

How ESL young learners view project-based learning?

Muhammad Noor¹ & Nurahimah²
^{1,2}Universiti Utara Malaysia

Article Info

Received:

29 January 2019

Accepted:

25 March 2019

Publish

15 April 2019

E-mail address:

**corresponding Author :*
muhammadnoorabdulaziz@gmail.com

Abstract

Project-based learning (PjBL) is a teaching method that places the learners at the centre of learning. This qualitative case study delved into the reasons for using PjBL with young learners and sought idea in making PjBL interesting for learning of English from the perspective of 12 young ESL learners. Semi structured interviews along with classroom observation were used in collecting the data. Atlas ti version 8 was used in analysing the findings and emerging themes from the data were recorded. Among the themes were engaging elements in PjBL, teacher's support, authentic assessment, parental involvement and the incorporation of technology. The implication of this study towards the betterment of teaching and learning is that voice of young learners can be used in preparing PjBL modules along with the ministry's suggestion for a student-centred approach in schools for 21st century classrooms.

Keyword: Project-based learning, Young learners, ESL, Authentic assessment, Parental involvement

Introduction

Project-based learning (PjBL) is a teaching method that places the learners at the heart of learning. It has been widely practised in the world of education. Many scholars (Chin, 2014; Grant, 2014; Kokotsaki, Menzies, & Wiggins, 2016; Santos, 2016) believe that PjBL has prodigious impact on the learning process as it involves learners to think creatively, collaborate, assess and present their work among their classmates or to another audience. Countries which have best education systems in the world like Finland, Canada, Norway and Singapore have long adopted PjBL as part of the learners' learning experience (Chun & Wong, 2000; Melin, Axelsson, & Wedlund, 2006). PjBL as highlighted by Blumenfeld, Fishman, Krajcik, Marx and Soloway (2000, p.150) can best be defined as the opportunity provided for students:

“to construct knowledge by solving real problems through asking and refining questions, designing and conducting investigations, gathering, analysing, and interpreting information and data, drawing conclusions, and reporting findings.”

In PjBL, learners will have to undergo a process of learning by constructing meaning from the activities they will carry out. This is parallel with the theory of constructivism which advocates that learning should be meaningful and constructed by the learners themselves through social interaction (Kemp, 1999). Constructivist believe that learners adopt reality through activities that are set upon them (Juvova, Chudy, Neumeister, Plischke, & Kvintova, 2015) and this is existential

in using project based learning in the classroom. Involving learners in an active environment in the learning process is certainly vigorous (Kokotsaki et al.,2016) in producing learners who are capable of doing more than what they are expected to do.

Literature Review

It is indisputably imperative to understand and agree that PjBL has great impact in learners' development in learning (Harris, 2013). As much as young learners of English as a Second Language (ESL) are concerned, through PjBL, they will be immersed in the language over social interaction (Almaguer, Diaz, & Esquierdo, 2015), have an opportunity to practice reflection in learning (D'Ambra, 2014), learn to interact and cooperate (Holmes & Hwang, 2016) as well as they are trained to be accountable for their learning (Tilchin & Kittany, 2016). However, it is always the teachers who are interviewed and asked about the effectiveness of PjBL (Baysura, Altun, & Yucel-Toy, 2016; Cook & Weaver, 2015). Learners' views are also vital since the theory of constructivism suggests that learners are at the centre of learning (Habók & Nagy, 2016). Subsequently, it is clear that learning in most schools in Malaysia is still centred around the teacher (Li, 2016; Sarina & Furbish, 2010) resulting in most classroom activities are planned, produced, carried out and evaluated by teachers without the inclusion of learners' views in the process.

Learner autonomy and self-assessment are another grave concern in our education system (Abdul Majid, Vethamani, Abd Samad, & Muhamad, 2011). There exists discrepancy in views between teachers and students as much as project-based learning is concerned (Beckett, 2002) and engaging learners in a happy learning environment is crucial (Blazar & Kraft, 2016). There is relatively an extensive literature that has sought the views of high school and college students (Goldstein, 2016; Zancul, Sousa-Zomer, & Cauchick-Miguel, 2017) but lack studies in relation to obtaining views from young learners. Contrastingly, considering learners' views on PjBL is proven to assist the teachers in implementing a better PjBL approach that caters to the needs of the learners in the classroom (Adams, 2018). As such, to contribute to the existing limited literature, this article will explore the views from young learners of the English language that can assist teachers in planning and implementing PjBL in the new English language curriculum in primary schools. From the findings of this study, English teachers can incorporate ideas to involve PjBL to a bigger group in the school since literature has only suggested using PjBL in individual classes (Alfonso, 2017; Dresden & Lee, 2007). This can be a professional learning community activity which involves partnership between teachers and young learners of the Dual Language Program (DLP) classes in Malaysia.

