would do if you were a plant in the desert?	IB
7	M	Mmmm... I don't know... I'd try to survive ...	
8	A	How would you try to survive? In what way would you try to survive?	IRE
9	M	I don't know maybe... (<i>looking at teacher</i>) are you saying in the desert?	
10	T	Yes in the desert for example	
11	M	Maybe I should like try, well, like to get water like from the soil but also like the outside like...	R
12	H	the moisture in the air	B
13	M	yeah	
14	A	it's quite difficult in the desert though because it's so dry	CH