Thus, the aims of this exploratory case study were to delve into the reasons for using PjBL with young learners and to seek explanation in making PjBL interesting for learning of English from the perspective of the learners. This study was guided by two research questions which were:

- i) Why is PjBL important for children's learning?
- ii) How can PjBL be made interesting for children's learning?

These questions are important for teachers to cater for the needs of the learners in the classroom. Getting learners to interact and solve problems is one of the ways in catering for their needs as supported by scholars of PjBL (Habók & Nagy, 2016; Kaur, 2017). Correspondingly, the novelty of this study is to give voices to the learners and also to establish a platform for teachers to prepare a module on using project-based learning with young learners of ESL.

Methodology

This holistic single case study research (Yin, 2014) recorded and discovered the voices and views of 12 young learners in a year 5 class of a Malaysian primary school in relation to the use of PjBL in their English language lessons. Their comments, ideas, and suggestions were recorded and analysed. In this qualitative case study, all of them were interviewed in five days, each individually with a set of interview protocols. Suggestions and advice by Danby, Ewing and Thorpe (2011) were abided by as to create a friendly and safe environment for the children to speak and share their views.

Purposive sampling (Patton, 2002) was used to enter the premise of the school with the knowledge that this school was one of the best schools in the northern state in Malaysia that used project-based learning as a core component in teaching of Malay language, English language, Science and Mathematics. This was accredited by the state education department. Upon preliminary visits to the school, the headmaster evidently showed the awards the school has obtained from innovations that were made in relation to teaching and learning.

A set of interview protocols with 8 main questions adapted from (Beane, 2016) was used and the interview was conducted in the English language as all the children were proficient in the target language with minimum marks scored in the latest examination was 85%. In fulfilling ethical responsibilities, consent letters were distributed to seek permission from their parents to participate in this study and gathered before they were interviewed. To triangulate the data, their English language lessons were observed with an observation checklist adopted from (Chin, 2014) for two weeks consecutively to consolidate the findings from the interviews. The data were later transcribed and analysed using Atlas.ti Version 8. Initial codes were assigned before emerging themes were brought out from the analysis.

The young learners in this study were the pupils from year 5 in the Dual Language Program (DLP) and they were only 12 of them. The pupils' profile was elaborated in Table 1. Braun and Clarke (2013) recommended researchers to use pseudonyms as opposed to revealing the identity of research participants by means of maintaining confidentiality.

Table 1

Profile of the Participants

No.	Pupils' names	Profile
1.	Zikry	The class monitor who is bubbly and very intelligent. He tops the class in most examinations. He always gives a lot of ideas during brainstorming sessions.
2.	Imtiyaz	A quiet boy who only talks when he is talked to. Never interrupts anyone. Obedient and respectful. He loves the English language and comes from English speaking family.
3.	Jit Sheng	A prefect in the school who loves reading. He is a fan of Harry Potter series. He is always the presenter during group presentations.

4.	Vishal	He is the school sprinter. He misses many days in school due to sports practice but he excels academically too. He loves projects that his teacher assigns because he likes independent learning.
5.	Vimala	She is Vishal's twin sister. An ardent reader who is a frequent visitor to the library. She helps Vishal a lot with his homework.
6.	Samantha	She is the daughter of the English teacher. Very active in the class during English lessons. She is the competitor for Zikry.
7.	Parames	She comes from a mediocre family. She stammers a lot when she speaks but she has good ideas when she discusses with her friends in the group.
8.	Salinda	Best friends with Farah. Loves working in pairs with Farah as both of them are school librarians. A bookworm who loves fairy tales.
9.	Farah	A hardworking girl who has a fair command of the English language. Loves asking questions in class and offers immediate helping hand to her friends.
10.	Rahimah	Just returned to school after a long break. She was with her family in Edinburgh as her parents were doing their postgraduate studies there.
11.	Pi Qing	She loves sports so much and she plays for the school netball team. An active girl who completes her homework on time and excels in her studies too.
12.	Celine	A quiet girl who sits next to Parames. She never talks much in class. She is reluctant when it comes to presenting. An introvert who is good at drawing and arts.

Results of the study

After reading the interview transcripts a few times and collating the observation notes, the researchers assigned codes from the data. Emerging themes were then decided for the categories of codes. The themes that were derived for research question 1 were classroom practices and teacher's support.

Research Question 1: Why is PjBL important for children's learning?

The themes that were derived for research question 1 were classroom practices and teacher's support.

The young learners unanimously agreed that PjBL is important for children's learning when they mentioned that it had elements of fun learning and group activities incorporated in PjBL.

"I think it is fun learning English with projects." (Imtiyaz)

"..doing projects in a group work" (Pi Qing)

"I enjoy working with my friends" (Celine)

The children felt that it was great to work with their classmates as the workload was shared and they were less burdened. All of them paid attention when the teacher explained the task (Observation Note 2)

They also added that project based learning is important because it fosters good relationships among group members. This is evident in the verbatims below:

- “I also get to know who is hardworking and helpful” (Zikry)
“We make friends with that one boy who is always quiet in class” (Samantha)
“My friend helps to draw and I help her to write in cursive writing” (Farah)
“Rahimah is a nice girl. She speaks good English and I can learn from her”
(Salinda)

It is clear from the observation that they children never fought or argued terribly during the lessons. They were polite with their friends and jovial by cracking jokes frequently while working on the task. (Observation Note 3)

It is true from the children’s perspective that PjBL makes them stress-free and focused.

- “I don’t feel stressed doing the activities because it is fun” (Parames)
“It is not like having to do many pages of homework. It is fun” (Vishal)
“My teacher does not scold us, that’s why we are not stressed” (Jit Sheng)

The teacher created a stress-free environment for the children to work in. She always played relaxing music while the children settle the task in the group. (Observation Note 5)

Immediate assistance is offered by the teacher during the completion of their PjBL.

- “We can talk to our teacher and tell her what we like and what we don’t like.” (Farah)
“My teacher answers our question when we call her to our group” (Imtiyaz)
“She calls every group leader to check our work at her table” (Vimala)

The teacher facilitated the groups by walking around and offering help when and where necessary. She also instructed the children to reduce their noise while working in the group (Observation Note 4)

Figure 1 and Figure 2 shows the derivation of the two themes from the codes that were assigned for the responses received from the participants.

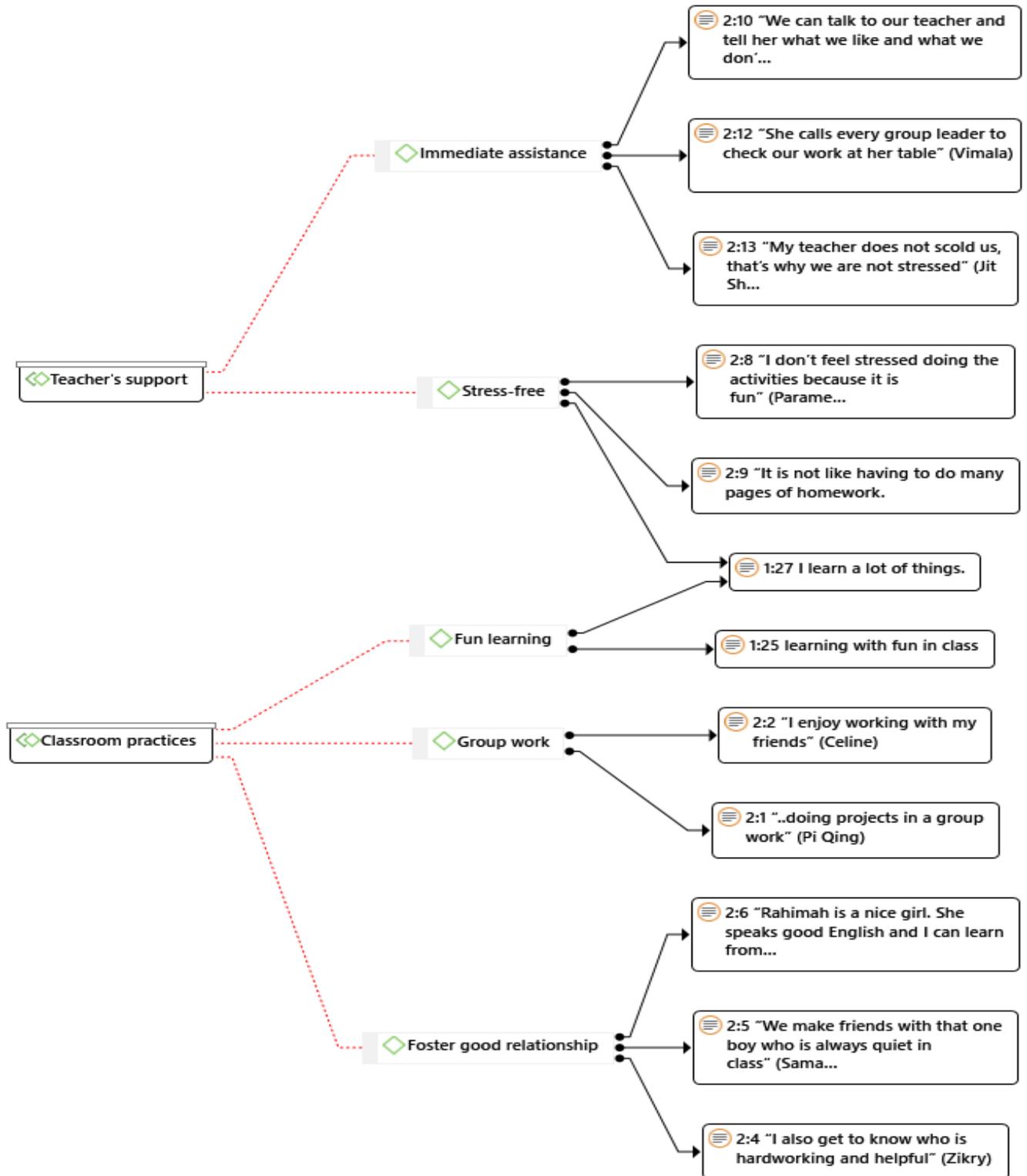


Figure 1 Codes and Themes for Research Question

Research Question 2: How can PjBL be made interesting for children's learning?

The themes that emerged to answer research question 2 were collaboration, incorporation of technology and authentic assessment.

When the young learners were asked to give suggestions on making their PjBL more interesting, many suggested that they would love to work with friends from other classes.

“Our English teachers can join us with other year 5 children.” (Zikry)

“Puan Syamala also does project with 5C. We can do together” (Samantha)

“I want to work with my best friend from 5I who is good at drawing” (Farah)

“How nice if 5C, 5I and 5S can combine and do a bigger project.” (Pi Qing)

Some children were very reflective of the task they were assigned to do and commented that their parents should be included in the learning too since they receive much help from parents.

“My father likes helping me do models of planet. I think teacher can ask my father to give marks to my work.” (Vishal)

“Since my mother is also an English teacher, she can be the person to mark this project for me. We can have two marks – one from mom and one from teacher.” (Samantha)

The children raised their hands and told the teacher that feedback forms can be given to their parents so that the marks given would be fairer. (Observation Note 10)

Since the class have learnt Scratch program (an animation software), they suggested that their teacher included technology in doing projects for their English topics.

“We can use computer to prepare powerpoint slides and use Scratch” (Vimala)

“I suggested using publisher to prepare a pamphlet on saving the earth” (Farah)

“I am good in powerpoint. I can prepare the slides for my presentation.

But must present in the computer lab. Our class got now LCD” (Jit Sheng)

Two children who were children of school teachers had the knowledge of authentic assessment. They suggested the teacher to use peer assessment and self-assessment in the class to check their group progress.

“I think teacher can give us forms to tick for us to check our work.” (Rahimah)

“I can inform teacher if my friends participate in the group work. I can give marks and they can also give marks to me. It will be fun.” (Samantha)

The teacher does share a self reflection form with smileys for them to tick and comment in the class pertaining to the project that they came up with. (Observation Note 10)

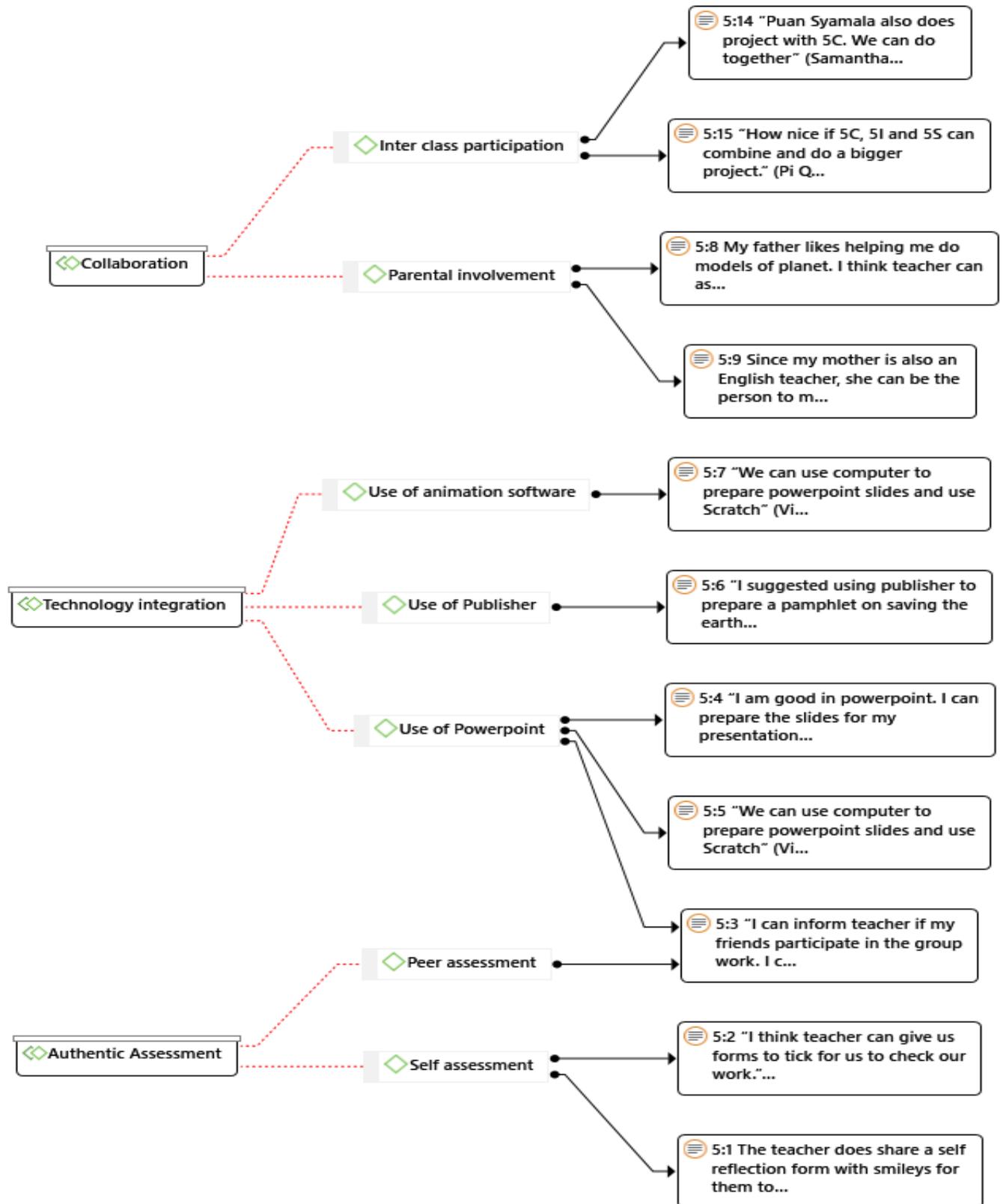


Figure 2 Codes and Themes for Research Question 2

Discussion

In the light of PjBL, scholars have clearly established that it is important to use PjBL as part of teaching and learning. The findings from this current study testify the literature from Adams (2018), Harmer, Stokes, Blake, Sterling, and Kagawa (2014) as well as Lou and Kim MacGregor (2004) who agree and advocate that PjBL is an integral tool in making teaching and learning fun and meaningful.

Classroom practices such as fun learning and group work are among the fundamental elements in PjBL as being pointed out by the young learners in this current study. This is consonant with the findings from Genc (2015) that classes become fun when it is injected with project-based approach. Apart from fun learning, enhancing creativity (Hong, Yu, & Chen, 2011; Ministry of Education Malaysia, 2015) is also another element that is apparent in PjBL which is not mentioned by the children in this study.

Catering to the importance of PjBL from the eyes of young learners, they realised that when their teacher adopts PjBL approach, immediate assistance is provided whenever necessary. The role of the teacher as facilitator is manifested well as agreed by Aiedah and Lee (2012) and Gülbahar and Tinmaz (2006) because this creates a stress-free environment for learning (Yusof & Yong, 2010). This study approves the findings from the literature when the children said that they were not stressed doing the activities because it was fun-filled.

As much as PjBL is concerned, collaboration is another key to the success of any group learning that takes place in the classroom. Here, two types of collaboration is detailed from the findings of this research : (a) students with students collaboration and (b) parents with teacher collaboration. This is a noteworthy finding that is parallel with Othman and Shah (2013) and Poonpon (2011) who found that collaboration is a significant component in PjBL which aids in the success of PjBL in the classroom.

What is strikingly unusual in the finding is that the children mentioned an inter-class collaboration as opposed to Hope and Allen (2009) who suggested a competitive PjBL. This is a better option that may create a healthier learning that does not address for competition but encourages positive collaboration.

In relation to assessment of the PjBL that happens in their classroom, two variations of authentic assessment is suggested by the children: (a) peer assessment and (b) self assessment. Experts in PjBL promote the use of self and peer assessment along with portfolio assessment and feedback from the teacher to make learning more evocative (Gülbahar & Tinmaz, 2006).

Integration of technology is long suggested in implementing PjBL in the classroom (Hou, Yu, Wu, Sung, & Chang, 2014; Muniandy, Mohamad, Fook, & Idrus, 2009). The children put forward notable idea on incorporation of technology such as Scratch, Microsoft Powerpoint and Microsoft Publisher. These idea from the young learners are remarkable as they have experienced using abovementioned elements of technology in their learning.

Conclusion, recommendation and suggestions for future research

In this study, the young learners have shared some striking comments and experiences from PjBL activities that have taken place in their classes. These sharing may support the teachers in catering for the needs of the learners in the classroom. Teachers can prepare modules on using PjBL to

work with ESL learners after taking into considerations the idea and views that are put forward in this research.

Support from the teachers and fun classroom practices are among the themes that emerged from this study which explains why the children love PjBL approach in the classroom. The children in this study also expressed that a different type of assessment adopted by their teacher in the classroom makes learning less stressful. These findings suggest that teachers should create a less threatening environment for children to develop their potential and improve on their learning.

In an attempt to further improve this area of research, future studies may focus on getting the young learners to suggest what kind of activities they wish to do in their PjBL lessons. This can be interesting since young learners are capable of sharing views that are significant with their learning and unequivocally support teachers in designing lessons for them. Next, research on parental involvement in PjBL in Malaysia is still at the beginning stage and worth to be explored.

Researchers may also shed some light on how parental involvement can be used in the classroom in the aspect of teaching and assessment. Finally, studies on the use of authentic assessment should also be taken into consideration since the Ministry of Education has ventured into such assessment practices to be used in the classrooms as an effort to move away from standardized testing and examination.

References

- Abdul Majid, Z., Vethamani, M. E., Abd Samad, A., & Muhamad, M. (2011). The school-based oral English test: Similarities and differences in opinion between teachers and students. *The English Teacher*, *XL*, 113–128.
- Adams, D. R. (2018). An empirical study on teachers' and students' perception of project based learning.
- Aiedah, A. K., & Lee, A. (2012). Application of project-based learning in students' engagement in Malaysian studies and English language. *Journal of Interdisciplinary Research in Education*, *2*(1), 37–46.
- Alfonso, S. (2017). Implementing the project approach in an inclusive classroom : A teacher's first attempt with project-based learning (voices). *Young Children*, *72*(1).
- Almaguer, I., Diaz, Z., & Esquierdo, J. J. (2015). Project-based learning: Innovative pedagogy for 21st-century English learners. *Teacher Education and Practice*, *28*(1), 177–190.
- Baysura, O. D., Altun, S., & Yucel-Toy, B. (2016). Perceptions of teacher candidates regarding school experience. *Eurasian Journal of Educational Research*, *(62)*, 15–36.
- Beane, M. K. (2016). *Exploring the Implementation of Project-based Learning at an Alternative High School*. Retrieved from http://digitalcommons.hamline.edu/hse_al
- Beckett, G. (2002). Teacher and student evaluations of project-based instruction. *TESL Canada Journal*, *19*(2), 52–66. <https://doi.org/10.18806/tesl.v19i2.929>
- Blazar, D., & Kraft, M. A. (2016). Teacher and teaching effects on students attitudes and behaviors. *Educational Evaluation and Policy Analysis*, *39*(1). <https://doi.org/10.3102/0162373716670260>
- Blumenfeld, P., Fishman, B. J., Krajcik, J., Marx, R. W., & Soloway, E. (2000). Creating usable innovations in systemic reform: Scaling up technology-embedded project-based Science in urban schools. *Educational Psychologist*, *35*(3), 149–164. <https://doi.org/10.1207/S15326985EP3503>
- Braun, V., & Clarke, V. (2013). *Successful qualitative research: A practical guide for beginners*. London: SAGE.

- Chin, W. (2014). *The effects of project-based learning in high school Geometry*.
- Chun, H., & Wong, P. (2000). Preservice teachers use it to present scenarios for problem-based learning. *Problem-Based Learning: Educational Innovation across Disciplines*.
- Cook, N. D., & Weaver, G. C. (2015). Teachers' implementation of project-based learning: Lessons from the research goes to school program. *Electronic Journal of Science Education*, 19(4).
- D'Ambra, L. N. (2014). *A case study of project-based learning in an elementary school setting*. Retrieved from <http://search.ebscohost.com/login.aspx?direct=true&db=psyh&AN=2014-99031-208&login.asp&site=ehost-live&scope=site>
- Danby, S., Ewing, L., & Thorpe, K. (2011). The novice researcher: Interviewing young children. *Qualitative Inquiry*, 17(1), 74–84. <https://doi.org/10.1177/1077800410389754>
- Dresden, J., & Lee, K. (2007). The effects of project work in a first-grade classroom: A little goes a long way. *Early Childhood Research and Practice*, 9(1).
- Genc, M. (2015). The project-based learning approach in environmental education. *International Research in Geographical & Environmental Education*, 24(2), 105–117. <https://doi.org/10.1080/10382046.2014.993169>
- Goldstein, O. (2016). A project-based learning approach to teaching physics for pre-service elementary school teacher education students. *Cogent Education*, 3(1), 1–12. <https://doi.org/10.1080/2331186X.2016.1200833>
- Grant, M. M. (2014). Getting a grip on project-based learning: Theory , cases and recommendations, (January).
- Gülbahar, Y., & Tinmaz, H. (2006). Implementing project-based learning and E-portfolio assessment in an undergraduate course. *Journal of Research on Technology in Education*, 38(3), 309–327. <https://doi.org/10.1080/15391523.2006.10782462>
- Habók, A., & Nagy, J. (2016). In-service teachers' perceptions of project-based learning. *SpringerPlus*, 5. <https://doi.org/10.1186/s40064-016-1725-4>
- Harmer, N., Stokes, A., Blake, J., Sterling, S., & Kagawa, F. (2014). The benefits and challenges of project-based learning A review of the literature, 1–41.
- Harris, K. (2013). Teacher, I had a dream: A glimpse of the spiritual domain of children using project-based learning. *International Journal of Children's Spirituality*, 18(3), 281–293. <https://doi.org/10.1080/1364436X.2013.858665>
- Holmes, V.-L., & Hwang, Y. (2016). Exploring the effects of project-based learning in secondary mathematics education. *The Journal of Educational Research*, 0671(June), 1–15. <https://doi.org/10.1080/00220671.2014.979911>
- Hong, J. C., Yu, K. C., & Chen, M. Y. (2011). Collaborative learning in technological project design. *International Journal of Technology and Design Education*, 21(3), 335–347. <https://doi.org/10.1007/s10798-010-9123-7>
- Hope, J. T., & Allen, W. J. (2009). Student competitive events : A strategy for integrating a STEM block in public schools. *Proceedings of Society for Information Technology & Teacher Education International Conference 2012*, 3852–3856. <https://doi.org/10.1080/00098650903505415>
- Hou, H. T., Yu, T. F., Wu, Y. X., Sung, Y. T., & Chang, K. E. (2014). Development and evaluation of a web map mind tool environment with the theory of spatial thinking and project-based learning strategy. *British Journal of Educational Technology*, 47(2), 390–402. <https://doi.org/10.1111/bjet.12241>
- Juvova, A., Chudy, S., Neumeister, P., Plischke, J., & Kvintova, J. (2015). Reflection of constructivist theories in current educational practice. *Universal Journal of Educational Research*, 3(5), 345–349. <https://doi.org/10.13189/ujer.2015.030506>
- Kaur, M. (2017). To recognise, realise and differentiate the learning needs of students. *Pertanika Journal of Social Sciences and Humanities*, 25(2), 503–510.
- Kemp, S. (1999). Constructivism and problem-based learning. *Journal of Further and Higher ...*, 45–51. Retrieved from <http://www.tandfonline.com/doi/abs/10.1080/0309877990230306>

- Kokotsaki, D., Menzies, V., & Wiggins, A. (2016). Improving schools project-based learning : A review of the literature, 1–11. <https://doi.org/10.1177/1365480216659733>
- Li, Y. W. (2016). Transforming conventional teaching classroom to learner-centred teaching classroom using multimedia-mediated learning module. *International Journal of Information and Education Technology*, 6(2), 105–112. <https://doi.org/10.7763/IJiet.2016.V6.667>
- Lou, Y., & Kim MacGregor, S. (2004). Enhancing project-based learning through online between-group collaboration. *Educational Research and Evaluation*, 10(4–6), 419–440. <https://doi.org/10.1080/13803610512331383509>
- Melin, U., Axelsson, K., & Wedlund, T. (2006). Project-based learning : An emergent framework for designing courses. *The Proceedings of the Information Systems Education Conference*. Ministry of Education Malaysia. (2015). *English language education reform in Malaysia : The roadmap 2015-2025*.
- Muniandy, B., Mohamad, R., Fook, F. S., & Idrus, R. M. (2009). Technology application in project-based learning. *Journal of Communication and Computer*, 6(12), 74–84.
- Othman, N., & Shah, M. I. A. (2013). Problem-based learning in the English language classroom. *English Language Teaching*, 6(3), 125–134. <https://doi.org/10.5539/elt.v6n3p125>
- Patton, M. Q. (2002). *Qualitative research and evaluation methods* (3rd ed.). Thousand Oaks, California: SAGE Publications.
- Poonpon, K. (2011). Enhancing English skills through project-based learning. *The English Teacher*, XL, 1–10.
- Santos, S. C. (2016). PBL-SEE: An authentic assessment model for PBL-based software engineering education, 1–7.
- Sarina, T., & Furbish, D. (2010). Encouraging lifelong learning through student-centred learning approaches in a Malaysian teacher education programme. In *Lifelong Learning International Conference 2010*.
- Tilchin, O., & Kittany, M. (2016). An adaptive approach to managing knowledge development in a project-based learning environment. *Journal of Education and Training Studies*, 4(10), 42–53. <https://doi.org/10.11114/jets.v4i10.1681>
- Yin, R. K. (2014). *Case study research design and methods* (5th ed.). Thousand Oaks, California: SAGE.
- Yusof, A. M., & Yong, H. S. Y. (2010). E-project based learning using animation in primary school. In *Proceedings of EDULEARN 10 Conference*.
- Zancul, E. de S., Sousa-Zomer, T. T., & Cauchick-Miguel, P. A. (2017). Project-based learning approach: improvements of an undergraduate course in new product development. *Production*, 27(spe), 1–14. <https://doi.org/10.1590/0103-6513.225216>